Electricity Saving Behaviours and Energy Literacy of New Zealand Children

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Abstract

Energy consumption is one of the most pressing issues facing society today, owing to the global energy crisis, climate change, and environmental degradation. Children represent the decision makers of the future and contribute to energy consumption in the present, yet remain understudied. This thesis draws on the theory of planned behaviour and energy literacy (knowledge, attitudes, and intended behaviour) to investigate how children in Dunedin, New Zealand, use electricity in their households, their efforts to save it, and the factors influencing them to acquire electricity saving practices. Furthermore, this study examines the children's potential to encourage their families to adopt energy efficient practices. The research is interdisciplinary and mainly qualitative (thematic analysis), but supported by quantitative methods (content and correspondence analyses). Data were collected through individual interviews with 26 children (9–10 years old) and their parents and teachers, surveys filled in by parents, focus groups with children, and photo elicitation.

Very few of the children perform electricity saving behaviours voluntarily, consistently, and with the intention to save power. Most of them try to save electricity for financial reasons, and many do not have a clearly developed attitude towards saving energy. The children's attitudes and behaviours are largely determined by their parents, and dependent on their level of control over electrical appliances. Attitudes and behaviours are formed through separate, parallel processes, with the former generally being passed on directly through conversations (although they sometimes also arise from an environmental identity or pre-existing behaviours), whereas the latter are acquired through modelling, rules and reminders. The children's knowledge about electricity production is mostly fragmented and learnt informally, with very few of the children understanding the relationship between electricity use and environmental issues. Relevant information is generally being neither transmitted nor structured by the parents or school, although the latter still has at least a small effect on the children's basic knowledge and attitudes. Because of the children's limited energy knowledge and attitudes, as well as their lack of intended behaviour, they cannot be considered energy literate. Finally, none of the children are successfully influencing their families to adopt new electricity saving practices, likely because of their limited practical knowledge, and the lack of an intention to help save energy to a further extent. Thus, their agency is currently confined to repeating their parents' reminders, although there are several indications that it could be developed further through appropriate guidance.

All of the findings of this research are summarised in a comprehensive model illustrating the development of children's electricity saving practices, including rational and unconscious approaches, as well as several parallel, interconnected processes for developing energy literacy and behaviours. This model is the first to explain children's socialisation into saving energy, provides insights into rarely researched processes affecting primary school children in their home context, and represents the first analysis of children's energy literacy and practices in New Zealand. In addition, this thesis makes a methodological contribution, demonstrates children's naivety as regards energy issues, and provides recommendations for educators, parents, policy makers and designers.

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Chapter 1

Introduction

The world is facing a multifaceted crisis including habitat destruction, biodiversity loss, pollution and climate change (Foley, 2010). In addition, energy resources will begin to decrease. For example, 'peak oil' – the point of maximum global production which will be followed by a terminal decline – may already have been reached, or is likely to occur within the next twenty years (Maggio and Cacciola, 2012; Rogner, 2012). Maximum production of other non-renewable energy sources will follow soon thereafter, such as coal around 2052 (Maggio and Cacciola, 2012). The shortfall in energy supplies that must follow peak production will likely lead to sharp increases in price, and, ultimately, a global energy crisis (Hall and Day, 2009). From a climate change perspective, there are even more foreshortened limits to energy use: the 2013 report for policymakers by the Intergovermental Panel on Climate Change makes it clear that current trajectories in the use of fossil fuels are not sustainable, and that staying within a two degree average global remperature rise will require avoiding the use of a significant proportion of known fossil fuel reserves (Alexander *et al*., 2013).

Given that energy is the "underlying currency that governs everything humans do with each other and with the natural environment that supports them" (KEEP, 2003 in DeWaters and Powers, 2008, p.1), the looming energy crisis might be seen as "the most important issue of the 21st century [...], the fundamental challenge we face" (Armaroli and Balzani, 2007, p. 52). Although its effects might be delayed or diminished by the exploitation of unconventional resources, such as tar sands and shale gas (Rogner, 2012), doing so will further increase carbon emissions, thus aggravating climate change (Chiari and Zecca, 2011). Renewable energy sources provide a partial solution to both of these problems, but are costly and highly dependent on the locality (e.g. wind, sunshine hours, availability of water). Furthermore, they pose challenges in terms of energy storage, and can themselves have severe environmental impacts, such as hydro dams fundamentally altering river environments (Abbasi and Abbasi 2004).

Another strategy to improve the situation is to use energy less and more efficiently, with the latter in particular being both more cost-effective than increased production (McKinsey and Company, 2010) – especially as regards the New Zealand electricity sector (KEMA, 2007) – and helpful in decreasing CO_2 emissions (Chiari and Zecca, 2011; Socolow and Pacala,

2006). According to the World Energy Outlook (International Energy Agency, 2012), energy efficiency has the potential to achieve "huge gains for energy security, economic growth and the environment" (p. 2), and to halve the growth of primary energy demand by 2035. Raising energy efficiency requires a multi-pronged approach involving both technological improvements (e.g. more efficient production mechanisms and appliances), and the promotion of end-user efficiency and conservation (Socolow and Pacala, 2006). The latter might be achieved by encouraging individuals to reduce their own energy consumption, as well as to use existing technologies in the most efficient way, and adopt relevant new ones as they become available.

Promoting energy efficiency at a personal level requires a sound understanding of human behaviour (Lutzenhiser, 2008), based on an interdisciplinary effort drawing on aspects of psychology, sociology, economics, and politics (Keirstead, 2006; Wilson and Dowlatabadi, 2007). Previous research on energy behaviour has focussed almost exclusively on adults as energy actors and decision-makers. In contrast, relatively little is known about the energy consumption of children, despite the fact that it is they who will bear the brunt of the energy crisis (Boylan, 2008; Zyadin *et al*., 2012), and are the decision-makers of the future (e.g. DeWaters and Powers, 2008; Gambro and Switzky, 1999; Zografakis *et al*., 2008). To address this gap in current knowledge, this thesis explores how children use, and learn about energy (mainly electricity), whether they are aware of the socio-enviornmental impacts of its production, and whether, and how, they are trying to save it, through a case study of New Zealand households located in the southern city of Dunedin. The following sections will provide an overview of the energy situation in New Zealand and the case study area, as well as the role of children in household energy use.

1.1 New Zealand

New Zealand is an isolated country in the South Pacific Ocean with a comparatively small population of 4.4 million (Statistics New Zealand, 2013a). Per capita, the overall energy consumption of New Zealanders is 3,966.4 kgoe/a (kilogrammes of oil equivalent per year) – more than both the global average (1,819.2 kgoe/a; The World Bank, 2011) and that of the European Union (3,620 kgoe/a; European Commission, 2011). About half of the country's total energy needs are met by imported oil, which is used mainly for transport, followed by electricity, gas, renewable, and coal (Ministry of Economic Development, 2011). Most of the

electricity is derived from renewable sources (79%), particularly hydro and geothermal (Ministry of Business, Innovation and Employment, 2013; Parata, 2011).

Within New Zealand households, energy (mainly as electricity, coal, wood, and gas) is mostly consumed by space heating (34%), followed by water heating (29%), and general appliances such as computers (19%), refrigerators (10%), and lights (8%). Electricity accounts for 69% of the total New Zealand household energy consumption, and, besides all appliances, nationally powers roughly 75% of water heating and 25% of space heating – although both figures are considerably higher (92% and 46%, respectively) for the colder region of southern New Zealand, where Dunedin is located (National Energy Research Institute and University of Otago, 2008). Considered in isolation, the electricity consumption of New Zealand households (8,000 kWh) is 50% lower than those in the United Kingdom and 70% lower than in Canada, mainly because of lower levels of space heating. Nonetheless, residential demand is growing at an average of 1.5% per year (Energy Efficiency and Conservation Authority, 2009), and exceeds the amount of electricity currently produced from renewable sources, especially at peak times (Ministry of Economic Development, 2007). Because electricity accounts for the majority of the residential energy use of New Zealand, it forms the context of this research (objective 1, p. 8).

New Zealand has announced a responsibility target to reduce its greenhouse emissions by 10%–20% below 1990 levels by 2020, and 50% by 2050 (Ministry for the Environment, 2010). Since achieving this goal would be aided by reducing the amount of electricity generated from fossil fuels (coal and gas), the government furthermore intends that the contribution of renewable sources should increase to 90% by 2025 (Ministry of Economic Development, 2007). This provides a challenge, given the rising demand, as well as the considerable, weather-dependent fluctuations in the amount of electricity that can be generated by hydro power (Energy Efficiency and Conservation Authority, 2009). Energy efficiency and conservation may provide a partial solution, since reduced, or at least more slowly rising, levels of consumption will lessen the need to increase production, and hence facilitate the development of renewable sources to the point where they cover most of the country's electricity needs (National Energy Research Institute and University of Otago, 2008; Energy Efficiency and Conservation Authority, 2013c).

The government acknowledges the importance of moving society towards energy efficiency by "continual research, development and uptake of new, more efficient technologies and practices" (Ministry of Economic Development, 2010, p. 1). However, the introduction of energy efficient technology is not a straightforward process, owing to a complex system of

"vendors, installers, regulators, financiers, a long-lived built environment and technology stock, and a range of ideas (right and wrong) and motivations" (Lutzenhiser, 2008, p. 3). Likewise, the adoption of energy efficient practices is made difficult by the fact that most people use energy subconsciously to achieve a variety of services as part of their daily routines (Gram-Hanssen, 2010, 2013; Wilson and Dowlatabadi, 2007). Changing such behaviours often requires sacrifices in terms of effort, comfort, time, and money (Wilson and Dowlatabadi, 2007), and could be seen as contradicting values of abundance and freedom, as well as a social norm emphasising consumption as a symbol of status (Lutzenhiser and Gosard, 2000; Sovacool, 2009).

Given these challenges, it may not be surprising that, in their latest six-year report, the Energy Efficiency and Conservation Authority (2009) found that New Zealand's residential energy efficiency had improved by a mere 0.003% *per annum,* compared to a 1.4% increase across the entire economy. While such slow progress is discouraging, the promotion of both efficient technologies and behaviour change remain options well worth pursuing, with the latter in particular having the potential to increase energy efficiency by at least 20% (Underhill, 2010). To achieve such gains, it will likely be necessary to raise the 'energy literacy' (objective 2, p. 8) of the general population – that is, people's knowledge and understanding of energy issues and possible solutions, their attitudes towards energy efficiency and conservation, and their intention to engage in energy efficient practices (DeWaters *et al.*, 2007).

1.2 Dunedin

Dunedin is a city located on the south-eastern coast of New Zealand's South Island. With a population of 122,000, it is the major centre of the Otago region, and the second largest in the South Island (Dunedin City Council, 2013). The local economy is dominated by tourism, farming, and especially education, with staff and students of the University of Otago accounting for over 20% of the city's inhabitants (Statistics New Zealand, 2013b).

Dunedin has a cool temperate climate, with summer mean temperatures usually ranging from 9– 18°C and winter temperatures from 4–11°C (Otago Regional Council, 2003), thus making it one of New Zealand's coldest regions. Nevertheless, as in the rest of New Zealand, individual homes tend not to have central heating, and are often old, made of timber, and poorly insulated (French *et al.*, 2007). The typical daytime living room temperature during winter is 14.7^{o}C – below the New Zealand average (16 ^{o}C) (Isaacs *et al.*, 2010) and the

recommended comfort and health temperature of 20-25°C (French *et al.*, 2007). Heaters, mainly in the living room and sometimes the bedrooms, are generally only turned on once the occupants return home, and practices such as wearing extra layers of clothing inside the house, as well as using hot water bottles and electric blankets, are common. Houses are typically made of timber, and insulation standards have only been introduced relatively recently – hence many homes are poorly insulated (Isaacs *et al*., 2010). Thus, despite the low room temperatures, Otago (including Dunedin) and the neighbouring region of Southland record the highest use of energy for heating purposes in the country (French *et al.*, 2007). Dunedin is therefore a prime example of inefficiency in terms of space heating and poses the challenge of how to increase household temperatures to more acceptable levels without significantly increasing energy consumption (Energy Efficiency and Conservation Authority, 2013a).

1.3 Children

There are 1.8 billion children under 15 years of age in the world, comprising about 26.2% of the global population (Euromonitor International, 2010). Families with children constitute the most common type of New Zealand household (35.5%; Household Energy End-use Project, 2004), and over 21% of New Zealanders are children, as are 16.8% of the inhabitants of Dunedin (Statistics New Zealand, 2013b). Although traditionally regarded as passive and lacking a voice of their own, children are increasingly being understood as "competent social actors and contributors to their own lives and society" (Taylor and Smith, 2009, p. 17), i.e. as citizens with rights and obligations. Children are also widely recognised in their role as the future decision makers (Buway, 2007; DeWaters and Powers, 2008; Gambro and Switzky, 1999; Gram-Hanssen, 2005; Legault and Pelletier, 2000; Strickland *et al*., 1984; Zografakis *et al*., 2008; Zyadin *et al*., 2012), and for being the ones who will be most affected by the consequences of the energy crisis, climate change, and environmental degradation (Boylan, 2008; Zyadin *et al*., 2012). In addition, they are energy consumers whose decisions and actions affect current household energy usage, and who have the potential to influence their parents' environmental practices (Ekström, 2010; Garabuau-Moussaoui, 2011ab; Robinson *et al*., 2011; Zografakis *et al*., 2008).

Even though as evidenced, children are an important part of society, they are frequently overlooked in research (Cook, 2008; Larsson *et al*., 2010; Smith *et al*., 2000), including research on environmental practices (Clayton, 2012; Hall, 2011) and energy consumption

(Toth *et al*., 2013; section 2.3.2). This is especially unfortunate, since it is generally during childhood that the socialisation relating to electricity use actually happens (Garabuau-Moussaoui, 2011a). As they reach adolescence, children tend to lose interest in conserving power (Gram-Hanssen, 2005; Grønhøj and Thøgersen, 2012), only to pick it up again as independent adults, when they start to reincorporate the energy efficient behaviours they learnt when they were young (Garabuau-Moussaoui, 2011a). Environmental values, curiosity about the world, and energy awareness are also all largely formed during childhood (Garabuau-Moussaoui, 2011a; Harta and Nolanb, 1999; Kahn and Kellert, 2002; Trumper, 1993; Zografakis *et al*., 2008), and young children have been shown to acquire a positive and stable attitude towards environmental activities more easily than both teenagers and adults (Crano and Prislin, 2008; Eagles and Demare, 1999; Lieflaender *et al*., 2013), for example, through family and school (Kasapoğlu and Turan, 2008). Finally self-efficacy, i.e. the feeling that personal actions have an impact, also mostly develops at a young age (Harta and Nolanb, 1999; Kahn and Kellert, 2002). Together, these observations suggest that childhood is a critical period for developing energy efficient practices, attitudes, and knowledge.

Research on energy and children has generally focused on the formal education context, specifically in primary and secondary schools (DeWaters and Powers, 2008; Morrisey and Barrow, 1984; Solomon, 1992). Most previous studies have aimed to evaluate children's energy knowledge or acquisition of information in the context of science education, targeting mainly physics and, more recently, environmental education, including topics such as renewable energy sources, global warming, and peak oil (DeWaters and Powers, 2008; Morrisey and Barrow, 1984; Solomon, 1992). However, children mostly associate energy use with their activities at home (Toth *et al*., 2013), yet very little is known about the processes guiding the development of energy literacy (section 2.2.2), the socialisation of children into saving energy (section 2.8.2), and learning experiences outside school (section 2.4.2). Indeed, the role of children in household energy consumption has generally been treated as a side topic (Larsson *et al.*, 2010), and has so far not been explored in New Zealand (objective 3, p. 8).

Although children have the potential to be agents of social and environmental change (Easterling *et al.*, 1995; Taylor and Smith, 2009), "the extent to which, and how, they actually do influence their family in connection with environmental issues is somewhat uncertain" (Grønhøj, 2006, p. 501; objective 4, p. 8). Several studies have found that children involved in environmental programmes in schools sometimes adopt environmental activities (e.g. recycling, composting, gardening) and practice them at home, often involving their families

(section 2.9.3). Indeed, there is even evidence of students making explicit efforts to influence their family's environmental behaviour (section 2.9.1). However, little is known about the processes that allow such environmental practices to be transferred to the household environment (Larsson *et al*., 2010; Palmer, 1998). Despite the explicit statement by Larsson *et al*., (2010, p.140) that "children's influence must be studied in context to depict the factors that determine their negotiation strategies and influence on family decisions", studies outside the school context remain rare – although the past decade in particular has seen a notable increase in research effort in this area (Grønhøj, 2006, 2007; Grønhøj and Thøgersen, 2007; Garabuau-Moussaoui, 2011a; Gram-Hanssen, 2005; Toth *et al*., 2013). Nevertheless, so far only one author (Garabuau-Moussaoui, 2011a) has specifically focussed on children of primary school age.

1.4 Rationale

Society needs to become more energy efficient in order to ameliorate the effects of an impending energy crisis, and to reduce the CO_2 emissions causing climate change (Socolow and Pacala, 2006). Understanding people's attitudes and behaviour is crucial to changing energy practices (Stern, 1977). Children are an important part of the population: they are energy consumers, agents of social change within their families, and the future decision makers (Garabuau-Moussaoui *et al*., 2009; Grønhøj, 2006; Schlossberg, 1992). In addition, childhood presents a unique window of opportunity for socialising people into energy conservation and awareness (Garabuau-Moussaoui, 2011a).

This thesis aims to explore children's energy use in the household context by investigating the topic from the perspective of both the children and their parents/caregivers[1]. In doing so, it explores important questions regarding environmental practices, particularly energy conservation, with potential implications for policy making, such as: how are energy-related knowledge, attitudes and behaviours formed, and how do they evolve through life? When is the best time to encourage energy saving practices? How stable are energy-related attitudes and behaviours formed during childhood? And to what extent school can have a long-term influence on such practices and related values? A better understanding of the role of children in household energy use will help to evaluate their potential as agents of social change in this regard, and to develop better policies, education, and media to guide them into becoming

[1] In some cases, the main caregiver or legal guardian (not the parent) took part in the study. However, both of them are here referred to as parents so as to preserve their anonymity (section 3.3.2)

energy efficient citizens in the future. Finally, this thesis will contribute to an underdeveloped body of research on children's energy consumption, and add to the fields of family environmental practices and the role of children as citizens.

1.5 Objectives

The general objective of this thesis is to identify and understand the factors influencing children's electricity use in New Zealand households, and to assess their potential to encourage their families to adopt energy efficient practices. In addition to any other relevant factors emerging from this research, the thesis will specifically explore:

1) Children's electricity use in the household and particular electricity saving behaviours.
2) Children's energy literacy: knowledge, attitudes, and intended behaviour.
3) The role of family interactions and dynamics (especially parental influence) in socialising children into saving electricity and developing their energy literacy.
4) The potential of children to convince their families to adopt electricity saving behaviours.

Since both the concept of energy literacy (DeWaters *et al*., 2007) and the theory of planned behaviour (Ajzen, 1991) indicate that actions arise from a combination of relevant knowledge, attitudes and intentions, a combination of these basic principles will be used to explore children's energy saving practices (Fig. 1.1; sections 2.2.1, 2.2.2). Ultimately, this thesis seeks to identify the conditions that allow children to develop all of the constituent components of these constructs, and the circumstances in which such conditions may (or may not) be met.

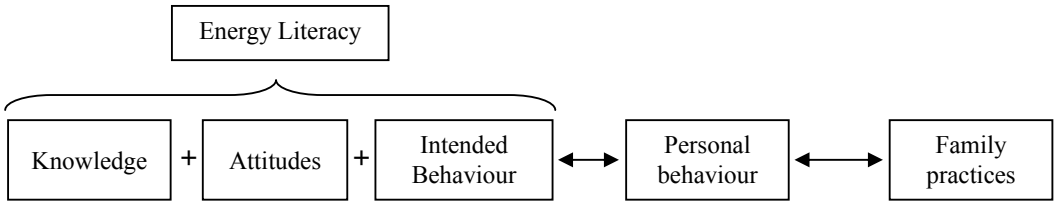

Figure 1.1. Approach to the research

The particular focus of the study is on the electricity use of nine and ten-year-olds (attending Year 5 in school), since children of this age are likely to be near the end of their socialisation into using electricity (Garabuau-Moussaoui, 2011a), are capable of having a structured conversation and clearly expressing their ideas (Curtin, 2001; Kennedy *et al*., 2001), and have completed most of the primary education system, while still not yet being adolescents (Berk,

2001). Behaviours chosen *a priori* for investigation include shower times and the use of heaters, owing to space and water heating accounting for most of New Zealand domestic electricity consumption (National Energy Research Institute and University of Otago, 2008), and switching off lights, TVs, gaming devices and computers, since these are the energy saving behaviours most accessible to children.

1.6 Outcomes

The results of this research will have immediate implications for energy policy, education, child rearing, and the media, and will be distilled into a series of recommendations on how to involve children in the national effort to increase energy efficiency. At the same time, this study will contribute to the development of methods targeted at understanding children and their daily lives. Specifically, this thesis will provide ideas for future studies on educational activities related to energy literacy, suggest how children's potential to create a more energy efficient society can be realised, and provide a baseline summarising the current role of children in household energy consumption for future and international comparison.

1.7 Structure of the Thesis

This thesis will start with a review of the current literature (Chapter 2) summarising key psychological and sociological concepts and theories, as well as previous research on factors influencing household energy consumption, including the role of children. Chapter 3 outlines and explains the methodological framework, data collection and analysis techniques, and discusses the validity, reliability and limitations of this study. This is followed by a detailed description of the field work and analysis protocols, as well as the main characteristics of the participating schools, families, and households.

The results are divided into five different chapters, each of which discusses specific findings and compares them to previous research. Chapter 4 introduces the electricity saving behaviours that children perform regularly at home, and highlights the importance of children having control over appliances. This is followed in Chapter 5 by a description of the children's socialisation process into saving electricity (e.g. through habits, modelling behaviour, and rules) and associated family dynamics. Chapter 6 explores the children's energy literacy: after first describing the state of their relevant knowledge (e.g. financial cost

of power, processes and socio-environmental impacts of energy production and consumption), the chapter moves on to the nature and development of the children's attitudes towards energy efficiency and conservation, and concludes by investigating their conscious and intended efforts to save power. The potential of children to act as agents for social and environmental change is analysed in Chapter 7, based on actual examples of the children's agency, negotiation processes with their parents, and the school-to-home transfer of knowledge, attitudes and behaviours. Finally, Chapter 8 integrates data from all parts of the analysis in a comprehensive multiple correspondence analysis, clustering the families into distinct groups based on their energy-related characteristics.

Chapter 9 summarises the key results in an overarching model, provides a general discussion of the main factors guiding children's energy saving behaviours, compares the results of this research with those of previous studies, and discusses their contribution to established theory. Finally, the thesis concludes (Chapter 10) by explaining the relevance and applicability of the present findings, and suggesting topics for future research.

Chapter 2

Literature Review

This chapter introduces the key disciplines relevant to the study of children's energy consumption, explores theoretical frameworks, and identifies gaps in existing knowledge. The chapter starts by presenting concepts related to energy efficiency and highlights the importance of behaviour change in improving it, before moving on to general theories explaining behaviour and attitudes. Following this, the chapter is based on the structure of Fig. 1.1, focussing first on energy literacy and the theory of planned behaviour, as well as a review of each of their key elements: behaviour, attitudes, self-efficacy, and knowledge (including formal and informal education). All of these elements are then further explored within a more sociological framework based on everyday life. Next, the family context is discussed in terms of the importance of childhood and the ways in which children are socialised into particular behaviours and rationales. The chapter concludes with a review of children's potential agency, including topics such as children's citizenship and school to home transfer.

Table 2.1 Summary of the research fields relevant to this thesis, as applicable to the broad topics of energy, children, and the household/family

Field of study		Energy	Children	Household/ Family
Education	Education for sustainability	✓	✓	
	Science Education	✓	✓	
Marketing	Children's consumption		✓	✓
	'Green' consumption	✓		✓
Sociology	Microsociology: family interactions			✓
	Sociology of childhood		✓	✓
Social Psychology	Behaviour	✓		
Environmental Sciences (context)		✓		

2.1 Energy Conservation

Energy efficiency is "using less energy to produce the same amount of services or useful output" (Patterson, 1996), whereas the terms "curtailment" or "saving" refer to lowering overall energy consumption by limiting the use of appliances (Kempton *et al*., 1992). Whereas increasing energy efficiency is often achieved through one-off purchases of suitable

appliances (Abrahamse *et al*., 2005), and thus considered to be mostly the domain of adults, children can actively perform curtailment behaviours, such as turning off lights or having short showers. Both energy efficiency and curtailment are forms of energy conservation (Kempton *et al*., 1992), i.e. "managing and restraining the growth in energy consumption" (International Energy Agency, 2013, p. 1). In the context of this thesis, nuances between these concepts are of little relevance, and the terms energy "efficiency", "saving" and "curtailment" are used to denote energy conservation in general, unless stated otherwise. Most of the findings of this study relate to electricity use, popularly also referred to as "power", as it is the most common source of energy in New Zealand households; however, in a few cases, energy services generated by gas (e.g. showers and stoves) are also included.

2.2 Understanding Energy Behaviour

Understanding behaviour is crucial in promoting the adoption and proper use of energy efficient technologies, as well as encouraging people to diminish their overall consumption of energy and reduce the number of appliances they own (Gram-Hanssen, 2013; Kempton *et al*., 1992). Social research aiming to understand energy consumption only started to appear following the oil shortages of the 1970s (Dholakia *et al.*, 1983; Kempton *et al*., 1992; Lutzenhiser, 1993), with the most commonly studied topics including:

> behaviour and variability in consumption; public opinion and conservation attitudes; price and information; billing and rates; consumer knowledge and the social contexts of consumption; micro-behavioural studies of actor-building-technology systems; and the macro-social organization of energy use (Lutzenhiser, 1993, p.248).

The complexity of energy behaviour and its importance to energy conservation strategies have given rise to an ongoing need to employ different approaches in its study (Lutzenhiser, 1992; Gram-Hanssen, 2010). However, most of the existing theories and models of behaviour are generic, with but a few focussing on pro-environmental behaviour, and even fewer dealing specifically with energy-related behaviours. Furthermore, even though energy awareness largely develops during childhood (DeWaters *et al*., 2013), none of them apply to children in particular (Darnton, 2008; Pelletier *et al*., 2011; Wilson and Dowlatabadi, 2007). These models and theories span fields as wide-ranging as economics, behavioural economics, technology adoption theory, attitude-based decision making, social and environmental psychology, and sociology (Wilson and Dowlatabadi, 2007). Models focussing on either social-environmental psychology or sociology are likely more applicable to children than

those based purely on economics: first, because the potential contribution of children to energy conservation is related to their everyday behaviours, rather than the purchase of efficient appliances; secondly, because children's economic experiences usually focus on the use of pocket money for their own purchases (Furnham, 1996; McNeal, 1999), as they do not have the responsibility to pay household bills; and finally, because their understanding of economy concepts such as taxes, profit, and the difference between buying and selling prices is fairly limited (Furnham, 1996). Thus, purely economic models based on the price of electricity and energy efficient appliances are unlikely to have a direct effect on children's energy saving behaviours. Nevertheless, children can understand that there may not be enough money to pay the bills (Furnham, 1996), and the financial concerns of the parents can still affect them, thus exerting an influence on their attitudes and behaviours (Webley and Nyhus, 2006).

Many behavioural models strive to find out "what determines an individual's ecological [i.e. pro-environmental] behaviour" (Kaiser *et al*., 1999, p.1) by drawing on independent variables such as values, attitudes, norms, skills, and capabilities (Wilson and Dowlatabadi, 2007). Most of the latter are integrated in the theory of planned behaviour (Ajzen, 1991), sometimes interpreted as a type of information deficit model, which proposes that environmental knowledge creates a positive attitude towards the environment and leads to pro-environmental behaviour (Burgess *et al*., 1998). Although more recent research has criticised this assumption of linearity, and shown that knowledge frequently does not lead to behaviour change (section 2.3.7), the constituents of the theory of planned behaviour are relevant to research focussing on children and energy, which is currently centred on environmental education (e.g. Table 2.2). Thus, for instance, the generally accepted definitions of environmental literacy and energy literacy are based on knowledge, attitudes, and behavioural components (DeWaters *et al*., 2007).

However, rational and attitudinal approaches to household energy consumption have been challenged on the grounds that there is a need to move beyond a focus on the individual (Lutzenhiser, 1992), and to incorporate the "social, cultural and technical determinants of energy demand embedded in routine behaviour" (Wilson and Dowlatabadi, 2007, p.190). Microsociological approaches to everyday practices, focusing on collective social and physical structures, as well as practice theory[1], are a "promising approach" (Gram-Hanssen 2013, p. 449), since they include the poorly researched "repetitive, unconscious, routine

[1] For an example of energy consumption research based on practice theory see Gram-Hanssen (2013), and the studies of Garabuau-Moussaoui (2011ab).

aspects of household energy consumption" (Gram-Hanssen, 2010, 2013). Another, more interdisciplinary, alternative is provided by the energy cultures framework (Stephenson *et al*., 2010a), which examines "the interactions between cognitive norms (e.g. beliefs, understandings), material culture (e.g. technologies, building form) and energy practices (e.g. activities, processes)" (p. 6123-6124).

To date, very little is known about children's energy use, with no published model specifically aiming to explain it. Drawing on the diverse range of previous research, this thesis therefore integrates elements from different models and disciplines, namely, the definition of energy literacy, theory of planned behaviour, and concepts related to everyday practices, all of which are explained below.

2.2.1 Energy Literacy

The term 'energy literacy' has been used since the 1970s to describe people's general knowledge and understanding of energy issues (Matthews, 1978; Morrisey and Barrow, 1984), and, since the 1980s, both their knowledge and positive attitude towards energy conservation and renewable energy sources (Lawrenz, 1988). Over time, the emphasis has shifted from the acquisition of knowledge towards the potential of using that knowledge (Solomon, 1992). DeWaters *et al.* (2007) developed a more structured definition based on environmental and technological literacy, which conceptualises energy literacy as "citizenship understanding" (DeWaters *et al,*. 2013) comprising cognitive (knowledge, understandings, skills), affective (sensitivity, attitudes) and behavioural (intentions, involvement, action) domains (DeWaters *et al.*, 2007; DeWaters and Powers, 2013). Overall, an energy literate person:

- has a basic understanding of how energy is used in everyday life;
- has an understanding of the impact that energy production and consumption have on all spheres of our environment and society;
- is sensitive to the need for energy conservation and the need to develop alternatives to fossil fuel-based energy resources;
- is cognizant of the impact of personal energy-related decisions and actions on the global community; and
- strives to make choices and decisions that reflect these attitudes with respect to energy resource development and energy consumption (DeWaters *et al*., 2007, p.3).

All of the above characteristics are explored in this study, specifically in relation to electricity consumption in the household by children. Knowledge, attitudes and intended behaviour are the key elements of energy literacy, and broadly overlap with the main components of the theory of planned behaviour (Fig. 2.1). In addition, energy literacy provides an excellent starting point for structuring this thesis owing to its frequent use in research focusing on children and youth (Table 2.2).

Table 2.2 summarises the international (Australia, Canada, Finland, Korea, Malaysia, Taiwan, UK and USA) energy literacy research conducted on children attending primary and secondary schools. Note that this table excludes studies focusing solely on one of the variables of energy literacy (such as Garabuau-Moussaoui, 2011a; Kuhn, 1979; Robinson *et al*., 2011; Zografakis *et al*., 2008), as well as papers concerned primarily with academic achievement or the broader fields of environmental knowledge, attitudes and behaviour (Ayers, 1977; DeWaters and Powers, 2008; DeWaters *et al.*, 2013).

Table 2.2 Energy literacy studies according to their methodology and children's age

School level	**Primary school**	**Middle and Secondary School**
Approx. age	6-11	12-18
Quantitative	Ayers (1977) Coffey (1981) Morris and Jensen (1982) Lawrenz (1988) Hanson (1993) Boylan (2008) Chen (2011)	Kuhn (1979) Morris and Jensen (1982) Sudderth (1984) Davis (1985) Lawrenz (1988) Barrow and Morrisey (1989) Halder *et al.* (2011) DeWaters and Powers (n.d.; 2008, 2011ab) Zyadin *et al*. (2012) DeWaters *et al*. (2013) Bodzin *et al*. (2013) Lay *et al*. (2012, 2013)
Qualitative	Solomon (1992) Huang *et al.* (2012) Toth *et al.* (2013)	Solomon (1985, 1992) Huang *et al.* (2012) DeWaters and Powers (n.d., 2011b) Toth *et al*. (2013) Tsai *et al*. (2013)

This summary highlights the relative dearth of studies on the energy literacy of children of primary school age, as previously pointed out by Boylan (2008), Lawrenz and Dantchik (1985), Newborough *et al*. (1991), and Rickinson (2001). In addition, most of the existing

studies on energy literacy are quantitative, and all of them (except Toth *et al*., 2013) are based on educational programmes set by schools, with the home context generally being excluded. Unlike their quantitative counterparts, which are mostly aimed at testing hypotheses, qualitative studies present an opportunity to explore the processes underlying the children's energy literacy, and provide a better way to assess the strength and variety of attitudes and behaviours (DeWaters and Powers, 2013; DeWaters *et al*., 2013; Halder *et al*., 2011; Larson *et al*., 2011). This thesis aims to address some of these gaps in current knowledge by studying primary school children from New Zealand, using a primarily qualitative approach largely focussed on the household context. Within New Zealand, previous studies (e.g. Gilbert *et al*., 1982; Osborne and Gilbert, 1980) have established the local field of science education research, but so far have concentrated on children's acquisition of scientific concepts, rather than attitudes or behaviours. To date, there are no published studies on the energy literacy of New Zealand children.

2.3 Key Concepts of Social Psychology

The following section explains the theory of planned behaviour and its similarities with the definition of energy literacy. It then provides a description of the main concepts used in this thesis, as well as a summary of the research in each field with regards to children (ranging from 6–18 years, according to UNICEF, 2013) and energy consumption, especially electricity.

2.3.1 The Theory of Planned Behaviour

The theory of planned behaviour was designed "to predict and explain human behaviour in specific contexts" (Ajzen, 1991, p. 181) based on the theory of reasoned action (Fishbein and Ajzen, 1975), but with the addition of a perceived behavioural control element. Attitudes arising from evaluative beliefs about the behaviour and its outcomes, which are themselves influenced by information or knowledge, form the central part of the theory (Fishbein and Ajzen, 1975). There they interact with the subjective norm, i.e. the opinion of significant others on the behaviour, as well as the persons' motivation to comply with that norm. Together with perceived behavioural control, which represents the person's judgment on how difficult it is to perform the behaviour, the attitude and the subjective norm create an intention, which then leads to the actual behaviour (Ajzen, 1991; Fig. 2.1; see sections 2.3.2,

2.3.3, 2.3.5 and 2.3.6 for further details on knowledge, attitudes, perceived behavioural control, and behaviour).

Many studies, especially on health and pro-environmental behaviour, have found this theory helpful in explaining 27% to 39% of the variance in behaviour (Wilson and Dowlatabadi, 2007), with attitudes being especially important in predicting, and thus understanding, particular actions (Kaiser *et al*., 1999). However, a study on the energy consumption of college students using the older theory of reasoned action (Fishbein and Ajzen, 1975) found that the omission of external practical circumstances from this model prevented it from accurately predicting the students' behaviour, even though some elements, such as knowledge and behavioural intention, correlated with consumption (Stutzman and Green, 1982). Although the theory of planned behaviour could potentially account for those external circumstances through the inclusion of perceived behavioural control, this approach has generally not been used in energy consumption research (Wilson and Dowlatabadi, 2007).

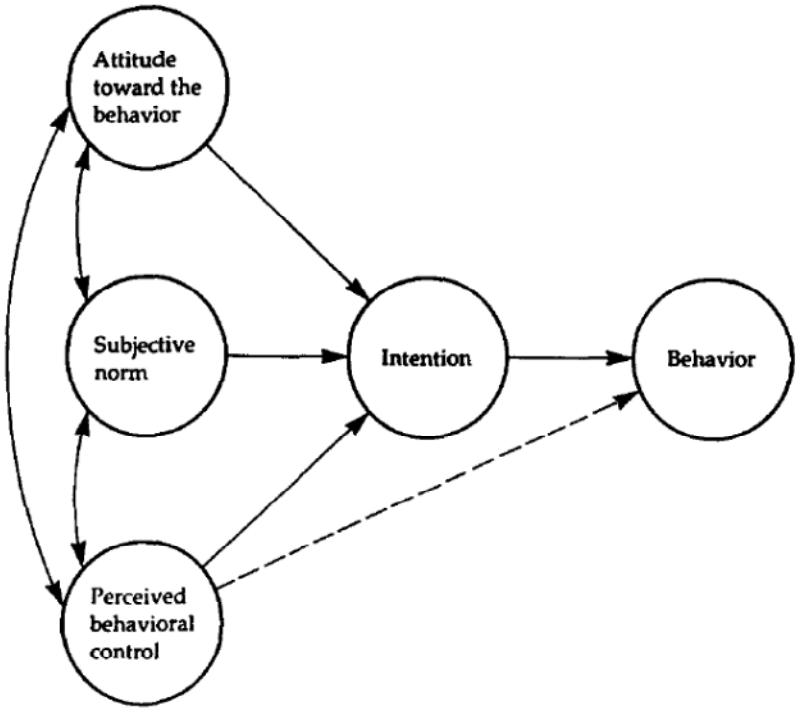

Figure 2.1 Theory of Planned Behaviour (Ajzen, 1991, p. 182)

The present study uses the theory of planned behaviour as a starting point to explore attitudes, perceived behavioural control (self-efficacy), subjective norms (parents' attitudes towards energy saving behaviours), and intended behaviour in relation to children's energy consumption, owing to (1) its wide use in predicting pro-environmental behaviour (Wilson and Dowlatabadi, 2007); (2) its elements representing some of the core concepts of social

psychology (section 2.3; Ajzen, 1991; Kaiser *et al*., 1999); and (3) its close resemblance to energy literacy (section 2.2.1). The theory of planned behaviour (Ajzen, 1991) is general to all behaviours, and has both more elements (subjective norm, perceived behavioural control) and a more complex structure than the definition of energy literacy. It also features a directional series of individual steps, with knowledge affecting attitudes, and attitudes leading to intended behaviour, whereas in energy literacy the order in which knowledge, attitudes, and intended behaviour are formed is not particularly relevant. However, both the theory of planned behaviour (Ajzen, 1991) and the definition of energy literacy (DeWaters *et al.*, 2007; DeWaters and Powers, 2013) consider knowledge, attitudes and intended behaviour to be necessary prerequisites for actual (energy saving) behaviours.

2.3.2 Behaviour

According to Fishbein and Ajzen (1975, p. 13) a behaviour is an "observable act" while a practice is "regularity in activities" or "a socially sustained activity" (Gherardi, 2009, p. 546). In other words, whereas the term 'behaviour' is used to describe an individual act, the existence of a 'practice' implies that a particular behaviour is repeated several times, thus becoming customary. However, both terms have very similar meanings, and are used interchangeably with regards to energy use both colloquially and in the literature (Gram-Hanssen, 2013). This pattern will therefore be followed throughout this thesis.

Previous research has shown that a change of behaviour can reduce household energy consumption by up to 22%, and electricity use by up to 19% (Abrahamse *et al*., 2005). Most daily household activities (e.g. cooking, working, cleaning, or heating the home) have the potential to accommodate energy saving behaviours[1] (see U. S. Department of Energy, 2010 and Energy Efficiency and Conservation Authority, 2013b for specific examples). Such behaviours generally manifest themselves either as individual investments with long-term effects, such as purchasing an energy efficient fridge, reducing the temperature of the hot water cylinder, or installing insulation; or in the repeated curtailment of energy consumption when using appliances or related infrastructure, such as turning off lights, or closing curtains.

In New Zealand, the most commonly installed energy efficient technologies include efficient light bulbs, fridges, washing machines, heat pumps, and insulation (Bond, 2012; Mirosa *et al*., 2011). In addition, many New Zealanders tend to turn off lights, dry laundry on the line, wear

[1] The types of energy saving behaviours that may arise are specific to the cultural context, the climate, and the existing infrastructure.

extra layers instead of turning up the heating, open windows instead of using air conditioning, do dishes by hand, fully load the washing machine before use, reduce the heating in unoccupied rooms, and generally keep the heating at a low level (Bond, 2012; Mirosa *et al*., 2011). By contrast, taking short showers, turning off appliances at the wall, washing hands and dishes in cold water, insulating heating pipes, and reducing the hot water temperature, as well as installing small refrigerators, double glazing, and water efficient shower heads are considerably less frequently undertaken (Bond, 2012; Mirosa *et al*., 2011). Children can be more easily involved in energy saving practices related to energy curtailment than in behaviours involving the purchase of efficient technology (Garabuau-Moussaoui, 2011a). However, their potential to save energy is generally limited to turning off appliances and lights in their own room and, as they get older, in common areas, such as the living room and kitchen (Garabuau-Moussaoui, 2011a).

Children's energy saving behaviours

As with adults, several studies have found that turning off lights is by far the most common electricity saving behaviour amongst children (DeWaters and Powers 2008, 2011a; Ivy *et al*., 1998; Rickinson, 2001; Solopova, 2008; Toth *et al*., 2013), likely owing to its high "visibility" (Newborough *et al*., 2011; Sovacool, 2009), whereas having short showers is much less common (DeWaters and Powers 2008, 2011a; Ivy *et al*., 1998; Solopova, 2008). Children aged around ten sometimes turn off, and even unplug, the television and DVD player (Garabuau-Moussaoui, 2011a; Robinson *et al.,* 2011; Toth *et al*., 2013), and girls of the same age sometimes air dry clothes on the line, as well as air dry dishes in the dishwasher (Robinson *et al.,* 2011). Many children also cook simple meals like their own breakfast (Garabuau-Moussaoui, 2011a), but there is no information as to whether they try to save energy whilst doing so.

When children consciously adjust their behaviour to reduce energy use, they generally focus on their energy consumption at home, while not feeling responsible for what they use at school (Toth *et al*., 2013). A study in Denmark showed that despite having a generally more positive attitude towards environmental conservation than the older generations, the willingness of young people to engage in environmental behaviours has diminished over the past few decades, and is now lower than that of their parents (Grønhøj and Thøgersen, 2009, 2012). Saving electricity in particular seems to be even less common among children than other environmental behaviours (Grønhøj and Thøgersen, 2012). Thus, teenagers in Denmark use about 20% more electricity than the average adult owing to increased amounts of laundry,

as well as their heavy use of information and communication technology (Gram-Hanssen, 2005). However, many of these teenagers adopt more energy saving behaviours once they take responsibility for their own power bills (Toth *et al*., 2013). Primary school children also own a plethora of electrical devices, and often have them all running at the same time, but their energy consumption is generally rather poorly understood (Garabuau-Moussaoui *et al*., 2009).

Owing to the limited number of relevant published studies, there is no generally accepted baseline for how many electricity saving behaviours one might normally expect children to perform (Toth *et al*., 2013). Most children are aware that many of their daily activities consume electricity (see studies in Table 2.2); yet, in surveys on energy literacy, they often achieve higher scores for energy saving behaviours than for knowledge (DeWaters and Powers, 2008), with their behaviour score still being far below the maximum possible (DeWaters and Powers, 2011a; Kasapoğlu and Turan, 2008). Both awareness of electricity use and willingness to reduce the latter seem to be lower in teenagers than in primary school children (DeWaters and Powers, 2011a). This indicates that the first ten years of childhood may be a particularly good time to create energy saving practices (Garabuau-Moussaoui, 2011a), although doing so need not necessarily involve the development of a conscious effort (Newborough *et al*., 1991). Instead, habits involving energy saving behaviours can be developed through modelling or extrinsic motivations (e.g. rules and positive reinforcement) (Grønhøj and Thøgersen, 2009; Garabuau-Moussaoui, 2008; Gram-Hanssen, 2010) and subsequently become internalised (Kochanska and Aksan, 1995), with energy consciousness often being acquired at a later stage (Garabuau-Moussaoui, 2011a).

Behavioural intention

Behavioural intention refers to a person's willingness to act based on forethought and a planned course of action (Bandura, 1989), and thus provides the potential to predict behaviour depending on the situational context and the combination of attitudes triggering it (Fishbein and Ajzen, 1975). Because behavioural intention is defined in terms of willingness and forethought, energy saving behaviours performed unconsciously (i.e. without being aware of their implications), or in response to external pressure, do not include an intentional component. For the purpose of this study, intended behaviour is understood as a person's "willingness to take part in the solution" to a further extent, and via specific actions, after acknowledging the existence of energy problems (DeWaters and Powers, 2013, p.45).

According to previous research, such willingness exists in 58% (Lay *et al.,* 2013) to 79% (DeWaters and Powers 2008) of teenagers, who stated that they would do more if they knew how. Otherwise, however, the intentions of children to engage in energy saving behaviours are poorly understood.

2.3.3 Attitudes

Attitudes can be defined as a "learned predisposition to respond in a consistently favourable or unfavourable manner with respect to a given object" (Fishbein and Ajzen, 1975, p.10). Attitude is one of the most important concepts in social psychology (Fishbein and Ajzen, 1975), and also the best studied in relation to children and energy (e.g. Ayers, 1977; Chen, 2011; DeWaters and Powers, 2008, 2011b; Kasapoğlu and Turan, 2008; Kuhn, 1979; Lawrenz and Dantchik, 1985; Lay *et al*., 2013; Solopova, 2008; Zydain *et al*., 2012), yet only explains a small percentage (9.7%) of the variance in the energy literacy of teenagers (DeWaters *et al*., 2013). Nevertheless, understanding attitudes is important, as they may lead to faster, easier, and sometimes "better" decision making (Baumeister and Bushman, 2013).

Attitudes are at the centre of a wide range of research (e.g. heuristics, attitude formation, attitude change, attitude stability, attitude accessibility, persuasion, cognitive consistency, decision making), and only the concepts most relevant to this thesis will be briefly touched upon here. The main part of an attitude is its emotional, or affective, component (e.g. feelings, motivations, or desires; Fishbein and Ajzen, 1975), which is complemented by a latent readiness to take action (Vaughan and Hogg, 2010). Although sometimes linked to personality, attitudes are mostly acquired through learning, and often depend on the available information about the object they are directed towards (Aronson *et al*., 1999). For instance, in one study children showed their attitude towards the looming energy crisis by commenting that we are using fossil fuels too fast, and must save energy (Solomon, 1992).

Attitude formation

Children acquire most of their attitudes from their parents (e.g. Grønhøj and Thøgersen, 2012) and the media, although peer groups (Hogg and Vaughan, 2011) and school also play an important role (Krech and Crutchfield, 1948). Parents in particular often unconsciously act as mediators for attitudes resulting from cultural influences (Grønhøj and Thøgersen, 2012; Krech and Crutchfield, 1948), although the ultimate adoption of these attitudes depends on the

home situation, as well as the importance that the child places on the underlying factors (e.g. values and beliefs) guiding them (Krech and Crutchfield, 1948).

Attitudes can be formed in several (often overlapping) ways, all of which commonly occur during childhood:

a) Mere exposure, i.e. an increase in familiarity with an everyday object or behaviour by simply being exposed to it on a regular basis. The more familiar the object becomes, the more favourable the attitude towards it (Breckler *et al*., 2006).
b) Classical conditioning, which occurs when a stimulus triggering an emotion is mentally associated with a neutral stimulus through being repeatedly experienced at the same time (Aronson *et al*., 1999).
c) Operant conditioning, in which positive or negative reinforcement of a particular behaviour leads to the formation of a corresponding attitude towards it (Aronson *et al*., 1999).
d) Social learning, involving cognitive inferences (and subsequent attitude formation) based on imitation and/or observations of the outcome of a particular behaviour as experienced by others (Vaughan and Hogg, 2010).
e) Self-perception, in which behaviours performed frequently without a clear underlying reason are interpreted to be positive. Although attitudes formed in this way are positive, they tend to be weak (Vaughan and Hogg, 2010).
f) Cognitively based attitudes, which are formed through the appraisal of information available about an object. The object is then classified according to the rewards and punishments it can provide. Cognitively based attitudes are commonly associated with utilitarian objects (Aronson *et al*., 1999), such as energy efficient appliances.
g) Cognitive dissonance, arising from a mismatch between an existing attitude and the actual behaviour it relates to. The psychological discomfort caused by this conflict leads to a change of either the attitude or, less commonly, the behaviour (Baumeister and Bushman, 2013). In some cases, the attitude must be changed owing to external conditions driving the behaviour, or because of forced compliance, such as rules set by parents (Fishbein and Ajzen, 1975; Wilson and Dowlatabadi, 2007).

As shown above, attitudes can be formed without much deliberate thinking (Vaughan and Hogg, 2010), with even two-year-old children being able to differentiate between good and bad to some extent (Baumeister and Bushman, 2013). Nonetheless, in order for an attitude to arise, the object it attaches to must exist in a person's psychological world (Krech and Crutchfield, 1948): if a child has never thought about his energy consumption, he cannot have

an attitude towards it. Attitudes (especially cognitive-based ones) are therefore largely dependent on the ability to create and generalise connections, which is still developing in children (Piaget, 1977; section 2.7.1). This means that children's attitudes tend to be weaker than those of adults (Hogg and Vaughan, 2011), thus making children more prone to changing their outlook, before their attitudes grow stronger and more stable later in life (Crano and Prislin, 2008; Eagles and Demare, 1999; Lieflaender *et al*., 2013). Thus, guiding children towards positive environmental attitudes seems to be more successful in primary school than during the last years of high school, owing to those attitudes stabilising after an initial phase of change and development (Eagles and Demare, 1999). Similarly, children below the age of eleven acquire and sustain environmental attitudes based on environmental education to a significantly greater extent than 13-year-old students (Lieflaender *et al*., 2013).

Attitudes acquired through either social learning or conditioning, in particular, tend to provide a stable basis for future behaviour (Baumeister and Bushman, 2013). Once obtained, strong attitudes tend to preserve themselves through polarisation (Krech and Crutchfield, 1948), i.e. strengthening of the attitude by reflecting on it or defending it (Baumeister and Bushman, 2013). This process may occur after children acquire environmental attitudes by being exposed to them through the media or conversations with their parents (Eagles and Demare, 1999). The stronger an attitude, the more readily accessible it is to the mind, and the more quickly it is expressed, thus making the actual behaviour more likely to be consistent (Aronson *et al*., 1999). In addition, stronger attitudes are more likely to drive behaviour change through a need to reduce cognitive dissonance (Baumeister and Bushman, 2013).

Attitudes and behaviours can arise from either external stimuli, such as rules, rewards, punishments and expectations, or internal stimuli, e.g. personal beliefs (Fishbein and Ajzen, 1975), which are often related to personality (Krech and Crutchfield, 1948). Externally driven attitudes are generally unstable, and tend to disappear once the stimulus that triggered them ceases (Fishbein and Ajzen, 1975). However, occasionally they can also be internalised, and thus become part of a person's character. While environmental attitudes should thus be guided by intrinsic values such as altruism, extrinsic motivations can be useful if they are framed to promote the internalisation of the underlying environmental values (Pelletier *et al*., 2011). In reality, financial concerns and incentives, both of them representing extrinsic motivations, are major drivers of energy saving attitudes (Wilson and Dowlatabadi, 2007), and the main reason for people in New Zealand to save energy (Mirosa *et al*., 2010), although environmental rationales also seem to play an important role (Mirosa *et al*., 2013).

Besides financial and environmental concerns, there are a variety of other possible reasons to engage in energy saving behaviours, such as feeling capable (e.g. being effective or efficient), following traditions, being intelligent about energy use, helping the welfare of others, and gaining social recognition (Lawson *et al*., 2010), as well as having a frugal attitude or lifestyle (Fujii, 2006). Frugality is a "trait characterized by the degree to which consumers are both restrained in acquiring and in resourcefully using economic goods and services to achieve longer-term goals" (Lastovicka *et al*., 1999, p.88). A representative survey of New Zealand found that a large proportion of the population (48%) has high levels of frugality (Todd and Lawson, 2003). Similarly, studies in Japan and France have found that many people are motivated to engage in energy saving practices in order to avoid waste in general, thus showing a frugal attitude towards their energy consumption (Garabuau-Moussaoui, 2011a; Fujii, 2006). Frugality is related to environmental practices (Fujii, 2006; Todd and Lawson, 2003), because it coincides with the goal of reducing the consumption of natural resources. However, environmental motivations are rooted in concern about the consequences of particular behaviours (e.g. climate change, pollution), whereas frugality is more concerned with the wasteful use of the resources themselves (Fujii, 2006). Frugality also coincides with the goal of reducing economic cost, although this interest is not borne out of financial constraint so much as the will to restrain immediate gratification to achieve long-term goals (Todd and Lawson, 2003).

Children's attitudes towards energy conservation and renewable sources

The studies reviewed in this section cover over 35 years of research, and possibly reflect a change in children's attitudes over time. However, because of the different methodologies, geographical settings and age groups, as well as changes in the availability of energy resources, the type of public discourse, and the social and economic situation at different points in history (Garabuau-Moussaoui, 2011a), it is not possible to discern a clear pattern. Although they do not consider it a priority (Gram-Hanssen, 2005; Toth *et al*., 2013), children have a generally positive attitude towards energy conservation and renewable sources (Ayers, 1977; Chen, 2011; DeWaters and Powers, 2008, 2011b; Kasapoğlu and Turan, 2008; Kuhn, 1979; Lawrenz and Dantchik, 1985; Lay *et al*., 2013; Solopova, 2008; Zydain *et al*., 2012), owing to concerns about environmental impacts, future generations, and financial costs (Toth *et al*., 2013). For example, Ayers (1977) found that primary school children support the development of nuclear energy despite knowing about its potential dangers, and think that the use of fossil fuel for electricity generation should be stopped for environmental reasons, thus

also demonstrating their capability of having attitudes towards complex issues. Similarly, high school students think that air pollution standards should be kept, support nuclear energy production, and believe that new inventions will solve energy problems, that people should limit their energy use, that building codes should be adjusted to aid energy conservation, and that energy policies will extend the availability of natural resources (Crater, 1978; Kuhn, 1979; Lawrenz and Dantchik, 1985). However, other studies have found that teenagers, in particular, have a significantly less favourable attitude towards personally saving electricity than their parents, are undecided owing to a lack of interest, see it as an inconvenience, or think that it has a negative effect on their personal lifestyle (Grønhøj and Thøgersen, 2009; Morris and Jensen 1982; Stubbs 1985; Sudderth, 1984; Toth *et al*., 2013). This is hardly surprising, given that teenagers in general are prone to decreasing their efforts to please their parents, often challenge established rules or practices to redefine their status as adults, and tend to reflect more about themselves than about others (including altruistic environmental concern) (Berk, 2001).

As in the case of adults, children's attitudes towards saving energy are motivated by financial concerns, even though they are not the ones paying the power bill (DeWaters and Powers, 2008; Lay *et al*., 2013; Solopova, 2008). However, financial concerns also mediate, and sometimes obliterate, the generally positive attitude of children towards energy conservation and renewable sources, if there is an increase in cost (DeWaters and Powers, 2008; Lay *et al*., 2013) – although the exact effects of the latter depend on the regional context. Thus, while high school students in the United States and Malaysia were found to support both energy conservation and renewable sources, this positive attitude falls to less than half if renewable sources or conservation measures result in an increase in the cost of electricity (DeWaters and Powers, 2008; Lay *et al*., 2013). While this is not the case in Jordan, students in rural areas of this country have a more positive stance towards fossil fuels than renewable sources (Zydain *et al*., 2012), which is consistent with previous findings showing rural populations to have more anthropocentric attitudes than their more ecocentric urban counterparts (Gifford and Sussman, 2012). Finally, teenagers in Finland would like to learn more about bio-energy, but are hesitant about using it for transport and at home (Halder *et al*., 2011), while teenagers in the United Kingdom have a more positive attitude towards nuclear power generation than energy conservation (Stubbs, 1985).

Like all attitudes, those towards energy conservation tend to change as people grow older (Lawrenz and Dantchik, 1985). Thus, primary school children agree with government rules to limit energy consumption, but are not too concerned about building standards, while the

opposite is true for high school students (Lawrenz and Dantchik, 1985). Teenage girls in Germany seem to have a positive attitude towards saving energy for environmental reasons, whereas adult women are equally concerned about its financial cost (Jentsch *et al*., 2011). Along similar lines, children in England and France are, like their parents, concerned with the financial cost of energy, but feel that their parents mostly stress the latter, whereas they consider environmental issues to be equally or more important (Garabuau-Moussaoui, 2011a; Toth *et al*., 2013). These examples demonstrate the influence of age on attitudes towards energy consumption and production (DeWaters and Powers, 2008; Garabuau-Moussaoui *et al*., 2009; Jentsch *et al*., 2011; Lay *et al*., 2013; Lawrenz and Dantchik, 1985), but might also indicate a generational shift from financial to environmental reasons for saving energy (Garabuau-Moussaoui, 2011a). These findings are consistent with those of previous research showing younger people to have a higher level of environmental concern than the older generation (Gifford and Sussman, 2012), but contradict other studies showing that children, specifically teenagers, are less committed to environmental conservation than their parents (Grønhøj and Thøgersen, 2009).

2.3.4 Values

Values have been described as a "higher-order concept thought to provide a structure for organising attitudes", or as "guiding principles in life" (Hogg and Vaughan, 2011, p.173-174). Values have a direct influence on attitudes, but their abstract and generalised nature make them a poor predictor of the resulting behaviours (Hogg and Vaughan, 2011; Steg and de Groot, 2012). Thus, previous studies have only found a weak or inconsistent relationship between energy use and a variety of values (Breemhaar *et al*., 1995; Mirosa *et al*., 2013), because (1) many values may interact in influencing a single energy behaviour; (2) similar values may guide very different behaviours; and (3) many energy behaviours are performed automatically, without being consciously linked to a value (Mirosa *et al*., 2013).

Nevertheless, pro-environmental values in particular have been found to affect how people behave, with their endurance providing a basis to guide stable behaviour (de Groot and Thøgersen, 2012). For example, families with very strong environmental values usually express environmental concern when explaining their energy conservation practices (Garabuau-Moussaoui *et al*., 2009). Such values are often passed from parents to children, who sometimes make them an integral part of their personal identity (Garabuau-Moussaoui, 2011b; Steg and de Groot, 2012), and later go on to save energy themselves out of

environmental concern (Toth *et al*., 2013). Thus, childhood is important in this regard, because values related to pro-environmental attitudes and behaviours (Grønhøj and Thøgersen, 2009), including energy efficient ones (DeWaters and Powers, 2011b; Garabuau-Moussaoui, 2011a; Strickland *et al*., 1984; Zografakis *et al*., 2008), are largely formulated during this time through family socialisation. However, the environmental values of parents and teenagers relating tend to be only weakly correlated (Grønhøj and Thøgersen, 2009).

Environmental values are not a central part of this research because they are only one of many possible factors contributing to energy saving behaviours. Furthermore, they are not a core part of the theory of planned behaviour, and are merged with attitudes in energy literacy. Nevertheless, it is useful to explore environmental values owing to their development during childhood and occasional strong influence on energy behaviour.

2.3.5 Self-Efficacy and Perceived Behavioural Control

Self-efficacy is an important part of social cognitive theory, and describes a person's belief that he can successfully perform a behaviour leading to a desirable outcome, which depends on his assessment of his own capabilities (Bandura, 1989). This assessment is equivalent to the perceived behavioural control element in the theory of planned behaviour (Ajzen, 1991; Fishbein and Cappella, 2006). Self-efficacy exerts a strong influence on intended behaviour and agency by guiding the choice of what to do, how much effort to invest, and how long to persevere when faced with challenges (Bandura, 1989); the easier a (pro-environmental) behaviour is perceived to be, the more likely it will be performed (Pelletier *et al*., 2011).

Self-efficacy, amongst other things, is formed through recurring self-evaluations of successful experiences and the adequacy of one's own knowledge, skills, and strategies, as well as by observing the capabilities of others in relation to their performance, and being persuaded by others about one's own abilities (Bandura, 1989). Self-efficacy develops during childhood, following the establishment of self-reflection, as well as other physical, social, and cognitive skills. The first experiences of self-efficacy are therefore centred on the family, followed by peers of similar age and, finally, school, which plays an important role in fostering (or hindering) self-efficacy by setting goals and developing persistence (Bandura, 1989). In this research, self-efficacy specifically refers to the children's perception that they are capable of having a positive effect in ameliorating energy issues, or saving money.

Children's feelings of self-efficacy with regards to saving energy

Together with personal values, self-efficacy explains around 30% of the variance in the energy literacy of high school students (DeWaters *et al*., 2013). According to DeWaters and Powers (2008, 2011a), 65% of teenagers believe that their personal energy consumption makes a difference, with a similar percentage having a positive attitude towards energy conservation. However, other research has found low levels of self-efficacy in children, who seem to believe that their personal efforts to save energy have no impact on a global scale (Stubbs 1985). In other cases, children reported that they would like to save energy, but have low self-efficacy owing to either a lack of knowledge (DeWaters and Powers, 2008; Solopova, 2008), or confusion arising from an overwhelming amount of information (Toth *et al*., 2013). Finally, the self-efficacy of adolescents appears to decrease as they grow older and increase their energy use (e.g. longer showers or learning to drive), because saving energy is perceived to require a greater degree of personal sacrifice (DeWaters and Powers, 2011a).

2.3.6 Knowledge

"Knowledge is the *substance* that correlates with cognitive processes such as remembering, analysing, and creating" and is, "inarguably, a key component of literacy" (DeWaters and Powers, 2013, p. 45). Energy-related topics range from scientific concepts such as energy measurements, local and global related environmental issues, energy shortage, and energy sources, to more practical issues such as energy efficient technology, energy saving behaviours, and understanding the power bill. Since the objective of this thesis is to understand how children use and try to conserve energy, this review will focus on the "citizen understanding of energy", i.e. the kind of practical knowledge that affects daily living and consumer decisions (Solomon, 1992). This includes knowledge about renewable and non-renewable sources, national trends and socio-environmental impacts of energy production, awareness of the importance of energy use and conservation, ways to improve energy-efficiency, and the ability to analyse and evaluate new information feeding into energy decision-making (DeWaters and Powers, 2013; Solomon, 1992).

Challenges to acquiring energy-related knowledge

Owing to their complex, abstract, and interdisciplinary nature, involving science, society, and politics, energy topics are difficult to teach and learn about (Boylan, 2008; Morrisey and

Barrow, 1984; Solomon, 1992). Because energy is neither tangible nor visible (Demirbas, 2009), and measured in a variety of units which require significant cognitive skills to comprehend and convert (acquired around the age of 15), young children in particular find it difficult to fathom the consequences of its production and consumption (Newborough *et al.*, 1991; Pierce and Paulos, 2010). Additional challenges are posed by the detachment of the source of production from its end use (Toth *et al*., 2013), as well as the lack of an observable immediate impact of consumption (Kollmuss and Agyeman, 2002; Dinzer, 2000). Finally, the seriousness of energy problems can be overwhelming and result in denial, apathy, and delegation of responsibility (Kollmuss and Agyeman, 2002; Pelletier *et al*., 2011), as well as anxiety in children (Garabuau-Moussaoui, 2011b), which may lead to paralysis (Jensen, 2002). Frequent and timely feedback on household energy consumption, for example through smart meters (currently rare in New Zealand), may help to make energy use more concrete and measureable (Abrahamse *et al*., 2007). This approach has recently been shown to increase the involvement of teenagers in energy saving behaviours (Grønhøj and Thøgersen, 2011), and is now being developed for young children (e.g. Caretosave, 2013). In addition, anxiety can be prevented by empowering people through their involvement in pro-environmental work (Demeo *et al*., 2013; Jensen, 2002).

Energy knowledge in the general population

Although little is known about primary school children (Boylan, 2008), the energy-related knowledge of the general public is poor (Bodzin, 2012; DeWaters and Powers 2008, 2011a; DeWaters *et al*., 2013; Eidelman, 2010; Kuhn, 1979; Stutzman and Green, 1982), and frequently overestimated (DeWaters and Powers 2008; Robelia and Murphy, 2012; Southwell *et al*., 2012), even when compared with other environmental topics (Robelia and Murphy, 2012). Most of the population could therefore be described as energy illiterate (Stubbs, 1985). In particular, the production and conservation of energy, and more specifically electricity (Robelia and Murphy, 2012), remain closed books to many people, especially in regards to their own homes and communities (Bodzin, 2012; DeWaters and Powers 2013). For instance, some studies have found that half of the respondents in the USA failed a basic energy quiz (Southwell *et al*., 2012), over 40% cannot name a fossil fuel or renewable source, 56% think that nuclear power contributes to global warming (DeWaters and Powers, 2011b), and the majority overestimate renewable energy production (Robelia and Murphy, 2012).

So far, most studies on energy knowledge have focussed on Europe and North America, which means that little is known about the energy knowledge of the general population in New Zealand. Both children and adults perceive a general lack of energy-related knowledge in the population as a major problem (DeWaters and Powers, 2011a; Toth *et al*., 2013), and as an obstacle to teaching children about the topic (Solopova, 2008), thus ascribing to it the same logic as information deficit models (sections 2.2 and 2.3.1). However, public knowledge about energy seems to be on the increase (DeWaters and Powers 2013; Robelia and Murphy, 2012). Thus, more than half of the parents participating in the *origin energy savers program* in Australia think that their children are smarter about energy than they were at that age (Sustainability Matters, 2013).

Children's energy knowledge

Energy knowledge is a "necessary but not sufficient" (Robelia and Murphy 2012, p.315) component of energy literacy, which helps people to make a conscious effort to save power and increase their self-efficacy – and, ultimately, their agency (section 2.9) (Bandura, 1989; DeWaters and Powers, 2013). It has previously been noted that children understand electricity as a commodity, and explain it in terms of its utility in the context of their daily lives (Solomon, 1992), rather than its origins or physical nature. Many researchers have judged children's energy knowledge to be poor, with both primary and high school students lacking a sound understanding of basic scientific facts, the socio-environmental implications of energy production and consumption, and general trends in resource use and supply (Ayers, 1977; Barrow and Morrisey, 1989; Bodzin, 2012; Bodzin *et al*., 2013; Boylan, 2008; Chen, 2011; Davis, 1985; DeWaters and Powers 2008, 2011ab; DeWaters *et al*., 2013; El-Salam *et al*., 2009; Erdogan and Ok, 2011; Gambro and Switzky, 1996; Ivy *et al*., 1998; Jentsch *et al*., 2011; Lawrenz, 1983; Solomon, 1985; Solopova, 2008; Stubbs, 1985; Sudderth, 1984). However, their level of knowledge seems to vary by topic, age, and country, with children from the United States generally scoring lower (e.g. DeWaters and Powers 2008, 2011ab; DeWaters *et al*., 2013), than those from Taiwan (Chen, 2011), Egypt (El-Salam *et al*., 2009), and Singapore (Ivy *et al*., 1998). For instance, 70 to 80% of the teenagers in Singapore know the most important energy source of their country, are able to identify green and renewable sources, and realise the effects of burning coal and oil (Ivy *et al*., 1998). Similarly, many children in England and France are aware of the environmental impact of energy consumption (Garabuau-Moussaoui, 2011a; Toth *et al*., 2013), including CO_2 emissions and climate change, although they do not necessarily understand them (Toth *et al*., 2013).

Studies of primary and secondary school children across many different countries have shown that children know that fossil fuels are a finite resource (Ayers, 1977; Kuhn, 1979; Lawrenz, 1983; Solomon, 1985; Solomon, 1992; Stubbs, 1985; Toth *et al*., 2013), although they are uncertain as to whether this will impact them individually, their families, or society as a whole (Solomon, 1985). High school students are also keenly aware of the financial cost of using power (DeWaters and Powers, 2008; Lay *et al*., 2013), and consider it a key issue in terms of their family's economy (Solopova, 2008; Toth *et al*., 2013). Yet, at the same time, they are less likely to conserve energy than younger children and adults (Gram-Hanssen, 2005; Grønhøj and Thøgersen, 2009). At least one study found that primary school children know about the environmental consequences of electricity production from fossil fuels and nuclear power (Ayers, 1977). In addition, about half of the children in other studies were able to name clean energy sources (Erdogan and Ok, 2011), or answer questions on polluting energy sources such as fossil fuels (Gambro and Switzky, 1996), although relatively few of them related them to climate change (Gambro and Switzky, 1996). However, children seemingly know little about the availability and production of fossil fuels (Lawrenz, 1983), or (like adults) nuclear power (Bodzin, 2012; Lawrenz, 1983). By contrast, many children seem to have some level of understanding of renewable energy sources (Bodzin, 2012; Bodzin *et al*., 2013), and are able to identify them more easily than non-renewable ones (Bolyan, 2008; DeWaters and Powers, 2008; Zyadin *et al*., 2012), although very few of them realise that renewable technologies are underdeveloped and often difficult to access (Solomon, 1985). Among renewables, children are most aware of solar and wind power, and least about geo-thermal energy and bio-fuels (Solomon, 1992; Zyadin *et al*., 2012).

Like most of the general public, children know least about electricity (Bodzin, 2012; DeWaters and Powers, 2008, 2011a; DeWaters *et al*., 2013). For instance, only a third of the students in a study by Ivy *et al*. (1998) knew how electricity is produced, despite 80% of them scoring highly for other energy topics. Very few children know that electricity is generated by an energy source (Solomon, 1985), identify coal as a source of electricity (DeWaters and Powers, 2011a; Lawrenz, 1983), or understand how an energy source is converted into power (Bodzin *et al*., 2013). Equally, relatively few of them recognise conservation as a way to address energy needs (DeWaters and Powers, 2011a), possibly because they lack the practical knowledge needed to understand their own consumption (Bodzin, 2012; Chen, 2011; Stubbs, 1985).

Along with the rest of the population, many children overestimate the relative importance of "visible" energy consumption, such as lights (Newborough *et al*., 1991; Sovacool, 2009).

Thus, children are aware that heating water uses energy (Lawrenz, 1983, 1985; Toth *et al*., 2013), but incorrectly assume its impact to be less than that of lighting and entertainment use (Bodzin, 2012; Davis, 1985; DeWaters and Powers, 2011a). Primary school children know that appliances in general, and refrigerators in particular, use electricity (Bolyan, 2008; Lawrenz, 1983, 1985; Trumper, 1993), but overestimate the consumption of the latter (Lawrenz, 1983, 1985). By contrast, high school students underestimate it (DeWaters and Powers, 2011a). Teenagers also seem to be aware that appliances on stand-by consume electricity (Gram-Hanssen, 2005), but do not realise that this includes fully charged, plugged phones (Bodzin, 2012). Finally, although teenagers understand that "energy star" appliances use less electricity (DeWaters and Powers, 2011a), they generally seem to underestimate the potential of energy efficient technology, except for fluorescent lights (Jentsch *et al*., 2011).

2.3.7 Relationship Between Knowledge, Attitudes and Behaviours

Environmental psychologists have frequently found the relationship between knowledge, attitudes and behaviour to be complex, weak, and sometimes even absent (Aune, 2007; Darnton, 2008, Gifford and Sussman, 2012; Wilson and Dowlatabadi, 2007), unless the attitude is very specific to the behaviour (Fishbein and Ajzen, 1975). The relationship is thought to be more strongly developed in children, owing to their relatively simple lives and reduced number of external constrains (Larson *et al*., 2011). However, in general, children have a lower level of behavioural control than adults, which can reduce the strength of the association (section 2.3.1). Overall, children and adults resemble each other in their limited environmental and energy literacy (DeWaters and Powers, 2013), as well as the lack of a clear connection between environmental knowledge, attitudes, intentions, and behaviours (Davis, 1985; Larson *et al*., 2011; Sudderth, 1984). For instance, although people generally believe that conserving energy voluntarily may help solve energy problems, this positive attitude rarely translates into action (Dholakia *et al*., 1983; Lutzenhiser, 1992). Similarly, despite their generally positive attitudes towards the environment, young people engage in relatively few environmental behaviours, (Grønhøj and Thøgersen, 2009), and increasing the strength of their attitudes does not lead to a corresponding increase in their number of energy saving behaviours (DeWaters and Powers, 2008).

Knowledge alone does not lead to action (DeWaters and Power, 2013; Kollmuss and Agyeman, 2002; Darnton, 2008; Kasapoğlu and Turan, 2008), and indeed is less strongly related to pro-environmental and energy saving behaviours than attitudes (Bodzin *et al.*, 2013;

DeWaters and Powers, 2011a). For instance, although teenagers are aware that appliances on stand-by consume energy, they do not unplug them owing to a simple lack of interest (Gram-Hanssen, 2005). Increasing knowledge also does not necessarily translate into new or strengthened attitudes (Stubbs, 1985), with the latter instead often being formed through conditioning (Aronson *et al.*, 1999). Finally, behaviour itself is not always consistent, as shown by teenagers turning off lights, but not computers (DeWaters and Powers, 2011a).

These observations imply that a positive attitude towards saving energy might be too general for highly context-specific situations (Gifford and Sussman, 2012; Reid *et al*., 2010), with pro-environmental behaviours often being driven, or at least mediated, by situational or other external factors (Kollmuss and Agyeman, 2002; section 2.5.3). Furthermore, even if a positive attitude would suffice to produce an intention to act, its implementation may be hindered by a lack of basic knowledge and skills (DeWaters and Powers 2008, 2011a), as shown by high school students generally scoring relatively high on energy attitudes, but very low on energy knowledge, and, consequently, energy conservation behaviours (DeWaters and Powers, 2008, 2011a; DeWaters *et al*., 2013; Kasapoğlu and Turan, 2008; Zyadin *et al*., 2012).

These results are discouraging, but not universal. Indeed, some studies have identified a positive correlation between environmental (El-Salam *et al*., 2009) or specifically energy-related knowledge, attitudes, and behaviours (Chen, 2011; Grønhøj and Thøgersen, 2012; Kuhn, 1979). However, such correlations do not necessarily imply directionality or causality. For instance, highly informed students tend to have more intense attitudes (Kuhn, 1979), yet might have acquired their knowledge *because* they were motivated to do so (i.e. had a positive attitude) in the first place. Similarly, a positive attitude may arise through cognitive dissonance occurring when being forced to perform a particular behaviour, such as following a rule (Wilson and Dowlatabadi, 2007). Bandura's (1989) social cognitive theory explicitly acknowledges this lack of linearity or causality, with behaviour, personal factors (cognitive, affective, biological), and environmental factors all being interrelated. Nevertheless, and regardless of this interaction, when knowledge is accompanied by a positive attitude and favourable situational factors, it has the potential to inform and leverage energy saving behaviours (Toth *et al*., 2013). For instance, feedback devices providing quick and detailed information about household energy consumption can successfully reduce energy use (Abrahamse, 2005). Similarly, environmental knowledge can make people more prone to engaging in pro-environmental activities (Bodzin *et al*., 2013; Kasapoğlu and Turan, 2008; Robelia and Murphy, 2012). Thus, although (practical) knowledge and (positive) attitudes are only two of many variables affecting behaviour, and are not always dependent on each other,

both are needed for conscious and responsible energy saving behaviours to occur (Bodzin *et al*., 2013; DeWaters and Powers, 2013).

2.4 Learning about Energy

Attitudes (2.3.3), behaviours (2.3.2), and knowledge (2.3.6) are all acquired through specific learning processes (DeWaters and Powers, 2011a; Kuhn, 1979; Larson *et al*., 2011; Robinson, 2010). The explanations of these processes throughout the following section are interrelated with the content of sections 2.3.2, 2.3.3 and 2.3.6, as well as with the section on children's socialisation into electricity use (2.8). Schools, media, and government campaigns have facilitated children's energy learning since the 1970s. After initially focussing on disseminating information, they later switched to encouraging a positive attitude towards energy conservation, and, more recently, encouraging particular behaviours and empowering children to act (Bjørnå and Dyhr-Mikkelsen, 2003; Morrisey and Barrow, 1984).

Learning can be divided into formal knowledge acquired through school (section 2.4.1), and informal knowledge arising from opportunistic everyday life experiences[1] (section 2.4.2), such as interactions with family, everyday conversations, and the media (4-traders, 2013; Erdogan and Ok, 2011; Solomon, 1992; Sustainability Matters, 2013). Children do not tend to integrate formal and informal types of knowledge by themselves, which therefore exist in different mental domains, and indeed may sometimes clash (Solomon, 1985, 1992). The topics children learn from each source vary, with informal sources (especially parents) providing information on how to operate appliances, use and save energy at home, the cost of power, and, sometimes, the relationship between energy use and the environment (Garabuau-Moussaoui *et al*., 2009; Jentsch *et al.,* 2011; Solomon, 1992; Toth *et al*., 2013; Zyadin *et al.,* 2012). Attitudes also are mostly acquired informally through listening to parents' opinions, which are sustained and long-term influences that are not normally provided by school (Eagles and Demare, 1999; Solomon, 1985). In contrast, children tend to learn about energy sources and their environmental impacts mostly through the formal education system (4-traders, 2013; Erdogan and Ok, 2011; Garabuau-Moussaoui, 2008; Rickinson, 2001; Sustainability matters, 2013; Toth *et al*., 2013; Zyadin *et al*., 2012), although informal sources may come to the fore when the latter fails to cover particular topics (e.g. bioenergy; Halder *et*

[1] This thesis uses the terms "formal" and "informal" knowledge to distinguish *learning sources*, rather than professional and general knowledge (Solomon, 1992).

al., 2011; Ivy *et al*., 1998). This, in turn, sometimes leads to teachers underestimating their students' knowledge (Buway, 2007).

2.4.1 Formal Learning: Energy Education at School

School is one of the main and, arguably, least biased sources of information for young people (Stubbs, 1985), and sometimes the only one enabling them to learn about the environmental impacts of energy production and consumption (4-traders, 2013; DeWaters and Powers, 2011a; Erdogan and Ok, 2011; Sustainability Matters, 2013; Toth *et al*., 2013; Zyadin *et al*., 2012). Energy education has been taught at some schools for the past 40 years (Morrisey and Barrow, 1984; Stubbs, 1985; Solomon, 1992; DeWaters *et al*., 2013), and is important because it "can play a pivotal role in instilling energy thrift and efficient behaviour and attitudes in society" (Zografakis *et al*., 2008, p. 3226), thus creating energy literate citizens (Eidelman, 2010; Kandpal and Garg, 1999; Morrisey and Barrow, 1984).

The curriculum

Energy education forms part of the curriculum of several countries, including Australia, Canada (Bodzin *et al*., 2013), Jordan (Zyadin *et al*., 2012), Mexico (Vásquez *et al*., 2005), the UK (Newborough *et al*., 1991), the USA, as well as that of the international baccalaureate (Bodzin *et al*., 2013). Despite not being compulsory, it is also frequently discussed at school in many other countries, such as Brazil, France, and Greece (DeWaters and Powers, 2011a; Garabuau-Moussaoui *et al*., 2009), although the resulting level of knowledge in this case is highly dependent on the individual teacher, and varies widely between different schools and classes (Garabuau-Moussaoui *et al*., 2009). In New Zealand, energy education is restricted to the science curriculum, with teachers being able to choose the particular topics (not necessarily energy production and consumption) they wish to focus on (Ministry of Education, 2007).

In addition, there are many, albeit sometimes unsuccessful (Solopova, 2008), government and privately funded programmes supporting school-based energy education across Australia (Energy Savers, n.d; Sustainability Matters, 2013), Europe (Bjørnå and Dyhr-Mikkelsen, 2003; Euronet 50/50, 2012; Sustainable Energy Authority of Ireland, n.d.), Russia (Solopova, 2008), and the USA (Eidelman, 2010; Hanson, 1993). In New Zealand, several companies and trusts provide free energy-related teaching materials for schools (e.g. Enviroschools,

2009; Genesis Energy, 2010; Lynch *et al.*, 2011; New Zealand Wind Energy Association, n.d.), and support localised projects, such as an energy education programme aimed at primary schools in the eastern Bay of Plenty (Eastern Bay Energy Trust, 2009, 2012).

Energy education is typically restricted to science lessons, with the primary goal of enhancing scientific knowledge (DeWaters *et al.,* 2013; Newborough *et al*., 1991; Toth *et al*., 2013). Although this approach is effective in teaching children basic facts (El-Salam *et al*., 2009; Gambro and Switzky, 1996), it often sidelines the socio-environmental impacts of energy consumption (Stubbs, 1985). This issue could likely be addressed by including a social and environmental dimension (Bodzin, 2012; Demeo *et al*., 2013; DeWaters and Powers, 2008; DeWaters *et al*., 2013; Morrisey and Barrow, 1984; Newborough *et al*., 1991; Solomon, 1985; Stubbs, 1985).

Owing to their reduced emphasis on distinct subjects, primary schools lend themselves particularly well to an interdisciplinary curriculum (Newborough *et al*., 1991), and offer further advantages in the high receptiveness of young children to acquiring a positive attitude towards saving energy, as well as corresponding behaviours (Baumeister and Bushman, 2013; Garabuau-Moussaoui, 2011a; Newborough *et al*., 1991; Zyadin *et al*., 2012). In addition, young children tend to focus more on themselves and their family than wider society (Toth *et al*., 2013), making primary school a good time to teach energy conservation at a personal level. Ten-year-old children are capable of understanding basic energy concepts and issues (Trumper, 1993), and indeed, children of all abilities can learn about energy, especially about its conservation, without being knowledgeable about academic physics (Newborough *et al*., 1991).

Importance of practical knowledge

Although effective at raising general awareness, knowledge-focussed units on energy frequently fail to develop energy literacy (DeWaters *et al.,* 2013; Gifford and Sussman, 2012). Children often struggle to see the relevance of abstract scientific (especially physical and ecological) concepts to their daily lives (Buway, 2007), and require guidance to gain the kind of practical understanding leading to the development of energy-decision skills (DeWaters and Powers, 2011b). An interdisciplinary approach, with hands-on teaching methods (Hobson**,** 2003; Newborough *et al*., 1991; Solomon, 1992), and fun activities such as games,

theatre plays, songs, or problem solving[1], are thus especially important for creating energy literacy (Buway, 2007; Demeo *et al.,* 2013; DeWaters and Powers, 2011b; Eidelman, 2010; Gifford and Sussman, 2012; Huang *et al*., 2012; Morrisey and Barrow, 1984; Nies and Witt, 1984; Robinson *et al*., 2011; Tsai *et al.,* 2013; Zografakis *et al*., 2008).

Despite being relatively uncommon (DeWaters *et al.,* 2013; Gambro and Switzky, 1996; Jentsch *et al*., 2011; Toth *et al.,* 2013), energy education structured this way has been shown to be effective in increasing:

1) Energy knowledge (Coffey, 1981; DeWaters and Powers, n.d., 2011b; Eidelman, 2010; El-Salam *et al*., 2009; Euronet 50/50, 2012; Gambro and Switzky, 1996, 1999; Hanson, 1993; Huang *et al*., 2012; Morrisey and Barrow, 1984; Sustainability Matters, 2013).
2) Positive attitudes (Collins *et al*., 1979; DeWaters and Powers, 2011b; Toth *et al*., 2013; Tsai *et al*., 2013);
3) Intended behaviour (Tsai *et al*., 2013);
4) Self-efficacy (DeWaters and Powers, n.d.; Robinson, 2010).
5) Actual, self-reported, energy saving behaviours (DeWaters and Powers, n.d., 2011b; Euronet 50/50, 2012; Hanson, 1993; Nies and Witt, 1984; Robinson, 2010; Sustainability Matters, 2013; Zografakis *et al*., 2008)
6) In some cases, all of them (Bodzin *et al*., 2013)[2].

In addition, energy education can reduce overall energy consumption at school (Euronet 50/50, 2012), and lead to more energy-related conversations at home (DeWaters and Powers, 2011b; Sustainability Matters, 2013). Finally, some schools in different countries have incorporated a whole-school approach providing energy education, while at the same time increasing the building's energy efficiency in a visible and measureable way (Euronet 50/50, 2012; Holloway, 2013; Lynch *et al*., 2011; Newborough *et al*., 1991). This approach helps to create a social norm around saving energy in the school by making the school's efforts visible, involving children in the campaign, having shared goals, raising the children's interest in energy issues, and creating a context within which energy conversations are more likely to occur (Euronet 50/50, 2012; Holloway, 2013; Lynch *et al*., 2011; Newborough *et al*., 1991; The Centre for Human Rights and Citizenship Education, 2011).

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[1] U.S. Department of Energy (2010) provides a detailed example including, for instance, writing stories about what it would be like to live without electricity, inviting architects to give talks about energy efficient homes, and asking children to suggest (and, with the permission of their parents, implement) energy efficient measures at home.

[2] Energy conservation programmes outside of the school context, although uncommon, have also been shown to be very effective in increasing household energy saving behaviour (Robinson *et al*., 2011).

Prescribed behaviour and critical thinking

There is an ongoing debate as to whether behavioural aspects should be included in environmental and energy education, and how to do so without prescribing them and indoctrinating children in the process (Darnton, 2008). In some cases, this has led to educational programmes specifically avoiding attitude and behaviour change (Solomon, 1985), which are the main objectives of energy literacy. However, since it is arguably impossible for teachers to be neutral, it might be better for them to acknowledge their attitudes openly, and allow students to feel empowered by encouraging debate and critical thinking (DeWaters and Powers, 2011ab; Solomon, 1985; Gambro and Switzky, 1996). The latter have been shown to increase the self-efficacy and attitudes of teenagers (DeWaters and Powers, 2011b; Solomon 1992), but may create too stressful and conflict-laden an environment for primary school children, who might instead be better served by other methods such as problem solving and role playing games (Lawrenz, 1988).

Although concerns about the ethics of encouraging particular behaviours at school still exist, educators are generally willing to teach energy-related topics to young children in the hope of diminishing future climate change (The Centre for Human Rights and Citizenship Education, 2011), and consider efficiency and the environmental impact of energy consumption the most important topics of energy education, ahead of purely scientific knowledge (Eidelman, 2010). Similarly, the majority of pupils are motivated to learn about energy (Halder *et al.,* 2011; Solomon, 1992; The Centre for Human Rights and Citizenship Education, 2011), and think that it should be discussed at school (Stubbs, 1985), or indeed be part of the curriculum (DeWaters and Powers, 2008). Finally, parents whose children were involved in a programme on energy efficiency generally feel that schools have a positive impact both on the future of their country (4-traders, 2013), and the development of energy management skills in their offspring (Solopova, 2008), with the environmental rationale behind the latter sitting comfortably with the widespread anti-waste ideology of the older generation (Garabuau-Moussaoui, 2011a). Both teachers and children tend to acquire a more positive attitude towards energy education after running a unit on it, especially when the latter is addressing local needs (Morrisey and Barrow, 1984).

Barriers to energy education

Regardless of its positive image, energy education is still limited in many countries, partially owing to the difficulty of including interdisciplinary topics in the curriculum, teachers feeling

uncomfortable discussing and guiding opinions on potentially controversial issues, the (erroneous) notion that children first need to understand scientific concepts before being able to grasp the idea of energy conservation (Solomon, 1992; Trumper, 1993), or simply a lack of demand (Solopova, 2008). However, the most commonly mentioned obstacles are logistical in nature, and include a lack of time, funding, appropriate teaching resources, and teachers' skills to teach energy topics, as well as an overcrowded curriculum (Eidelman, 2010; Morrisey and Barrow, 1984; Newborough *et al.,* 1991; Solopova, 2008; Stubbs, 1985; The Centre for Human Rights and Citizenship Education, 2011).

2.4.2 Informal Learning about Energy

Developing children's consumer skills has traditionally been the responsibility of family and educators, but also involves other agents, such as the media, retailers, and advertising agencies (Ekström, 2010). Parents, the media (e.g. nature shows, internet, newspapers, radio) and, to a lesser extent, friends and the wider family, are the main sources of environmental knowledge and attitudes in children (Eagles and Demare, 1999; Erdogan and Ok, 2011; Garabuau-Moussaoui *et al*., 2009; Jentsch *et al*., 2011; Toth *et al*., 2013), and generally more important than school as regards the practical aspects of energy use (Ivy *et al*., 1998; Solomon, 1992). Overall, children seem to be more influenced by "push" sources, such as parents and television, whereas adults tend to rely more on "pull" sources, such as the internet (Jentsch *et al*., 2011). Children watch television programmes aimed at a variety of audiences (Ekström, 2010), which often cover energy topics (Garabuau-Moussaoui *et al*., 2009), albeit with a sensationalist focus. As a result, primary and secondary school students in the US know more about the risks of nuclear power and the Chernobyl accident than about how energy is produced in their region (Solomon, 1992). Nevertheless, at times the media also convey information on bio-fuels (Halder *et al*., 2011) or efficient technology (Zografakis *et al*., 2008), as exemplified in New Zealand by advertisements offering practical advice on how to increase energy efficiency at home (Energy Efficiency and Conservation Authority, 2012).

While the media can increase environmental and energy-related knowledge, they most strongly affect attitudes (Gifford and Sussman, 2012; Halder *et al*., 2011) and are often employed to influence public opinion through environmental campaigns (Pelletier *et al.,* 2011). The latter is frequently achieved using "propositional and disconnected" (Solomon, 1985, p. 354) information, which generally presents phenomena without explaining their underlying causes (Newborough *et al*., 1991), and aims to create attitudes in people who lack

a complete understanding of the issue at hand (Solomon, 1985). The fragmented knowledge thus created is often apparent in both children and adults, especially in cases where the media represent their main source of information (Solomon, 1992). Despite being well socialised, this knowledge is inconsistently applied and not conceptually understood (Solomon, 1985). In addition, although media campaigns create awareness about certain environmental problems, they rarely provide advice on how to ameliorate the situation (Pelletier *et al.,* 2011) or reduce energy consumption (Newborough *et al*., 1991). Indeed, the media in general (e.g. movies and product advertisements) often send messages that are contradictory to energy conservation, endorsing wasteful practices instead (Newborough *et al*., 1991). Thus, the media can complement, but certainly not substitute, formal education (Solomon, 1992), although more structured sources, such as books and documentaries, could be used more intensively to promote energy knowledge (Ivy *et al.,* 1998).

Unfortunately, there is very little research about how parents affect their children's energy literacy and what knowledge they share (section 2.8; Ivy *et al.,* 1998), despite their importance as a source of information (Jentsch *et al*., 2011). However, the knowledge acquired from the media and from parents is often interrelated, with the latter tending to learn much from the media themselves (Solomon, 1992). Furthermore, children actively discuss television shows (Ekström, 2010), thus inspiring family conversations (Garabuau-Moussaoui *et al*., 2009). Finally, energy saving challenges for families, as well as competitions among friends to reduce their energy consumption through the use of smart meters and online games, are only recently becoming available. They represent an addition to the list of informal learning sources (Geelen *et al*., 2010; Gustafsson *et al*., 2010; Jentsch *et al*., 2011; Toth *et al*., 2013), and may be an effective way to reduce household energy consumption (Geelen *et al*., 2010). However, participants do not generally seem attracted to these games (Jentsch *et al*., 2011), which themselves are difficult to run (Johnson *et al*., 2012), and have mixed feelings about sharing their energy consumption information (Toth *et al*., 2013).

2.5 Beyond an Individual and Conscious Approach

2.5.1 Rationality

Both the theory of planned behaviour and energy literacy are fundamentally rational approaches assuming internally consistent beliefs and practices (DeWaters *et al.*, 2007), and are therefore likely to overlook a wide range of emotions and non-rational habits contributing

to pro-environmental behaviour (Reid *et al*., 2010) – especially since "there is overwhelming evidence that humans cannot be" always rational (Kahneman, 2011, p. 411). For instance, energy is generally being consumed without conscious consideration for either the amount or associated environmental impacts (DeWaters and Powers 2008, 2011a; Toth *et al*., 2013), although the activity for which it is used may be perfectly rational with regards to other objectives, such as entertainment or cleanliness (Gram-Hanssen, 2005).

Routine decisions are often made based on non-rational approaches, which are automatic, unconscious, fast, and influenced by experiences, emotions and memories. By contrast, conscious and logical reasoning is slower and requires more effort, owing to its reliance on critical thinking, facts, comparisons, and rules. As a result, it only tends to be activated when quick, non-rational thinking fails to provide an answer, or is contradicted by external events (Kahneman, 2011). Nevertheless, both approaches are interrelated, with the feelings, impressions, intuitions and intentions created by non-rational thinking feeding into rational thought, which in turn constantly monitors one's own behaviour and is "in charge of self-control" (Kahneman, 2011, p.27).

Non-rational approaches are based on habits, rather than attitudes or values (Kahneman, 2011). This usually makes them an important (though by no means exclusive) determinant of everyday behaviour (Gram-Hanssen, 2013), but also difficult to manipulate and liable to random, non-directional change (e.g. to being less sustainable; Kollmuss and Agyeman, 2002). By contrast, rational thinking provides more opportunities for change (Kahneman, 2011), and can be encouraged by raising people's awareness of their unconsciously performed actions (Stutzman and Green, 1982). Thus, information can sometimes influence behaviour by forming positive attitudes and reinforcing norms (Wilson and Dowlatabadi, 2007; Tsai *et al*., 2013), and environmental and energy education programmes can be effective even when aiming to change attitudes and behaviours, rather than increase environmental knowledge (section 2.4.1; Demeo *et al*., 2013; Zografakis *et al*., 2008). This study primarily analyses rational behaviour, but allows for non-intentional processes to emerge by exploring children's everyday behaviour independently of their attitudes and knowledge.

2.5.2 Sociological Approach

Whereas for psychologists "perception, valuation and decision are the practical accomplishments of unique individuals" (Lutzenhiser, 1992, p.52), sociologists hold that a practical sense on how to view the world arises from cultural and societal norms acquired

subjectively through experience[1] (Bourdieu, 1994; Gram-Hanssen, 2010; Wilson and Dowlatabadi, 2007). In this light, knowledge is seen as intersubjective, i.e. being based on common sense and popular agreement, largely unstructured, and passed from one generation to the next ("social stock of knowledge"; Schutz and Luckmann, 1973, p. 99). The intersubjectivity of this "practical consciousness" (Hobson, 2003) implies that knowledge and behaviour are implicit and not prone to being examined or questioned (Bourdieu, 1994; Schutz and Luckmann, 1973). However, established social structures, though binding in the short term, need to be confirmed and reinforced by the actions of individuals, who can therefore transform them over time (Reid *et al*., 2010; Spaargaren and Van Vliet, 2007). Because energy use is generally taken for granted as an integral part of daily life, increasing energy efficiency may require actively searching for and developing possibilities for change (Aune, 2007).

Interactions between individuals in relation to everyday practices are most appropriately studied in the context of the family or community (the meso-level), which lies between psychology (the micro-level) and the broader economic, sociological, and political scope (the macro-level) of general sociology (Reid *et al.*, 2010). The meso-level can mediate between the other two levels, generate and propagate new social values, and shape how that propagation occurs in the real world (Reid *et al*., 2010). In terms of this research, children are exposed to social norms and structures mostly through their families and school (both meso-level), but could potentially themselves influence family practices and thus, over time, have an effect on the wider social norm. From this perspective, households can be used as "a framing device to understand everyday practice" (Reid *et al*., 2010, p. 319) by identifying domestic roles, as well as normative and routine behaviours, such as habits, in an attempt to make "practical consciousness" explicit and more available for examination (Hobson**,** 2003, p. 104).

Habits

Habits are "learned sequences of acts that become automatic responses to specific situations" (Verplanken *et al*., 1997, p. 540), and constitute about 45% of daily behaviours (Verplanken and Wood, 2006), including those related to children's energy use (Toth *et al*., 2013). Habits are more than mundane behaviour, because they constantly recreate social ordering by establishing rules of conduct (Hobson, 2003). They generally arise through repetition within a

[1] Bourdieu (1994) refers to this as "habitus"

stable environment (Lally *et al*., 2010), with new ones forming when there is a change of context that breaks the routine (Verplanken and Wood, 2006). Once established, habits are difficult to change owing to the significant impact such a move is likely to have on the individual's lifestyle (Clayton 2012). In the context of energy use, the stability of habits can be seen as a double-edged sword: whereas those resulting in energy savings are highly desirable, wasteful ones are equally persistent and hard to change (Dahlstrand and Biel, 2006; Verplanken, 2012). Rather than investing considerable effort into breaking established habits (Verplanken and Wood, 2006), it may therefore be easier to influence them when the behaviour is first being performed (Verplanken, 2012) - a process that often occurs during childhood.

Lifestyle

Lifestyle is "a more or less integrated set of practices which an individual embraces, not only because such practices fulfil utilitarian needs, but because they give material form to a particular narrative of self-identity" (Giddens, 1991, p. 81). Groups of people with similar status and socio-cultural backgrounds may share a common lifestyle (Breemhaar *et al*., 1995), of which consuming material goods is a key part (Spaargaren and Van Vliet, 2007) – often in excess of actual needs (Bourdieu, 1994). For people with a "green lifestyle", this leads to a curious paradox: although they wish to minimise environmental risks by using resources efficiently (Spaargaren and Van Vliet, 2007), they need to balance these concerns with the prevailing social norm, which sees energy use as a strong symbol of a modern lifestyle, and therefore status (Garabuau-Moussaoui, 2011b). Families are aware of this paradox, and, depending on their particular values and financial means, consequently aim to lead a "normal" lifestyle by advocating the use of energy, but in moderation (Garabuau-Moussaoui, 2011b). Exactly what constitutes a "moderate" or "frugal" level of energy consumption varies widely across families, but usually relates to avoiding waste (Garabuau-Moussaoui, 2011b; Hall, 2011).

Children are at the centre of some consumer cultures (Todd, 2010), and are influenced by symbolic consumption, owing to being in a constant process of socialisation. Given the symbolic value of energy as the basis of a modern lifestyle (by powering electrical devices), it is hardly surprising that children often show no signs of a sense of critical consumerism in terms of energy use. Instead, many seem to think that saving energy would negatively affect their lifestyle (Morris and Jensen, 1982), likely because being eco-friendly is not perceived as

"cool" (Toth *et al*., 2013), and because of the social prestige inherent in the extensive purchase and use of information and communication technology (Gram-Hanssen, 2005). Energy literacy will thus be able to facilitate a shift towards energy conservation only if it is supported by society as a whole, with institutions, the media, and especially parents guiding the change (Garabuau-Moussaoui, 2011b; Halder *et al.*, 2011; Zyadin *et al*., 2012).

2.5.3 External Factors

Environmental behaviour can be guided by internal factors, such as the psychological constructs described in section 2.3, or by external ones (e.g. geographical, social, economic, institutional, and cultural), which are generally beyond the individual's control and can limit or facilitate energy efficiency either directly, or through their effect on knowledge and attitudes (DeWaters and Powers, 2013; Kollmuss and Agyeman, 2002). External factors are often more important than internal ones for explaining energy behaviour (up to 80%; Kollmuss and Agyeman, 2002), but are also much more difficult to change. For children, their parents' attitudes, education and socioeconomic status are an important part of their environment, and affect their own view of the world (Halder *et al*., 2011) – especially with regards to saving energy (Chen, 2011).

Socioeconomics

Education level and income significantly predict environmental knowledge (Larsson *et al*., 2010; Robelia and Murphy, 2012; Southwell *et al*., 2012), as well as energy attitudes and consumption (Garabuau-Moussaoui, 2011a). Thus, both children (El-Salam *et al*., 2009; Gambro and Switzky, 1999; Morris and Jensen, 1982; Sudderth, 1984; but see Davis, 1985), and adults (Bechtel, 1997) from a high socioeconomic background tend to know and care more about environmental issues and energy efficiency (El-Salam *et al*., 2009; Gambro and Switzky, 1999; Morris and Jensen, 1982; Sudderth, 1984; but see Davis, 1985). Similarly, a higher level of formal education in parents correlates with having more knowledgeable children (Gambro and Switzky, 1999). Environmental concern could thus be interpreted as a kind of luxury often only affordable to the rich (Gifford and Sussman, 2012), with children from poorer families having more immediately pressing issues (e.g. family income) to attend to (Zyadin *et al.,* 2012). This is reflected in the comparatively high level of environmental concern encountered in rich countries (Gifford and Sussman, 2012).

However, low-income families can also show high levels of environmental concern (Gifford and Sussman, 2012). For instance, New Zealand research shows that financial constraints often force people with a low income to engage in many energy saving behaviours, be environmentally aware, and consume less energy than their wealthier peers (Lawson and Williams, 2012). By contrast, households with the highest incomes tend to be less environmentally concerned, less inclined to make an effort to save energy, and usually consume more energy than people from other socioeconomic backgrounds (Lawson and Williams, 2012). In fact, the most important differences in energy consumption between different socioeconomic groups are their material culture and energy practices, rather than their attitudes and values (Lawson and Williams, 2012). Therefore, although people from higher socioeconomic backgrounds might have more knowledge and environmental awareness, their actual energy consumption is comparatively high (Barton *et al*., 2013; Bechtel, 1997; Davis, 1985), likely owing to the lack of an economic incentive to save (Bechtel, 1997).

Geographical and cultural differences

People of different countries and cultural communities vary in their level of environmental concern (Gifford and Sussman, 2012) and the way in which they use energy (Stephenson, 2013), likely as a result of their socioeconomic situation (see above), particular geographic or political conditions (e.g. the absence of nuclear power in New Zealand), or differing cultural values. For instance, children in Mexico seem to talk more about environmental problems in relation to energy consumption than children in New Zealand (Aguirre-Bielschowsky *et al*., 2012). Similarly, rural populations tend to have more anthropocentric attitudes than urban ones (Gifford and Sussman, 2012), which is reflected in the more positive attitude of urban teenagers towards energy conservation and renewable resources (Sudderth, 1984; Zyadin *et al*., 2012). These differences indicate that findings from one country should not simply be extrapolated to another without additional evidence, thus highlighting the importance of this study being interpreted within the New Zealand context.

Gender

Gender plays an important role in family decisions on pro-environmental behaviour (Carlsson-Kanyama and Linden, 2007; Krantz, 2005; Robelia and Murphy, 2012), in defining

specific roles of energy use, such as household chores (Garabuau-Moussaoui, 2008), and in household behaviour, such as paying the power bill (Jentsch *et al*., 2011). It also influences energy and environmental knowledge and attitudes, with females tending to have less environmental knowledge, but stronger environmental attitudes than males (Gifford and Sussman, 2012; Southwell *et al*., 2012). The same holds true for energy knowledge and attitudes in children (Ayers, 1977; Barrow and Morrisey, 1989; Bodzin *et al*., 2013; Gambro and Switzky, 1999; Lawrenz, 1983, 1985; Lawrenz and Dantchik, 1985; Lay *et al*., 2013; Stubbs, 1985; Sudderth, 1984; Solomon, 1985, 1992), although young children (up to Year 4) might be less affected (Lawrenz, 1983). Thus, it is important to consider gender differences when assessing energy literacy, since education programmes and the media might be received differently by boys and girls.

Boys and girls differ in their level of knowledge and attitudes depending on the specific topic. Thus, boys are more oriented towards technology and more likely to know more about fossil fuels and nuclear energy, have a more positive attitude towards energy production and efficient technology, and are more motivated to obtain scientific information (DeWaters and Powers, 2011a; Halder *et al.,* 2011; Kuhn, 1979; Solomon 1985, 1992; Tsai *et al.,* 2013; Zyadin *et al*., 2012). By contrast, girls are more aware of renewable energy sources, more cautious towards energy production, and more motivated to help the environment and reduce energy consumption (Ayers, 1977; DeWaters and Powers, 2011a; Kuhn, 1979; Solomon 1985, 1992; Tsai *et al.,* 2013; Zyadin *et al*., 2012). They also tend to support more government regulations, talk more about energy with their family, and display greater self-efficacy in thinking that their personal actions make a difference (DeWaters and Powers, 2011a; Kuhn, 79). Perhaps as a result, girls are more prone to changing their behaviour after having been educated about energy (Bodzin *et al*., 2013).

Gender differences may be linked to wider interests in life. For instance, women often contextualise knowledge in particular situations, and thus tend to rate lower on energy knowledge surveys (Robelia and Murphy, 2012). Similarly, girls tend to associate the term energy with life, and hence are more aware of environmental concerns, while performing worse in examinations based on physics (Solomon, 1985). On the other hand, boys associate the term energy with non-living entities, relating it more to technology (Solomon, 1985). In addition, males are generally more interested in science and technology and tend to choose corresponding courses of study and professions, which likely affect their energy attitudes and knowledge (Gifford and Sussman, 2012; Kuhn, 1979; Stubbs, 1985).

Material culture

The focus of this thesis is on literacy and behaviour, rather than material culture. However, both are interrelated (Gram-Hanssen, 2013; Stephenson *et al*., 2010a), with the physical characteristics of the home (e.g. its size, construction, insulation) and the type of available technology (e.g. efficient technology, forms of heating, type and number of appliances) having a major effect on energy consumption (Wilson and Dowlatabadi, 2007). To an extent, these characteristics can be chosen, but they are largely constrained by geographical and socioeconomic factors, and by whether the property is rented and thus cannot be substantially altered. Thus, the characteristics of typical New Zealand dwellings, and more specifically those of the participating families, are described in section 3.3.3.

2.6 Households and the Family Context

A household is a "social unit occupying a single physical space [...], best seen as both a social institution and a diverse range of physical living arrangements" (Reid *et al*., 2010, p. 318). The members of a household tend to have similar values, lifestyles and norms, but are heterogeneous in terms of their respective roles in decision-making (Reid *et al*., 2010). As a result, everyday family consumption is full of tensions (Hall, 2011), and negotiations of shared responsibility and possessions (e.g. temperature of space heating) (Reid *et al*., 2010). This complexity makes households difficult to research, and indeed has caused them to be understudied (Larsson *et al*., 2010; Lutzenhiser, 1992; Reid *et al*., 2010). For example, children's environmental behaviour is performed mostly in the household context, but usually researched at an individual level (Grønhøj and Thøgersen, 2012).

Households are essential for understanding private energy consumption because (1) individual actions depend on household decision making; (2) they are the surroundings in which most everyday practices and interactions occur (Aune, 2007; Reid *et al*., 2010); and (3) they provide the context in which children are socialised into using energy (section 2.8). In addition, the domestic sector is a major energy consumer, accounting for 13–20% of total energy use in OECD countries (Abrahamse *et al.,* 2005; National Energy Research Institute and University of Otago, 2008), 13% of New Zealand's total energy consumption, and 33% of its electricity consumption. Importantly, in New Zealand the homes with the highest energy consumption consist of families with dependent children (Barton *et al*., 2013; Lawson and Williams, 2012). Finally, although families tend to pay attention to their energy consumption,

and have done so for many generations (Garabuau-Moussaoui, 2011a), they also value other factors, such as aesthetics and creating a warm atmosphere, which need to be taken into consideration (Aune, 2007).

2.7. Childhood

This research focuses particularly on nine and ten-year-old children, who are not yet teenagers, and whose social world consequently revolves mostly around family and school (Berk, 2001). Childhood is a key time for acquiring energy awareness (Zografakis *et al.,* 2008), being socialised into energy practices and acceptable levels of consumption (Garabuau-Moussaoui, 2011a), and learning to be a critical consumer (Ekström, 2010). Indeed, childhood presents a unique window of opportunity to create energy-efficient practices that may remain strong throughout life (Garabuau-Moussaoui, 2011a), before energy consumption starts to increase during adolescence (DeWaters and Powers, 2011a), or habits solidify during adulthood (Garabuau-Moussaoui, 2011a). In addition, environmental values and world views develop most rapidly in 6–12 year-olds (Harta and Nolanb, 1999; Kahn and Kellert, 2002), along with aesthetics, knowledge, critical thinking, and independence from continuous adult control (Kahn and Kellert, 2002).

Traditionally, studies on children have focussed on raising responsible future citizens (Taylor and Smith, 2009), which is still the main aim of research on energy and children (Buway, 2007; DeWaters and Powers, 2008; Gambro and Switzky, 1999; Gram-Hanssen, 2005; Legault and Pelletier, 2000; Strickland *et al*., 1984; Zografakis *et al*., 2008; Zyadin *et al*., 2012). However, even young children can be seen as participating citizens and important consumers in the context of modern society, partially owing to their exposure to the media and commercial activities (Ekström, 2010; Larsson *et al*., 2010; Taylor and Smith, 2009; UNICEF, 2013). The latter perspective represents a shift from children being regarded as passive to being considered active, critical agents with rights and obligations (Ekström, 2010; Taylor and Smith, 2009), and forms the basic assumption of the sociology of childhood (Taylor and Smith, 2009).

Children as young as eight are experts in interpreting their own world, and can make a significant contribution to determining their rights and responsibilities. For instance, it has been found that children in New Zealand feel entitled to a clean and warm physical environment, to choose subjects in school, and to have a say in the decisions that affect them.

At the same time, they consider behaviours such as picking up litter and recycling as part of their obligations, revealing a sense of citizenship responsibility with regards to the environment. However, they do not make the connection with saving electricity in particular, and seemingly do not feel obliged to save energy (Taylor and Smith, 2009). Overall, children see themselves as part of society and seek to engage with and contribute to it, although opportunities to do so seldom occur (Taylor and Smith, 2009). They also actively negotiate and interpret modern trends in consumption, sometimes more effectively than their parents; however, children have different consumption patterns, and little is known about their electricity usage (Ekström, 2010).

2.7.1 Child Development

At 7–11 years of age, children are "prisoners of their own phenomenology" (Lawrenz and Dantchik, 1985, p. 190), since their thought patterns, though becoming logical, flexible and organised, are still bound to real, immediate or visible objects (Piaget, 1977). At this age, children often enjoy classifying objects and following chains of events, are capable of planning and carrying out sequences of acts (Berk, 2001), and perceive other people's behaviours and thoughts in a way similar to adults (Cohen, 2002). However, they struggle to understand abstract concepts, such as political debates about energy (Lawrenz and Dantchik, 1985), and, at least initially, cling to naive scientific concepts – which, however, tend to become more accurate over time as their understanding of the world grows (Solomon, 1992). Such cognitive development can be aided and guided by adults, and heavily relies on the co-evolution of thought and language, with the acquisition of relevant and increasingly more precisely understood vocabulary (Berk, 2001) allowing children to comprehend more complex ideas (Rieber and Robinson, 2004). In the context of this research, such guidance might take the form of exposing children to concepts and vocabulary related to energy production and consumption, including a clear, step-by-step explanation of the connection between energy production and household consumption. In addition, focussing on energy saving behaviours at this stage could build on their increased capacity for logic and planning.

Child development has been interpreted as either an individual process (Piaget, 1977) aided by other people (Rieber and Robinson, 2004), or a social one involving observation and imitation (section 2.8; Bandura, 1989). Bronfenbrenner (1979) goes a step further by arguing that children develop through regular and sustained interaction with everything that surrounds them, including people, objects, organisms and symbols. In the context of this "ecological

systems theory", the children's environment is divided into four systems (micro, meso, exo, and macro) according to the closeness of interaction. The microsystem, which is characterised by bi-directional relationships in places such as the home and school, is where the most direct contact happens (Bronfenbrenner, 1979), and therefore provides most of the opportunity for the children's interaction and development. This also seems to be the case for energy topics, with young children focussing on information acquired from home, whereas teenagers and adults tend to rely on external sources (Jentsch *et al*., 2011; Lawrenz, 1983). Similarly, primary school children describe energy consumption in terms of their households, while teenagers incorporate other settings like school and wider society (Solomon, 1985; Toth *et al.,* 2013). Thus, the household is the most effective context for teaching children about energy consumption.

2.8 Socialisation

Socialisation teaches young people "the necessary skills, values, and behavioural patterns to become well-functioning members of their social group(s) and the culture in which they live" (Grønhøj and Thøgersen, 2009, p. 415). Most behaviours arise from personal experience and are motivated by seeking the acceptance of society. This happens mostly at the meso-level (section 2.5.2; Reid *et al*., 2010), with the family in particular providing the main, most direct, and most enduring example for children to follow (Ekström, 2010) through both descriptive (how things are) and injuctive norms (what ought to be) (Cialdini and Goldstein, 2004). Typically, family, and, to a lesser extent, other relatives, teachers, peers, and youth organisations, are the most important influence in terms of environmental values (Chawla and Derr, 2012), responsible citizenship (Taylor and Smith, 2009), environmental consumer practices (Grønhøj and Thøgersen, 2012), economic socialisation, and energy conservation (Nies and Witt, 1984; Sustainability Matters, 2013). For instance, the more a family engages in energy conservation, the more corresponding knowledge, intentions, and beliefs develop in the child (Kasapoğlu and Turan, 2008*;* Nies and Witt, 1984). However, peers can also play a particularly significant role in creating a norm encouraging the purchase and use of "screen devices" (e.g. computers, televisions, iPads, mobile phones, gaming devices; Garabuau-Moussaoui, 2008).

2.8.1. Socialisation Processes

Children are socialised either through indirect processes, such as observing others and personal experiences, or direct ones, i.e. purposely being taught (Bandura, 1989; Neeley, 2005), following the same processes for attitude formation presented in the attitudes section (2.3.3). Both processes shape consumer practices, including energy use (Toth *et al*., 2013), but indirect ones generally prevail (Garabuau-Moussaoui, 2011b; Grønhøj and Thøgersen, 2012; Moore *et al*., 2001; Neeley, 2005). The latter often take the form of modelling, which is based on socially reinforced imitation, but also includes the conscious inference and subsequent application of the guiding rules of the observed behaviour (Bandura, 1989). Modelling thus heavily relies on descriptive norms (Grønhøj and Thøgersen, 2012), conveyed through either personal experience or the media. However, the level to which the knowledge thus acquired is translated into rules of thought and conduct depends on the identification of the child with the modelled person, the perceived success and context of the specific behaviour, and the sequential occurrence of attention, retention, reproduction, and motivation (Bandura, 1989). Because modelling is based on observation, less visible practices are less likely to be socialised (Moore-Shay and Lutz, 1988), which may explain why certain more tangible environmental behaviours such as recycling are more preponderant than saving energy (Grønhøj and Thøgersen, 2009).

Direct socialisation methods include operant conditioning, which makes use of positive and negative reinforcement, as well as other forms of explicit parental guidance (Bandura, 1989), such as rules, punishments, reminders, instructions, and explanations. These measures not only control the child's external behaviour, but also cause it to develop a self-directed, internal framework guiding its thoughts, feelings, and actions (Bandura, 1989). Thus, children can be taught energy saving behaviours (e.g. turning off lights) in the same way that they are trained to perform any other behaviour (e.g. washing hands) before they even become conscious of their energy use (Newborough *et al*., 1991), with rules, punishments, and rewards playing an important role (Garabuau-Moussaoui *et al*., 2009; Gram-Hanssen, 2010).

Simply talking about the topic at home also seems to foster the development of environmental attitudes (Eagles and Demare, 1999; Larson *et al.,* 2011) and energy saving practices (DeWaters and Powers, 2011a). However, family conversations about the latter are rare (Halder *et al.*, 2011) and secondary to observational methods of socialisation and conditioning (Garabuau-Moussaoui, 2011a; Grønhøj and Thøgersen, 2012). This is demonstrated by electricity saving behaviours being more strongly correlated than attitudes between parents and their children, thus possibly indicating that children are modelling their behaviour, or

following rules, without necessarily adopting the underlying rationale (Grønhøj and Thøgersen, 2009). Nevertheless, most of those children who learn about energy at school (Sustainability Matters, 2013), or watch relevant television shows together with their families, subsequently discuss the topic with their parents (Garabuau-Moussaoui *et al*., 2009, Solomon, 1992), and often adopt the concerns and rationales they are exposed to in this way (Garabuau-Moussaoui *et al*., 2009). In addition, understanding the logic behind a particular behaviour through communication may serve to reinforce and justify it, even if it was originally adopted for different reasons (Garabuau-Moussaoui, 2011a).

Interestingly, children's perception of their parents' environmental attitudes and behaviours are more strongly correlated with each other than the parent's *self-reported* attitudes and behaviours, showing that children expect their parents to be consistent. Because children are learning mostly though modelling, they are inferring injunctive norms from descriptive ones, thus resulting in their parents' behaviour having a bigger impact than their speech. Discrepancies in what parents preach and do are more common in electricity curtailment than other environmental behaviours, and may be related to the comparatively poor uptake of electricity saving behaviours by their children (Grønhøj and Thøgersen, 2012).

The financial cost of power is sometimes discussed in families with their children (Garabuau-Moussaoui, 2008), thus introducing a financial rationale. Children are socialised into using money in a very similar way to their socialisation into environmental attitudes and general behaviours, through observing their parents, conversations, explanations, rules, and practical experience (see below) (Furnham, 1996; Roland-Levy, 2010; Webley and Nyhus, 2006). Although children do not have an income, in Western countries they often earn money by doing chores in the house, in addition to weekly allowances, and gifts. This allows children to learn the value of money and to practice how to save it (McNeal, 1999), which means that by the age of ten they understand that it requires work and effort to obtain, and that there may sometimes not be enough to cover basic needs (Furnham, 1996). All of these insights are likely to increase their understanding of the financial dimension of energy consumption.

Experiential learning

Children are able to observe and assess the outcome of their own actions, to which they may respond by developing new behaviours, an understanding of when it is appropriate to perform them, and an increase in their self-efficacy (Bandura, 1989). Learning by experience is one of the main socialisation methods into everyday economics and citizenship participation: the

more children use money or are involved in civil activities, the better they understand the importance of budgeting and democratic participation (Roland-Levy, 2010; Taylor and Smith, 2009). Although less well studied, the same can be said for energy use: children with a higher, albeit parentally guided, level of autonomy in using appliances use the latter more responsibly (Garabuau-Moussaoui, 2011b), whereas energy consumption they cannot directly manipulate (e.g. at school) does not feature in their minds (Toth *et al.,* 2013). However, this type of learning is frequently hindered by parental safety concerns limiting the children's control of certain appliances (Garabuau-Moussaoui, 2011b; Garabuau-Moussaoui *et al.,* 2009; Mirosa *et al.,* 2011; Toth *et al*., 2013), thus causing them to remain incompetent (Jensen, 2002). Ironically, it is often exactly this perception of incompetence which causes parents to retain the restriction on their children's use of an appliance, thereby depriving them of the chance to ameliorate the situation (Taylor and Smith, 2009).

2.8.2 Stages of Socialisation into Energy Use

Environmental arguments feature little in the minds of parents when it comes to socialising their children into energy practices – unlike, for example, the building of social relationships, risk management, and satisfaction of physical needs (Garabuau-Moussaoui, 2008). Children's socialisation into energy use is based on a build-up of micro-rituals, often encouraged by their parents, which allows them to develop new skills, autonomy and recognition within their family (Garabuau-Moussaoui, 2011b). This process generally happens in progressive stages between the ages of three and ten (i.e. mostly primary school), although the exact timing varies widely across families and particular behaviours, and, at least initially, may be subject to inconsistent behaviour on the part of the children (Garabuau-Moussaoui, 2008, 2011a). After an initial phase of utter dependence on the parents, children gradually learn how to operate certain appliances (e.g. microwave, TV) and are allowed to use these by themselves, but within limits and levels of supervision determined by the parents' mood and situational factors (Garabuau-Moussaoui, 2008, 2009, 2011a). Finally, children achieve autonomy in their actions and start to manage their own behaviours, usually by the age of ten (Garabuau-Moussaoui, 2008, 2011a).

2.8.3. Parenting

Socialisation processes generally depend on parenting styles. The latter vary across cultures (Ekström, 2010; Nixon and Halpenny, 2010) and are generally classified it into four distinct styles (Table 2.3) defined by the interplay between parental responsiveness (warmth, support, sensitivity to children's needs) and control, i.e. rule-driven demands of maturity and responsibility (Nixon and Halpenny, 2010).

Table 2.3 Maccoby and Martin's (1983) two-dimensional classification of parenting styles (in Nixon and Halpenny, 2010)

	Demanding (Controlling)	Undemanding (Low control)
Responsive (accepting)	Authoritative	Permissive- Indulgent
Unresponsive (rejecting)	Authoritarian	Permissive - Neglectful

Research on New Zealand families has shown that, over the past 30 years, parenting styles have moved from negative, authoritarian methods of discipline, based on hierarchy and the parents' power, towards more authoritative ones, which are more 'democratic' and based on dialogue. Today, the majority of parents avoid physical punishment and verbal aggression (71%; Kremer *et al*., 2010). Authoritative parents generally have a warm relationship with their children, clearly communicate their goals, provide explanations for rules and punishments, and establish clear boundaries and consistent routines (Kremer *et al*., 2010). Unlike their authoritarian peers, they are usually also open to some degree of negotiation, and foster their children's feeling of self-efficacy by encouraging independence and self-reliance (Bandura, 1989; Fischer and Crawford, 1992; Kremer *et al*., 2010; Larsson *et al*., 2010). This effort to make plain the benefits and reasons behind a particular behaviour often increases the children's compliance and intrinsic motivation (Kremer *et al*., 2010), and predisposes them to the development of internal control and greater competence (Nixon and Halpenny, 2010).

To date, relatively little is known about the effects of authoritative parenting styles on pro-environmental behaviours (Grønhøj and Thøgersen, 2012). In general, authoritative parenting would be expected to encourage children to think critically about materialism, with their greater autonomy requiring them to rely on their own attitudes (Grønhøj and Thøgersen, 2012). Yet, while autonomous teenagers indeed tend to purchase environmentally friendly

products and recycle more, the same does not hold true for electricity consumption and conservation. The latter instead seem to be guided more by modelling and rules (Grønhøj and Thøgersen, 2007), and are not clearly related to parenting styles (Grønhøj and Thøgersen, 2012).

2.8.4. Family Dynamics

Family dynamics describe the pattern of interaction among family members, and as such are determined by parenting styles and socialisation processes, as well as the way in which children react to them (Schermerhorn and Cummings, 2008). A particular family dynamic arises from both momentary interactions and long-term developments, and depends on a variety of factors, such as individual family hierarchy, age, gender, temperament, political views, values, and beliefs (Schermerhorn and Cummings, 2008). Family dynamics around household energy use tend to involve more conflict than other environmental practices (Grønhøj, 2006). Typical points of tension include children (not) switching off lights or turning up the heating without their parents' permission (Garabuau-Moussaoui, 2011b), making electricity use "the centre of a daily guerrilla" (Garabuau-Moussaoui, 2008, p. 3). Such tensions may reflect a more fundamental power struggle within the family, especially when children choose to defy their parents' rules and authority (Garabuau-Moussaoui, 2008, 2011b). However, by pushing the boundaries, children can also demonstrate that they can perform a particular behaviour responsibly, and thus ultimately gain more autonomy (Garabuau-Moussaoui, 2011b).

Frequent tensions notwithstanding, there are some families in which cooperation, rather than conflict, is the dominant dynamic when it comes to saving energy, with the benefits of the latter being clearly understood by everyone involved (Garabuau-Moussaoui *et al*., 2009). Pro-environmental practices are frequently underpinned by this principle, which not only aims for a positive impact on wider society or the environment, but importantly also promotes a more direct goal shared by all family members (Reid *et al.,* 2010).

2.9 Children's Agency

Sociologists disagree on whether individuals form the social structure through voluntary and independent actions aimed at influencing either their own or other people's behaviour

("agency"[1] of Jensen and Schnack, 1997), or whether the social structure instead determines individual practices (Scott and Marshall, 2009). Giddens (1976) argues that structure and agency are interrelated: human agents act by using structured knowledge, which therefore not only constrains agency, but also enables it and allows it to be used in innovative ways. Eventually, depending on the power and number of agents, this may lead to the transformation of the original structures (Giddens, 1976). Thus,

> to be an agent means to be capable of exerting some degree of control over the social relations in which one is enmeshed, which in turn implies the ability to transform those social relations to some degree […]. Agents are empowered to act with and against others by structures: they have knowledge of the schemas that inform social life and have access to some measure of human and nonhuman resources (Sewell, 1992, p. 20).

In the context of this research, children are socialised into the existing social structure by their family, school and the community (sections 2.5–2.8), but can subsequently develop agency through becoming energy literate (sections 2.2–2.4), thus ultimately contributing to energy conservation. Specifically, agency implies the ability to have an influence on social relations (Giddens, 1976) and therefore (in this context) having an impact on other members of the family in order to change established family practices.

Overall, agency has a strong influence on children's identity, and how they view their role in society (Taylor and Smith, 2009). The capacity for agency depends on cultural, historical, and social factors, as well as knowledge, innovation (Sewell, 1992), courage and commitment (Jensen and Schnack, 1997), and self-efficacy (Bandura, 1989). Children can develop all of these by becoming engaged in conservation activities (Chawla and Derr, 2012; Jensen and Schnack, 1997), which can lead to a virtuous circle involving a gradual increase in competence and responsibility: the more children do, the more skills they acquire, thus making them more likely to take the initiative to do more (Taylor and Smith, 2009). Children's agency grows with their ability to distinguish consequence from effect, differentiate facts from judgements, and manage conflict and emotions, as well as the recognition they gain for their efforts (Taylor and Smith, 2009). In this light, the dependence of children on their parents should not be seen as contradictory to agency, but instead as a source of support enabling children to make their own decisions and to cope with problems arising along the way (Taylor and Smith, 2009). Thus, encouraging autonomy while ensuring support helps children to internalise environmental goals and retain environmental practices into adulthood (Pelletier *et al.*, 2011).

[1] Other authors refer to agency by describing people as actors or advocates.

2.9.1 Children's Influence in the Family

Children have a strong influence on family consumption, and are often the ones driving purchase decisions (Ekström, 2007; Martensen and Grønholdt, 2008; McNeal, 1999; Reid *et al*., 2010; Swinyard and Sim, 1987; Todd, 2010). Although parents generally head the household (Grønhøj and Thøgersen, 2009), all family members tend to have an input in consumption-related decisions (Hall, 2011; McNeal, 1999; Reid *et al.,* 2010), which in the case of children may take the form of asking nicely, bargaining, showing affection, simply asking, begging and pleading, showing anger, and lying (Williams and Burns, 2000). Despite their limited authority, proactive children are capable of purposely influencing others, including their parents ("reverse socialisation"; Ekström, 1995), and of changing daily routines in their home (Garabuau-Moussaoui, 2011a; Garabuau-Moussaoui *et al*., 2009; Larsson *et al*., 2010). This impact extends to environmental practices, with children frequently pointing out to their parents the inconsistencies between their environmental attitudes and behaviours (Garabuau-Moussaoui, 2011a; Gifford and Sussman, 2012). In addition, their receptiveness to new concepts and technologies sometimes even allows children to teach their parents about the topic (Ekström, 2007; Reid *et al*., 2010; Rickinson, 2001; Zografakis *et al.,* 2008), and can make them a catalyst for involving their family in environmental behaviours, such as buying eco-friendly products (Easterling *et al.,* 1995; Rickinson, 2001).

The considerable influence of children is exemplified by them, together with the media, becoming the main influence on environmental matters in a quarter of UK families (National Ethical Investment Week, 2008). Yet, despite this, their agency in terms of energy conservation seems to be surprisingly small. In one case study, 24% of parents had been convinced by their children to start recycling, but only 5% had been persuaded to save energy (Schlossberg, 1992). Although children are sometimes quick to point out when parents or siblings forget to pay attention to energy, their own behaviour is often inconsistent, and likely motivated by the wish to challenge authority, be perceived as the "good child", or accuse siblings (Garabuau-Moussaoui *et al*., 2009). Similarly, Grønhøj (2007) found only weak signs of reverse socialisation with regards to electricity curtailment, with parents instead being the primary influence. Their somewhat carefree attitude to energy conservation might be the result of these children being less environmentally committed than their parents (Grønhøj and Thøgersen, 2009), although Garabuau-Moussaoui (2011a) found that some children inspire environmental discourse around energy use at home. In addition, interventions aimed at children have been effective in influencing their parents' conservation behaviours (e.g.

Robinson, 2010; Zografakis *et al*., 2008; section 2.9.3). Further research needs to address this apparent paradox, and investigate the processes that enable children to trigger the adoption of new family practices.

2.9.2 Parents' Acceptance of Children's Agency

Messages instigating action tend to be more readily accepted when the source is highly credible, the content provides arguments as to the benefits of change, includes an explicit conclusion, and is repeated several times (Miller *et al*., 1975). However, except for constant repetition, children generally are not able to meet these criteria, since they do not tend to use argumentation, and are usually not considered to be highly credible (Williams and Burns, 2000). Additionally, in showing agency, children run the risk of interfering with the family power structure (Garabuau-Moussaoui, 2011a). Thus, the parents' attitude towards accepting suggestions coming from their offspring is as important as the message itself (Garabuau-Moussaoui, 2008), and varies widely across families (Garabuau-Moussaoui, 2011a) depending on parenting styles (2.8.3). For instance, Garabuau-Moussaoui *et al*. (2009) found that parents might be put off by their children's own inconsistency in performing the behaviour they are advocating, or might choose to support their children in changing their own behaviour while refusing to invest any effort in changing the family routine as a whole. Other families had already incorporated most of the environmental practices they could afford, leaving little room for children to improve the situation. Finally, some parents, mostly from families emphasising cooperation (Garabuau-Moussaoui *et al*., 2009) did consider, support and implement their children's suggestions, thus reinforcing their efforts (Garabuau-Moussaoui, 2011a).

2.9.3 School to Home Transfer

Personal contact is more efficient in disseminating information, changing attitudes and developing a will to act than more indirect sources, such as the media (Zografakis *et al*., 2008; Stephenson and Carswell, 2012). For instance, a New Zealand study found that family and friends are the main drivers of energy efficient changes in the household (Stephenson and Carswell, 2012). Schools offer a platform enabling personal communication between children and their teachers, peers, and parents, and can therefore help them to "act as educational agents and opinion leaders at home" (Halder *et al.,* 2011, p. 1234). The role of formal

education in socialising children is widely acknowledged (Larsson *et al*., 2010), and indeed ultimately responsible for most cases of reverse socialisation (section 2.9.1) at home (Garabuau-Moussaoui, 2011a), with children acting as "mediators" between the public agenda and the population at large (Garabuau-Moussaoui, 2011b). This has been the case, for instance, in anti-smoking campaigns involving schools, but targeting parents (Ekström, 2010).

As discussed previously (section 2.4.1), energy education is an effective means of changing children's attitudes and behaviours, thus leading them to become more aware of their energy use, and act accordingly[1] (DeWaters and Powers, 2011b; Robinson *et al*., 2011; Zografakis *et al*., 2008). However, little is known about when and how educating children this way may affect their parents' behaviour (Larsson *et al*., 2010; Legault and Pelletier, 2000; Toth *et al*., 2013). Environmental education programmes targeting children have been found to increase their parents' awareness of environmental issues, but seemingly fail to change their practices (Legault and Pelletier, 2000) – except when being aimed specifically at developing advocacy (e.g. Larsson *et al*., 2010; Reid *et al*., 2010; Rickinson, 2001) by encouraging more conversations about energy within the family (DeWaters and Powers, 2011b). To do so, such programmes rely on activities like role playing games, the direct feeding of information to parents, getting children to set goals and undertake pledges, and asking children to prepare a report for their parents on how they can save energy at home, with the goal of using it as a basis to discuss and implement feasible changes (Robinson *et al.,* 2011; U.S. Department of Energy, 2010). For instance, an energy programme run in a girl scouts' group doubled the number of parents adjusting the fridge and hot water temperature, and installing energy efficient technology (Robinson *et al.,* 2011). Similarly, an energy programme run at some schools in Greece resulted in many parents adopting energy efficient light-bulbs, doing only full loads of laundry, boiling only the amount of water needed for cooking, and managing the heating according to the season (Zografakis *et al*., 2008).

These observations suggest that children's energy education can have a significant effect on household practices, and, if it were provided on a wider scale, could contribute towards social change. However, it is important to keep in mind that ideas brought home from school are sometimes seen as an external imposition on the private realm and a threat to parental authority (Ekström, 2010; Garabuau-Moussaoui, 2011ab), especially when children use information learned at school to undermine their parents' financial, logistical or

[1] E.g. turning off appliances and lights, unplugging electronics, doing large loads of laundry, line drying clothes, taking shorter showers, closing the fridge door quickly, boiling only the amount of water needed for cooking, and managing windows, curtains and the heating according to the season.

environmental arguments (Garabuau-Moussaoui, 2008, 2011a). This point is often ignored by institutions, which try to empower children without creating the conditions for the acceptance of their agency within their family (Garabuau-Moussaoui, 2011ab; Larsson *et al*., 2010). In addition, energy education runs the risk of overwhelming children with the pressing nature of the environmental issues it presents, especially since they often fail to understand that the individual actions they are encouraged to perform are part of a much larger collective effort. This can create a sense of unbearable responsibility, leading to feelings of anxiety, anger and guilt (Garabuau-Moussaoui, 2011a). Finally, it needs to be borne in mind that being made to repeat certain behaviours learnt at school does not necessarily enable the children to analyse them critically (Garabuau-Moussaoui, 2011b). These sticking points raise several questions about how, when and where school should be used as a means to influence children, parents, and ultimately society, without infringing on ethical standards of education, burdening the children's consciousness, and creating conflict within families (Ekström, 2010; Garabuau-Moussaoui, 2008; Larsson *et al*., 2010).

Overall, recent years have seen the emergence of a new focus on the role of children in energy consumption and conservation (e.g. Garabuau-Moussaoui, 2011ab; Garabuau-Moussaoui *et al*., 2009; Grønhøj and Thøgersen, 2009, 2011; Toth *et al*., 2013). Despite this, relatively little is known about:

a) The energy knowledge of children in primary school.
b) How children use energy in the home, which energy saving behaviours they are performing, and what level of engagement in energy saving behaviours can be realistically expected.
c) The extent to which energy education provided in schools can be transferred into action at home through children influencing family practices, and the parents' reaction to their children's energy saving suggestions.
d) The processes developing children's energy literacy and practices in the household context.
e) Children's energy behaviours, knowledge and attitudes, as well as their socialisation into energy use in the New Zealand context.

This thesis aims to address these research gaps by moving beyond a purely individualistic framework and investigating children's everyday lives, as well as their interactions with other people, in their natural context. Given the limited amount of information on primary school children's understanding of energy, as well as their household electricity use, it is difficult to formulate hypotheses *a priori*. In addition, exploring children's energy use must take into

account a wide range of factors and processes affecting this age group in particular, such as levels of control, socialisation methods, and family dynamics, in addition to the broader topics of knowledge, attitudes, and behaviour. Therefore, this thesis will use an interdisciplinary, exploratory and comprehensive approach to researching children's household energy use in New Zealand, based on a mainly qualitative methodology conducive to the identification of processes.

Chapter 3

Methodology

There are a variety of ways to obtain data on children's behaviour and attitudes, including tests, questionnaires, story writing, diaries, creating comic books, drawings, photographs, ethnographic participant observation, and online blogs (Clayton, 2012; Davis, 2010; Punch, 2002; Smith *et al*., 2000). Typically, children's experiences have been assessed in a structured way (e.g. questionnaires and tests), which deprives them (the children) of the chance to share their opinions and perspectives (Smith *et al*., 2000). As a result, "children are not used to expressing their views freely or being taken seriously by adults because of their position in adult-dominated society" (Punch, 2002, p. 325). Thus, the methodological challenge is to motivate and enable children to express their views (Clayton, 2012; Curtin, 2001; Ekström, 2010; Punch, 2002), while taking into account time constraints and practical issues.

The first section of this chapter outlines and explains the basis for the choice of the methodological approach and the particular methods implemented in the primary research component of this study. It also discusses the implications for the validity and reliability of the findings as a result of those methodological choices. The second section reports the procedures followed to recruit participants, and the collection, analysis and synthesis of the data. Finally, the last section provides a description of the participating schools and families, including the latter's home context.

3.1 Methodological Approach

Given its aims of exploring and understanding everyday practices and processes relating to children's energy use, this study employs a qualitative framework based on social constructivism and phenomenology, complemented and enriched by a mixed methods approach, including exploratory statistical analysis. Each of these components, and their contribution to the present study, are described in more detail below.

Alhough the focus of this thesis is on social constructivism the consideration of individual children's opinions could be interpreted from a more individualistic or psychological point of view. In this sense, the research could be framed in terms of epistemological pluralism, allowing it to embrace both a focus on the individual arising from social psychology *and* a more sociological framework based on social constructivism (Miller *et al*., 2008). This is

consistent with the interdisciplinary and mixed-methods approach taken here which is also at the core of epistemological pluralism (Miller *et al*., 2008).

a) Qualitative approach and social constructivism

Social constructivism and social constructionism both describe the contextual premise that reality is subjective and perceived differently depending on the individual (Burr, 2003; Kalof *et al*., 2008; Guba and Lincon, 1994), thus providing the framework for this research[1]. In this light, research questions, methodological approaches, and the interpretation of results are seen as social constructs arising from the interaction between the researcher and a particular social phenomenon within a specific geographic and historic context (Guba and Lincon, 1994). Overall, a social constructivist paradigm can provide rich insights into human behaviour, with its meaning and purpose explained from the perspective of the participants themselves (Guba and Lincon, 1994). Thus, social constructivism has been especially influential in shaping qualitative research (Kalof *et al*., 2008), although it is also compatible with quantitative approaches (Guba and Lincon, 1994; see mixed methods approach below).

Social phenomena focussing on human reality, as expressed in the voice of the actors, acquire meaning depending on the specific and variable contexts in which they occur (Guba and Lincon, 1994). Qualitative research aims to (1) comprehend and explain social phenomena by taking into account social context; (2) focus on the meaning and motivations behind personal experiences, as well as intentionality; and (3) be empirical, interpretative, and empathetic towards the participants (Starke, 2010; Kalof *et al*., 2008; Von Glasersfeld, 1993*)*. Owing to its flexibility, the qualitative approach can be regarded as an approximation to social phenomena, and is compatible with different research paradigms. This makes it the most appropriate framework for this research, which aims to reconstruct individual, everyday experiences in order to identify areas of agreement and generate sophisticated information on children's electricity consumption.

b) Phenomenology

A phenomenological social approach "emphasises the direct experience of phenomena to determine their essence, the things that make them what they are" (Russell, 2011, p.18). It also asks the researcher to "see reality through another person's eyes, in order to understand how the participants feel and think about their lives" (Russell, 2011, p. 20). Phenomenology uses in-depth theoretical analysis (Habermas, 1984, 1987; Giddens, 1976) to analyse the

[1] Psychologists tend to use the term social constructionism (instead of constructivism) to denote a more sociological approach. However, both terms are founded on the same theoretical principles (Burr, 2003).

behaviours, meaning and intentions of social actors in micro-social or everyday life spaces, such as the *habitus* of Bourdieu (1994), or the *Lebenswelt* ("lifeworld") of Schutz and Luckmann (1973). This fits well with the emphasis of this research, which is on understanding children's everyday practices and related discourses in the realm of the "unproblematic" *Lebenswelt*, where "taken for granted" or "natural" attitudes prevail (Schutz and Luckmann, 1973).

As a broad paradigm, phenomenology overlaps with elements of interpretative and comprehensive sociology (Weber, 1978), anthropology, and social psychology (Russell, 2011). In addition, it incorporates hermeneutics as a means to discover meaning through the interpretation of texts (Prasad, 2005; Russell, 2011), so as to explore how "the individual and the world constitute and are constituted by each other" (Laverty, 2003, p. 9). One example of this approach is the interpretation of individual encounters through language (Laverty, 2003), such as the transcribed interviews forming part of this study, with hermeneutic research empathetically recognising categories that generate from discourses (Laverty, 2003).

c) Sociology of childhood

Although children have traditionally been seen as a subset of family or education studies (Lenzer, 1991), they are "active, creative social agents who produce their own unique children's culture, while simultaneously contributing to the production of adult societies" (Corsaro, 2011, p. 4). Acknowledgement of children as a distinct social group led to the development of the sociology of childhood in the 1990s, integrating insights from a range of disciplines as varied as education, psychology, and health (Lenzer, 1991).

The framework of the sociology of childhood is intertwined with the human rights of children (Smith, 2002), because both frameworks consider children to be equal in importance to adults, and assign to them both rights and obligations, as well as cultural and economic importance (Darbyshire *et al*., 2005; Smith, 2002; Smith *et al*., 2000). At the core of this idea is the recognition of children's autonomy and capacity to make competent decisions, and therefore their role as "active participants in, rather than the passive recipients of, research, policy and provision of services" (Smith *et al*., 2000, p. xi). Thus, it is crucial to include children's direct opinions, and allow their voice to be heard in order to support their empowerment through a bottom-up approach (Corsaro, 2011; Davis, 2010; James and Prout, 2004; Smith *et al*., 2000; Warming, 2011). As explained by Smith *et al*. (2000, p. xi), "finding out about children's perspectives reduces the ethical risks for advocates, develops children's capacity for the exercise of autonomy, encourages them to become effective citizens and produces useful

information". Overall, this makes the sociology of childhood the appropriate tool to study children's potential to act as agents for energy efficiency in the present, and to become energy efficient citizens in the future.

d) Mixed methods approach

Because the focus of this thesis is on phenomenology and the sociology of childhood, the main participants are children (26 interviews, three focus groups), with parents (one per interviewed child) and teachers (four in total) providing contextual information (section 3.3). Besides interviews and focus groups, data were collected through photo elicitation methods, drawings, and surveys (section 3.1.1), and analysed using both qualitative and quantitative techniques (see below).

Though mainly qualitative in nature, the data collection and analysis was supplemented by the use of quantitative questionnaires, as well as frequency counts and content analysis of the data from the photographs and interviews (Guest *et al*., 2012). A mixed methods approach such as this offers several advantages (Guba and Lincoln, 1994; Guest *et al*., 2012; Singleton and Straits, 2010). First, different methodologies have the potential to generate complementary data (Guest *et al*., 2012); for instance, the questionnaires completed by the parents add information about their own attitudes and values, thus complementing the main data on the children obtained from the interviews. Secondly, one methodology can offset the weaknesses of another (Singleton and Straits, 2010); thus, quantitative analyses are more objective than qualitative ones, but the latter are better suited to the characterisation of processes, and offer insights into participants' opinions (Hall, 2011; Kalof *et al*., 2008). Finally, results obtained through different methodologies can be compared and contrasted, resulting in more compelling evidence (Davis, 2010; Kalof *et al*., 2008) – for example by facilitating triangulations, and helping to address questions of validity and reliability (Singleton and Straits, 2010).

Exploratory research using mixed methods can be designed as sequential or concurrent (Kalof *et al*., 2008). While the former approach calls for two or more phases of data collection and analysis, the latter uses simultaneous, but independent, analyses of different data sets to compare and validate specific results, identify contradictions, and explain social phenomena (Guest *et al*., 2012). While a sequential design allows explicit testing of qualitative results, substantial time and resource requirements (Guest *et al*., 2012) make it unfeasible in this case. Instead, this study therefore employs a concurrent approach, based on a variety of methods: quantitative analyses of the photographs and questionnaires, qualitative analyses of the focus

groups, and both qualitative (thematic analysis) and quantitative (content analysis, statistical tests, correspondence analysis) analyses of the interviews. Besides providing an opportunity to assess the degree to which these approaches corroborate each other, or triangulate, this mix may help to strengthen qualitative findings, and to identify the processes guiding any quantitative patterns.

e) Other possible approaches

Other possible approaches to the research are grounded theory, ethnography and questionnaires, which are all suitable for studying children's energy literacy, behaviours and socialisation processes, and, to varying degrees, have influenced the design of this study. For example, the present analysis incorporates aspects of grounded theory by developing codes and categories through a grounded analysis of interviews and focus groups, questioning the data for processes[1], giving a voice to the participants and aiming to represent them as accurately as possible, and constructing a theory based on qualitative data (Charmaz, 2006; Guest *et al*., 2012). However, unlike in a grounded theory approach, this research uses a model based on previous literature as a starting point[2] (Fig. 1.1), considers the family (as opposed to a particular incident) as the unit of analysis, and relies on a mixed methods approach (Charmaz, 2006; Glaser and Strauss, 1967; Prasad, 2005). Similarly, while the interest in children's everyday life (see phenomenology above) completely coincides with the aims of ethnographical research (McNeill and Chapman, 2005; Russell, 2011; Warming, 2011), this study deviates from strict ethnographical principles by focussing on specific research questions about energy literacy, practices, and agency in the context of the household, rather than trying to understand the children's broader culture (Prasad, 2005). Furthermore, direct observation of the children's energy use in their homes would not have been possible in this case owing to time constrains, as well as ethical and practical considerations (McNeill and Chapman, 2005; Punch, 2002).

Some of the research questions, such as the children's energy knowledge, attitudes and behaviours could potentially be addressed through questionnaires (Kalof *et al*., 2008). However, pre-determined lists of questions can overlook aspects that are important to the participants, or overestimate attitudes (Krech and Crutchfield, 1948). More importantly, they are a quantitative approach, and thus better suited to testing a particular hypothesis than to

[1] "What process is at issue here? How can I define it? How does this process develop? How do the research participants act while involved in this process? What do the research participants profess to think and feel while involved in this process? What might his or her observed behaviour indicate? When, why and how does the process change? What are the consequences of the process?" (Charmaz, 2006, p. 51).

[2] Although this model can be considered a working hypothesis, the purpose of the study is not to test the hypothesis, but to use its elements to explore children's electricity use.

exploring and understanding the processes guiding everyday behaviour (Darbyshire *et al*., 2005; Kalof *et al*., 2008), especially when, as in this case, relatively little is understood of both the behaviour and the processes. Finally, they do not allow children to express their thoughts (Smith *et al*., 2000). Nevertheless, due to their ability to enable the relative quick collection of specific data, and provide important contextual information (Kalof *et al*., 2008), they are used here to obtain complementary information on the parents' behaviours, attitudes and values, as well as about physical aspects of the families' dwellings.

3.1.1 Choosing Data Collection Techniques

For this study, children were recruited from schools in order to obtain participants of similar age, but from a range of socio-economic backgrounds (section 3.3.1 and 3.3.2). Data were mainly collected through semi-structured interviews with children, their parents, and their teachers, and complemented by focus groups, photo elicitation methods, drawings, and surveys. Together, these techniques maximise the amount of data that could be gathered within the time limits set by the schools, and provide "complementary insights and understandings that may be difficult to access through reliance on a single method of data collection" (Darbyshire *et al*., 2005, p. 417), while still allowing the children to express their opinions (Davis, 2010; Punch, 2002).

Although children are considered to be as competent as adults in engaging in conversations and sharing their perspective, they nonetheless are restricted by a shorter attention span, a more limited vocabulary, a need for more concrete conversations, and an inherent power imbalance with adults (Curtin, 2001; Punch, 2002). At ten years of age, children have not yet fully developed abstract thought (Lawrenz and Dantchik, 1985; Piaget, 1977), and instead "process information best when they are asked to access information they use frequently" (Davis, 2010, p. 65). A mix of interviews and pictures provides an effective way to address these issues (Cook and Hess, 2007; Punch, 2002): while interviews allow children to show their competence and avoid being patronised, inviting them to take photographs and produce drawings acknowledges the age difference between them and the researcher, provides a concrete focus for discussions, and thus helps them to feel more comfortable (Punch, 2002). As a result, this particular combination of methodologies has been found to be the most powerful way of gaining access to children's perspectives (Davis, 2010).

Throughout the research, an effort was made to talk to the children in terms they are likely to understand (Davis, 2010; Punch, 2002). To help the children remember and recognise relevant

information, both the interviews and focus groups were guided to revolve around their everyday lives, often based on the context provided by their pictures (Peracchio, 1992; Punch, 2002). When the discussion moved away from the photographs and into topics such as their agency, children were asked to think and talk about specific examples so as to make the conversation as concrete as possible. Finally, to keep the children's attention, both the interviews and focus groups were kept short (approximately 30 min and one hour, respectively) (Curtin, 2001), and the procedures and goals guiding them were explained to the children, first as an overview, and then one step at a time throughout each activity (Davis, 2010).

a) Pictures: drawings and photographs

As a first step of taking part in this study, all of the children were asked to take photos of how they (themselves) use electricity at home. These photographs not only provide data in their own right, but were used as a guide for each of the interviews and focus groups. During the latter, children were also given the opportunity to complement their photos with drawings, whereas this approach was not implemented in the interviews to avoid the possible discomfort arising from the child having to draw alone while the researcher waited and watched. Drawings, photographs, and videos are widely employed in child-based research, which uses them as projective techniques helping to elucidate the meaning of practices that children might struggle to articulate, such as feelings and their relationship with objects (Corsaro, 2011; Davis, 2010). From a hermeneutic point of view, pictures thus allow meaning to be constructed and deciphered (Atkinson, 1993; Laverty, 2003). Despite being a relatively recent development[1], photo elicitation methods in particular seem to be very effective in fostering a 'child-centric' approach and providing an insight into children's everyday lives through their own eyes (Cook and Hess, 2007; Darbyshire *et al*., 2005; Davis, 2010; Punch, 2002). In addition, photos are relatively unobtrusive, thus overcoming ethics and access issues, and children often regard the task of taking them as fun and exciting (Cook and Hess, 2007; Punch, 2002).

b) Interviews and focus groups

In order to give the participating children as much opportunity as possible to express their views, they were interviewed individually at their respective schools, so as to avoid any possible influence arising from the presence of their parents or peers (Davis, 2010; Smith *et al*., 2000). Interviews have a long tradition in child-based research (Davis, 2010), and have

[1] They have become more common with the appearance of inexpensive and easy-to-use photographic cameras.

the obvious advantage of providing a direct pathway for children to convey their opinions and experiences (Smith *et al*., 2000). Although children as young as eight have been shown to be capable respondents (Darbyshire *et al.,* 2005), a successful interview often depends on responding to their particular needs. Thus, it is important to make children feel at ease with the researcher, reassure them that the conversation will remain confidential, avoid ambiguous questions, be sensitive to their desire to skip a question or not to participate in a task, minimise the anxiety caused by video cameras and audio recorders[1], and diminish the power imbalance between the child and the researcher as much as possible (Curtin, 2001; Davis, 2010; Smith *et al*., 2000). All of these issues shaped the way in which the present interviews were conducted (section 3.2.1). All of the audio recordings of the interviews and focus groups were later transcribed for analysis (section 3.2.2; Guest *et al*., 2012).

All the interviews were semi-structured, based around pre-established opening questions, and followed by prompts and more detailed questions which changed according to the specific context (Olsen, 2012; Appendix 13). This type of interview was chosen to encourage conversations and allow the participant to talk about the topics that interest them the most, while making sure to cover all the subjects required by the research objectives in a set amount of time (Olsen, 2012).

In addition to the interviews, focus groups exploring similar, energy-related questions – and therefore involving a different set of children – were set up at some of the schools. Focus or discussion groups are increasingly used with children (Darbyshire *et al*., 2005) since they can sometimes produce more information than individual interviews (Curtin, 2001), especially as regards the participants' experiences, perspectives, and ideas (Kennedy *et al*., 2001). The main advantage of this method is the rich data collected through the natural interaction between the participating children, who are used to talking about a variety of matters in groups (Curtin, 2001), and, by the age of ten, are adept at sharing their feelings and thoughts with each other (Kennedy *et al*., 2001). In addition, being part of a group helps children to feel comfortable, and less intimidated by the researcher (Curtin, 2001; Kennedy *et al*., 2001), thus allowing them to guide the conservation towards the things they consider important (Curtin, 2001).

[1] All the interviews were audio recorded with a Dictaphone. In addition, focus groups were also video recorded with small digital cameras, placed in the room as unobtrusively as possible.

c) Parents' interviews and surveys

Supplementary sources of information, such as the parents' interviews, both enrich a study and enable triangulation (Kennedy *et al*., 2001). However, it is important to note that the purpose of this information was *not* to test or verify the children's answers, which form the core of this study (Smith *et al*., 2000), but to complement their views, and broaden the understanding of the household context (Kennedy *et al*., 2001). These data were further enriched by the use of quantitative surveys, which made it possible to collect a vast amount of largely categorical information about the household and the parents themselves in a brief period of time (Appendix 14).

3.1.2 Procedures for Analysing the Data

a) Unit of analysis

The unit of analysis of this research is the family, represented by the parent-child dyad, because the household or family context is the place where children are the most likely to be in control of their electricity use (section 2.6). Furthermore, many household practices, such as those related to energy consumption, are shared between family members, and not solely controlled by a single individual, whether adult or child (Garabuau-Moussaoui *et al*., 2009; Reid *et al.*, 2010; section 2.5.2). Such an approach is not unusual, but carries the danger of interpreting children as merely an appendix of the family, without giving credit to other influences on their lives (Smith *et al*., 2000). In addition, it is important to acknowledge the parents' influence on their children because they are not independent entities (Ekström, 2010). Therefore, this thesis focuses particularly on the child, with the parents only playing a supporting or contextual role. In addition, it explores other potential sources of influence, such as school (through interviews with teachers), or the media (by asking the children and their parents directly about different sources of learning).

b) Thematic analysis

Thematic analysis is a "rigorous, yet inductive, set of procedures designed to identify and examine themes from the textual data in a way that is transparent and credible" (Guest *et al*., 2012, p. 15). Sometimes imprecisely or wrongly labelled as qualitative analysis, qualitative content analysis, or discourse analysis, thematic analysis is extremely common, and indeed a foundational tool in the understanding of qualitative data (Braun and Clarke, 2006; Guest *et al*., 2012). Specifically, this method involves the identification of main themes in a text,

followed by their transformation into codes, and their aggregation into categories (Guest *et al*., 2012). Thematic analysis is very practical because it (1) is flexible; (2) enables the analysis of meaning in large text-based data sets, such as transcriptions of interviews and focus groups; (3) allows the inclusion of data from several different participants; and (4) can be used to build theory and address real-world problems (Braun and Clarke, 2006; Guest *et al*., 2012; Willing, 2013). In addition, it is not bound to any a particular epistemological framework (Willing, 2013), and instead borrows and mixes techniques from phenomenology, grounded theory, interpretivism and positivism (Guest *et al*., 2012). This makes it particularly suitable to the objective of this research to understand children's everyday life through creating theory grounded in the data, interpreting children's experiences, and using a model arising from literature as a starting point (Fig. 1.1).

NVivo9[1] was used to analyse the transcripts and facilitate the thematic analysis, because it makes the process of coding large data sets (especially above 20 texts) easier and more systematic (Guest *et al*., 2012; QSR International, 2013). More importantly, it allows the exploration, reduction, merging and labelling of the categories in an organised fashion, according to procedures that can be saved, revisited, adjusted, and replicated, thus opening the possibility to verify the accuracy of the codings, and improve overall consistency (Guest *et al*., 2012).

c) Statistical analysis

An exploratory statistical technique, correspondence analysis (in SPSS 20), was used to investigate the data of this study in a quantitative manner. Unlike confirmatory statistics, exploratory analyses do not seek to test hypotheses, but instead contribute to their formation by summarising complex data to discover underlying patterns (Ho, 2013; Mulaik, 1985; Tukey, 1980). Correspondence analysis is an ordination technique aimed at reducing the dimensionality of a data set by creating a smaller series of orthogonal variables capturing most of the existing variance, thus allowing major patterns (e.g. those related to behaviour) to be visualised in a two- or three-dimensional plot (Hair *et al.*, 1987). Because it is based on the cross-tabulation of two or more categorical variables, correspondence analysis is perfectly suited to the analysis of qualitative data (Hair *et al.*, 1987). In addition to correspondence analysis, the data were analysed using Kruskal-Wallis, exact chi-square, and exact Mann-Whitney U tests. Although these analyses are traditionally used to test hypotheses, in this case they served as a tool to explore all possible combinations of variables for significant

[1]A qualitative data analysis computer programme.

relationships (Chamblis and Schutt, 2010). Exact versions of the tests were used because of their ability to cope with small, unbalanced or poorly distributed data sets with many ties (Mehta and Patel, 2010), which reflects most of the data of this study.

In order to become meaningful, exploratory statistical analyses must be judged and interpreted within the context of the research (Mulaik, 1985). In the case of this study, this is done within the framework of the qualitative data, with the quantitative approaches playing a supporting role in clarifying patterns, strengthening qualitative observations, and complementing the results (i.e. they do not in themselves constitute definitive evidence; Tukey, 1980). Nevertheless, an extension of this study could, ideally, test the results arising from this thesis using larger samples, and an explicitly quantitative study design (Tukey, 1980).

3.1.3 Validity and Reliability

Face (i.e. perceived) and external validity (i.e. generalisability) are the only two concepts of validity applicable to qualitative research (Guest *et al*., 2012). In order to enable readers to assess the trustworthiness and interpretation of the findings (Guest *et al*., 2012), the concepts, methods, questions and coding schemes used in this study, including examples and many quotes, are presented and explained in the methods section (3.2) and the results and ensuing discussion chapters (4–9). Given the exploratory nature of this study, it is explicitly noted that the sample of participating families cannot be considered to be representative of the country, or even the particular city, as a whole – although the present findings are nonetheless relevant, and may therefore serve as a basis for future representative studies of larger sections of the general population. Instead of representativeness, this study aimed to include families of diverse backgrounds. Similarly, the concept of reliability, i.e. the consistency and replicability of the findings, does not apply to qualitative studies (Guest *et al*., 2012), because individual answers depend on the context and the experience of each participant at the time of the interview or observation. Although surveys were also used in this study, their purpose was to contrast and complement the qualitative data, not to increase reliability which would require large samples (Singleton and Straits, 2010).

There are concepts better suited to the assessment of qualitative research than validity and reliability, such as credibility, which refers to the "confidence in the truth of the findings, including an accurate understanding of the context" (Ulin *et al*., 2005, p. 25), and dependability, which reflects a consistent data collection approach and adherence to the commonly understood rules and conventions governing qualitative research (Guest *et al*.,

2012). To gain an in-depth view of each family and participant, and ensure a consistent data collection and analysis protocol, all of the interviews, focus groups, surveys, codings, and analyses were designed and carried out by the same researcher (Guest *et al*., 2012). While this approach is both common (Guest *et al*., 2012; Kalof *et al*., 2008) and has the advantage of applying the same logic when coding transcripts, the lack of cross-coding (Singleton and Straits, 2010) carries the danger of introducing a variety of individual biases (Guest *et al*., 2012). To address this issue, some of the first transcripts were coded 2–3 times by the researcher until each code was well defined, and all of the quotes within a given code were compared with each other several times to ensure that they fit its definition. This process is greatly aided by NVivo, which facilitates the adjustment of the codes and records their respective descriptions in a log file (Guest *et al*., 2012; QSR International, 2013). In addition, a selection of codes was presented to a colleague to confirm that the code definitions are intuitive and appropriately selected (Guest *et al*., 2012), and 'cherry picking' of quotes in the results section was avoided by choosing them either for being typical examples, or to include the voice of all the participants – except when specifically stated otherwise.

Finally, the credibility and consistency of the results was assessed through several triangulations (Guest *et al*., 2012; Kalof *et al*., 2008; Singleton and Straits, 2010) relating to data collection techniques, informants, methodological approaches, and quantitative methods (Table 3.1).

Table 3.1 Types of triangulations carried out in this research

Triangulation type	Compared elements	Examples for which results were compared using different sources or techniques
Data collection	Interviews, focus groups, photographs, surveys	Children's use of electrical appliances
Informants	Children, parents, teachers	School to home transfer
Methodological approaches	Quantitative, qualitative	Rules as an effective socialisation method
Quantitative methods	Correspondence analysis, multiple correspondence analysis, and exact chi-square, exact Mann-Whitney U, and Kruskal-Wallis tests	Identify the main variables associated with children's socialisation into saving electricity

These triangulations support the main results, thus generally validating this study. However, there are particular instances in which data from different informants, data collection techniques, or methodological approaches diverge. In most of these cases, the different sources complement, rather than contradict, each other. Nevertheless, wherever contradictions occur, they are clearly stated and discussed as part of the results (Guest *et al*., 2012).

3.2 Methods

The procedures used to recruit the participants, and to collect and analyse the data, are summarised in Figure 3.1, and explained in detail throughout the rest of this section.

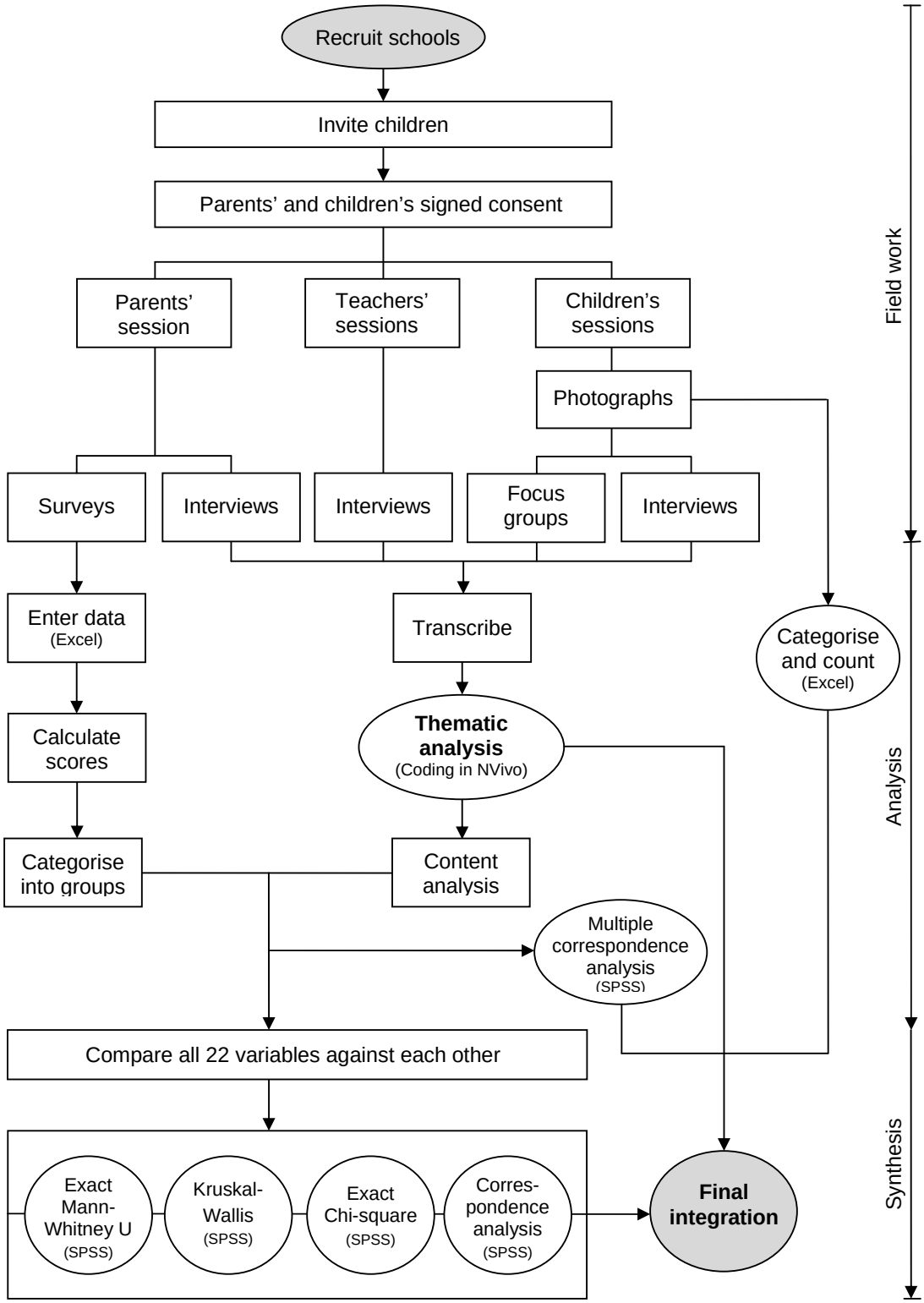

Figure 3.1 Methods and procedures followed in this research

3.2.1 Field Work

Recruiting the participants

In line with previous qualitative analyses focussing on the household (Carlsson-Kanyama and Linden, 2007; Garabuau-Moussaoui, 2011a; Krantz, 2005; Grønhøj & Thøgersen, 2011), this study aimed to interview members of 20–30 families, and form discussion groups comprising 4–6 children (Kennedy *et al*., 2001; section 3.3). Although 12 interviews are usually enough for emergent themes to reach saturation point (Guest *et al*., 2006), a higher number was sought in this study to account for the (intentionally) diverse backgrounds of the participants. Overall, 26 families (each represented by one child and one parent), three focus groups (comprising 14 children in total), and four teachers were recruited (see section 3.3).

Co-educational Dunedin primary schools attended by more than 150 students (thus raising the chances of sufficient participants) and/or offering a successful enviroschool programme were initially identified for potential recruitment, with smaller schools being considered later (section 3.1.1). The schools were grouped into those with a medium (4-7) and a high decile rating (8-10), respectively[1]. Decile ratings (ranging from 1–10) are a ranking system used by the New Zealand Ministry of Education and reflect the socioeconomic level of the community from which the school draws its student body. A low decile rating reflects a low socio-economic background, and attracts increased government funding (Ministry of Education, 2013). The enviroschool programme is a voluntary initiative that schools can opt into, and supports the teaching of environmental topics at school, thus helping children to "plan, design and implement sustainable projects and become catalysts for change in their families and the wider community" (Enviroschools Foundation, n.d.). Currently, about 30% of New Zealand primary and secondary schools are enrolled in the programme.

Two medium and two high-decile schools, each including one 'regular' and one enviroschool respectively, were then invited to participate through an email, a phone call, and a meeting with the school principal. If the principal declined, or not enough children volunteered (section 3.3.1), another school was chosen according to the same selection criteria. Between August 2011 and March 2012, ten schools were invited, five of which took part in this study (section 3.3.1). Once the school had agreed to participate, the researcher met with the teacher of year 5 (nine and ten-year-old children; section 1.5) to explain the project in detail and arrange the collaboration. Following an introduction by the teacher, the children were personally invited to take part by the researcher, who dressed informally and asked to be

[1] There are no schools with more than 150 students and a low decile rating in Dunedin.

called by her first name. After talking briefly about her own background, the researcher explained the project and procedures, and, while encouraging participation, stressed that the activity was entirely voluntary, not related to school, and not in any way assessed (reduction of power imbalance; Curtin, 2001; Smith *et al*., 2000; Warming, 2011). To clarify the aims of the study and facilitate interaction with the class, the children were asked to name examples of how they use electricity at home by raising their hands, and given an opportunity to ask questions (building rapport and communication; Smith *et al*., 2000). Finally, those children willing to participate[1] were provided with information sheets and consent forms[2] to be signed by themselves and one parent/caregiver. Besides the parents' contact details, the form asked whether participants would prefer to take part in a focus group or an interview (section 3.3), and whether a disposable camera was required for the children to take pictures, in case they had no access to a digital one (Appendix 12). In all cases, the majority of the class was interested, asked questions, participated with ideas, and took home the information and consent forms. During the following week, the teachers collected the signed forms, having previously reminded the children to return them.

Data collection

a) Photographs

After the consent forms had been collected, the participating children were encouraged to take pictures of anything that they related to electricity, as well as being given the specific task of taking five to ten photographs on how they themselves use power at home. This number was based on previous research (Cook and Hess, 2007) and was deemed sufficient for children to identify at least 5 ways in which they use electricity, while at the same time ensuring that the pictures could easily be returned to the researcher. Those children who requested it were provided with a disposable camera, taught how to use it, and asked to take a few test pictures (Punch, 2002). On the same day, their parents were sent an email or given a phone call to explain the procedure and thank them for their participation. One week later (and sometimes following a gentle reminder), the children returned the disposable cameras back to the school, while pictures taken with digital cameras were sent directly to the researcher by the parents via e-mail. All of the digital photographs were printed, and the pictures from the disposable cameras were both printed and scanned.

[1] The researcher did not insist when the children declined, so as to respect their decision (Section 3.1).
[2] All the information sheets and consent forms follow the University of Otago guidelines and were approved by the University of Otago ethics committee.

Ultimately, the photographs turned out to be a central part of this research because they helped to (1) recruit children and create a fun association with the project (section 3.3); (2) find out what electrical devices are recognised and used by the children (Table 4.1, Figure 4.1); (3) gain an impression of their household and the technology available; (4) break the ice and facilitate the conversation during the focus groups and interviews (see below); and (5) provide an insight into school to home transfer through the family conversations that arose from the photographs exercise (section 7.3.1).

b) Focus groups

A time and place (library, study room, empty classroom) to run the focus groups was arranged by the teacher at each school. In all cases, the furniture was set aside and a wooden board carrying a large piece of paper and several packets of colour pencils and felt pens was placed on the floor (Punch, 2002). Because the focus groups were run by only one researcher, the role of facilitator was prioritised, and notes were only taken after each session had finished (Smith *et al*., 2000). However, a dictaphone was placed in the centre of the board, and two small digital video cameras were set up to record the context of the conversation, as well as the children's faces and non-verbal expressions (Kennedy *et al*., 2001; Smith *et al*., 2000). The videos were only used by the researcher to make the transcriptions, thus loss of confidentiality regarding the possible recognition of the children's faces was not an issue. The non-verbal expressions were noted on the transcripts to aid in their interpretation in the thematic analysis.

A detailed description of the protocol for the focus groups is provided in Appendix 13. All of the children (4 to 6 per focus group) and the researcher sat on the floor (Curtin, 2001; Smith *et al*., 2000), around the board. The researcher then started by informing the children that they were being audio and video recorded, and reassured them that the meeting was entirely confidential, not related to school, not being assessed, and that there were no right or wrong answers (Curtin, 2001; Davis, 2010; Kennedy *et al*., 2001; Smith *et al*., 2000; Punch, 2002). Next, the children were eased into participating through the simple and relatively concrete task of explaining their photographs. After all the children had displayed and explained their photographs, they were asked if there was anything missing and, if so, to produce a quick sketch of it. In the two focus groups where children did not identify hot showers as requiring energy, the researcher guided the children towards the answer. Afterwards the conversation was moved towards more abstract issues (Cook and Hess, 2007; Curtin, 2001; Davis, 2010; Smith *et al*., 2000). The latter was achieved though simple and direct questions (Appendix 13), which were rephrased to aid understanding whenever necessary (Smith *et al*., 2000;

Punch, 2002), and covered the following topics: (1) how and why the children use electricity in their homes, focussing on heating[1], showering times, turning off appliances (lights, TVs, computers, and gaming devices) and switching off appliances at the wall (e.g. Garabuau-Moussaoui, 2011a; Toth *et al*., 2013); (2) their efforts to save electricity (e.g. Toth *et al*., 2013); (3) family conversations about energy use (e.g. Garabuau-Moussaoui, 2011a); (4) their efforts to change electricity saving practices at home; (5) possibilities of saving electricity to a further extent (e.g. Toth *et al*., 2013); (6) sources of electricity production (e.g. Solomon, 1992); (7) problems with using electricity (e.g. Garabuau-Moussaoui, 2011a; Solomon, 1992; Toth *et al*., 2013); and (8) learning sources (e.g. Garabuau-Moussaoui, 2011a; Toth *et al*., 2013).

Although a pre-determined structure was implemented for the focus groups (Appendix 13), and the main steps and topics were covered in the same order, the questions and conversations were very flexible and differed between groups (Curtin, 2001; Smith *et al*., 2000). Conversations among the children were encouraged by the researcher remaining silent, except for giving positive reinforcement and attempting to include the quieter children (Curtin, 2001; Smith *et al*., 2000). When a conversation ceased, or went off topic, the researcher moved on to a new question (Kennedy *et al*., 2001). Because children tend to associate the term 'energy' with strength, life and movement, rather than electricity (Solomon, 1992; Trumper, 1993), the specific term 'electricity' was used many times by the researcher to keep the participants focussed. Any further cues were restricted to specific practices (e.g. showering) or family dynamics (e.g. communication and rules), and never mentioned saving energy or financial/ environmental issues as such – although they were used to facilitate conversations when the children themselves brought up those topics.

The focus groups each lasted one hour (Kennedy *et al*., 2001; Taylor and Smith, 2009), and at the end children were thanked, given a printed copy of their pictures to take with them, a participation certificate, and a little pot plant as a gift (Kennedy *et al*., 2001). All of the groups were very informal, and the children seemed comfortable, were talkative, and appeared to enjoy the activity. The children interacted well with each other, likely owing to the fact that they were classmates and share a similar culture and background (Kennedy *et al*., 2001). In addition, in all cases, the children wanted to extend the discussion group after it had finished, thus indicating a good level of interest and rapport.

[1] Children's practices in regards to household heating are not generally studied (section 2.3) because central heating is usually automatic and controlled by parents. However, in New Zealand, electric heaters are more common (section 3.3.3) and thus children's use of heaters and heat pumps are an important part of this study.

c) Children's interviews

The individual interviews with the children were run in a similar way to the focus groups. Different children were recruited to participate in the focus groups and the interviews (section 3.3), as the content of both was very similar (p. 78). Three consecutive interviews were conducted on a single day at the time and place (e.g. common room, library, empty classroom, study room, teacher's office) indicated by the teacher (Appendix 15). The door was always left open, and, on several occasions, other children or teachers were present, but engaged in their own activities. By the time of the interview, the child had met the researcher several times at school and had occasionally interacted with her individually (e.g. providing instructions for taking the photographs), thus increasing familiarity.

The child and the researcher sat next to each other on the floor (Smith *et al*., 2000). After introducing herself again, the researcher asked what the child would like to be called, and then followed the same procedure as that for the focus groups (Appendix 13), except that the interviews: (1) were not video recorded because there was no need to distinguish particular children's voices; (2) did not include drawing activities (section 3.1.1); (3) included a few basic questions about the child's age, how long they had been attending the current school, and city of origin; (4) although being semi-structured, needed more specific questions and prompts; (5) were intended to last half an hour (Curtin, 2001); and (6) included a more detailed discussion of the school to home transfer of general behaviours, and the children's ability to influence family dynamics (Appendix 13). In addition, all of the interviews included explicit questions about heating the home during winter, so as to reduce the effects of the particular season on the children's answers and level of awareness in this regard (all of the focus groups took place in spring or autumn, whereas some of the interviews took place during the summer). Even though the interviews lasted for just half an hour, their focus on a single child meant that all of the practices depicted in the children's photographs could be discussed in detail, and supplemented with additional questions on topics including, and indeed going beyond, those touched upon by the (usually greater) variety of pictures in the focus groups (e.g. closing curtains, doing laundry, having short showers).

Though rarely necessary, the researcher was sensitive to the children wanting to skip a question, e.g. when they were silent, looked away, or seemed uninterested (Curtin, 2001; Kennedy *et al*., 2001; Smith *et al*., 2000). Most of the interviews lasted about 20 minutes, but ranged from 10 to 30 minutes depending on the child (Appendix 15). Short interviews appeared to be related to a lack of knowledge and/or awareness of energy topics, rather than an unwillingness to participate. All of the children were asked if they had questions or wanted

to add anything at the end of the interviews. The majority took this opportunity to engage in a more general conversation with the researcher, thus once again showing a good level of rapport. Finally, the children were thanked for their participation and given the same gifts as those in the focus groups. As expected, while the focus groups provided insights into the children's thinking processes by allowing them to build on each other's ideas, the one-on-one interaction of the interviews led to more detailed conversations about family dynamics and particular behaviours. Thus, the focus groups and interviews each contributed unique, complementary information to the research.

d) Parents' interviews

Parents were contacted after their child had been interviewed at school, and a time and place to meet with them for approximately one hour was arranged at their convenience. Most of the interviews took place at the participants' home while the child was in school, but some of the parents instead preferred other venues, such as the researcher's office, a café, or the parent's workplace (Appendix 15). Usually only the researcher and one parent were present. However, on three occasions the children were at home and playing in another room, listening to the interview for brief periods of time. Although this situation is not ideal, and might have inhibited some of the parents' answers, the interviews proceeded as usual and generated valuable information. In another two cases, the father was present when the mother was the main participant being interviewed (Appendix 15). On both occasions, the fathers were engaged in other activities, but occasionally participated by helping to answer particular questions, which enriched, rather than disturbed, the data collection process. Finally, one of the parents was unable to meet personally, and instead was interviewed over the phone and answered the survey via e-mail.

The interviews with the parents lasted 45 minutes on average (ranging from 25 to 60 minutes; Appendix 15), and were relaxed and more flexible than those with the children, often turning into lengthy conversations including a series of anecdotes. An effort was made to conclude the interview after 45 minutes to allow enough time to fill in the survey (see below). Each session started with introductions, an explanation of the research project, reassurance of confidentiality, pointing out that the interview would be followed by a survey, and by asking permission to audio record the conversation with a dictaphone. The interviews were semi-structured and asked for the parents' perspective on all of the questions that had previously been put to their children (Appendix 13). In addition, they were asked about their own motivations for saving power, and their opinion on the role of school in encouraging specific behaviours in general (e.g. environmental practices, eating healthily), teaching energy-related

topics (e.g. energy sources, climate change, efficient technology), and encouraging children to introduce new energy saving behaviours at home. Prior to the interview, the researcher listened to the recording of the child's interview to identify specific issues in need of clarification. However, none of the information provided by the child was disclosed to the parent.

e) Parents' surveys

Immediately after their interview, the parents were asked to complete an adapted and shortened version of a pre-existing multiple choice survey on the material culture, cognitive norms, and practices of energy consumption in New Zealand households (Barton *et al*., 2013; Lawson *et al*., 2010; Stephenson *et al*., 2010a; Appendix 14)[1]. Although many different values have been previously identified, such as capability and respect for tradition, as influencing energy saving behaviours (Lawson *et al*., 2010), the version of the survey used here focussed only on environmental values, both because the overall reasons to save power had already been discussed in the interviews, and because the main goal was to investigate the relationship between environmental discourses and lifestyles, and the children's opinion on saving electricity.

The first 20 questions of the survey were read out by the researcher to allow the participants to provide additional details and explanations, and asked about individual family members (e.g. age, time spent at home), the characteristics of the dwelling (e.g. number of rooms, insulation, heating methods), and the electrical devices available in the house (Appendix 14). In addition, the survey recorded how many of the available appliances are used directly by the children, thus providing a useful point of comparison with their level of control as discussed in the interviews (section 4.1 and 4.3). The second part of the survey was of a more personal nature, and was directly completed by the parents to save time and minimise social desirability bias. Specifically, the parents were asked to rate a series of statements about (1) how often they performed certain energy saving behaviours appropriate for New Zealand (never, rarely, sometimes, often, always; 11 statements) (Lawson *et al*., 2010); (2) the purchase and installation of energy efficient technology (never, unlikely, would possibly consider, would actively consider, already do; 14 statements) (Lawson *et al*., 2010); (3) particular attitudes towards saving energy (disagree strongly, disagree, neither, agree, agree strongly; 9 statements) and their overall attitude towards energy consumption (reduce for

[1] This survey was developed by the Energy Cultures group at the University of Otago (Stephenson *et al*., 2010ab). Its design was based on the literature (e.g. Barr and Gilg, 2006 for sustainable behaviours; Dunlap and Van Liere, 2008 for personal values), and all of its questions were revised by an external panel of experts and trialled and developed in four stages (Lawson and Williams, 2012).

economic or environmental reasons, stay the same, increase, use more efficiently); and (4) personal environmental values (same options as above, 8 statements). Finally, the survey concluded with a series of contextual questions about the size of the monthly energy bill during summer and winter, and the approximate annual income of the household (Thayer-Hart *et al*., 2010; Appendix 14).

Overall, the survey succeeded in quickly assessing the parents' own behaviours, attitudes and environmental values in regard to energy use, thus allowing most of the interview to focus on the children. At the end of the session, the parent was given a bar of fair trade chocolate, an energy efficient light bulb, and a thank you card.

f) Teachers' interviews

All of the large schools (> 150 students, Table 3.2) had more than one group in Year 5, and a head teacher who was aware of the activities and projects run in all of the classes. Because the aim was to obtain general information on energy-related portions of the curriculum and classroom activities, rather than do a detailed pedagogical assessment, only the head teacher of Year 5 was interviewed in each case. The interviews took place at school, were audio recorded with a dictaphone, and lasted 20–45 minutes, depending on whether or not the teachers had previously taught energy topics and/or had been involved in environmental projects (sections 3.3.1, 6.1.7). In particular, the teachers were asked what, if any, specific energy-related topics they had taught, what methods they had used to do so, the content of any explanations and discussions they had provided, whether they try to encourage energy saving behaviours at school, and to what degree environmental activities engaged in at the school tend to include energy topics. In addition, the interviews explored whether and how pupils are encouraged to talk to their parents about what they have learnt at school, the extent to which the school promotes behaviours to be carried out at home, and how such attempts are received by the parents. Finally, the teachers were asked about their personal opinion on providing energy education to primary school children, whether it should be included in the curriculum, and if so, how it ought to be taught. At the end, the teachers were given chocolate to thank them for their participation, as well as a gift for the school, consisting of a book voucher for the library and a power meter for use in units on energy efficiency (Environmental Sustainability, n.d.).

3.2.2 Analysis

Thematic analysis

The recordings of all of the focus groups and interviews (including those with the parents and teachers) were transcribed[1], and annotated with contextual information recording laughter, long silences, and ironic tones. All of the interviewees were given pseudonyms to ensure their anonymity. The transcripts were then imported into a single large data set in NVivo ver. 9 (QSR International, 2013) and analysed using the same codes, regardless of the type of participant (Braun and Clarke, 2006). However, some codes (e.g. parents' motivations for saving power) relate specifically to a particular group of participants, and thus contain little information – though not necessarily none – from any of the others (e.g. children).

Segments of text were coded to capture a full thought or argument, and occasionally included a few extra lines to clarify the context (Guest *et al*., 2012). The coding focussed on content, rather than specific questions. In total, more than 350 individual themes, which form the most basic level of thematic analysis ("units of meaning"; Guest *et al*., 2012, p. 50), were inductively identified as they emerged from the data (Braun and Clarke, 2006). As much detail as possible was captured through the themes, and often segments were coded for two or more different purposes (Guest *et al*., 2012). For instance, the quote "I usually turn them [lights] off so there's not going to be light just out there using up electricity" was coded as (1) "yes" under the broader code "efforts to save power"; (2) "turning off lights" under the broader code "energy saving behaviours"; (3) "identification of electricity use" under "knowledge"; and (4) "saving electricity" under "reasons to perform energy saving behaviours". With very few exceptions, the number of segments fitting a particular theme tends to be relatively large, thus indicating that the level of split is appropriate (Guest *et al*., 2012).

Once identified, the themes were aggregated into codes in an iterative process, and finally subdivided to form hierarchical code groupings. For instance, the overarching code "knowledge" comprises 9 subdivisions (e.g. "learning sources") divided into several, more detailed, codes, which in turn include many specific themes covering 3–34 segments each (Figure 3.2). A list of the main codes is provided in Appendix 11.

[1] The recordings of all of the focus groups and nine of the interviews were transcribed by the researcher, while the remaining interviews were processed by a paid assistant. All transcripts were double-checked for accuracy (Olsen, 2012).

Content analysis

All of the photographs taken by the children (including those from the focus groups) were sorted by appliance and counted (Table 4.1), in order to assess the children's awareness of electricity use. The number of times the children and parents talked about the environment, money, helping the family, and safety in relation to electricity consumption, was counted from the codings created for the thematic analysis in NVivo, and classified into three categories (low, medium, and high; see Appendix 2). Families with at least one rule related to saving energy (mentioned by either the parent or the child), and children who said that they are trying to save power in any way were also identified from the NVivo codings, and summarised in a table for use in statistical analyses (Appendix 2).

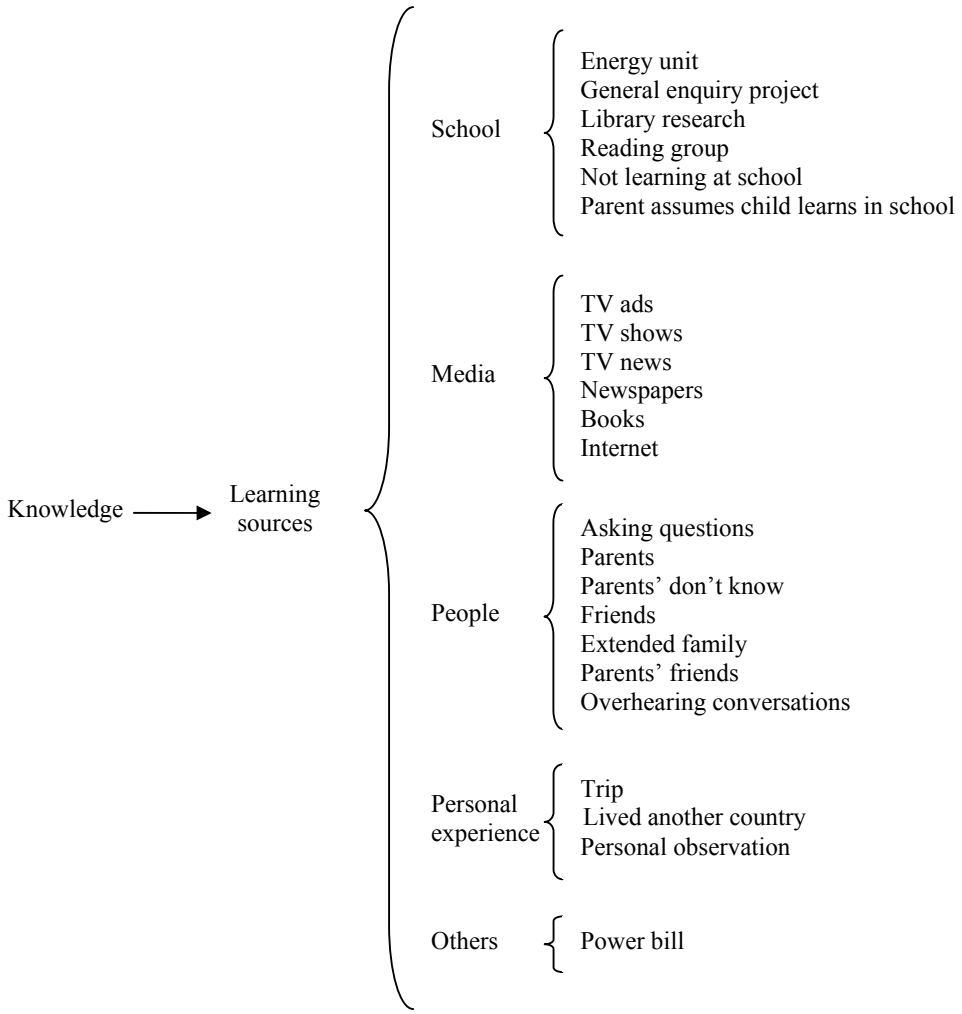

Figure 3.2 Example of the coding structure by codes and themes

Independently from the thematic analysis[1], specific answers relating to electricity use, conversations about the environment, and school to home transfer were identified and counted. Together with information on the children's age, gender, and country of origin, these answers were then aggregated into a large matrix (313 themes x 52 participants), which recorded the individual responses of each parent-child pair. Within this matrix, answers were arranged into overarching topics (e.g. showers), which were in turn subdivided into specific subjects (e.g. shower times, reasons to have short showers, rules regarding shower times) comprising all of the relevant statements made by the participants (e.g. short shower, medium shower, long shower).

Once completed, the matrix was used to explore patterns in the data with regard to the following topics:

1) Overall level of agreement

All of the themes that were commented upon by both the child and the parent were identified, and classified according to whether their statements agreed or disagreed with each other. Where there were multiple, not mutually exclusive themes within a given topic (e.g. "sources of learning about electricity"), only one disagreement was recorded if the statements made by the child and the parent did not match, since it cannot be expected for two people to give exactly the same answer to an open question. For instance, if the child cited trips to electricity generation sites, parents, books, and documentaries as his sources of learning, whereas the parent instead mentioned documentaries, him- or herself, and school, two agreements (documentary and parents), but only one disagreement (visiting power plants and books vs. school) were marked. Next, the level of overall agreement for each family was calculated as a percentage of the total number of possible comparisons, i.e. the sum of all the agreements and disagreements of a particular parent-child dyad, and ranged from 37%–87%. Finally, this range was arbitrarily divided into three equal groups (Appendix 2): low (37-53%), medium (54-70%), and high (71-87%), with the medium category including both the average (64.5%) and the highest frequency count (13). These groupings were explored further through statistical analyses (see below).

[1] Content analysis requires a more detailed level of (i.e. quantifiable) themes than is appropriate for thematic analysis (Guest *et al*., 2012). However, many of the themes were the same, and checked for consistency between the two analyses.

2) Level of agreement on reasons to save power

The number of families agreeing (i.e. both parent and child mentioning it) or disagreeing (i.e. only one of them mentioning it) on a particular reason to save power was counted. Next, for each reason, the overall level of agreement was calculated as a percentage of the total number of families that had mentioned it, and taken as an indication of how often the family members communicate about the topic in question[1]. However, only reasons that were mentioned by at least one member of more than five of the families (possible comparisons) were taken into account, in order to avoid spurious patterns based on very few cases (Table 5.2).

3) Level of agreement on children's energy saving behaviours

The parents' impression of how often their children perform a particular energy saving behaviour was compared to the children's self-reported level of engagement in the behaviour in question (Table 4.5). In addition, the length, rather than the frequency, of the children's showers was analysed in the same way. Individual comparisons were classified as same, similar (often vs. sometimes, long vs. medium showers), or opposite (often vs. never, short vs. long showers), and expressed as a percentage of the total for each behaviour. For the reasons explained above, only practices mentioned by both members of more than five of the families were considered.

4) Children's energy saving behaviours

The number of electricity saving behaviours performed by the children was counted based on their statements during the interviews, with consistently performed behaviours being assigned a value of 1, and occasionally performed behaviours a value of 0.5. Although this tally relies mainly on the children's own answers, additional behaviours mentioned by their parents were taken into account (Tables 4.3, 4.4, 5.1). While this procedure might potentially overestimate the total number of behaviours actually performed by the children, it accounts for the issue of the latter not always realising that some of the behaviours they engage in help to save power (section 4.2). Furthermore, notwithstanding the inclusion of specific questions regarding the children's energy saving behaviours in both their and their parent's interviews (Appendix 13), the list of behaviours analysed here is by no means exhaustive, and changed slightly for each participant owing to the semi-structured nature of the interviews. The figures provided here should thus be interpreted only as a broad indication of the relative engagement of the children in energy-saving practices, rather than as accurate measurements. Children

[1] Grønhøj and Thøgersen (2012) also discuss communication between parents and children based on the correlation of their answers.

performed a maximum of 10.5 behaviours, which were arbitrarily divided into three subequal categories[1]: low (0-3.5), medium (4-7.5) and high (8-10.5) (Appendix 2). The "medium number of energy saving behaviours" category included the highest frequency count (13), as well as the average (6.5) and mode values (4.5 and 5.5). These categories were explored further through statistical analyses (see below).

5) Children's energy saving behaviours performed voluntarily, consistently, and with the motivation to save electricity

Information on the frequency with which the children perform particular energy saving behaviours (see (3) above) was complemented with information from the thematic analysis, in order to determine whether they do so voluntarily and with the motivation to save power. The data were summarised in a large table (Appendix 1), which served as a basis for constructing Tables 4.3, 4.4 and 5.1. Only statements made by the children themselves were taken into account, since the aim was to focus on their own explanations of their actions, rather than their parents' interpretations of the latter.

6) Children's knowledge

The matrix was used to obtain the frequency of particular responses regarding children's learning sources and knowledge of energy sources (Figs. 6.1, 6.2).

7) Common topics

The sum totals of the matrix served as an indication of the most common themes raised by the participants, as well as those with the largest degree of internal variation. These therefore complemented the thematic analysis by identifying topics and patterns that could be explored further by turning them into variables – e.g. children mentioning at least one energy source, or the level of the children's control over appliances (Appendix 2).

Surveys

1) Energy behaviours, attitudes and environmental values

A score was calculated for each of the sections in the parents' surveys relating to their energy saving behaviours, purchase or installation of energy efficient technology, attitudes towards

[1] The "high number of behaviours" category is slightly smaller than the other two, since it was not possible to divide the maximum number of behaviours into three intervals of exactly the same length.

saving energy, and environmental values (Appendix 14). Each of the statements was rated from 1 (never/disagree strongly) to 5 (always/already/agree strongly), with the few statements that were worded negatively (e.g. "I don't think very much about ways of saving energy in my home") reverse coded. The total scores for each section were then arbitrarily divided into three equal categories (low, medium and high; Table 3.4) for use in statistical analyses (see below).

2) Household income

The annual household income of the participants (before tax) was divided into three categories for the purpose of statistical analysis (Appendix 2). The definition of the low income category (less than NZD 70,000) reflects the most commonly used threshold below which New Zealanders have guaranteed access to tax credits, and subsidised childcare assistance (New Zealand Government, 2011). Two of the families included in the low income category fall into the 2nd and 4th national household income decile, with the rest being in the bottom decile (Perry, 2013). Similarly, the high income category (over NZD 100,000) reflects the fact that no government support is provided to families earning more than this amount, as well as the fact that only 20% of New Zealand households earn more than NZD 100,000 per year (Perry, 2013). The medium income category (NZD 70,000–99,000) includes the median household income for couples with one (NZD 75,000), two (NZD 73,000), or several (NZD 70,500) children (Perry, 2013).

3) Appliances

The appliances used by different family members were counted, and calculated as a percentage of the total number of options named in the survey (Table 4.2). In addition, families owning a heat pump were recorded separately (Appendix 2), in order to explore possible relationships of this technology with other variables.

4) Other information

All of the remaining data from the surveys were organised into tables, converted into percentages, and analysed for patterns. This information was then used throughout the thesis to support the results, and describe the participants (sections 3.3.2 and 3.3.3).

Statistical analyses

The variables and categories obtained through the content analysis (see above), the children's attitudes towards saving power and the level (depth and frequency) of family conversations about energy as coded in the thematic analysis, and the children's enrolment in the enviroschool programme were summarised in a table (Appendix 2) and analysed in SPSS ver. 20.0 (IBM, 2011; Mehta and Patel, 2010) using the following statistical techniques:

1) Exact chi-square test

Every possible combination of the 23 nominal and ordinal variables in Appendix 2 was analysed using exact chi-square tests[1] (Mehta and Patel, 2010). Although this large number of comparisons dramatically raises the probability of obtaining false positives, adjusting the significance level to counteract this trend could result in genuine relationships being overlooked (Tukey, 1980). Therefore, since the chi-square tests were mainly employed in an exploratory fashion to support the results of the thematic analysis, all statistically significant results were taken into consideration, and are reported in Appendix 3.

In order to increase the validity and reliability of the analysis, variables with categories having less than three frequency counts were excluded. In addition, the threshold of significance was set to $p = 0.04$ instead of the traditional $p = 0.05$ (Mehta and Patel, 2010), since many of the marginally significant results turned out to be unstable – likely owing to the small sample size. Thus, for tests significant at $p = 0.05$, changing one cell frequency by one unit resulted in most of them no longer being significant; however, this was not the case for tests significant at $p \leq 0.04$. Finally, whenever two of the categories comprising each of the three-category variables seemed to follow a similar pattern during the first round of analyses, they were aggregated into one (e.g. PBehMedHigh, comprising medium and high scores for parents' energy saving behaviours; Appendix 2), and the variable analysed again, in order to determine whether any significant patterns were driven by just one of the categories, or all of them.

2) Kruskal-Wallis one-way analysis of variance and exact Mann-Whitney U test

All of the discrete variables, including the number of energy saving behaviours performed by the children, as well as the parents' survey scores relating to energy saving behaviours, purchase or installation of energy efficient equipment, attitudes towards energy efficiency, and environmental values, were tested against all of the nominal[2] (two categories, e.g. yes and

[1] An exact chi-square test based on a 2x2 cross-tabulation equals Fisher's exact test.
[2] Including those variables obtained by transforming the survey scores and children's behaviours into categories.

no; 12 tests per discrete variable; Appendix 2) and ordinal variables (3 categories, e.g. low, medium, high; 11 tests per discrete variable; Appendix 2), using exact Mann-Whitney U tests and Kruskal-Wallis one-way analyses of variance, respectively (Huizingh, 2007)[1]. As above, all of the significant results (Appendix 3) were taken into consideration, despite the heightened risk of obtaining false positives (Tukey, 1980). However, unlike for the chi-square analyses, the traditional cut-off point for statistical significance ($p = 0.05$; Huizingh, 2007) was retained.

3) Correspondence analysis

Simple correspondence analyses for all possible combinations of the 12 three-category ordinal variables (Appendix 2) were run in SPSS (IBM, 2011). However, only those analyses resulting in total inertia values greater than 0.2 (i.e. explaining more than 20% of the total variance; Hair *et al*., 1998; Mazzocchi, 2008), and significantly different from zero ($p < 0.05$; Mazzocchi, 2008; Starkweather and Herrington, 2012) were taken into account (Appendices 4–8). Finally, a multiple correspondence analysis including all of the variables listed in Appendix 2[2] was performed in order to explore associations between families with similar characteristics in regard to conserving electricity (Fig. 8.1 and 8.2).

3.2.3 Synthesis

All of the topics described in the results chapters (4-8) are fundamentally based on the thematic analysis, but were compared, complemented and, where necessary, contrasted with the results of the various statistical procedures (chapter 3.1). The only exception is the overview of the families (chapter 8), which primarily follows the patterns arising from the multiple correspondence analysis – although the latter were still checked for consistency and interpreted using the results of the thematic analysis. This approach was taken because the level of complexity resulting from the grouping of 26 families based on 23 variables cannot be understood through qualitative observation alone. Finally, the most prominent patterns and processes identified by the qualitative and quantitative analyses were summarised in an overall model (Fig. 9.1).

[1] Exact tests are appropriate for small sample sizes. However, SPSS does not offer an exact version of the Kruskal-Wallis one-way analysis of variance.

[2] Except for the presence of a heat pump in the house, since this variable did not appear to be related to anything else in the previous analyses, and differed from the remaining variables in being the only one related to the type of technology used in the household.

3.3 Description of the Participants

A total of 70 people from five schools participated in this study, including 26 families (one parent and one child), 14 individual children, and 4 teachers[1]. The parents and children from the 26 families, as well as the teachers, were interviewed individually, whereas the remaining children took part in one of three focus groups (Table 3.2). One of the teachers happened to be the mother of one of the participating children (whom, however, she did not teach), and was hence interviewed and counted on two separate occasions. Mothers (84.6% of participating parents) and female teachers (100%) dominated the interviews. This is unsurprising, given that 83.8% of New Zealand primary school teachers are women (Trading Economics, 2013), but raises the chances of a female bias. However, gender comparisons are not an objective of this study, and the male perspective is still well represented owing to over a third of the participating children being boys.

Table 3.2 Description of the schools, children, parents, and teachers participating in this research. Schools are classified according to decile (medium, 4–6; high, 9–10) and school size (large > 150 students; medium, 50–150 students; small < 50 students).

School	Decile	School size	Enviroschool programme	Activity	Children		Parents		Teachers	Totals	
					Girls	Boys	Mothers	Fathers		Activity	School
A	Medium	Large	No	Interview	6	1	7	0	1	15	19
				Focus Group	2	2	-	-	-	4	
B	High	Large	No	Interview	4	6	9	1	1	21	27
				Focus Group	3	3	-	-	-	6	
C	Medium	Large	Yes*	Interview	0	1	1	0	1	3	7
				Focus Group	4	0	-	-	-	4	
D	High	Medium	Yes	Interview	4	2	4	2	1	13	13
E	High	Small	Yes	Interview	2	0	1	1	-	4	4
Totals					25	15	22	4	4	**70**	
					40		26				

*The environmental programme of this school has been nationally recognised for its excellence (Enviroschools Foundation, n.d.).

[1] The teacher from school E school was unable to attend an interview at the time of the study. However, the only two parent-child pairs associated this very small institution were, together with the school webpage, able to supply comprehensive information about the school framework, the curriculum, and the activities run during the current term.

All of the children in Year 5 (aged nine and ten) from the five schools were invited to participate. Family diversity was purposely aimed for by targeting schools from different socioeconomic backgrounds (see below). Nevertheless, self-selection bias is always a possibility in this type of research (Singleton and Straits, 2010), although it does not appear to have influenced the present results as regards energy literacy and electricity saving behaviours (chapters 4, 6). This is corroborated by the variety of the children's informally expressed motivations to take part in the study, such as their excitement about taking photographs, getting out of class, and contributing to research, which might have been more important than either their or their parents' particular interest in the topic of this study.

3.3.1 Description of the Schools

In order to facilitate the recruitment of families from a wide range of backgrounds, schools were chosen so as to maximise diversity in terms of their size, decile ranking, neighbourhood, and the presence or absence of an enviroschool programme. Because low-decile schools tend to be rare and relatively small in Dunedin, only those with a medium decile (2 schools) or high decile ranking (3) were included (Table 3.2). Two of the schools that agreed to take part are close to the city centre, while the remaining three are located in the suburbs or semi-rural areas. The socioeconomic indicators for their respective neighbourhoods show considerable differences in terms of income, formal education levels, occupations, and single parent households (Table 3.3), which is significant given that most of the participating children live close to their school. School E in particular stands out for being part of a small community with a strong environmental orientation and a renewable energy project (Transition Towns, New Zealand Aoteraoa, 2012).

Enough participants for the focus groups were recruited at the first attempt. By contrast, the response rate for the interviews was low (approx. 16%) and required several rounds of invitations and/or reminders, likely owing to the unwillingness of many parents to spend the time required to participate in the research, or commit to meeting with the researcher in person – as was confirmed by some of the children. This issue is inherent to the methodology, and hence unavoidable (Singleton and Straits, 2010). Schools with a higher decile ranking had a higher participation rate than those with a lower one; thus, ten out of 30 invited families from school B decided to take part in the interviews, compared to just one out of 30 at school C. As explained by the teachers, this discrepancy may reflect a lower level of overall involvement of the parents with the medium-decile schools. Because of the low participation

rate, recruiting families for the interviews was given priority over recruiting children for the focus groups, since the former provide the more important data in terms of this research. Thus, no focus groups were held at medium or small schools, so as not to divide the already small pool of interested children between different activities.

Table 3.3 Indicators describing the socioeconomic background of the neighbourhoods of the participating schools (Statistics New Zealand, 2013b)

School	A	B	C*		D	E
Individual median income per year (NZD)	19,400	29,700	18,900	15,700	23,000	24,500
% population earning below NZD 20,000/ year	51.4	37.1	52.9	65	46	44.8
% population lacking a formal qualification	42	8.1	30	44.4	15.5	13.5
Most common occupations (descending order)	Labourers, technicians, administrative workers	Professionals, managers	Professionals, labourers	Labourers, community workers	Professionals	Professionals, technicians, managers
% population with non-European ethnicity	15.8	18.8	19.6	20.4	20.3	18.9
Single parent households (%)	16	11.2	23.9	34.7	15.5	19.6

*Recruits children from two neighbourhoods

3.3.2 Description of the Interviewed Families

Families with many different characteristics participated in this research. The following section provides a summary of their main features; for comprehensive descriptions of each family, see Appendix 15. Similar to the average New Zealand family (Statistics New Zealand, 2008), most of the households in this study comprise a couple with two, or sometimes three, children, although some (about 19.2%) are single parent families (compared to 28% across New Zealand; Wilson *et al.*, 2010). Most of the interviewed children are the oldest sibling (38.5%), but some are also the middle (19.2%), youngest (26.9%), or only (15.4%) child. In two cases, the children live with a legal guardian instead of their birth parents. However, owing to (1) the guardian's role being equivalent to that of a parent, (2) the difference not being relevant for analysing the children's understanding of electricity consumption, and (3)

the need to preserve their anonymity, all of the caregivers are referred to as "parents" throughout this thesis. Nevertheless, it is noteworthy that in both cases, the caregiver interviews frequently switched from electricity consumption to the particular family situation, with the children's need for safety and belonging taking precedence over their socialisation into saving power.

The majority (61.5%) of the parents are 40 to 50 years old, with a third (30.8%) being younger, and the rest (7.7%) being older. They vary widely in terms of their profession, ranging from university lecturers, teachers, nurses and technicians, to labourers, students, stay-at-home mothers, and unemployed. Although the socioeconomic background of the interviewed families generally matches that of the school and the neighbourhood (Tables 3.2, 3.3), there are also some exceptions, with a few of the children from wealthy families attending medium decile schools, and vice versa. More than a third of the participating families (38.5%) are relatively wealthy, earning more than NZD 100,000 a year, with a further 26.9% earning NZD 70,000–99,000. The remaining third (34.6%) have relatively low incomes of less than NZD 70,000 a year, with most of those families (23.1%) earning less than NZD 30,000 (Appendix 2, section 3.2.2). This patterns is unusual in that most participants fall well above or below, rather than close to, the national median income of households with one (NZD 75,000) or two children (NZD 73,000), respectively (Perry, 2013). However, this is unproblematic, since this research aims for diversity, rather than representativeness, owing to its qualitative framework.

According to their survey scores, most of the parents fall within the "medium" group (section 3.2.2) as regards their environmental values, as well as their energy-related behaviours and attitudes (Appendix 2), although some also scored either very high or very low (Table 3.4). The most variable answers concern the parents' attitudes towards energy efficiency, while there is less diversity in terms of electricity saving behaviours (Table 3.4). Most of the parents named financial reasons as their main motivation to save power, followed by environmental concerns and a general dislike of waste. However, a few also reported that they had no desire to change their consumption at all. Surprisingly, the parents' behaviours, attitudes and values do not seem to correlate with their income, or their child's enrolment in an environmental programme at school, with wealthy parents equally likely to fall either into the high or low environmental value category (Appendix 2). Most of the interviewed parents indicated that they did not purposely look for an environmental programme when choosing a school for their child, instead usually opting for the institution closest to their home.

Table 3.4 Summary of the parents' survey scores, and percentage of interviewed parents belonging to each category

	Min. – max. possible score	Min. – max. actual scores	Low scores	%	Medium scores	%	High scores	%
Environmental Values	8-40	25-38	8-29	34.6	30-34	50	35-40	15.4
Attitude towards energy efficiency	9-45	27-44	9-32	34.6	33-38	42.2	39-45	23.1
Purchase and installation of energy efficient technology	14-70	46-70	14-50	19.2	51-60	53.8	61-70	26.9
Electricity Saving Behaviours	11-55	39-50	11-40	19.2	41-45	61.5	46-55	19.2

There is also no noticeable difference in parenting styles across families, likely owing to the predominance of an authoritative approach to child-rearing in New Zealand (Kremer *et al*., 2010; section 2.8.3). Thus, although the parents are sometimes strict and impose rules in certain areas (e.g. with regards to safety concerns or electricity consumption), they always explain to their children why they are taking such measures. In addition, many of the children are included in family decision making, offer suggestions to change family practices, negotiate with their parents (section 7.2), and feel comfortable giving reminders (section 5.4.2). Another reason for the relatively similar parenting styles observed here might be self-selection of the participants, with parents who are approachable and sensitive to their children's request being more likely to participate – especially in this case, where they learnt of the study through their offspring.

3.3.3 Description of the Dwellings

Dunedin has one of the highest proportions of old buildings in New Zealand (77% of houses were built before insulation became compulsory[1]; East Harbour Management Services and the Centre for Research, Evaluation and Social Assessment, 2007). Most of the participating families (80.8%) live in houses built before 1978[1], some of which only have partial insulation, and sometimes none at all. A minority live in newer houses and not only tend to benefit from better insulation, but often also double glazing (80%), thus conforming to the national trend (National Energy Research Institute and University of Otago, 2008). The houses of the participants tend to be relatively large (3–4 bedrooms), and most of the children (80.8%) have

[1] In 1978, insulation standards were included in the New Zealand building code for the first time (Department of Building and Housing, 2010).

their own room. Only four of the families are able to heat the whole house through central heating or solar passive technology, with the vast majority instead only heating the main living space and, sometimes, the children's bedrooms. The most common heating methods are portable electric heaters (73.1%), followed by heat pumps (61.5%), wood burners (46.2%), and open fires (19.2%), with most families using a combination of two or more of these. Heat pumps and central heating are more common in families with higher incomes, while the opposite is true for wood burners and open fires. The majority of the households (69.2%) have energy efficient light bulbs, but only about a third of them own other efficient appliances, such as fridges (34.6%) or washing machines (38.5%).

In the majority of the families (61.5%), the monthly power bill amounts to NZD 100–200 during summer and NZD 150–300 during winter. At the lower end of the range, the thriftiest of the families spend less than NZD 100 per month during summer (19.2%) and less than NZD 150 in the winter (15.4%). By contrast, power bills exceeding NZD 200 in the summer and NZD 300 in the winter are paid by 19.2% and 23.1% of the families, respectively. The only apparent link between building standards (and available appliances) and the power bill seems to be higher costs arising from the use of portable electric heaters as the main source of heating. The proportion of old houses, number of bedrooms, poor insulation, choice of heating methods, average electricity bills, and the use of energy efficient light bulbs are all typical for New Zealand (East Harbour Management Services and the Centre for Research, Evaluation and Social Assessment, 2007; Howden-Chapman *et al.*, 2009).

Chapter 4

Children's Behaviours

Together with chapters 5, 6 and 7, this chapter presents the description and analysis of the information obtained during this research. It also discusses possible interpretations of the results, compares the immediate findings with other research, and identifies the relationships between different factors influencing children's electricity saving behaviours. A broader discussion comparing the main results to the literature, and exploring the wider implications of this study, will be presented in Chapter 9.

The results are presented by topic, combining relevant information arising from all the different data collection techniques (interviews, focus groups and surveys), participants (children, parents, and teachers), and different types of analyses. Specifically, the following four chapters move from subjects dealing with concrete and individual actions, such as individual behaviours, towards broader and more abstract social influences, before finishing with the potential of children to influence society. Before addressing the processes through which children acquire electricity saving behaviours, it is first necessary to understand how they are using energy in their homes in general. The chapter therefore starts by describing the appliances the children use regularly, followed by the ways in which those appliances are used and their relation to reducing energy consumption.

4.1 Children's Electricity Use

4.1.1 Photos

The pictures taken by the children show how they use electricity from their own perspective, and give an insight into their awareness of their own energy consumption (Table 4.1; Fig. 4.1). All but two[1] of the 41 children participating in the interviews and focus groups provided pictures, generally 8–10, though sometimes as few as two or as many as 26, resulting in a total of 351 photographs (Table 4.1; Fig. 4.1). Only nine of the pictures (e.g. photos of friends) were judged not to be relevant. Overall, the children found it easy to use the camera itself (all but two had used one before), and had no trouble identifying electrical appliances at home.

[1] In one case, photos were taken by the parents, and hence excluded from the analysis. The second child reported taking pictures, but they were not forwarded to the researcher.

Figure 4.1 Example of the pictures taken by the children

For instance, Tom said that he "could have took millions" of pictures, and although the children were only asked to take five to ten photographs, many of them took more. Some minor problems arose from the use of disposable cameras by some of the children, since, in the absence of a digital screen, they sometimes had problems understanding that they had taken pictures at all. Three of those children further struggled with low light levels and the manually operated flash. Had time and funds allowed it, using only digital cameras would have been easier for the children, and more environmentally friendly. Nevertheless, all of the

children were able to talk about their pictures irrespective of their quality, and, if needed, could describe those that were not readily recognisable.

The children generally seemed to enjoy the task, as shown by Tim who "was quite excited when he was allowed to get photos" (Tim's mother), as well as the eagerness of the participants of the focus groups to see their printed photographs and share them with their classmates. Taking pictures therefore not only helped to outline the children's electricity usage and guide the interviews, but also served as an ice-breaker, and a motivation for the children to participate in the study. In addition, parents were asked about their awareness of the children's "picture exercise" and any conversations at home that had arisen from it, thus providing an insight into the level of information transfer between the school, children, and parents (section 7.3.1).

Table 4.1 Number of pictures taken by the children per item (excluding duplicated photos of the same object)

Item	Pictures	Item	Pictures
TV	36	Vacuum cleaner	3
Lamp or light	36	Food mixer	3
Computer or laptop	30	Hair dryer	3
Electric heater or heat pump	30	Power meter	3
Stereo or radio	23	Panel box	3
Microwave	20	Power plant	3
Stove and/or oven	14	Overhead power cable	3
Fridge	13	Printer	2
Phone	11	MP3 player	2
Toaster	10	Satellite dish	2
Kettle	9	Exercise machine	2
Gaming device	9	Car	2
Alarm clock, clock, or watch	8	Street light	2
Electric plug	7	Battery charger	1
Hot water (boiler, tap, shower)	7	Iron	1
Keyboard or electric guitar	7	Electric blanket	1
Dishwasher	6	Sewing machine	1
Washing machine	6	Baby monitor	1
Coffee machine	5	Electric fireplace	1
DVD or video player	4	Electric fence	1
Dryer	4	People and test photos (not relevant)	9
Aquarium pump	4	Total	351
Mobile phone	3		

In total, the children identified 45 different ways (i.e. appliances) in which they and their families use electricity at home, as well as a further four items related to distribution infrastructure (power plant, street cable, panel box and power meter). The most common items were those that children tend to use themselves, and included, in descending order, television sets, electric lighting, computers, electric heaters and heat pumps, stereos, and microwaves (Table 4.1; Fig. 4.1). The children thus seem to have followed the instruction of identifying how they, personally, use electricity in their homes – which, encouragingly, turned out to cover all of the behaviours chosen *a priori* for the interviews (section 3.2.1), with the exception of hot water use.

While the children said that they found it easy to take the pictures, they also commented that doing so required them to think. Several of them made a list of appliances before deciding what to photograph, while others derived inspiration from walking around their homes. Although most of the children discussed with their parents what pictures to take, none of them were given precise instructions, and instead were encouraged to think for themselves: "He [his son] said, 'I'll take a photo of this,' and then he said, 'What else can we take a photo of?' and I said, 'You have a bit of a think about it,' […] we supported him, but, you know, we let him have a free reign" (Charlie's father). The exercise of taking pictures thus prompted the children to think about their own electricity consumption prior to the interview or focus group, and may even have served as an educational tool to raise their awareness in this regard.

Taking pictures also led some of the children to clarify some doubts regarding electricity consumption with their parents – most notably, the question of whether electricity is needed to heat water. For instance, Mark's mother explained: "Oh he [her son] would just say when he was taking the photographs 'Does this use electricity? Does this use electricity?' – and all of the time, 'Yes.' […]. That's when he asked me, 'Does hot water use electricity?' 'Yes'." Surprisingly, a few of the children also were unsure whether "the heat pump took electricity or not" (Ron), and "took a wee while to work out whether the TV was electricity or not" (Tim's mother). Similar doubts were raised regarding a microwave, a DVD player, a hair drier, a watch, an electric blanket, a car, and a toilet. Part of the reason why certain appliances, such as boilers and heat pumps, were initially not associated with electricity may lie in the absence of easily visible plugs, as exemplified by Grace's personal breakthrough: "First I just started [taking pictures] with some easy stuff, and then I realised that it was just mostly all about the plugs, so I just took most things that had plugs".

Overall, these results show that children are capable of identifying electrical appliances, and that to some extent they are aware of their own electricity consumption. In addition, they

illustrate the advantages of encouraging children to think about concrete devices that consume electricity *before* engaging them in conversations about energy use.

4.1.2 Surveys

In addition to being interviewed, the parents were asked to complete a survey on the appliances owned by the family, and who they are used by (Appendix 14). These surveys reveal all of the participating families to have fridges and televisions, and most of them have computers, Sky TV, DVD players, electric blankets and electric heaters (Table 4.2).

Table 4.2 Survey results regarding the use of specific electrical appliances by family member (the percentage of family members using a particular appliance was calculated based on the number of families who both own and use the item in question)

	Families who own it and use it		**All family members use it**		**Only children use it**		**Only adults use it**	
	#	%	#	%	#	%	#	%
Fridge	26	100	26	100	-	-	-	-
TV	26	100	25	96.2	-	-	1	3.8
Computer or laptop	25	96.2	25	100	-	-	-	-
DVD player	23	88.5	22	95.7	-	-	1	4.3
Sky TV	20	76.9	18	90.0	-	-	2	10.0
Electric heater	20	76.9	12	60	2	10	6	30
Electric blanket	18	69.2	13	72.2	-	-	5	27.8
Deep freezer	17	65.4	10	58.8	-	-	7	41.2
Dishwasher	17	65.4	6	35.3	-	-	11	64.7
Clothes dryer	17	65.4	2	11.8	-	-	15	88.2
Heat pump	16	61.5	11	68.8	-	-	5	31.3
Gaming device	16	61.5	7	43.8	9	56.3	-	-
Towel rail	9	34.6	8	30.8	-	-	1	3.8
Dehumidifier	6	23.1	1	16.7	-	-	5	83.3

In addition, more than half of the families own gaming devices, heat pumps, deep freezers, dishwashers and dryers. By contrast, heated towel rails and dehumidifiers are considerably less common, and no one mentioned electric vehicles, water beds, heated pools or spa pools. Assuming "use" to mean operation of an appliance, whether voluntarily or under instruction, the vast majority of the children use most of the appliances owned by their families, sometimes including heaters of their own, but usually excluding dryers, dishwashers and

dehumidifiers. However, some of children are not directly involved in the use of electric blankets, heat pumps, electric heaters, and deep freezers.

These results largely correspond with the children's picture-based identification of their own electricity use, since all of the appliances most commonly used by the children (computers, TVs, fridges, gaming devices, and heaters/ heat pumps) are also among the most photographed ones (Tables 4.1, 4.2). By contrast, only one child took a picture of an electric blanket (Table 4.1), despite the fact that 72% of the children whose families own electric blankets also use them (Table 4.2). Similarly, only four children brought back pictures of DVD players, although they are used by all of the children from the families who owned them, except one (Table 4.2). It is possible that the children may be relatively unaware of the electricity consumption of these items compared to other household appliances, for example because their parents might be operating them more often than they do themselves. In addition, electric blankets are usually out of sight and hence possibly also out of mind, while taking a picture of the television might have distracted the children from taking a second picture of the nearby, less obvious, DVD player.

Overall, the perspectives of the children (photos; Table 4.1) and their parents (surveys; Table 4.2) corroborate and complement each other, thus providing a more complete view on how children use electricity at home. The variety of appliances identified by these sources is an indication of the surprisingly high direct involvement of nine and ten-year-old children in electricity consumption at home. Future surveys should include a wider range of appliances, such as ovens, stoves, washing machines and mobile phones, which, according to the interviews, focus groups and pictures, are used by at least some of the children (section 4.2).

4.2 Electricity Saving Behaviours

Wherever possible, the number of behaviours was counted based on the children's interviews, although additional information was derived from the parents' interviews in cases where the children had not discussed the particular behaviour (Appendix 1). As a result of the semi-structured nature of the interviews, the list of reported electricity saving behaviours and the reasons to perform them which are presented throughout this thesis might not be exhaustive – the children might have omitted some behaviours owing to not being prompted, or not being aware that certain behaviours contribute to saving electricity. The behaviours described in this

section include all those in which children engage at home and that save electricity – although not always intentionally or consciously.

In general, the children tend to engage in several electricity saving behaviours, although there was a large variation (ranging from 3 to 10) in the number of behaviours mentioned (Table 4.3). There is currently no national or international reference point in the literature to assess whether the children who participated in this study are engaging in relatively few or many electricity saving behaviours. The present results therefore serve as a preliminary baseline. While all of the children are engaging in at least some electricity saving behaviours in spite of their relatively young age, many of them only perform half the number of behaviours reported by their most active peers – or even fewer. Thus, there clearly is some room for children to improve their electricity saving performance.

The interviews, as summarised in Table 4.3, show that very few of the children are saving electricity both voluntarily and consciously, with about half of them either not taking any responsibility for saving electricity at all, or only with regards to a single behaviour. In order for a behaviour to be identified as "voluntary to save electricity", the children had to report performing it without being asked or required to do so by their parents, and without contradicting their parent's interviews in that regard. The children furthermore had to mention saving electricity or reducing the power bill as at least one of the reasons for engaging in the behaviour in question[1]. A typical example is provided by Alysa: "I just turn things off because it's not very safe to leave on a heater or waste electricity".

Arguably, when educating or socialising children into saving energy, the main goal is not just for them to perform a particular behaviour, but to do so out of their own volition, initially being conscious of saving energy, and, eventually, as a habit (Grønhøj and Thøgersen, 2012). While it is understandable that saving energy might not be a priority when engaging in a particular household behaviour, it is nonetheless surprising that many of the children discussed their electricity saving behaviours without relating them to energy consumption at all – despite the fact that it was made clear to them that the study was particularly related to their electricity use, that they were prompted to talk about the latter many times, and that they were asked in advance to take pictures of their own electricity consumption. This might be an indication of their general lack of concern in regard to energy consumption, as has previously been found to be the case in teenagers (Gram-Hanssen, 2005).

[1] Note that, on it own, knowing that a particular behaviour saves electricity was not deemed sufficient for it to be coded as a *voluntary* energy saving behaviour.

Table 4.3 Number of reported electricity saving behaviours compared with the number of behaviours performed both voluntarily and with the motivation to save electricity (a fraction indicates that the behaviour was reported as only being performed sometimes. See Appendix 1 for detailed information on each behaviour)

	Children's electricity saving behaviours	
	Total	**Performed voluntarily to save electricity**
Alex	9	3
Alice	5	1
Alysa	6.5	3.5
Amanda	10	3
Amy	5	1
Andy	4.5	0
Blake	6	0
Charlie	9	1
Grace	10.5	6
James	10	1
Jessica	4.5	3
Kaila	8	3
Karla	4.5	2
Kelly	4.5	1
Lisa	2.5	0
Malcolm	5.5	1.5
Marion	3	0
Mark	4	2
Mary	6.5	3.5
Mike	5.5	2.5
Molly	9	2
Paula	10.5	4.5
Ron	3.5	1
Tabatha	4	0
Tanya	8	4
Tim	8.5	2

Table 4.4 provides a summary of the number of children performing the behaviours that were mentioned in most of the semi-structured interviews (section 3.2.1 and Appendix 13) out of their own will to save electricity and/or out of habit (section 5.1). Each of these behaviours will be described in more detail below, then be discussed in relation to its associated processes, in sections 4.3 (control), 5 (socialisation strategies), and 6 (energy literacy). Note that the *total* number of children performing each behaviour should not be interpreted as an

indicator of the most common electricity saving behaviour as such (which will be discussed below), since the topic might simply not have arisen during some of the interviews. However, the proportion of children voluntarily performing a given behaviour to save electricity serves as a useful indicator as to which activities are most often carried out with the intention to reduce consumption – in this case, turning off lights, TVs, and appliances at the wall, followed by turning off computers and heaters. While more than half of the children who turn off the computer, wear extra clothing before tuning up the heater, and turn off appliances at the wall do so habitually, less than half have made a habit of turning off lights, TVs and heaters, and drawing the curtains. Finally, very few children have the habit of taking short showers. Previous studies similarly found turning off lights to be the most common energy saving behaviour performed by children, followed by turning off other appliances (DeWaters and Powers 2008, 2011a; Garabuau-Moussaoui, 2011a; Ivy *et al*., 1998; Rickinson, 2001; Robinson *et al.,* 2011; Solopova, 2008; Toth *et al*., 2013), with short showers coming last (DeWaters and Powers 2008, 2011a; Ivy *et al*., 1998; Solopova, 2008).

Table 4.4 Behaviours performed by the interviewed children voluntarily to save electricity and/or out of habit (based on Appendix 1; see also section 5.1) (none of the categories are mutually exclusive)

	Total	**Performed voluntarily to save electricity**		**Habit** (consistent and autonomous)	
	Children (#)	Children (#)	Total (%)	Children (#)	Total (%)
Lights off	25	14	56	10	40
TVs off	22	12	54.5	8	36.4
Closing curtains	21	1	4.8	7	33.3
Short and medium showers	19	3	15.8	4	21.1
Computers off	16	5	31.3	10	62.5
Heaters off or low	13	5	38.5	6	46.2
Wearing extra clothing	13	2	15.4	8	61.5
Appliances off at the wall	12	8	66.7	7	58.3

4.2.1 Turning off Lights

Switching off lights was one of the main topics of the interviews and focus groups. More than half of the children took pictures of lights or lamps, and all of the interviewed children mentioned it. All of the children seemed to be aware that lights require electricity and that turning them off helps to save power and/or reduces cost. Tim's comment: "We turn them [lights] off when nobody's in there […] so it can save electricity for the power bill" provides a

typical example. This comparatively acute awareness might explain why switching off lights is one of the most frequent voluntary energy saving behaviours (Table 4.4): with the exception of one girl, all of the interviewed children reported switching off lights sometimes or always (Appendix 1.1), thus making it the most common electricity saving behaviour overall (Appendix 1.1). When talking about their children's behaviours, the parents gave very similar answers and largely agreed (76%) with their offspring on this topic (Table 4.5). For instance, a common answer was given by Charlie: "[I] turn off the light [...], I just remember" and his father: "Yeah, yeah […], it's just a habit".

Other studies also found that children are more aware of, and indeed tend to overestimate, the electricity consumption of lights compared to other appliances, (Bodzin, 2012; Davis, 1985; DeWaters and Powers, 2011a), likely owing to their high degree of visibility (Newborough *et al*., 1991; Sovacool, 2009). This visibility also makes it easy for other family members to notice if the lights have been left on or switched off, possibly resulting in more reciprocal reminders (section 5.4), and explicit communication about the topic (section 5.3) than is the case for other, more personal electricity saving behaviours (e.g. short showers). In addition, none of the interviews mentioned any reason for turning off lights besides saving electricity, whereas other factors, such as safety concerns (section 4.3.1) and family routines (section 5.1) might at least partially be behind the remaining behaviours identified in this study.

Table 4.5 Similarity of the interview responses given by children and their parents regarding electricity saving behaviours (the possible comparisons are based on the number of families for which both parties covered the same topic in their respective interviews)

Children's Behaviour	**Possible comparisons**	**Same**		**Similar**		**Opposite**	
		#	%	#	%	#	%
Controlling heaters and heat pumps	22	16	72.7	-	-	6	27.3
Turning off lights	21	16	76.2	2	9.5	3	14.3
Having short showers	14	7	50	3	21.4	4	28.6
Turning off the TV	13	7	53.8	4	30.8	2	15.4
Turning off the computer	8	5	62.5	2	25	1	12.5
Turning off appliances at the wall	6	6	100	-	-	-	-

Some of the parents and children pointed out problems with consistency: "Well, sometimes I leave it on and sometimes I turn it off" (Mary); or: "Well, he does switch off, he's getting better at switching off lights. They don't tend to leave the lights on as much as [they used to]" (Alex's mother). Indeed, only 40% of the children seem to switch off lights most of the time

(Table 4.4). Both the children and their parents also identified, without prompting, particular situations in which the children are more prone to leaving the lights on, such as in the bathroom, their own room, the lounge, and hallways. Finally, some of the parents and a few of the children from the focus groups stated that they rarely or never switch off lights: "I forget to turn off […] my mum's lamp, my mum's lamp, my dad's lamp, my sister's bedroom light, we've got to share a room" (Becky). Similarly, although Alysa claimed that she sometimes turns off the lights, her mother thought that: "They [Alysa and her brother] don't normally turn the light off, unless I've said anything. No one makes a move to do it." Possible explanations as to why some of the children are not consistent in performing electricity saving behaviours are presented in section 5.2.

4.2.2 Turning off the Television

The vast majority of the children brought pictures of television sets and talked about them during the interviews. More than half of them stated that they always turn off the TV, but only some children do so habitually (Table 4.4). In addition, three of the children said that they only turn off the TV sometimes (Appendix 1.1). There was a high level of agreement between the parents and children, who mostly gave the same, or similar, answers (Table 4.5). Like switching off lights, turning off the television may be a common practice owing to its high degree of visibility and generally longer socialisation period compared to other electricity saving behaviours (section 5.1), as was also found by Garabuau-Moussaoui (2011a). Frequent comments such as: "I turn it [the TV] off to save power" (Alex) show that most of the children know that doing so will save electricity, which is consistent with it being one of the most common voluntary energy saving behaviours (Table 4.4). However, a few of the children and their parents do not relate switching off the television to energy consumption, and instead are solely concerned about restricting TV times, avoiding noise, and having a quiet dinner, which echoes the findings of some earlier studies (Gram-Hanssen, 2005; Garabuau-Moussaoui, 2011b). Only two of the children in this study switch off the television rarely, either because they forget or because of a lack of expectation.

4.2.3 Turning off Computers

Most of the children took pictures of computers, and, as was also found in another analysis (Gram-Hanssen, 2005), all of the children (except one) regularly use computers at home

(Table 4.2). More than half of the children reported switching them off sometimes or always, and it was identified as one of the most common habits (Table 4.4). However, although most of the children recognise that computers require electricity, only some of them turn them off voluntarily to save power (Table 4.4), with the rest seemingly following their parents' examples without any specific rationale (section 5.2). A few of the children specifically mentioned that switching off computers was important to save battery and limit internet use. Those children who switch off computers only sometimes do so out of forgetfulness, or "in case they [parents or siblings] want to go on it" (Lisa). The five children who never switch off the computer live in homes where the latter is left on all day, and "just turns back into sleep" (Marion). The parents' responses largely agreed with those of their children, with only one parent-child pair contradicting each other (Table 4.5). Overall, this particular behaviour seems to be mostly driven mostly by the example set by parents (section 5.2), as well as reminders (section 5.4.1).

4.2.4 Heating

All of the children were prompted to talk about their involvement in the heating of their homes. According to the parents, 70% of the children use electric heaters or heat pumps (Table 4.2), in stark contrast to the situation in France, where primary school children have very little access to radiators and heating systems (Garabuau-Moussaoui, 2011b).

About half of the children took pictures of heating devices, and all of them, except one, reported to be involved in at least one relevant electricity saving behaviour (Appendix 1.1) – although they often did not recognise the latter as such. Indeed, out of the 13 interviewed children who said that they voluntarily turn off heating devices, or keep them at a low temperature (Appendix 1.1), only five seem to do so to save power: "An eco-heater in my room [...] takes up a lot of power in the house [...], mum and dad told me so I decided to pull it out of the wall when I go out of the house, I turn it off" (Amanda). Although a few of the parents stated that they explained that setting temperature limits helps to save electricity, none of the children seem to recall this link. Instead, they focus mostly on comfort: "[otherwise] it would get a wee bit too stuffy in our room" (Tim), possibly as a result of parental explanations (section 5.3) emphasising the latter over reducing power consumption. In this, heating devices strongly differ from lights and TVs, which are switched off with electricity in mind even by those children who are compelled to do so by their parents.

Only about half of the children switch off heaters or keep them at a low temperature (Table 4.4). This seems surprising, given that space heating is both widely used by them and constitutes the main source of energy consumption in Dunedin households (National Energy Research Institute and University of Otago, 2008), but may be explained by a preponderance of heat pumps. The latter were identified by all of the participants who mentioned them as particularly easy to operate (section 4.3.1), but, according to the interviews, are also the appliance most often misused by the children (see also Garabuau-Moussaoui, 2011b). As a result, heat pumps are often either put beyond the children's direct control (section 4.3.1), which may account for their low engagement in managing them efficiently (Table 4.4), or their operation becomes subject to rules. For example, all but one of the children who stated that they keep the temperature "low" do so as a result of specific limits set by their parents (section 5.5)

Most of the children close curtains before turning up the temperature or asking parents to do so (Appendix 1.1), making it the most common electricity saving behaviour related to space heating. However, only one child made a direct link between closing curtains and saving power:

> *Researcher:* How [do you save electricity]?
> *Ron:* Because we've got my sister's room, my mum's room, my room, [brother's] room and we've got the curtains and the dining room curtains and we've got to shut all of them because we've got three windows in the dining room.

More than half of the interviewed children are aware that closing the curtains helps to "keep the house warm" (Blake) because it "traps some warm air inside so it's a warmer night" (James). While this association is arguably the first step towards understanding the link with saving power, the fact that it was not explicitly mentioned (except by Ron; Table 4.4) indicates that none of these children have as yet realised the full implications of their behaviour. The remainder of the children explained that they close curtains only because of privacy or light control, and one child was actually unaware of any particular reasons. For most of the interviewed children, closing curtains was a duty set by their parents. Thus, Paula reported with pride: "That's my job", while Jessica explained that: "Me and my brother, we have even and odd days of the week, so if it's an odd day [my brother] will go and pull the curtains upstairs and I'll do it in the lounge". As will be discussed further in section 5.5, this is a good example of how children tend to perform a particular behaviour consistently when given a set responsibility in an organised and explicit fashion, thus helping to save energy at home.

As shown by the example of the curtains, the connection between electricity consumption and behaviours that do not involve controlling appliances might be too abstract for children to grasp on their own. For instance, if we follow Grace's logic about plugs indicating electricity consumption (p. 100), handling curtains might understandably not be perceived as being at all related to energy use. This point is further supported by the data shown in Table 4.4, which indicate that the children rarely report making a voluntary effort to save electricity by having short showers, or by engaging in more abstract behaviours, such as wearing extra clothing, even when they undertake these behaviours – possibly because of the lack of an obvious association with visible plugs or switches. It is possible that children might be able to understand such a connection if specifically prompted to think about it; however, there is no evidence in any of the interviews that the parents have made the link between curtains and electricity use explicit (section 5.3). This issue seems to be very similar to the children's limited awareness of the energy required to heat water (section 4.2.5). It would have been interesting to prompt the children participating in the focus groups to talk about the relation between closing curtains and saving energy in order to gain an insight into their thinking processes, but unfortunately there was not enough time.

In addition to closing curtains, there is tendency for children to put on extra clothing before warming up the room itself (Appendix 1). Half of the children "carry a blanket down with me" (Alex), or wear dressing gowns, extra jumpers, and sometimes even jackets inside the house because they find it easier or more comfortable than using heaters: "Because it's much easier, because normally you have to wait for the heater to warm up and [...] once it's warmed up it takes a while to heat the whole room and it's just easier to put my dressing gown on" (Tabatha). For three of the children, wearing extra layers is sometimes the only option to stay warm because they lack control over heating devices and their parents are not always available. For instance, Kaila explained that: "Mum […] goes to sleep, so I'm not allowed to touch the heater", while Alex stated that: "It's easier to get [a blanket] because I know where it is and sometimes Mum and Dad put the remote for the heater [in] places that I don't know where they are". This variety of reasons for wearing extra clothing might explain why only a couple of children are conscious of the fact that their behaviour may help to save electricity: "It can *like* sometimes save the electricity" (Mary); "It saves a lot" (Jessica), despite this behaviour being one of their most common habits (Table 4.4)[1]. Only three boys said that they

[1] It is common in New Zealand houses to wear extra layers and keep the homes at low temperatures (Bond, 2012; Cupples *et al*., 2007; Mirosa *et al*., 2011). Cupples *et al*. (2007) relates it not only to the household infrastructure but also to a New Zealanders' pioneer cultural identity.

use heaters before putting on extra clothing because "it's just a bit easier" (James), or that they do not feel cold because in their families they "have the heat pump on anyway" (Ron).

Closing doors was another unprompted topic mentioned by both parents and their children, and was usually discussed as an important and constant issue. Although in five interviews it was reported that children consistently closed doors (Appendix 5), consistency seems to be an ongoing problem in a further five cases. A typical example was given by Melanie in one of the focus groups: "It [the heater] doesn't really warm up our house, though, because everyone leaves the doors open and argh! So mum and dad have to yell at us every time, oh!".

Other important topics that were discussed by the participants in relation to heating included (a lack of) trust in children using the technology correctly (section 4.3.2), discrepancies in the responses between the children and parents (Table 4.5), and safety issues (section 4.3.1).

4.2.5 Shower Times

There are no identifiable differences between the discourse of participants using either gas (7) or electric (19) water heating, and both will therefore be discussed together in this section. Whatever the power source, shower times seem to be an important issue, triggering a more emotional response in both the parents and their children than any of the other behaviours. They also were a major topic of conversation in all three focus groups.

Shower times considerably vary between families as exemplified by the following dialogue from one of the focus groups:

> *Rachel*: I normally have a shower and I am only allowed to stay in for 3 minutes in the shower. I usually just don't yeah… mum just don't come in and I have a digi timer too and it beeps really loudly when I have to get out […].
> *Researcher*: So Simon, how is it in your house?
> *Simon*: Weeeell, let me think about this… not bad! (all laugh) […]. I'm allowed about half an hour in the shower.

Depending on the family routine and the activities planned for the day, shower times can also considerably vary within some of the families: "We have a shower for about twenty minutes, but if we are doing it before school what we do quite a lot is only about five minutes" (Miles). Nevertheless, in most families the children's shower times seem to be more or less regular, and are here classified according to comments made by the children and their parents. Thus, short showers range from a "one minute shower" (Melanie) to five minutes: "I have a shower

very quickly, like five minutes" (Charlie). By contrast, showers lasting more than 15 minutes are often considered long, as implied by Marion's mother: "I am going to implement a 5 minute rule from now on 'cause otherwise it can just turn into 15, 20 minutes showers" and Kaila's mother: "They don't rush (laugh). They are good half an hour at least". Finally, shower times between 5–15 minutes that were not described as either particularly short or long by any of the participants are considered medium. Some of the children and parents did not name specific times, and their responses were instead classified based on the adjectives they used.

Most of the interviewed children reported having short or medium showers, while long showers only occur in three of the families, likely owing to relaxed (e.g. not more than half an hour) or non-existent parental limits, as well as the example set by the parents (section 5.2). For instance, Lisa admitted that she has "long showers", which her mother – despite expressing frustration about Lisa being "hopeless" and taking "ages in the shower" – described as characteristic of the whole family, including herself. Some of the children also occasionally enjoy a bath, and can usually stay in as long as they want: "You can't take four hours in the shower but you can take five, four hours in the bath, 'cause the bath is the bomb!" (Simon). Finally, for two children baths, rather than showers, are the norm.

Most of the participants cited more than one reason for having shorter showers. Besides saving energy, which is important to about half of the families, the most commonly mentioned include:

a) For more than half of the families, having a busy family routine and no spare time for long showers: "Well, it depends on how warm the water is and what's going on outside of the shower […] or if you have no time" (Alice).
b) For about half of the families, especially those with four or more members, ensuring that there is enough hot water for everyone to have a shower: "I don't waste too much water, 'cause the people need the shower, cause there are six people in my family" (Ashley).
c) For some of the families, avoiding the waste of water in general: "We run on a tank system from the rain, so mum and dad are a little bit fussy about us wasting water so we normally just have short showers" (Andy).
d) For a few of the children, a dislike of showers: "Tim's showers are very, very quick. Sometimes I wonder if he actually gets wet, because there's other more exciting things to do than shower" (Tim's mother).

None of the children mentioned shower times, or any other activity related to saving hot water, without being prompted. Similarly, only one mother talked about her daughter helping to save electricity by rinsing dishes in cold water. When asked directly whether heating water for showers requires energy, half of the children admitted that they had "never really thought about it" (Lisa) or "have no idea" (Blake). Nevertheless, half of the interviewed children who reported having short or medium showers are aware that they save energy, and a few of them even know that heating water for showers is one of the main sources of energy consumption. For instance, Amy has short showers because her parents explained to her that they use "quite a lot of electricity and power, so you don't want to stay in there too long", while Tanya's mother thinks that her daughter has short showers owing to having "more of a concept of using electricity than water".

These observations are consistent with the small number of children who took pictures related to the use of hot water (Table 4.1), or who voluntarily have short showers to save electricity (Table 4.4). They also imply that the children are comparatively unaware of their own energy usage in regard to space (section 4.2.4) and water heating, despite these being the two major sources of New Zealand household energy consumption. This contrasts with previous research, which found that children know about the energy consumed by heating water, despite underestimating it (Lawrenz, 1983, 1985; Toth *et al*., 2013).

Unlike lights, computers, and the television set, which are operated manually, heating water is a relatively obscure (i.e. out of sight) process, meaning that its energy requirements are likely not immediately apparent to the children. Two of the focus groups provide insights into the children's mental processes in this regard. None of the children participating in those focus groups took pictures relating to water heating, or independently discussed it. They were thus prompted on the topic and, once they had realised its link with electricity, were asked to make drawings on how they use hot water (Fig. 4.2).

> *Researcher*: What about how water?
> *Becky*: Yes, hot water!
> *Researcher*: Do you think it uses electricity? [...]
> *Melanie*: Yes.
> *Tamara*: No.
> *Ashley*: No, yes, yes.
> *Melanie*: How would it be hot then?!
> *Ashley*: Jugs do [...].
> *Melanie*: Because, the… it's… it's hot, the electricity is sort of hot and electrical and the water and the heat up the water 'cause the water would be connected to a microwave or [...] an oven and they both use electricity.
> *Ashley*: And so does the water tap [...].
> *Melanie*: How would you get hot water without at least... [...]

Ashley: I use hot water for my porridge in the morning for breakfast [...]
Melanie: I use hot water for heating up my hottie at night [...].
Researcher: And what about showers or baths?
Ashley: Yes.
Melanie: Yeah, yeah.
Ashley: We've got hot water cylinders [...].
Becky: Not, not if you have cold showers and cold baths.
Ashley: But my mum, but my mum calls it a hot water cupboard.

The previous quote shows that children can grasp the link between hot water and electricity quickly when guided and encouraged to think about it. In this case, the children explained relevant concepts to each other in an easy and practical way, and moved from needing electricity to produce heat (e.g. using microwaves), to electric kettles, and, finally, hot water cylinders and hot water taps. A very similar process, but with slightly more prompting, occurred in the other focus group:

Researcher: Great, and did you think about hot water?
Eleni: No.
Dani: No.
Researcher: Do you think that uses electricity?
Larry: No.
Eleni: No [...].
Larry: Unless it's in a jug [...] but if you put it [water] with a plug it will electrocute you [...]. They are not good for you.
Researcher: Do you have hot water cylinders?
Dani: Yeah.
Eleni: Yeah [...], yes, I have one of those at home.
Larry: I have a… we've got a cylinder, I've heard of one.
Tom: Oh yeah I've got one.
Larry: Mine has pink batts around it, I don't know why.
Eleni: To keep your house nice and cosy [...].
Researcher: Would someone like to draw some things that you use hot water for in your house? [...]
Larry: What are you drawing?
Tom: A jug.
Larry: Lame [...]. I normally just have Milo.
Tom: Coffees, I don't drink coffee, I accidentally had it once.
Researcher: And how else do you use hot water that is not related to food?
Dani: Drinking! [...]
Researcher: That has nothing to do with drinking.
Dani: Having a shower! [...]
Eleni: I know something that also uses hot water! A bathtub!

Although in this case the researcher had to point out the existence of hot water cylinders, the children were still capable of making the connection with heating water for showers on their own, following the same logic of first recognising a link with kettles and hot drinks. It is interesting that Larry knows that combining water and electricity carries the risk of

electrocution, which may act as a mental barrier to their association in the children's minds. However, not all of them seem to be affected by this, as shown by Alysa, who found it easy to understand during her interview that "the *boiling* kind of makes sense with water and heating hot water". She also "took a photo of the boiler because it uses most of the electricity [...] because it's quite a big thing and it powers a bigger thing like a shower and other things that have hot water, like the taps".

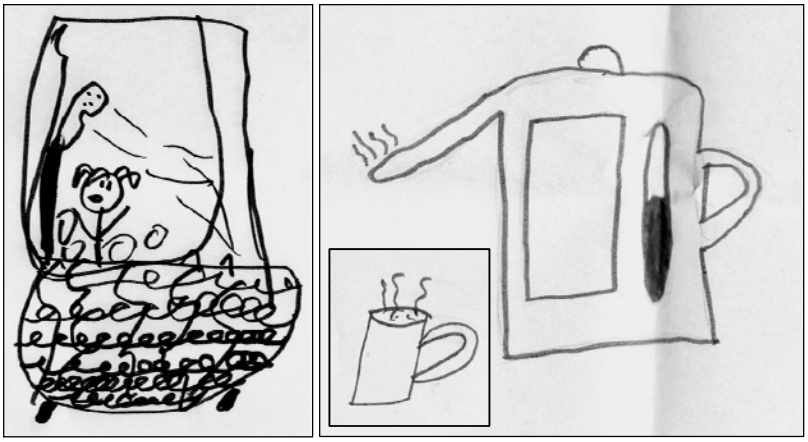

Figure 4.2 Drawings about hot water use made by the children participating in the focus groups. Shower (left), cup of hot drink (middle), kettle (right).

Overall, these observations show that children are perfectly capable of understanding the link between hot water and electricity, especially when guided from familiar concepts like electric kettles towards understanding hot water cylinders as big kettles supplying water for the shower. Triggering discussions about the "big" size and the "boiling" function of the boiler/hot water cylinder, as well as contrasting the large amount of water used for a shower with a cup of tea or coffee, might furthermore help children to realise that showering it is one of the main sources of household energy consumption.

There are many disagreements (Table 4.5) between the answers given by the parents and their children, possibly arising from the private nature of showering or a poorly developed sense of time on the part of the children, making shower times the least consistent behaviour analysed in this study. Family routines and the setting of rules also emerged as important topics, and are discussed further in sections 5.1 and 5.5.

4.2.6 Laundry and Cooking

Some of the children brought back pictures of washing machines and clothes dryers. Furthermore, when prompted, the majority of the children talked about laundry, knowing that it requires electricity. About a quarter of the interviewed children help with this chore, and a few of them have either just learnt how to operate the washing machine, or are in the process of doing so: "She [her mother] taught me how to use the washing machine [...]. She tells me what she wants it on, like, light or something, and then I… But if I don't put on the proper thing she tells me off" (Tabatha). However, only three of the children (all girls) do full loads and avoid the use of the dryer in order to save electricity: "Sometimes I help my Mum with the washing [...]. We have a dryer, but we don't quite use it […]. It wastes quite a bit of electricity and it takes a lot of time" (Paula). Although not doing the laundry themselves, another four girls try to save electricity by "handing in dirty clothing" (Alysa) so their parents can do full loads, wearing clothes "for a few days" (Linda), and trying "not get dirty" (Jessica) to reduce the amount of washing. The efforts of these children to save electricity when doing the laundry reflect the results of previous research (Robinson *et al.,* 2011).

A similar pattern emerged in terms of cooking, with the vast majority of the children taking pictures of kitchen appliances, and some of them cooking often themselves. All of the interviewed children use the fridge (Table 4.2), and about half of them also use basic cooking appliances (e.g. toasters, kettles and toastie makers). Similar finding were reported by Garabuau-Moussaoui (2011a) regarding children in France, although ten-year-olds there seem to be somewhat more autonomous. As with laundry, most of the parents and children who talked about cooking referred to it as an ongoing learning process: "She's read about cooking, she's watched cooking and I've helped her with a few little skills [....]. She's come home and wanted to do more baking" (Alysa's mother), and "Mum showed me which cord it was that was turning on [the microwave...] when I'm making my breakfast" (Ron). Despite the obviously high degree of involvement in cooking activities, only three girls mentioned related electricity saving behaviours: while Jessica only turns on the oven just before baking, "but in a tiny bit higher so we're using a bit less electricity, but get the same result", Eleni explained that her mother "forgets about the jug", and that she reminds her in order to avoid boiling it twice. Similarly, Kelly knows that she could save electricity by "not [having] so much hot drinks". By contrast, most of the other conversations focussed on safety concerns (section 4.3.1). It is striking that only girls commented on saving electricity in relation to both cooking and doing the laundry, possibly indicating a gender difference in terms of what household chores the children perform, and the way they talk about them with their parents.

Overall, these results also show that nine and ten-year-old-children are becoming involved in more complex household chores than simply switching off appliances. This may provide an opportunity to promote energy efficiency, since influencing newly acquired behaviours is arguably easier than trying to change a particular practice later in life (Verplanken, 2012). One of the parents made this point explicit: "She [her daughter] started using some of the gadgets by herself, so that's the time that we should tell them how to take care of it and how to use it more efficiently".

4.2.7 Switching off Appliances at the Wall

About half of the interviewed children reported switching off appliances at the wall (Appendix 1), although neither they, nor any of the participants of the focus groups, talked about it without being prompted. Appliances switched off this way include computers, electric heaters, microwaves, gaming devices, lamps, stereos, keyboards, toasters, ovens, and, in a single case, the TV. Similar to these observations, previous studies found that teenagers know about the electricity consumption of devices left on standby; however, unlike the children in this study, they seemingly do not unplug them (Gram-Hanssen, 2005). Most of the children who switch off appliances at the wall do so to save electricity, and more than half do so voluntarily (Table 4.4): "I should really turn off everything from the wall […] because, if you don't turn the switch off, I think it's still using electricity" (Grace). However, two of the children instead unplug appliances because they either only have a single socket available, or are afraid that the heater "might get on fire" (Karla). Most of the children who switch off appliances at the wall talk about it with their parents (section 5.3) and seem to be following their example (section 5.2), which may explain why they completely agree regarding this behaviour (Table 4.5).

4.2.8 Other Behaviours

In addition to the previously mentioned behaviours, ten of the children variously talked about turning off stereos, electric blankets, keyboards, and gaming devices, as well as closing cupboards containing automatic lights, and unplugging mobile phones after charging (Appendix 1). In addition, a few of the children mentioned energy efficient infrastructure and appliances (section 6.1.6), but only one of them (Grace) related the latter to her own energy saving behaviours. A lack of direct contact, visibility (section 4.1), and/or relevant knowledge

may partly explain why some of these behaviours were mentioned so rarely – despite the widespread presence of the objects they refer to. Thus, many of the children might not be aware that plugged-in mobile phones consume electricity even when fully charged (Bodzin, 2012), while a previous study from France has shown that children there do also not tend to talk about, or have much contact with, energy efficient appliances (Garabuau-Moussaoui, 2011a). These observations reveal some scope for improvement, especially as regards some of the more common items (e.g. mobile phones, electric blankets).

Finally, a few of the children said that they save electricity by turning off lights and the TV for other people (Appendix 1): "Sometimes, when they're [her parents] just sleeping, I sneak into their room and turn it [the lamp] off" (Amanda). Although it is possible that these children are more conscious of saving electricity than the rest, their interviews gave the impression that they are primarily thinking about doing another family member a favour.

Overall, it appears that most of the children engage in several electricity saving behaviours, although they often do not actually realise this themselves. Recognising that they are already doing more to save electricity than they are aware of might be empowering for children, and encourage them to take further steps to conserve energy.

4.3 Control

In order to engage in electricity saving behaviours, children must first have some control over the appliances available in the household. While this is mostly the case as regards lights, the television, computers, and, in some cases, their own shower times, the children's control over heating devices, unplugging appliances at the wall, and cooking varies considerably between families. For instance, while some children are allowed to operate the heaters "whenever we want" (Melanie), others are not permitted to use them at all: "We don't like them touching the [heater]" (Mike's mother). In most families, the children's level of control also depends on the specific situation. For example, Mark can "just decide" to turn on and off the heat pump in the living room, and to shower "as long as I want", but it is his mother who controls the heater in Mark's room.

For the most part, the children's perception of their own level of control seems to be higher than that ascribed to them by their parents, which may explain the high number of disagreements regarding heating behaviours (Table 4.5). For instance, in spite of Tim's

mother commenting that her children are "not supposed to touch it [the heater], but they have, so it gets turned off [...]. They know now", Tim reported the following:

> *Tim*: We (Tim and his sibling) kind of put a line where we should put it [the temperature] with a pen on our heaters, so we just know where to put it.
> *Researcher*: Did your parents help you to decide that?
> *Tim*: No, we just did it.

Garabuau-Moussaoui (2011b, p. 70) identified the children's use of electricity in excess of their parents' expectations, rules or instructions as a common "poaching" practice. Nevertheless, in several of the families (Appendix 2 and 15: Amy, Karla, Lisa, Malcolm and Marion), the children have almost no control over any appliances, and thus engage in significantly fewer electricity saving behaviours than their more autonomous peers (Mann-Whitney exact test, $p = 0.015$; Appendix 3.1). On the other hand, it appears from the interviews that those children who do the most to save electricity, such as Paula and Kaila (Table 4.3), are also allowed to operate most of the appliances in their homes, including those used for cleaning and cooking. These observations confirm that having at least some control over electrical devices is necessary for the direct involvement of children with energy consumption and, ultimately, conservation.

The main reasons for restricting control are related to the material culture of the particular household (e.g. appliances being considered unsafe; see below) and the level of trust parents place in their children (e.g. possible misuse of heaters; section 4.3.2). However, in some cases a lack of control might also arise out of habit: "He [her son] hasn't got control over it [the heat pump] […]. That's just the way it's been done, because the heat pump has only been there for, oh, just over a year and no, the kids don't seem to use it that much" (Tim's mother), or a lack of interest on the part of the children: "She's [her daughter] probably more interested in maybe a cartoon she's watching on TV, or she's reading a book, and she doesn't really take the initiative to do it [use heaters] much" (Alysa's mother).

4.3.1 Material Culture

In some cases, such as heating, the type of technology available in the house seems to be a major determinant of whether the children are seen as able (and hence allowed) to operate a particular appliance, and whether the latter is regarded as safe. All of these factors, as well as the parents' willingness to delegate responsibility, are interrelated.

Accessibility

Obviously, the children cannot have regular contact with an appliance their family does not own, thus making the question of control (and, ultimately, saving electricity) highly dependent on the available technology. For instance, two of the families do not possess any electrical heating devices and instead rely on an open fire or wood burner, both of which are usually considered dangerous, and hence beyond the children's control:

> *Researcher*: Do you think that she's [her daughter] trying to save power in any way by herself […]?
> *Lisa's mother*: No probably not, probably because we don't have heating and stuff. Maybe if we had that sort of thing she might do it more, but she'd only have lights on if we needed lights on and we cook and that's it.

Some appliances are programmed by the parents to turn on or off automatically, removing the need for constant interaction, as well as the ability of the children to take control: "It [the heat pump] just flicks on and goes to the heat that it wants to [...]. My parents set the temperature [...]" (Mark). This issue mostly seems to affect heat pumps, but was also mentioned with regard to central and solar passive heating, computers with an automatic shut-down function, and sensor lights. None of the children (except Grace) seem to relate these automatic setting to saving electricity:

> *Mark*: It [heat pump] just flicks on and goes to the heat that it wants to [...]. My parents set the temperature [...].
> *Researcher*: Do you know why [...] they set it that way?
> *Mark*: No, not necessarily

Finally, even where relevant technology is both available and operated manually, it may be physically out of the reach of the children, as became apparent repeatedly in both the interviews and focus groups. For instance, Tabatha finds it hard to close curtains, "because you have to pull them with your hand, and sometimes I can't get them all the way", while Larry had to ask his father to put the remote control of the heat pump "down a wee bit, so that I can reach it". In addition to these relatively common issues, children also have trouble reaching bathroom heaters, microwaves, stoves, kettles, toasters, light switches, and plugs – especially above the kitchen counter. However, this does not seem to be a major impediment, since in all cases it only interfered with just one of the possible electricity saving behaviours per household. Furthermore, it is obvious that this issue will ultimately resolve itself as the children grow, although it is still an important factor to consider in terms of younger age groups.

Capability and Safety

In certain cases, the children are only allowed to control a device if their parents deem them capable of operating it both correctly and safely. For instance, traditional heat pumps are generally considered to be easy to use, with none of the participants reporting any problems, and most of the children learning how to operate them by themselves. By contrast, heaters and ducted heat pumps are thought to be more complicated: "If we fiddle with [the heater], it can do something real wrong" (Alex). Turning off computers was also identified as difficult by all of the participants who talked about it (except one), but in this case all of the parents not only allowed, but even encourage their children to take an active role, albeit under a higher level of supervision: "Switches [in the remote control of the heat pump] are pretty [easy], down and off, so that's fine. The computer is one we have to teach her how to shut it down and all those things" (Paula's father); or: "It's a bit hard though [to turn off the computer], because you can't just turn it off. You have to do the switch" (Grace).

As in several previous studies (e.g. Garabuau-Moussaoui, 2011b; Garabuau-Moussaoui *et al.,* 2009; Mirosa *et al.,* 2011; Toth *et al*., 2013), safety concerns are one of the most important topics that emerged from the interviews, with both parents and children from about two thirds of the families referring to it as a major issue – although it should also be noted that the remainder did not mention the topic at all. Likewise, the participants of all of the focus groups spent a long time sharing their experiences with unsafe devices, ranging from electric fences to faulty gaming devices, and even a toy catching fire after coming into contact with a heater. Both the children and their parents associate the word electricity with danger: "With the plugs and stuff we're not allowed to use them because we might get an electric shock" (Mike) and "[…] safety reasons, we would have talked about, you know, if I've gone in and after she's been out of the room for half an hour and I said, 'Molly, the heater's still on. It could have caught fire, rah, rah, rah'." (Molly's mother).

Safety concerns are the most common reason for the parents not to allow their children to operate cooking devices and, to a lesser extent, electric heaters, or unplug/ turn off appliances at the wall. Encouragingly, these restrictions only affect three possible electricity saving behaviours, compared to a maximum of ten performed by the most active children (Table 4.3), In addition, the children are generally not barred from contact with electrical devices, even if safety is considered to be an issue. For instance, both Kaila and her mother worry about safety when unplugging appliances, but Kaila nonetheless does so regularly in order to save electricity: "[When unplugging devices behind furniture] make sure [to] keep an eye out for [...] the switches, so don't knock them over or don't knock the DVD player over or

something" (Kaila); and: "I kind of think sometimes it's a safety thing too, you know? I don't laugh if it [electricity] really does do [dangerous] things, but, you know, it's [...] a good thing [for children to unplug appliances]" (Kaila's mother). Indeed, Tabatha was the only participant who explicitly pointed out a situation in which safety concerns prevent her from helping to save electricity: "Mum […] never keeps an eye on the fire and it goes out, and then she turns on all the heaters, and, maybe, if you keep an eye on the fire we wouldn't need all the heaters and we would save money […], [but] I'm not allowed to use the fire because she says it might burn my fingers".

Nevertheless, in four of the families, safety concerns combine with a lack of trust (section 4.3.2, below) to deprive the children of control over the vast majority of electrical appliances. In these families, saving electricity is not regarded to be as important as safety, and is usually not discussed among family members, which may explain the low level of engagement of these children in electricity saving behaviours (always less than five, see Appendix 2), even if considered safe (e.g. having short showers or turning off computers). A typical example is Marion, whose mother made it clear that: "I don't actually let her turn anything on […]. I am just a bit scared that, if she is plugging things in, she may not do it correctly and I may not have shown her, but I'm still... she is only nine so I don't want her getting electrocuted". She also admitted that she has not talked with her daughter about saving electricity in general, because all of the appliances "are mainly used by me".

4.3.2 Trust

The interviews and focus groups revealed that the level of control the children have over an electric device does not solely depend on the characteristics of the technology itself, but also on the parents' willingness to delegate responsibility. The latter, in turn, seems to be mostly determined by their trust in their offspring's ability to use the appliance efficiently. For instance: "Tabatha can't think… yeah, I suppose she could, but she'd normally… no" (Tabatha's mother); or "I just run around and do it [turn off lights and appliances] myself subconsciously […]. I don't know if I trust them [her children] to do it" (Amy's mother).

Most of the children who lack general control over electrical appliances (see Appendix 2: Amy, Karla, Malcolm and Marion) have parents who find it easier and more reliable to take control themselves. Typical examples are given by Karla's mother: "I'd rather do it [save power] myself so that I know that it's done […] because if you asked them to do something they'd say, 'Yeah I've already done it,' but then you find out that they haven't" and

Malcolm's mother: "I know I'm going to do it [controlling energy use] right and I don't have to go and check that they've [her children] done it sort of thing if I go and do it myself".

Misuse of appliances

In other cases, restrictions, e.g. on the use of heaters and heat pumps, mostly seem to result from previous – generally unintentional – misuse by the children. For example, Mark is not allowed to choose the temperature on the heat pump "because he's done it before. He's taken it up to 32 and didn't have it on there for long, but we've explained again about the energy use and cost and 20 is sufficient" (Mark's mother). Although to a lesser extent, a similar pattern emerged regarding shower times. For instance, Molly explained: "One time me and my brother had about 15 minute showers and then Dad hopped in and […] he had to have a cold shower […]. He decided that we were going to time them [showers]". Nevertheless, and notwithstanding its common occurrence, misuse only seems to have led to a complete lack of control over a device in a couple of cases, such as Linda's family where her "mum hides the remote […] so we can't tamper with it". Most of the time, control is simply restricted in some way, for example by the child not being allowed to run one of the heaters (e.g. in the bedroom) while being able to use another (e.g. in the living room), the setting of temperature limits, or by making the child ask for permission before using an appliance.

In summary, most of the children seem to have some control over electrical devices, and thus the potential to save electricity, provided appliances are (1) physically accessible to the children, (2) easy to use, and (3) deemed to be safe, and (4) parents trust their children to use them correctly. All of these requirements are related to the children's age and perceived level of responsibility, and thus should be overcome as they grow up. At ten years of age, this seems to be an ongoing process varying in speed between families, as well as countries (Garabuau-Moussaoui, 2011a). Those children who have obtained some level of control over their own electricity behaviours have an opportunity to make energy efficient choices, which might be affected by, and in turn affect, their family dynamics (chapter 5) and energy literacy (chapter 6).

Nevertheless, difficulty in meeting all of the conditions seems to be the main reason why some of the children engage in relatively few electricity saving behaviours. Besides its direct effect on behaviours, a lack of control also deprives these children of the context in which they might talk to their parents about energy consumption and use, as well as the chance to observe and imitate relevant parental behaviours (i.e. experiential learning; Roland-Levy,

2010; Taylor and Smith, 2009). This, in turn, may hinder the development of their energy knowledge (section 6.1) and attitudes (section 6.2). Unfortunately, these concerns indeed seem to be borne out by the fact that those children with no control over appliances almost never talk about conserving electricity within their families (Appendix 15), have very little knowledge on the topic (section 6.1), and, likely as a result, weakly developed attitudes towards saving electricity (section 6.2). However, at least some of these parents seem willing to take a more liberal approach once they realise that it is normal for most other children to operate a variety of appliances. Thus, even though the questions asked during the interviews were as neutral as possible, simply talking about the topic triggered a few of them to question the level of control they allow their offspring:

> I mean it is probably about time that we [mother and daughter] actually sit down and have a talk about [electrical] things, and how they work properly, and how we plug things in properly [...]. I haven't [...] actually sat down and had a good discussion about it – that is why [her daughter does not use appliances]. But definitely [this] is something, now that I've talked to you, I feel like I should [do] (Marion's mother).

Chapter 5

Socialisation Processes and Family Dynamics

Having analysed the children's level of involvement in electricity saving behaviours (Chapter 4), the question arises how such behaviours are acquired and habitualised. At the time of the interviews, several of the children had already incorporated some energy saving behaviours into their daily routine, and, like their parents, talked about doing so as a past experience. However, in line with previous research (Garabuau-Moussaoui, 2011a), the socialisation of energy saving practices was mostly described as "a work in progress" (Ron's mother) with the children being "still on the learning curve" (Paula's father). This chapter starts by exploring already established habits, before moving on to identify the mechanisms underlying their ongoing formation. Parents seem to be the main factor driving this process through specific socialisation strategies and communication patterns. Indeed, family dynamics and socialisation strategies are inseparably intertwined in the participants' discourse, and hence will be presented together in the following section. Ongoing socialisation processes will be discussed in terms of the extremely common, indirect strategy of behavioural modelling, followed by a series of more direct strategies, presented in their order of dependence on the parents: explicit conversations and explanations, reminders, rules, and punishments. In most cases, the children are being socialised into their family's household energy practices through a combination of two or more of these.

5.1 Habits

Habits are automatic and relatively fixed behaviours (Verplanken *et al*., 1997), and thus, from a behaviourist perspective, an important part of the children's socialisation process into saving electricity. Note that the participants sometimes used the word "habit" to refer to any automatic behaviour. However, since it is not always possible to infer from the interviews how "automatic" the behaviour in question actually is, a habit is here considered to exist only when both the child and the parent agree that the former performs a particular behaviour (1) consistently and (2) autonomously (i.e. without parental interference), regardless of the underlying rationale. Although only a small proportion of the children's electricity saving behaviours are habitual according to these criteria, at the time of the interviews most of the children had already acquired at least one habit (Table 5.1). Tanya provides a typical example: "I remember [to turn off the heat pump]. Before, I used to use it so much, my Mum

always told me to turn it off once I was finished with it. [… I have been doing this] probably since I was about seven [years old]". Independently, Tanya's mother agreed that "that's part of her routine".

Table 5.1 Number of reported electricity saving behaviours compared with the number of behaviours performed habitually (i.e. consistently and autonomously). A fraction indicates that the behaviour was reported as only being performed sometimes.

	Children's electricity saving behaviours	
	Total	Habitual (consistent and autonomous)
Alex	9	2
Alice	5	5
Alysa	6.5	2
Amanda	10	7
Amy	5	3
Andy	4.5	0
Blake	6	1
Charlie	9	5
Grace	10.5	7
James	10	1
Jessica	4.5	3
Kaila	8	6
Karla	4.5	1
Kelly	4.5	1
Lisa	2.5	0
Malcolm	5.5	1
Marion	3	0
Mark	4	0
Mary	6.5	2
Mike	5.5	1
Molly	9	4
Paula	10.5	3
Ron	3.5	0
Tabatha	4	1
Tanya	8	6
Tim	8.5	4

One intuitive way to look at the establishment of habits may be to assume that they follow naturally from prolonged engagement in a particular behaviour, or use of a particular appliance. Although the interviews did not specifically enquire about this point, some of the

participants did provide some indications. For example, Jessica's mother explained that her daughter started to learn about appropriate shower times a long time ago, through indirect socialisation:

> I think probably they've [children] just picked it up [having medium showers] from the routine, and I guess when they were little and started […] I would go with them and help wash hair and things. So, I guess they got a feeling as to how long they were going to be in the shower, so by the time Jessica would go and shower on her own, she'd already know. For months, or for a year or two, I'd probably be in there or popped in and out and said, 'Are you finished yet?', you know, and so she seems to just have a feeling. Like, she goes in […], does her hair, and then she's out again.

Similarly, most of the participants talked about the children turning off lights as a practice that started in the past, as exemplified by Grace's father: "*that's been* our sort of family policy" and Molly's mother: "she [her daughter] *would've been* told initially to turn the light off". Finally, the organised fashion in which most of the children are closing curtains (section 4.2.4) might be taken as a sign that it, too, represents a long-established behaviour. By contrast, Paula's statement that her 6-year-old brother is "too young" to use the heat pump, and Tanya's explanation that she has been using it since she turned seven, gives an indication that at least some of the children started to use heat pumps relatively recently (within the last two years). Equally, several of the children remember the particular situation in which they learnt to switch off the computer, suggesting it to be a relatively new practice: "I didn't know how to turn it off so my dad taught me. He showed me the hard way and I didn't understand, so he taught me how to do it easily" (Larry). Finally, comments such as: "if she's cooking, I *still* need to be in the room" (Jessica's mother) point to even more recently acquired behaviours.

Surprisingly, comparing the 'age' of a particular behaviour to the number of children performing it habitually (Table 4.4) suggests that these factors are not obviously related. Thus, only four of the 19 interviewed children who reported having short showers have made a habit out of it, only ten (out of 25) persistently switch off lights, and only seven (out of 21) regularly close the curtains (Table 4.4). Instead, the time the children have been involved in a particular behaviour seems to be determined by the perceived level of danger associated with it. For example, the children only recently started to use potentially hazardous cooking appliances, whereas at least some of them have been closing curtains (which does not require the use of electricity, and is hence considered safe) for a long time (see also section 4.3.1: Safety). Similarly, Garabuau-Moussaoui (2011a) reported that children in France start to

switch off TVs at an early age, before beginning to unplug appliances, and, finally, control heating devices at a later stage.

Some of the parents consider their children's daily routine – i.e. not just one, but several habitual behaviours performed consecutively in a specific context – to play a key role in creating particular electricity saving habits. For instance, Tanya's mother explained that: "That's part of her routine, you know, she gets up, opens the curtains, turns the heater off, comes upstairs type thing […]. She's actually really good at those sort of methodical routine things", while Amanda's mother thinks that "routines, routines work with children". Interestingly, the children of the four parents who talked most emphatically about daily routines (Tanya, Kaila, Amanda, and Charlie) also had a comparatively high number of particular habits (Table 5.1). Daily routines are an important part of children's lives, and have the potential to encompass several energy saving behaviours at the same time. Therefore, using existing daily routines (e.g. getting ready to start the day) as a vehicle, rather than simply encouraging a given behaviour out of context (e.g. always turning off the heater), might be an effective way of facilitating and maximising the acquisition of electricity saving habits.

5.2 Modelling Behaviour

Following their parents' example, or "learning by osmosis" (Tim's mother), was mentioned in connection with all of the behaviours analysed in this study (section 4.2), making it one of the main ways in which children acquire electricity saving behaviours (see also Garabuau-Moussaoui, 2011a and Grønhøj and Thøgersen, 2009, 2012). The importance of this kind of indirect socialisation is made clear by the fact that, in the majority of cases, the whole family seems to be engaging in the same electricity saving behaviours, as shown by the frequent switching of the participants to the plural form (we): "if the computer's finished, *we*'ve got […] to log it off and turn the screen off" (Charlie's father).

Members of more than half of the families explicitly talked about following the example set by the parents as a way of learning a particular behaviour, but the process may be much more widespread, though unconscious. Marion, who sometimes turns off the lights "because I watch my mum, and I learnt from her", and Mary, who "when I was little I would watch Dad turn things off at the wall, and I would start to get used to it and I started to do it" are typical responses. In both cases, their parents did not explain the reasons for performing these

behaviours, which means that children might be performing them without the particular intention to save energy. Thus, Jessica explained that her family does "not very often" talk about saving electricity because "we don't really need to talk about it because we all do it anyway", and her mother acknowledged that Jessica "turns lights off and such, but whether she's just doing it from habit or whether she's doing it as a conscious decision to do it [save electricity], I don't actually know".

In most of the families, the children are modelling their parents' behaviours in addition to receiving specific instructions or explanations (sections 5.3 and 5.4), with parents generally being consistent in terms of their speech and actions as regards electricity use (data from interviews and surveys; Appendix 15). For example, Andy's mother tends to remind her son: "don't forget the lights", and indeed is herself "very conscious about lights […]. My husband jokes about working in the dark all the time, because I am working on my computer in the dark". However, there are several exceptions, particularly as concerns shower times. For instance, Molly explained that despite setting a five minute shower limit (p. 123), her "dad doesn't" take short showers. While some of the children do not seem to be upset by such inconsistencies, others, such as Lisa, expect their parents to do as they preach: "I say, 'Mum, you have to turn the light off, because you always say that we have to turn the light off'." Lack of consistency on the part of the parents may represent a barrier for their children to help save electricity, as pointed out by Karla's mother:

> I think it's partly to do with us [parents], because […] there's just so many [electrical] things around the house and she [Karla] says, 'Oh if that thing's on, I may as well leave that thing on then.' […] We've got a fridge, a big fridge […]. and there's just one thing in the big fridge and there's nothing in the [other] cooler, so, yeah, I think Karla says, 'But that big thing's on anyways, so I may as well turn that one on' […]. I mean […], it's not really fair on me to say, 'Oh Karla, five minutes [in the shower]' and then I'll just go and... (laughs)".

Based on these results, as well as those of previous studies (Grønhøj and Thøgersen, 2012), it therefore seems that setting an example for children to follow is highly beneficial, whereas the opposite (encouraging or insisting on a behaviour without any personal commitment) is less effective, and possibly even counterproductive. This idea is further supported by the fact that the number of electricity saving behaviours performed by the parents (as judged from the surveys; Appendix 2) and their children (based on the interviews) seems to be correlated – the more active the parents, the more active their child (Exact Chi-square, $p = 0.018$, Appendix 3), as was also found by Grønhøj and Thøgersen, (2009) based on surveys of teenagers. It is important to note, however, that the number of behaviours the children in this study engage in

also seems to be related to their parents' attitudes towards energy efficiency (section 6.2). A correspondence analysis (an exploratory, multivariate statistical technique measuring the association between rows and columns of a contingency table; section 3.2.2) of the same data associates those parents and children who engage in a high or medium number of electricity saving behaviours, respectively, but not those showing low levels of engagement (Fig. 5.1, Appendix 4). Possible explanations for this pattern might include a lack of control over appliances on the part of the children (e.g. Marion and Lisa; section 4.3), the existence of rules obliging children to engage in electricity saving behaviours even when their parents do not (Appendix 2; section 5.5), and children being particularly receptive to the few examples actually set by their parents (e.g. Amy and Jessica).

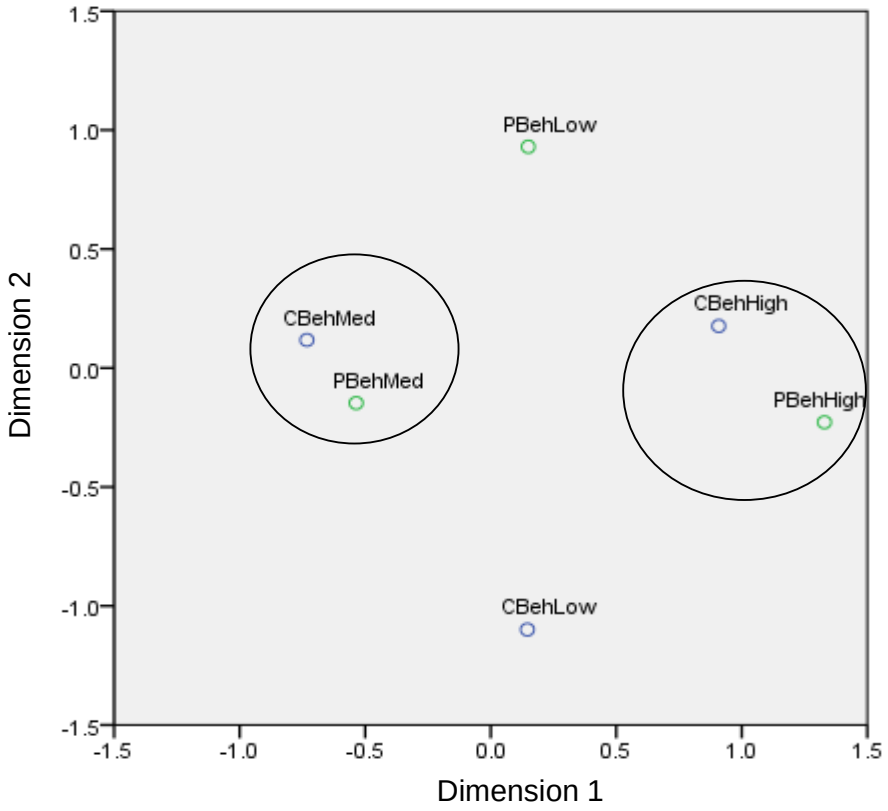

Figure 5.1 Correspondence analysis for parent's (P) and children's (C) level of engagement in electricity saving behaviours (Beh) (Med = Medium)

Overall, the finding that parents are able to pass on electricity saving behaviours to their children by simply setting a consistent example is encouraging, while at the same time raising concerns about families in which such examples are limited. In addition, indirect socialisation methods, such as modelling, have the disadvantage of not requiring children to understand the underlying rationale of a particular behaviour, and hence do not contribute to energy literacy

or the creation of a positive attitude towards saving power. This may have future repercussions, especially in terms of limiting the children's ability to surpass their parents' efforts through the adoption of further electricity saving technologies and behaviours as they grow older.

5.3 Conversations and Explanations

5.3.1 Level and Frequency

The participating families differ widely in the extent to which their members communicate with each other about how and why to save electricity, with roughly one quarter of them talking often and at a deep level about electricity consumption (Appendix 2), as exemplified by Grace: "My dad always talks about it [electricity consumption] to me, why it's important" and Alice's father:

> *Alice's father*: It is a pretty regular topic of conversation, so we might talk about we need to buy a car and we'll talk about the fuel economy, or we need to buy a freezer and talking about, well, what model is more energy efficient. So that kind of thing is a topic of conversation that goes both ways with us.
> *Researcher*: […] When you say regularly, do you mean like daily, weekly, monthly?
> *Alice's father*: Perhaps weekly. I think especially most recently, since we recently moved here and so we are making a lot of new decisions about things. We just bought a house, the house is going to need insulation... so that kind of topic.

The key features of this relatively high level of communication include (1) clear explanations as to why and how to save energy; (2) talking about energy consumption in context; and (3) frequent, dedicated conversations on the topic, thus impressing its importance on the children. For instance, Grace implied that her strong attitude towards saving electricity was conveyed to her by her father, who: "tells me [to save energy], because he just is so precious about it." These points were further summarised by Paula's father: "We try to give them reasoning, but, you know, they're too young […]. But, constant hammering – maybe something will get there".

Most commonly, conversations within the 25% of highly communicative families (Appendix 2) revolve around reasons for performing a specific energy saving behaviour, or the effects of efficient technology on their own family in terms of, for example, keeping warm or saving money. These conversations occur mostly while the child is learning to use a device, or after

they have misused it. However, they are not meant as a reprimand or an instruction, with the children also talking, and usually asking questions:

> We [the family] talk about it [energy consumption], those things get brought up and stuff, it's just common […]. When we do washing […], we fill up the washing machine and they understand like 'Oh, don't set it for small loads, keep small loads, just do a big load' […]. They realise that dryers […] use, you know, more [power] meter and ra ra ra […]. Power bills get dearer over winter, and usually are cheaper over summer, so they understand things like that (Kaila's mother).

Another example is Grace, who has had several conversations with her father about their solar passive house, especially when Grace was helping to build mud bricks at the age of seven: "We've talked to her [Grace] about why we've built the house, and that the sun warms the house and we don't have to worry about power […]. I think she's only aware of that, the thermal mass context about the mud bricks" (Grace's father). Grace seems to have understood the content of these conversations, as she was able to explain that "my Dad designed the house especially to save electricity […]. The mud bricks are there to make it warmer and to save electricity as well". A few of the families also have more complex conversations about energy consumption and production, usually around the dinner table, after watching a related documentary or the news, and, occasionally, as a result of school homework. Such conversations might focus, for example, on the relationships between energy production, the family's energy consumption, and environmental issues, as explained by Charlie's father:

> We talk about, you know, especially in the news […], we need to save power, and why, and the increase of industry and all that; and that households have a higher consumption of power because […] these big devices that we have nowadays use more power, and we have more of them […]. Because we've got a wood burner […], we say 'We get our heat, [therefore] we're producing greenhouse gases […]. A lot of industries use coal and all that, so they're [children] aware that it produces energy, but then it has a by-product as well, […] producing dams and all that – it probably destroys the habitats.

Conversations about energy production and associated environmental problems also occur in many of the other families. However, they are relatively infrequent and usually dissociated from those families' electricity consumption, and hence will be discussed further in the context of energy literacy (section 6.1).

Having frequent and deep conversations about electricity consumption seems to have an effect on these children's attitudes towards saving power (section 6.2), since most of them stated that they are actively trying to save electricity, and several of them think that doing so is important (Appendix 2). Statistically, there is a significant relationship between the level of conversations and explanations within a family, and both the children's (Exact Chi-square, p =

0.022; Appendix 3) and parents' attitudes towards energy efficiency (as judged from the surveys; Exact Chi-square, p = 0.027, Appendix 3). In addition, the parent's attitudes are significantly associated with the number of electricity saving behaviours performed by both themselves (Kruskal Wallis, p = 0.017, Appendix 3) and by their children (Kruskal-Wallis, p = 0.023; Appendix 3). A correspondence analysis (Fig. 5.2) of the same data also indicates that parents with strong, positive attitudes tend to engage in more frequent and in-depth conversations about energy; however, this association seems ambiguous based on the underlying contingency table (Appendix 5), and there is no clear pattern in the case of medium and weak attitudes (Fig. 5.2).

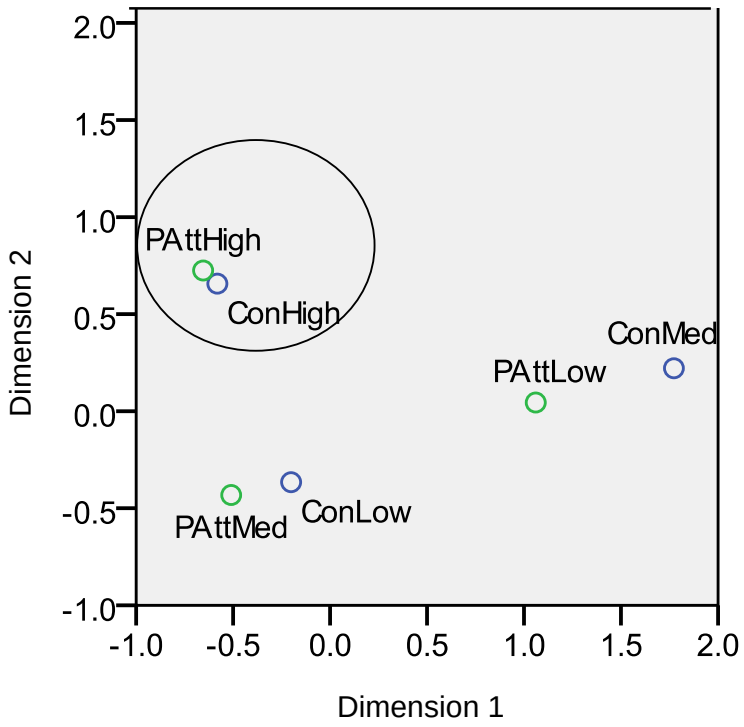

Figure 5.2 Correspondence analysis of the parents' attitudes towards energy efficiency (PAtt) and the depth and frequency of family conversations about energy production and consumption (Con) (Med = Medium)

Most of the children having frequent conversations about energy consumption also engage in a high number of electricity saving behaviours, which is consistent with the findings of DeWaters and Powers (2011b). However, this relationship is not statistically significant. Instead of a causal link between energy-related communication and behaviour, these results therefore suggest that parents with a strong attitude towards energy efficiency set an example for their children to follow by engaging in several electricity saving behaviours themselves. This marks an important difference between the effects of indirect (i.e. modelling) and direct

socialisation methods: whereas the former is likely the predominant factor leading children to adopt a variety of electricity saving behaviours, it is frequent and deep family conversations that allow them to understand the importance of, and rationale behind, their own actions, thus fostering a positive attitude towards saving energy. An alternative explanation might be that parents with a strong positive attitude towards saving energy control their children's behaviour through a variety of rules, with the positive attitudes of their offspring being either the result of frequent conversations, or of cognitive dissonance (section 2.3.3). The strong evidence for modelling (section 5.2) suggests that rules and the resulting reduction of cognitive dissonance are secondary pathways, likely acting in conjunction with modelling to produce the observed patterns.

Some of the families demonstrate only one of the characteristics of high-level communication (here coded as 'medium level of conversation'), having either infrequent deep conversations, or frequent superficial ones. For example, although Tabatha's and Jessica's families have in-depth conversations regarding energy use, the latter occur only rarely: "She [her daughter] knows the dams make electricity and then it's used in the house […]. I suppose we had talked about different things, you know, how different dams have been proposed before, and why people have said they didn't want them, so that's come up a little bit" (Tabatha's mother). Similarly, Alysa and Amanda frequently talk with their parents about saving energy, but in their case the explanations are usually short, concise, and relatively superficial: "They [the parents] say, if we have it [the light] on for a while it will cost a lot of money […]. They said it just wastes power […]." (Amanda). Although none of these children (except Amanda) engage in many electricity saving behaviours, they do think that saving energy is important, and said that they were making a conscious effort to save it. This likely reflects the still comparatively high level of communication about energy consumption these children experience at home, and indicates that either frequent *or* in-depth discussions may be enough to influence their attitudes.

In contrast to the examples above, and corroborating previous research (Halder *et al.*, 2011), conversations about saving energy are virtually absent in the majority of the families, and generally limited to infrequent and superficial explanations: "If we're not in a room, I think the appliances should be turned off and the lights, [but I] don't know how good I am at explaining that to the kids […]. I think all I've said to Amy is that it uses electricity and it costs money, just fairly simple, and the same with the gas" (Amy's mother). Similarly, Mike commented that: "We don't talk about it [saving energy] that often, but sometimes we might have to if it's something important". However, his parents generally only explain that, if he

saves electricity, "they don't have to pay so much". In some cases, when trying to explain the importance of performing a particular behaviour, parents also fail to make the link with electricity consumption explicit, apparently assuming that their children will make the connection by themselves. Thus, when asked by her daughter why it was necessary to have short showers, Karla's mother oversimplified the issue by explaining that:

> *Karla's mother:* "Because we have to, because you have to pay. I sort of had to lie for that bit, but, 'You have to pay for water Karla'."[1]
> *Researcher*: […] Do you think that she knows that heating the water costs [and uses] power?
> *Karla's mother***:** I think she does.

Finally, in the two most extreme cases (Malcolm and Blake), none of the interviewed family members could provide examples of explanations regarding saving energy, indicating that the topic is non-existent for them: "We [the family] never think about it [saving energy] at all […]. Well Mum and Dad probably do, but they don't really talk about it to us" (Malcolm).

The children exposed to such superficial explanations, if any, often only have a limited understanding of some of the more abstract relationships between certain behaviours, such as having a short shower or closing curtains, and using electricity (section 4.2). This observation is likely to have significant implications for the children's energy literacy, since most of them cited parents as their primary source of learning about energy conservation (Fig. 6.2)[2]. Nevertheless, more than half of the children claimed, or were reported by their parents, to be proactive in asking questions, with over a third of the participants recalling specific examples related to energy consumption and production. Some parents also pointed out that the children often initiate the conversations, which provides a perfect, though often lost, opportunity for more in-depth explanations and conversations (continued in section 5.3). In addition, all of the children are aware of the relationship between money and electricity despite the superficial nature of the explanations many of them have been given (e.g. Amy mother's and Amanda's quotes on p. 113 and 134), thus indicating that topics considered important by the parents are preferentially passed on to their offspring (see also Garabuau-Moussaoui *et al*., 2009). This likely also holds true for environmental reasons to save power, albeit less commonly, and possibly via a more complicated process (section 5.3.2).

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[1] Water in Dunedin is not metered or paid according to consumption level. Thus, Karla's mother used the arguably more easy to understand *apparent* cost of water as a proxy for explaining the *actual* cost of heating it.

[2] The contents of the interviews and focus groups on energy literacy and family conversations are inextricably linked, and will be discussed further in relation to energy literacy (Chapter 6).

5.3.2 Rationales Underlying the Explanations

The financial cost of power is by far the most predominant topic of conversation to emerge from the interviews, and was dwelt upon especially by those parents paying the highest electricity bills (over NZD 200 a month in either summer or winter), regardless of their income. The survey data (Appendix 14) yield comparable results, with the majority of the parents (65%) citing money as their main motivation to save electricity. Similar patterns have previously been explained as arising from a general dislike of waste (Gram-Hanssen, 2010); however, "hating waste" in general and "social fairness" were only mentioned by five or fewer of the participants. Besides saving money, the most commonly mentioned reasons for saving electricity are environmental concerns and energy security (Table 5.2), which reflects the results of previous research (e.g. Garabuau-Moussaoui, 2011a; Jentsch *et al*., 2011; Mirosa *et al*., 2010, 2013; Toth *et al*., 2013).

Table 5.2 Parent-child agreement on the most frequently cited reasons to save energy, according to the interviews. Possible comparisons is the number of families (out of 26) for which at least one member mentioned a particular rationale.

Reasons for saving energy	**Possible comparisons**	**Same**		**Different**	
		#	%	#	%
Money	24	20	83.3	4	16.7
Environment (including climate change)	14	5	35.7	9	64.3
Energy security	10	3	30	7	70

The children and their parents generally agree on the importance of saving energy for financial reasons, whereas the opposite is true for environmental concerns and energy security (Table 5.2). Yet, surprisingly, many of those parents who claim to follow an environmental rationale, thereby generally contradicting their children, nonetheless seem to agree with their offspring across the rest of the interview – indeed, much more so than any of their peers (Exact Chi-square, $p = 0.038$; Appendix 3), thus suggesting them to have a different communication style. There are several potential reasons for this mismatch:

1) Some of the parents who mentioned the environment during their interviews do not consider it their primary motivation for saving electricity, and hence might not talk about it with their children. For example, Mark's mother makes it clear that she "could go into lots of environmental reasons, but it really comes down to the cost."

2) Some parents might only have mentioned the environment because of social desirability bias, without actually being concerned about the topic. For instance, Blake's mother said that she is "quite aware of, you know, just the money aspect of it, and also just […] an eco-kind point of view". However, she does not talk about it with her son, and scored low on the environmental values survey. Blake also explained that, in general, it is he who starts conversations on environmental topics: "Nature terms it's usually me, and business terms it's usually [mum] or [dad]." Social desirability bias is also suspected to have affected previous studies on pro-environmental behaviour (e.g. Abrahamse *et al*., 2005; Garabuau-Moussaoui *et al*., 2009).
3) The social-environmental impacts of energy consumption are inherently more abstract than its financial cost, and may not lend themselves to simplification. Thus, there are no examples of superficial explanations attempting to justify saving electricity out of environmental or energy security concerns, with families either having more in-depth conversations about the topic, or not talking about it at all – possibly because some of the parents seem to think that doing so would take too much time and effort, or that their children would not be capable of understanding it, anyway (e.g. Amy's mother's quote on p. 134).

Those parents who do agree with their offspring on having an environmental rationale for saving electricity stand out for being highly concerned about the matter, with the children being more likely to mention environmental concerns if their parents did so more than once during their interviews (Exact Chi-square, $p = 0.005$; Appendix 2). The same relationship can be identified qualitatively: for instance, both Tanya and Alice attend an enviroschool, and live in a transition town "aiming to achieve New Zealand's first community owned and developed wind cluster" (Transition Towns, New Zealand, Aoteraoa, 2013). Their parents scored medium and high, respectively, on the surveys relating to environmental values, energy efficient attitudes, and behaviour, and, like their children, talked emphatically about the environment during their interviews. Both considered saving electricity to be important for environmental reasons, as exemplified by Alice's father: "I think that concern about climate change, if I was going to pick the top [reason for saving energy], I would say that I think of that as being a critical issue ... and it is important to do whatever we can, to do what you could personally, reducing power use". Alice herself is trying to save electricity because "we don't want the Earth all polluted, because then we won't be able to live here". Similarly, Tanya's mother stated that: "I've always been [...] conscious of resources […]. At the moment it's budget, but I also have an understanding of the environmental impacts […]. It's there in the background type thing, you know, we grow our own vegetables and we grow our own fruit

and that sort of thing, and we have chickens", while Tanya herself specifically pointed out that "fossil fuels are going to run out", and that we should "use the sun's energy, not fossil fuels [because] it's more environmentally friendly".

Based on these observations, it appears that environmental rationales can indeed guide family decisions, and be adopted by the children – but only if the parents have a high degree of environmental awareness. This might be seen as cause for some concern, given how uncommon such families seem to be. However, about half of the parents have at least some level of awareness of the environmental impact of using electricity (Table 5.2), and thus the potential to foster the development of a corresponding mind set in their children.

5.4 Reminders and Instructions

5.4.1 Parents to Children

Reminders and instructions are the most direct and simple forms of communication analysed in this study, and are also the most common interaction between children and their parents as regards electricity use. A verbal message given for the first time is considered an instruction, and only turns into a reminder if it is repeated. Nevertheless, they are discussed together here owing to their similar nature, with neither involving any type of reasoning (unlike explanations), and both being unidirectional (unlike conversations), short, and concise.

All of the parents and children, including those from the focus groups, reported giving or receiving reminders and/ or instructions, often on a frequent basis. This is hardly surprising, given that none of the children (except Alice) perform all of their electricity saving behaviours habitually (Table 5.1). In many cases, the parents previously provided an explanation, and take the view that there is no need for repetition: "I say 'don't forget the lights' […], probably [there are] not [explanations] now. We've talked in the past about wasting power, but probably not now so much as 'don't forget the lights'." (Andy's mother). The way in which instructions and reminders are given is very similar in most of the families, and always complements, rather than substitutes, other socialisation strategies. Both the children and their parents talked about reminders mostly in relation to turning off lights, followed by shower time restrictions and, to a lesser extent, turning off TVs, computers, and electric heaters: "After [my daughter has been showering] ten minutes, I go and say to her, 'Come on, time to get out'." (Mary's mother). In addition, a few of the parents also remind their children to close the fridge quickly, close doors, and switch off stereos.

Many of the participants talked about friction caused specifically by reminders and instructions (but none of the other socialisation strategies). In some cases, conflict seems to be avoided owing to the children knowing that "it's an expectation" (Grace's father), even though the reminders may still occasionally make them "a bit grumbly" (Amanda's mother). However, in a third of the families there seems to be some mild conflict arising from the need to give reminders (see also Grønhøj, 2006 and Garabuau-Moussaoui, 2011b), mostly by parents getting angry: "Dad and Mum yell at us if it's [the heat pump is set to] over 22 [degrees]" (Malcolm) and "sometimes I accidently do it [leave the lights on], and my Dad gets mad at me" (Jessica). In a few cases, the children even stated that their only reason for engaging in a certain electricity saving behaviour is to avoid such conflict:

> *Alex*: [I] just turn it [the light] straight off when I go back out.
> *Researcher*: Okay, and why do you do that?
> *Alex*: Because Mum gets angry with me if I keep it on.

Several of the participants explained how extremely frequent reminders can turn into "nagging", as exemplified by Blake's mother: "Oh just, you know, 'Can you turn the lights off after [...]' you know, 'when you're not using it', or 'when you've left the room'; or, 'Why are all the lights in the house on?', or that kind of more – nagging, actually". Nagging is likely an indication of children not always following a particular instruction, leading to parents giving it more often: " 'Turn off the lights,' because you start getting frustrated, 'Turn off the lights', 'Would you please turn off the light!'." (Mike's mother). This dynamic often creates a vicious cycle, with children becoming used to an increasing number of reminders. In some cases, the instruction is given so often that it eventually becomes meaningless, and is simply ignored by the child: " 'It's time to get out of the shower now' […]'. I don't… I don't listen. They have to drag me out" (Miles). Interestingly, most of the children who experience nagging pointed out that their parents are themselves not consistent in following the behaviour they seek to enforce (section 5.2). For instance, Tabatha's mother reported that: "I nag her to turn the lights off", but her daughter retorted: "I don't know why she keeps telling me off, because she does it sometimes, too". This lack of consistency might erode the parents' credibility, and contribute to children either ignoring an instruction, or feeling conflicted about it. Setting an example (section 5.2) is crucial in this situation and, in conjunction with other socialisation strategies such as clearly defined rules (section 5.5), and frequent, deep conversations (section 5.3), might help to make reminders more effective or even obsolete, thus hopefully alleviating the negative feelings associated with saving electricity in some of the families.

In stark contrast to those cases in which reminders have led to conflict, there are also a few families where gentle, but repeated parental instructions are well received by the children. For instance, Grace's father explained that:

> We're still going through the process of reminding her [his daughter] to turn her stereo off […]. Some mornings […] I just turn it off […], I don't get on her case […]. I'm not, you know, at her all the time […], because I don't want to stress her out, don't want to make her feel so uncomfortable, but, you know, we'll get there.

Grace's response to this considerate approach is positive: "My Dad always reminds me, so I'm glad he does". All of the children in this situation consider saving electricity to be important, and stated that they are trying to help their families to do so: "I'm helping with it, because it helps all of us [the family]. It's helping all of us, and it's saving money too" (Paula). Once the children are making a personal effort to save power, they are more likely to regard reminders as helpful, rather than an imposition. In this particular situation, reminders could be interpreted as a positive way to achieve a common goal (Garabuau-Moussaoui *et al*., 2009), and – at least in this study – are always accompanied by frequent conversations about electricity consumption, thus reflecting an efficient overall approach to family communication (see previous section). Finally, there are only two families (Charlie's and Alice's) in which instructions and reminders are rare. In both of these cases, the children perform a relative high number of behaviours habitually (Table 5.1), thus reducing the need for reminders, as explained by Alice's father: "Alice is *very* conscientious about that sort of stuff [saving electricity] [...]. She'll say 'it's strange I was just in the bathroom, and the light was on, but no one was in there'."

The fact that all of the families use reminders at least to some degree suggests that they might be an essential (first) step towards getting children to save electricity, but also makes it impossible to say how effective they are compared to other socialisation strategies. Their main role seems to lie in preventing the extinction of a particular behaviour through simple repetition, in a way similar to advertisements or classical conditioning (Aronson *et al*., 1999). Many of the participants also commented on certain behaviours being turned into habits following a period of frequent reminders: "initially she [daughter] probably didn't turn it [heater] off, and then we keep saying 'You're supposed to turn it off!', so... learned behaviour" (Molly's mother). However, given the low number of children who have developed energy saving habits (Table 5.1), it seems that reminders – at least on their own – are not particularly effective. Further research taking into account the role of time and frequency of repetition of particular reminders might help to clarify the way they work. Finally, it should also be noted that, although reminders may help to create electricity saving

habits in the long run, they are, by definition, very superficial, and do not help children to understand how their behaviour relates to the broader implications of energy consumption.

5.4.2 Children to Siblings and Parents

Owing to their simple, unidirectional nature, reminders are a communication method that children can relatively easily acquire and use in their interactions with other people. As in some previous analyses (Garabuau-Moussaoui *et al*., 2009; Grønhøj, 2007), this study revealed multiple examples of the children giving reminders to their parents and siblings, such as Amanda telling her mother that: "You forgot to turn the TV off", or Karla pointing out to her mother that: "It's not that cold. It's warmer outside, why have you got the heat pump on?" (Karla's mother). In most cases, the reminders given by the children reflect those they themselves receive from their parents, and therefore mostly deal with turning off lights, followed by switching off the heat pump, computers, TVs, closing doors, and having short showers. In addition, several of the children (all of them girls) also ask their parents to turn off the oven, close the fridge and microwave, and boil the kettle only once. The children thus mostly seem to be learning to give reminders by following their parents' example. Often, reminders also become a part of the family dynamic, as explained by Kaila's mother: "It is good [to give and receive reminders], it is good to help each other out", and James: "I tell him [his brother], so we're telling each other what not to do". Interestingly, none of the participants mentioned any conflict arising from children giving reminders to their parents. Instead, the latter are usually either thankful, giving replies such as: "Thanks mate, […] we better go and check" (Ron's mother), or "find it funny" (Molly), thus likely positively reinforcing their children's agency.

The majority of the children also give reminders and instructions to their siblings, thus taking an active role in helping to socialise them into energy saving practices: "Well, she [the sister] usually turns that heater on and lies by it when it's a nice, sunny day, so I tell her to turn it off" (Amy). However, in this case, about half of the children who talked about the topic also mentioned associated conflict: "I try to [give reminders], but he [her brother] gets annoyed with me, so it's hard" (Paula). In some cases, this may even lead children to avoid giving reminders altogether. Thus, when asked whether Alysa gives reminders to her brother, her mother explained: "I don't really think so [...]. They don't like receiving instructions from each other" (Alysa's mother).

It is noteworthy that several of the children who give reminders to their parents only do so rarely, mostly because their parents "usually don't [forget]" (Alice). In addition, over a third of the interviewed children do not give reminders to their parents at all, often citing similar reasons: "They know how to save electricity, so I don't have to remind them" (Amy). Another possible reason for some children not giving instructions might be their interpretation of the latter being a sign of authority. Therefore, children might avoid challenging the family hierarchy by not giving reminders or instructions. This may be the reason why younger siblings sometimes find it difficult to remind older ones: "She [Malcolm's sister] just keeps it to herself [when electricity is being wasted] – I guess since she's a younger sister, right" (Malcolm's mother). In addition, it may explain why half of the children who do not remind their parents nevertheless remind their siblings (who have a similar level of authority), and why those who do not give reminders at all are either the youngest sibling (least authority in the family) or a single child. The only exception to this pattern is Marion, who does not give reminders at all despite being an older sister – likely owing to her general lack of control over appliances, as well as the fact that her family generally does not discuss energy consumption (Appendix 15).

Finally, it is important to acknowledge that children do not always give reminders out of a genuine will to save power. Instead, they might simply be imitating their parents' example, trying to help the family in general (e.g. Paula's quote p. 142), challenging authority, or "trying to antagonise" (Mary's father) a sibling (see also Garabuau-Moussaoui *et al*., 2009). Nevertheless, the fact that the vast majority of the children endeavour to remind other family members of their duties indicates a high degree of awareness of the electricity saving behaviours that they, collectively, are meant to engage in. Even more importantly, it shows that the children are adopting an active role in saving electricity (regardless of their motivations), thus providing a clear example of children's agency (section 7.1).

5.5 Rules

Many of the participants reported having rules in the house (a direct socialisation method). For the purpose of this study, the latter are defined as a precise and explicit command given by the parents, which must be always followed by their children. Words such as "not allowed", "limit", "have to" or "mandatory" often indicate that a rule is in place. The children and their parents mostly agreed on the topics of rules, as well as their underlying reasons, thus confirming that they are generally made explicit and clearly understood by both parties. Rules

are commonly used to limit the time the children are allowed to watch TV or use the computer, and to restrict the use of appliances perceived as dangerous (section 4.3.1), but are often not motivated by a desire to save power: "Not really rules in regards to electricity. I mean, I have rules related to, like, 'You've had the TV on for far too long,' and it goes off, but that's more because I don't want them to watch it" (Jessica's mother).

Nevertheless, over a third of the families and several of the children from the focus groups talked about at least one rule aimed at reducing energy consumption, often coinciding with safety concerns and levels of comfort (Appendix 2). Most commonly, such rules require the children to limit their shower times, to ask their parents before using a heater, not to set the heat pump above a certain temperature, and, to a lesser extent, to turn off lights, the computer, and the TV. Interestingly, the most widespread rules are related to the major sources of household energy consumption (water and space heating), indicating that the parents are the most concerned, and therefore strictest, about those behaviours using the largest amount of power. However, it is also possible that controlling heaters and timing showers are regarded as slightly more complex behaviours than turning off a switch, and thus in need of clear guidelines to avoid misuse (section 4.3.2). In addition, the more private nature of such activities makes it more difficult for children to observe and imitate their parents, and for the latter to monitor their offspring, thus necessitating rules.

In contrast to other direct socialisation methods, such as conversations and explanations, rules are effective at controlling the children's actions, with their presence resulting in a greater number of energy saving behaviours (Mann-Whitney exact test, $p = 0.003$; Appendix 3; see also Garabuau-Moussaoui *et al.*, 2009). In some cases, rules seem to work even when the parents are not setting a good example, as demonstrated by Alex and Molly, both of whom engage in many electricity saving behaviours despite their parents scoring low or medium on the energy saving behaviours, environmental values, and energy saving attitudes surveys (Appendix 2). However, all of the parents setting rules provide an explanation for them to their children (section 5.3), and usually abide by them themselves. This is nicely illustrated by Amanda, who was distraught that everyone in her family "used to take really long in the shower, […and] the last person to get a shower, which is normally me, gets the cold water". In response, Amanda's mother "decided that each person in the house, five minutes" (Amanda), which fits well with her own concerns about the family using "too much gas" (Amanda's mother). The mother explained that she set the rule herself because the children "are not old enough to make that decision". According to her, the rule is working, and the children "have quite fun with that. If one of them has been in there too long, you know,

‘Amanda go and turn the water off on [your brother].’ She like, ‘Yay,’ […] [Her brother] will do the same thing for her, you know? It’s not a problem”. Similarly, Amanda stated that she is sometimes “able to turn off the water” when her father is in the shower for “too long”.

Having rules in place might be effective not only because they provide strict guidelines, but also because they contain an implicit message that there is an important issue, worthy of being regulated this way. Unlike reminders, rules do not seem to cause friction between the parents and their children, possibly owing to their clear and explicit nature. Nevertheless, it is important to remember that rules, while effective, are still an imposed measure, i.e. not followed voluntarily. Longitudinal studies are needed to determine whether rules can be internalised and give rise to habits, or whether their withdrawal will ultimately lead to the cessation (or resumption) of the behaviours they was meant to enforce (or prevent).

5.6 Consequences and Punishment

Leaving on lights and having long showers seem to be the only behaviours that result in consequences for some of the children, such as having the hot water turned off while still in the shower (see Amanda’s quote in the previous section), or having to switch off the light following a reminder: “If we [parents] notice a light on, I won’t turn it off – I’ll ask them” (James’ mother). This is seen as an important part of the socialisation process, as explained by Mike’s mother: “[I am] trying to get them to do it, because if I keep doing it, they won’t learn”. However, a few of the parents are more lenient: “I do turn them [the lights] off for her [the daughter], and she’ll go, ‘Oh I’m sorry’, yeah... but it is a bit of both” (Tabatha’s mother). Punishments are very rare, and were mentioned by only two of the children. When Becky forgets to switch off several appliances at once, she “get[s] told off and my mum tells me to stay in my room for an hour”. Similarly, Molly explained that: “when we [the children] leave the room, we always turn the lights off – otherwise we don’t get any pocket money”. She added that this measure is effective, because “we turn them [the lights] off now”.

The present data do not reveal why there is a relatively low level of consequences and punishments. However, possible reasons may include: (1) parents not considering energy efficiency important enough to warrant punishments; (2) no need to enforce rules because the children are usually obeying them; or (3) a perception that the children are generally making an effort to cooperate, and thus do not deserve to be punished. In any case, the low level of punishments likely helps to prevent children from developing a negative attitude towards

saving energy, and may put more emphasis on alternative strategies based on reasoning, such as conversations and explanations.

Overall, most of the children in this study seem to be in the process of being socialised into saving electricity in the household, which corroborates previous work by Garabuau-Moussaoui (2011a). In general, the children perform electricity saving behaviours because they follow their parents' example (indirect socialisation) and/or obey rules (direct socialisation). By contrast, their attitude towards saving energy and knowledge about the topic largely depend on conversations with their parents or brief explanations (indirect socialisation). Reminders by the parents reinforce the children's behaviours, and provide them with a strategy which, when imitated, also enables them to be proactive agents for a particular behaviour. However, when used too frequently or on their own, reminders can also turn into counterproductive nagging. Combining different, direct and indirect socialisation strategies at the same time seems to be the most effective approach. Thus, the children who engage in a high or medium number of electricity saving behaviours, and perform more than half of them habitually (Charlie, Kaila, Tanya, Alice, and Grace) have been socialised into them through a combination of the example set by their parents (high or medium energy saving behaviours survey scores), reminders, and frequent conversations about energy consumption and conservation (Table 5.1 and Appendix 2). By contrast, those children whose parents set a poor example (low or medium electricity saving behaviours survey scores), rarely talk to their children about energy use, and do not impose rules (Kelly, Mary, Ron, Andy, and Blake) engage in few or a medium number of behaviours, and perform just one, or none, of them habitually (Table 5.1 and Appendix 2).

All of the socialisation strategies described here are general trends that emerged from the interviews and focus groups. However, the socialisation process might also be affected by other factors, which were mentioned only superficially by a few of the participants and are beyond the scope of this study, such as the children's relationship with their parents, and diverse personalities. Other possible contributing factors are knowledge acquired from school and the media, which will be discussed in the next chapter.

Chapter 6

Children's Energy Literacy

The concept of children's energy literacy (DeWaters *et al*., 2007; Fig. 1.1) integrates several factors relating to the ability and will of children to save power, and, together with the Theory of Planned Behaviour, was one of the starting premises of this thesis (section 1.5, Fig. 1.1). This chapter explores to what degree the children in this study meet the criteria of energy literacy by focussing on each of its constituent elements – knowledge (including learning sources), attitudes, and intended behaviour – in turn, before concluding with a discussion on how the latter relate both to each other, and the children's electricity saving behaviours. The inclusion of different school types in this study was solely for the purpose of gaining access to a broad range of families, rather than between-school comparisons; consequently, the participants' responses in this chapter are not presented according to the particular school from which they were recruited. However, in recognition of their role as an important source of information for the children, this chapter does include a dedicated subsection on the contribution of schools to the creation of energy literate citizens.

6.1 Knowledge

The children's knowledge about electricity consumption can be divided into: 1) the practicalities of how to save power in the household, i.e. relevant behaviours and how to use appliances (section 4.2); and 2) the broader social and environmental context of energy production. To establish how much the children know about the latter, they were prompted to talk about how energy is produced, and were asked whether they were aware of any related problems. In addition, their parents and teachers were asked for their perceptions about the children's knowledge of the topic.

As in most previous studies (e.g. Bodzin *et al*., 2013; DeWaters *et al*., 2013; El-Salam *et al*., 2009; Gambro and Switzky, 1996; Solomon, 1985), the children's knowledge about energy consumption and production seems generally very limited. Even when asked directly, some of them were completely unaware of any issues related to energy production and consumption, and instead thought that "electricity is awesome" (Lisa). Many of the others "don't really know" (Marion), but sometimes described electricity as a finite resource. For the most part, the children's energy-related and environmental knowledge seems to consist of fragmentary,

disconnected and, mostly informally acquired pieces of information (sections 6.1.2, 6.1.3 and 6.1.7), as was articulated by Tim's mother: "I don't even know if he [Tim] has connected that [hydropower] to turning a switch on [...]. They're so separate, between a big dam and a lake, and turning your TV on [...]. I don't think that's even connected [in Tim's mind]". Although the children make an effort to connect such fragments using their own logic, this often leads to misinterpretations (section 6.1.3). Nevertheless, all of the children know about the financial cost of power (section 6.1.1), and some of them were able to mention a few energy sources, as well as some associated environmental and social issues, and make comments on energy efficient technology.

6.1.1 Financial Cost

The financial cost of power was the main topic of conversation during most of the interviews and focus groups, resembling the results of previous studies (e.g. Mirosa *et al*., 2010; Wilson and Dowlatabadi, 2007). Like their parents, several of the children talked repeatedly about money (Appendix 2), and the majority of them identified it as their only reason for saving electricity (section 5.3.2). Thus, Ron tries to save power "because it wastes our [family's] money, and that's all." For most of the children, financial considerations seem to be the primary framework within which to make sense of issues arising from the use of electricity. For instance, at the end of one of the focus groups, some of the children started to debate the benefits of solar energy based on a purely economic rationale, while seemingly being oblivious to its environmental implications:

> *Simon:* My parents have solar electricity.
> *Miles*: It costs thousands to…
> *Simon*: No it doesn't… oh, and install it, but then it will save you like a million in your lifetime.
> *Researcher:* And why are solar panels so good?
> *Simon*: They don't make you pay as much money to the…
> *Miles*: You just don't want to pay something!
> *Simon*: Yeah.
> *Miles*: You have to pay to make the solar panels.
> *Simon*: But what if you already have one? Like, I have a tiny one about that big [smaller than his hand].
> *Miles*: But it's like, once you install it, 'cause the thing is when you get power wire [main grid], you have to pay a lot of money to install it, then you have to pay, keep on paying more, and more, and more, and more, and more, and a little, little more, more, more. But with the solar panel, you pay once, and then you just wait.
> *Simon*: No, you still have to keep paying.
> *Rachel*: I know.

> *Simon*: We've got our own water, like... tank water, but we have to pay, like, half the price of the normal water [compared] to… well, if we didn't have that.

These findings add to a growing body of conflicting evidence identifying money as either *the* key concern of children as regards energy (Solopova, 2008; Toth *et al*., 2013), or as just one factor of many, often equal, or even subordinate, to environmental concerns (Garabuau-Moussaoui, 2011a; Jentsch *et al*., 2011; Toth *et al*., 2013).

Some of the children regularly read the monthly power bill, either out of interest (Rachel) or because of their parents, who use it to impress upon them the need to save electricity: "I'll remind them how much the power bill was I just paid, so, 'You know how much electricity costs? It cost *this* much for the bill'." (Alysa's mother). In one of the focus groups, the children were even able to discuss the price of high power bills, thus demonstrating their awareness of the specific cost of electricity in their homes:

> *Rachel*: Mum gets 300 dollars [bills] and she hates it [...].
> *Miles*: We have a 300 one!

For some of the children, any money saved by consuming less power helps to satisfy other basic needs: "So you don't end up poor, and like me you can pay the rent" (Eleni) and "Well, the bills go up, there's less to eat and stuff" (Charlie), whereas others would consider spending it on luxuries: "the cost of money that we would be spending on bills... we could use that money to go on holidays or, yeah, go to something else, like a fun park, or have dinner out" (Mark). While there seems to be no general relationship between family income and how often the topic of money was brought up during the interviews, several of the participants from the medium decile schools mentioned the risk of the power being cut off as a result of unpaid bills. One of the teachers explained that:

> We've had some children here [...] [whose] power gets cut off regularly because they haven't paid the bills, and that would be the one thing sometimes they talk about. They might come and say they couldn't do their homework, or they couldn't do something, or 'Guess what happened last night? Our power got cut off'.

Similar stories were mentioned by Kelly's mother, who had just experienced her "first power cut, and that was maybe, like, three months ago", and Larry, who identified them as his only reason for saving electricity:

> *Researcher*: Why is it that [saving electricity] important [...]?
> *Eleni*: So we don't waste money,and stuff.
> *Larry*: Power doesn't go off.

Tom: [...] If you don't save it then your power bill… If you don't save it in every room and leave everything on, your power bill will go up rapidly.

Larry: Then you won't be able to use the power anymore 'cause you won't be able to pay the power, and then they will just turn off your power, and then you won't be able to watch TV and stuff like that, like my next door neighbour.

Furthermore, all of the parents who are currently unemployed (independent of the school type) have made it clear to their children that they are economically stressed and cannot afford to waste power: "She [her mother] tells me to turn off the lights or it will waste money, and we can't waste money right now because she doesn't have a job" (Tabatha). Understandably, saving money is the only motivation driving energy efficient behaviours in these households. For instance, Mary's mother explained that:

> No, we [the parents] haven't [talked to the children about other problems related to electricity use], it's just the fact that... basically the cost. It costs money [...]. With [my husband] being a student, we don't have a lot of money, so we are always at them [her children] about, you know, leaving the fridge door open [...].

The depth and extent of the children's knowledge of the cost of electricity (and its implications if bills are not paid) implies a certain level of understanding and concern for the financial resources of their respective families (see also section 5.3.2). Nevertheless, many of the parents explicitly expressed the belief that their children do not care about, or even understand, such topics, as exemplified by the following comments: "I'm not sure about the saving electricity, like the money side. I'm not sure she [her daughter] would really understand that." (Molly's mother); "She [her daughter] doesn't know how easily some things can just disappear, like how the power [price] can just rise" (Kelly's mother); and: "They [her children] haven't really taken that [saving electricity] on board fully yet, I guess because they're not the bill payers" (Alysa's mother). Yet, the same parents persist in giving explanations about the financial cost of power to their children, presumably in an attempt to further their efforts and level of understanding: "I usually say, […], 'I can't afford the electricity for that sort of length shower'." (Molly's mother); or: "Shut the door. You're losing the heat, and it's costing lots of money." (Alysa's mother)

Perhaps the parents' disregard for their children's ability to comprehend the financial implications of electricity consumption arises from the assumption that awareness (e.g. of the cost of power) ought to translate into action (i.e. saving energy) – with the latter in many cases not meeting the parents' expectations (section 5.4), and hence triggering reminders and further explanations. However, awareness and knowledge do not necessarily lead to a change in behaviour (Abrahamse *et al*., 2005; Kollmuss and Agyeman, 2002; Wilson and

Dowlatabadi, 2007), and there are several other factors, such as rules and setting an example, that may drive the acquisition of a particular electricity saving practice or habit (chapter 5).

6.1.2 Energy Sources

As may be expected, there is a significant relationship (Exact Chi-square, p = 0.007, Appendix 3), between the children who are able to mention at least one energy source, and those who talked about the environment in regards to electricity consumption and production. Thus, it is very important for children to be aware of how electricity is produced in order to be able to understand associated environmental problems, and, ultimately, the importance of reducing electricity consumption.

Unfortunately, reality currently does not seem to reflect this ideal, with the children's knowledge about energy production generally being extremely limited (see also Bodzin, 2012; DeWaters and Powers, 2008, 2011a; DeWaters *et al*., 2013; Ivy *et al*., 1998). About half of the children "don't really know" (Amy) of any energy sources, or simply "forgot" (Malcolm). Although several of the children are aware that electricity comes from power lines, most of them could not identify the original source. They often seemed to guess or to be unsure about their answers, giving them in the form of a question, e.g. "I think it is called fossil fuel?" (Andy), or: "The wind farm?" (Molly). This general lack of knowledge is also reflected in their limited use of relevant vocabulary, with none of the children mentioning words such as "renewable", only one child using the term "hydro", and only a couple explicitly talking about "fossil fuels". The absence of such specific terminology may be due to a lack of understanding, as was also found by a previous study on teenagers (DeWaters and Powers, 2011a). The following quote from one of the focus groups provides a good example of the level of discussion:

> *Researcher*: And does anyone know where electricity comes from? How do we make it?
> *Tom*: Power poles, power poles.
> *Larry*: Yeah.
> *Dani*: Power lines.
> *Tom*: Power lines, that's what I was looking for.
> *Eleni*: Big towers, and the sun hits on to them and then little lightening bulb thingies go down, they travel into the power lines and then, when you turn on something, it goes all the way to the computer, the television, the phone, my cell phone, the radio and etc. etc. etc. [...]
> *Researcher*: And where do you think the electricity comes from to get to the cables or to the power station?
> *Eleni*: The sun!!! [...]

Tom: The sun… electricity… I am not really sure.
Larry: The solar system? Satellites? With the TV satellites go around the world to get them.
Tom: Lightning strikes.

Most of the children who could identify one or more energy sources mentioned hydro, wind, and even solar power (Fig. 6.1), even though the latter contributes very little to New Zealand's total electricity production (Ministry of Business, Innovation and Employment, 2013). Overall, the children are thus mostly aware of those energy sources represented in the region by visible technology, i.e. dams, wind turbines, and solar panels, with half of the children or their parents making reference to seeing them: "I think I've seen an electricity dam before [...]. I think it was the Clyde Dam" (Mike) (section 6.1.7: trips). By contrast, none of the children (or their parents) talked about geothermal generation, and only very few of them mentioned nuclear power[1] and fossil fuels (Fig. 6.1), coinciding with the findings of Solomon (1992) and Zyadin *et al*. (2012).

This pattern is likely explained by the absence of nuclear power and the comparatively low importance of fossil fuels in electricity generation in New Zealand[2], as well as the fact that geothermal energy is not produced in the South Island (Ministry of Business, Innovation and Employment, 2013). Nevertheless, in the context of a looming global energy crisis, this level of unawareness is surprising – especially considering that geothermal generation represents the third largest electricity source in New Zealand (Ministry of Business, Innovation and Employment, 2013).

Compared to the other topics explored in this research (e.g. behaviours, socialisation, financial cost of power), the children seem to learn relatively little about energy production from their parents or school (section 6.1.7), and instead rely on a diverse number of (other) unstructured sources, such as television news, newspapers, books, documentaries, and personal observations (as was also found by Buway, 2007). This lack of communication is reflected in a relatively low level of agreement on this topic, with the perceptions of only two of the parents matching the answers of their offspring, and a third of the families disagreeing completely. Most of the parents variably over- or underestimate the children's knowledge (Fig. 6.1), as exemplified by Lisa's mother, who, despite her daughter being unable to name any energy sources, speculated that:

[1] Even the Fukushima nuclear disaster, which had occurred just nine months before the first interviews, was only mentioned by a single parent.
[2] Fossil fuels account for 23% of the total electricity production of New Zealand.

> She [her daughter] should be aware of the dam, you know, at Clyde there, and we've taken them up, and stopped and showed her [...]. The wind farm, probably we've talked about it, but not as a topic of conversation, you know. Like, if we've seen the big pylons driving down the road, we'll talk about it.

The above quote also illustrates a possible reason as to why some of the children may not be aware of any energy sources, despite having seen examples of production technology themselves: because conversations about power generation frequently occur in the context of a trip, it might be difficult for the children to relate them to the household context. Indeed, there is only one example of a mother talking to her daughter about energy sources in the context of household energy consumption: "When the lakes were really low and it was always on TV, and so we were always running around the house saying, 'Oh, make sure we turn the lights out, because the water levels are down, and we've got to save electricity'." (Molly's mother).

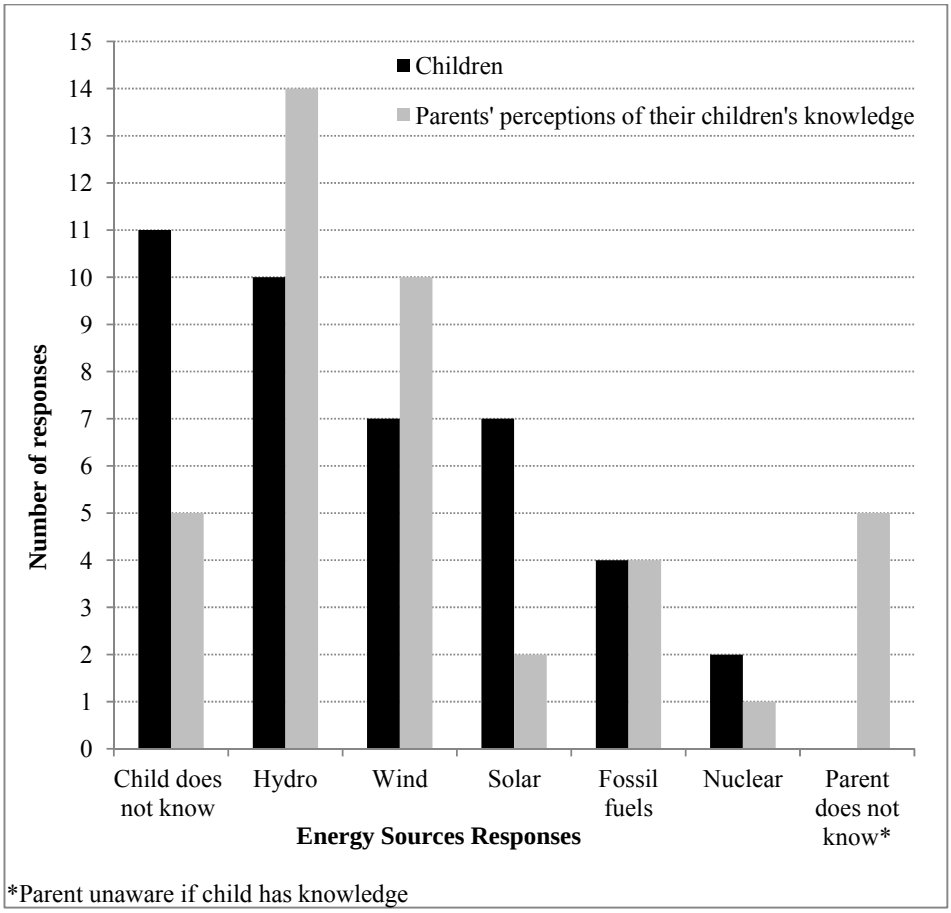

Figure 6.1 Energy sources known to the children according to their and their parents' interviews. Note that the participants frequently mentioned more than one energy source.

Although most of the children have only a limited understanding of energy sources, there are a few that are better informed. In addition to mentioning three or four sources, some of these children (Tanya, Blake, Alice, and Andy) also pointed out that renewable sources are better for the environment, or energy security. In contrast to most of their peers, these children seem to have acquired their knowledge in a structured way, since they usually listed the sources first, followed immediately afterwards by their (sometimes vague) identification as renewable or non-renewable, and/or an outline of their respective problems and benefits. For instance, Blake quickly identified "oil, sun, wind, water" as sources of energy, and then moved on to saying that "the water electricity won't run out, some [sources of] electricity won't run out, but the ground electricity [oil], which is the most strongest, will run out [...]. If that runs out, gas will run out". He also stated that he learned all of this from books given to him by his father. Similarly, Alice explained that electricity:

> is usually made by moving something [...]. One way is a wind turbine [...], well, nuclear power – you split an atom, and then use the heat from splitting the atom to make steam to spin something [...]. I'm not sure... solar panels are the only thing I can think of that don't involve moving something [...]. Another way to make electricity is to take a magnet with copper wire and you spin either the magnet or the copper wire.

and then commented on how using electricity causes environmental problems. In her case, her knowledge "comes from the family" (Alice's father), including conversations triggered by seeing different power generation technologies during national and international trips, and overhearing conversations of her parents with some of their close friends, who happen to be climate scientists. Finally, Tanya talked about energy sources and problems in a similar way (p. 138 and 158), and said that she had learnt about them from "an energy project at school last year". Interestingly, schools were found to be important sources of learning about energy production in other countries (4-traders, 2013; Erdogan and Ok, 2011; Garabuau-Moussaoui, 2008; Sustainability matters, 2013; Toth *et al*., 2013; Zyadin *et al*., 2012), but generally do not seem to assume this role in the context of this research (section 6.1.7: school).

On the whole, these observations demonstrate that the children are unlikely to make the connection between a particular energy source and their own electricity consumption, unless this link is made explicit. Understanding energy sources is more abstract and complicated than learning behaviours to save power at home, and thus likely requires a more structured educational approach. Some of the parents gave examples of such types of explanations occurring, which were referred to independently by their children. For instance, Mark's mother explained that: "[When] we saw the hydro dams, we did talk about electricity, the generation of it, and then how it comes to our house". Mark likely recalled this experience

when he stated that: “Turbines, like, turn something that creates electricity, and also it’s the same thing with dams.”

6.1.3 Environmental Problems

Most of the children, including those from enviroschools (section 3.2.1), have an extremely limited awareness of the environmental impact of electricity production and consumption, thus corroborating the results of previous research (Bodzin, 2012; DeWaters and Powers, 2008, 2011a; DeWaters *et al*., 2013; Ivy *et al*., 1998). Overall, only about a third of the children in this study know that there is any environmental impact at all, and some of them are unable to explain what the latter consists of. For instance, Jessica realises that wasting electricity “it not very good for the planet”, but does not know why, because “I haven’t read about that”. Likewise, although recognising “pollution” as a problem, Mike admitted after the interview that “I don’t really understand that, I only know we save the environment by using electricity or not using electricity”.

Almost all of the children talked about environmental problems in a superficial manner, and seemed to struggle to explain why a particular problem exists. For instance, Andy identified that fossil fuels “can sometimes harm the environment, so it is better maybe to use light from water power plants”, but was unable to explain why. He added that “I was thinking, maybe because some people might [...] chop down things, maybe to get, like, logs, and maybe to burn to make fire... I am not exactly sure about that”, implying that he has a vague idea of another problem, either deforestation or air pollution, but does not completely understand it. Climate change was rarely discussed by the children, as was also found by Gambro and Switzky (1996), but not Toth *et al*. (2013). The topic was only mentioned in two of the focus groups, possibly because the children were asked to cooperate by brainstorming possible environmental problems. In both cases, the children made the connection between global warming and electricity consumption through the risk of causing a fire:

> *Eleni*: And global warming
> *Tom*: [...] Oh, global warming, yeah [...]. I used to think that it was pronounced “global warNing”.
> *Larry*: I don’t know what that is.
> *Eleni*: Global warming is a big thingy that space ships have to go through, also known as rockets, and then it is this big red circle and there is a little, and there’s a hole in it… I think [...].
> *Tom*: Global warming is when the world warms up too much, and Antarctica basically melts.

Researcher: Exactly, and how is that related to electricity? [...].
Tom: Electricity causes fires sometimes [...].
Larry: That's why a lot of fires are usually caused [...].
Tom: Makes global warming slow down basically [...]. Using less electricity causes less fires, causes less electricity to be used obviously. Yeah, slows it down.

And:

Miles: Global warming [...], and then a polar bear comes in (all laugh) [...].
Linda: Environment!
Researcher: [...] How is that related to using electricity?
Linda: I don't know, don't ask me that [...], Mum says stuff [...]. Power lines!
Researcher: Power lines? [...]
Linda: 'Cause… if you keep on using electricity, more people will go through the power line, and that might make the power lines heavy, which would wear them, which would make fire, which would destroy the earth! Series of events…

Among those children who are more informed, most are only aware of a single environmental issue, with none of them mentioning more than two. Fossil fuels are the most commonly identified problem, with all of the children who recognise them as an energy source also realising that they are harmful to the environment, because "it pollutes the air" (Alice), or because of "oil spills" (Tanya). A couple of the children also mentioned that building a dam may change an ecosystem: "they're actually not very good, because the dams [...] are cutting off what the environment used to be like, so the water would have been like really up, really high, and they build the dams and then it's down lower" (James). In addition, Blake discussed the risk of animal extinction due to the extraction of "ground electricity [oil]", "because we're moving into the sea, into their territory, and then the Hector's dolphins don't like sounds".

Although in a few cases the children's environmental knowledge seems to stem from conversations with their parents (section 5.3.2), many of them seem to rely on a wider, less structured range of learning sources, which often depends on their personal interest, and may explain their relatively low level of environmental awareness. As may be expected, learning about environmental problems and energy sources go hand in hand, with the children talking about both at the same time (see above), and in relation to the same learning source. Indeed, all of the children who talked about environmental problems also know energy sources (Appendix 2), although, depending on the energy source, the opposite is not always true. Thus, all of the children who talked about fossil fuels also mentioned pollution, whereas those who are only aware of renewable energy sources did not talk as much about associated environmental problems – probably because their impact is less severe, and hence less often discussed. Although it is important for children to understand that some energy sources are

more environmentally friendly than others, it should not be forgotten that any kind of energy production has an impact (e.g. large-scale hydro dams), especially in a country as committed to renewable electricity generation as New Zealand, and thus that reducing consumption is always beneficial. Such a rationale was not discussed by the children, and has only rarely been identified in previous research (DeWaters and Powers, 2011a). Nevertheless, children might find it empowering, since, unlike choosing a particular energy source, saving electricity is within their competence even at a young age.

Several of the parents regard their children as "probably a little bit too young to grasp the big picture so much" (Ron's mother), or think that they "don't [...] understand that much" (Paula's father), which has led some of them to avoid talking about complex problems, such as peak oil. Interestingly, all of the parents extensively remarked on talking with their children about a range of other environmental topics, such as pollution, recycling, water conservation, and climate change, to a much greater degree than about electricity consumption or production. This is exemplified by Grace's father, who has conversations about once a week with his daughter about various environmental issues, without, however, relating them to electricity:

> We don't have those sorts of in-depth [electricity-related] conversations with her. I think, talking about not using the car as often and, you know, saving on petrol and those sorts of things, she'd get that sort of concept. But no, we haven't talked about peak oil and... we may have had some conversations about climate change. We definitely have talked to her about trying to reduce our resource use and having a lower impact on the earth's resources and things like that (Grace's father).

Similarly, some parents talk to their children about "things like global warming, but I wouldn't say in much detail at all [...]. I guess he's worried about sea level" (Malcolm's mother). Unsurprisingly, both Grace and Malcolm are unaware of any environmental problems associated with energy production, and none of the children mentioned climate change (as a consequence of energy use) during their interviews.

However, some of the children are capable of understanding at least relatively simple issues related to energy production, such as changing the environment by building a dam (p. 155, James' quote). In addition, as is typical for their cognitive development at this age (Berk, 2001), some of them proudly recalled relatively long chains of consequences at several points during the focus groups:

Eleni: You could use tilt tip to fill up a jug, and then you heat up the water with the jug, and then you pour it out to make a cup of tea, a milo, or coffee.
Dani: And then it goes into your tummy, and then it...
Eleni: Digests!
Dani: Yes, digests.
Eleni: And then it comes out into the toilet.
Dani: And then it goes down to the pipes, and then maybe in the sea, maybe? The fish swim in it.

Unfortunately, none of these chains were related to energy. Nevertheless, guiding children to construct similar chains of events, leading from different energy sources to associated environmental problems, and, finally, their own electricity consumption at home, might help them to understand the environmental implications of energy production and use. In addition, a similar exercise starting from the children's electricity consumption at home might help to make these connections more pertinent to their daily lives, and help them realise the broader, long-term consequences of their individual actions.

Taken together, these examples show that, although the children may be aware that there are environmental reasons for saving electricity, they do not necessarily understand how these issues are connected. In the absence of formal knowledge, the children seem to use whatever fragmented information is available to them to create their own – often wrong – theories, as was also suggested by Solomon (1992). Nevertheless, once they become aware of energy sources, they also tend to mention environmental problems (section 6.1.2), thus coming very close to making the link themselves. Even a small amount of guidance by their parents or school might therefore be effective in helping these children understand the environmental impacts of energy production and use. Potentially, this could be achieved relatively easily, since the great majority of the families already talk about the environment about once a week, or on a monthly basis. In addition, many of the children are interested in environmental topics, and are often the ones initiating conversations (section 5.3.1): "He [her son] is very interested in nature" (Blake's mother); and: "They [her children] have seen documentaries where [...], animals have got caught up in fishing nets or plastic bags [...], and they're just horrified because they're real animal lovers" (Jessica's mother). Such conversations, especially when met with interest on the part of the child, are helpful in creating a positive attitude towards the environment in general, and could easily be expanded to include energy topics. Without awareness of the environmental impact of using electricity, it is difficult to see how the children would be able to develop an environmental rationale for saving power (section 6.2).

6.1.4 Electricity as a 'Finite Resource'

Several of the children realise that modern society depends on electricity, and that, if it were to become less readily available, life would change drastically: "Electricity is real handy I guess, and it's better than not having [it]... just lighting a fire for light, not having much [electricity] left and stuff, not being able to dance with the stereo [...]. You can have fun when you can play around with electricity, and if we didn't have it we wouldn't have as much fun" (Lisa). Similarly, in one of the focus groups, some of the children explained that:

> *Eleni*: Yes, electricity makes a difference, because without electricity like…
> *Tom*: We're caveman!
> *Eleni*: We would have to use little lanterns like they did in the old days, and these little cars, like those the first Fords, and yeah… [...]. If all the electricity ran out in the world at the same time, [we] would end up like caveman and have to catch in about animals and eat them.

"Run[ning] out of power" (Becky) is the second most commonly identified problem of using electricity, with only its financial cost being more important, and was mentioned by over a third of the interviewed children, as well as in all of the focus groups (see also Ayers, 1977; Kuhn, 1979; Lawrenz, 1983; Solomon, 1985; Solomon, 1992; Stubbs, 1985; Toth *et al*., 2013). This is surprising, considering that New Zealand generates most of its electricity from renewable sources, but may simply be a function of a lack of awareness of different production methods (section 6.2.1). Encouragingly, a couple of the children (Tanya and Blake; p. 138 and 153) understand that the problem of finite energy supplies is specifically linked to fossil fuels, which are "going to run out and we can't use [them], and without fossil fuels we can't really use energy, so we have to like save energy now, and we have to have fossil fuels" (Tanya). However, the vast majority of the children only seem to have a very vague idea of this issue (see also Solomon, 1985), and none of them talked about the topic at a deeper lever, or used terms such as "peak oil", "energy crisis" and "energy security".

In general, the children appear to think of electricity itself as a finite resource, e.g.: "if we don't use as much electricity, then there's still heaps left" (Molly), and usually in relation to running out of power in their own home:

> *Tom*: So you don't waste money, and so electricity doesn't run out, basically.
> *Researcher*: Run out where? [...]
> *Tom*: If everybody left everything on, then probably everywhere, but probably just in your house. Not absolutely everywhere, that would just be quirky.

Strangely, many of the children seem to be concerned about not having enough electricity at any one time to power all their appliances, possibly as a result of outdated wiring in their

homes (BRANZ, n.d.): "[The TV] uses all the power and we won't have power for the SKY, and we won't have power sometimes for the computer" (Amanda), or: "After there is a power cut, sometimes we try [...] not to use as much energy, so that [...] we have a little bit of extra energy for other things" (Andy). A couple of the children also talked about saving power for times when it might be needed most:

> I think it's really important to save electricity, and save it for when we actually really need it, not just want it, because sometimes I think that you might need it [...]. Like, if there's a really big problem, someone needs to, maybe. If there's an earthquake, but some things are still good, and the electricity is on, but sometimes we might not have any left because we used too much before [...]. Or a flood, or something like a disaster, and suddenly like they fixed the electricity, but then suddenly there's no left because we've used it all" (Grace).

Many of the children seem to perceive electricity as a concrete material, comparable to plants and water. Deforestation and wasting water are common topics of conversation for the children, both at home and at school (section 4.2.5). Thus, they might be used to discussing other general environmental problems in terms of saving a particular resource, and consequently apply the same reasoning to power conservation, without understanding the processes behind its generation. For instance, in one of the focus groups the children talked about natural resources, but were unsure which ones are used to produce electricity. Instead, they ended up talking about saving water and trees (paper):

> *Miles*: [Saving electricity is good], because I think it uses natural resources or something?
> *Simon*: What? Did he say natural resources? [...]
> *Miles*: We had this thing [at school] that, like, once [...] you've finished [washing] your hand, don't keep it [the tap] on while you are trying to get something to wipe it with [...]
> *Simon*: How many times do we turn the tap on, and use electricity, and…
> *Miles*: Apparently we use… we use about… a year about 90% of a swimming pool [...]
> *Miles*: But, actually, the thing is when they say 'Everybody counts [in saving electricity]', it's actually quite true, 'cause if everyone goes like 'Ah, I don't count' and they just sit back, many other people do that and then…
> *Simon*: We'll die!
> *Miles*: Yes, we'll die [all laugh]
> *Researcher:* How come […]?
> *Miles*: Because we lose our natural resources just like 'damn the trees' [all laugh].
> *Rachel*: The trees will kill us.
> *Miles*: Yeah, I am reading a book about that. There's a lost forest, it got mutated, and it killed us [...].
> *Rachel*: Read books.
> *Simon*: That wastes our natural resources, it makes no sense!
> *Miles*: Yes, it does.
> *Rachel*: Maybe you just take the books that are already made.

Miles: Yeah, we're going to stop producing them... but we could keep the books, but stop producing them.

Applying a similar logic to hydro power, Grace thinks water might become scarce as a result of producing electricity: "I think the water is produced to make the electricity [...], and if we make too much electricity stuff, then there'll be hardly not much [water] left [...], like for us to drink". Overall, the children's notion of power running out thus seems to be based on misconceptions arising from their very limited knowledge of energy production. Some of their parents obviously think about natural resources in relation to saving power: "about those resources, obviously electricity's renewable, but, yeah, and also use of gas" (Amy's mother). However, none of them appear to have talked to their offspring about this particular connection, mentioning that "oil will run out one day" (Alysa's mother) only in the context of supplying petrol for the car. Thus, in general, the children are not learning about topics such as energy security from their parents. Instead, Blake and Tanya obtained their accurate knowledge from a book and school, respectively (section 6.17), whereas the other children seem to have arrived at their (often inaccurate) conclusion that electricity may run out by themselves, drawing on experiences such as power cuts (section 6.1.1), conversations with their families about earthquakes potentially affecting the electricity supply (mentioned by a few of the parents), and a general awareness of natural resource depletion (such as water).

6.1.5 Social Problems

Social problems were the least commonly discussed energy-related problem, and did not come up at all during the focus groups. Those participants who did talk about them mostly seem to be concerned about distribution issues and the difficulty of making power, as well as the importance of not taking it for granted. Alysa explained that electricity is "kind of a resource, because lots of people use it, and [...] it's power for most of our things that we have in everyone's house, and it could be used for other people's homes who actually need it". Similarly, Paula's father, whose family comes "from a developing country, where electricity is very scarce" tends to remind his daughter: "Look, there are a lot of people who are not having this [electricity]. You are fortunate enough to use this, and you should know how to make proper use of it", while Andy remarked on a documentary he had seen that "shows how tough it is to make energy just from pedalling, and [...] when it comes to save energy, power, we actually need to be a little bit thankful for it." The parents generally did not mention the same social issues as their children, and vice versa, implying that they are not normally a

topic of conversation between them. Nevertheless, knowing that many people do not have access to electricity may lead children to appreciate it more, and thus hopefully conserve it.

The only example of a parent and child discussing an energy-related social issue in depth was provided by Tabatha and her mother. When stopping at a hydro dam during a trip on the weekend, when they were supposed to take pictures for the interview, Tabatha "kept saying that it [the dam] takes a lot of space and takes away the view" (Tabatha). Subsequently, her mother "talked about the gorge and how it was filled up with water, and then how the blossom trees, how there used to be lots of orchards there and they disappeared, and a lot of people were upset [...]. She [Tabatha] wanted to know why that was so then, and so it's quite hard to try and explain how attitudes change". Tabatha also noticed that in the "old Smurf cartoons [...] they're building a dam", but that in the new "movie there was no dam [...], and she wanted to know why it was different and I say, 'Oh, it's probably because dams aren't PC [politically correct] anymore'." (Tabatha's mother). However, Tabatha understands that "if we didn't have it [hydro dams], you wouldn't have any television" (Tabatha). Although this is a unique example, it demonstrates that children are capable of discussing, and forming an opinion on, relatively complex issues surrounding the social acceptability of electricity production. Perhaps, if the parents or schools were to offer more opportunities for such conversations, it might help the children to evaluate for themselves the benefits and drawbacks of energy production, and the impact of their own electricity consumption.

6.1.6 Energy Efficient Technology

Although the children were not specifically asked to talk about energy efficient technology, there were plenty of opportunities for them to explain how their families save electricity. Despite this, only two of the children from the focus groups talked about their families having "LED lights – and they're automatic" (Simon) and insulation to "keep your house nice and cosy" (Eleni). Similarly, most of the interviewed children did not mention any energy efficient technologies, despite about a third of their parents specifically reporting to have, amongst others, insulation, double glazing, and energy saving light bulbs. Similar results were reported by Jentsch *et al.* (2011), who found that teenage girls in Germany did not identify using efficient technology (except for energy saving light bulbs) as a way to save energy, whereas adult women did.

All of the children who are aware of energy efficient technologies seem to have learnt about them from talking to their parents or other family members. However, such conversations do

not appear to be common. Grace and Tabatha were the only children who talked extensively about energy efficient technology, with both Grace and her father spending much of their interviews describing details of their solar passive house, ranging from mud bricks, efficient light bulbs, and a wetback system, to a convection microwave which does not "take too much electricity – not as much as the oven" (Grace). Tabatha brought pictures of energy star ratings and explained that "the most energy rating stars you have, the less money it's going to cost" – knowledge she obtained from "television and my granddad, [who] always talks about that he's got too many bills because of the energy rating on the washing machine". Interestingly, she also shared that "Granddad doesn't care about the money it's going to cost later on, he only wants to get things for a bargain, or something cheap. So he gets probably the lower stars, and then he wonders why it costs more later on". Tabatha thus both identified and challenged her grandfather's notion that efficient technology is too expensive, which represents a primary concern for about 15% of the New Zealand population (Thorsnes and Lawson, 2011). Notwithstanding their rarity, these examples demonstrate that children are capable of understanding and taking an interest in the concept of energy efficient appliances (DeWaters and Powers, 2011b).

6.1.7 Sources of Learning

As summarised by Miles, the children learn about electricity because they "kind of see signs out and about in the world", i.e. mostly in an informal manner (Eagles and Demare, 1999; Erdogan and Ok, 2011; Garabuau-Moussaoui *et al*., 2009; Ivy *et al*., 1998l Jentsch *et al*., 2011; Solomon, 1992; Toth *et al*., 2013). In doing so, the children are drawing on a variety of sources, including mostly their parents, but also school, trips, the news, TV shows, advertisements, books, magazines, and their extended family and friends (Fig. 6.2). For the purpose of this study, sources of learning refer to both actual sources of information, such as a TV advertisement or a book, and particular contexts creating a learning opportunity, such as a school exercise or a trip – which might, for example, require the children to read a book, or initiate a conversation with their parents. In such cases, the children's learning experience was coded based on all of the learning sources which combined to create it (e.g. trip and parents). In the vast majority of cases, the sources identified by the members of any given family agree, although the parents generally seem more perceptive (Fig. 6.2).

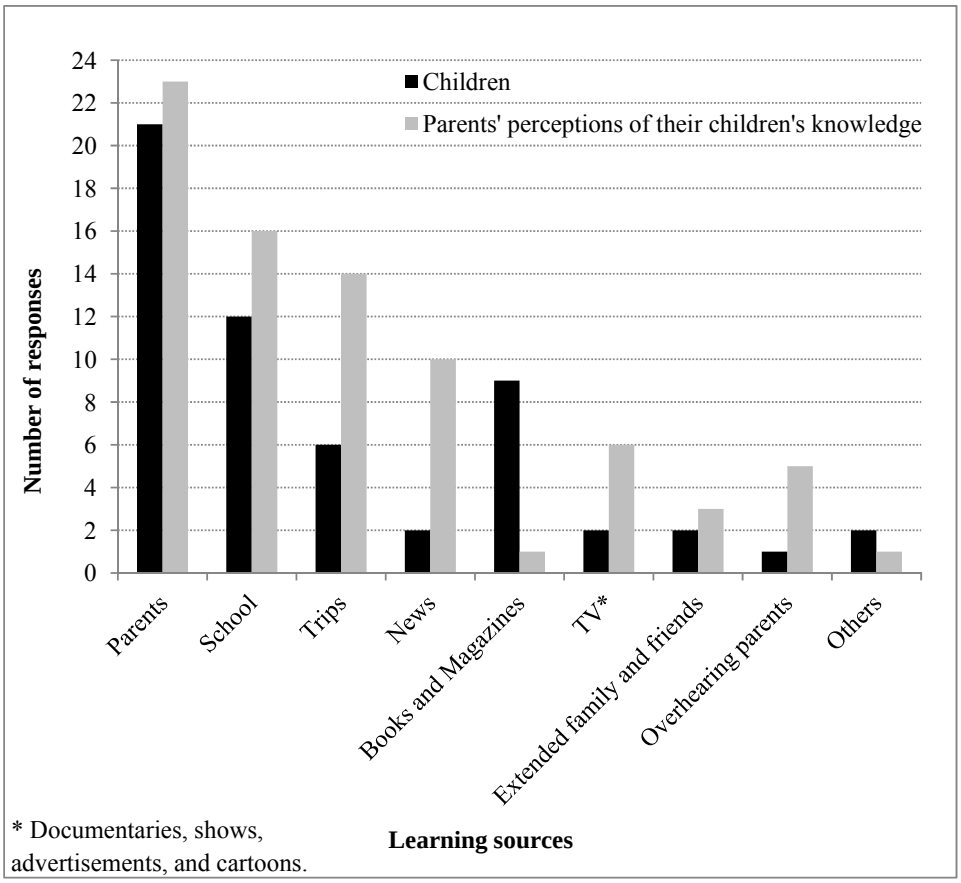

Figure 6.2 Sources drawn on by the children to learn about energy production and consumption, according to both their and their parents' interviews. Note that the participants frequently mentioned more than one source of learning.

Parents, friends, and extended family

Similar to the findings of Garabuau-Moussaoui *et al*. (2009), the children seem to derive most of their knowledge about energy production and consumption from their parents, who are also the main influence leading them to engage in electricity saving behaviours (chapter 5), and are the main driver behind their adoption of both environmental and economic rationales for saving power (sections 5.3.2 and 6.2). In addition, a few of the children are learning in the same manner from other people with whom they spend large amounts of time, namely, grandparents, aunts, and friends (e.g. Tabatha's quote, p. 162). The children often take an active role in learning from their parents through asking questions and initiating conversations: "I ask Mum heaps of questions, so I probably just put it all together" (Malcolm). At least one member of more than half of the families made reference to the child being curious or opinionated, and/or gave examples of specific questions related to electricity

production and consumption (e.g. the way specific appliances work). For instance, Mark's mother explained that her son wanted to know more about "the dam and the turbines at the bottom, and things like that [...] – how it got from the turbines to make electricity [...]. He's very inquisitive, asks lots of questions." In addition, some of the children asked the researcher questions after the interview, again showing curiosity and interest. This obvious motivation to learn about energy provides fertile ground for guided teaching.

Although some of the parents lack confidence in the ability of their offspring to fathom complex, energy-related issues (section 5.3.1), many of them are proud of their children taking the initiative in discussing such topics, and encourage them to do so. For instance, James' mother explained that her "kids are quite good communicators, and are quite openly asking questions about 'Why does that do that?' or, you know… and we tell them what we know", and Charlie's father pointed out that his son "is the one who usually generates the discussion, and all the kids do, and we just sit down and hear their [point of] view. And if they want any advice, we discuss it with them too – so kind of an open policy at home and, you know, we let them lead in as much as possible". He also said that he welcomes questions even when he does not know the answer: "We just talk about bits and pieces, and he [Charlie] asks how they work; and if I'm not quite sure, we look it up".

However, other parents are less eager to get involved in such discussions, as exemplified by Kelly's mother: "I think it's good that she [her daughter] doesn't ask me, because I'm not on to it. I left school way too early". Indeed, several of the participants gave precise examples about parents being unable to answer some of their children's questions. For instance, when Malcolm asked his mother "How do nuclear plants create radiation and not let it out?", his mother could only reply "Ask Dad". Interestingly, it is mostly the mother who seems unable to answer the child's questions, which likely reflects a common trend of women having less technical knowledge or interest in the topic (e.g. Barrow and Morrisey, 1989; Bodzin *et al*., 2013; Gambro and Switzky, 1999; Lay *et al*., 2013). Alex's mother specifically articulated this gender difference: "They [her sons] ask questions more when they are at the power station [...], and half the time I sort of fudge an answer, because I don't always necessary know myself [...]. Boys [...] think about different things, I think. They're a bit more practical, maybe." In cases like this, a good opportunity to use the children's interest and curiosity to create a learning experience may be lost, unless parents make a specific effort to research the topic with their children (like Charlie's father).

On the whole, despite the efforts some of them go to in trying to satisfy their children's curiosity, the parents seem to be hampered in their role as a primary learning source by their

distrust in their offspring's ability to understand complex concepts, as well as their own lack of knowledge or interest. This deficit is demonstrated by both the infrequent nature of family conversations on energy-related topics (section 5.3.1), and the fact that the children's knowledge is generally rather limited (section 6.1), despite their obvious interest. In the absence of guidance from the parents, whose influence otherwise dominates the processes leading to energy literacy and associated behaviours (chapter 5), and with little help provided by schools (see below: school), the children are left to rely on secondary learning sources, such as the media – often, however, with limited success (see below).

Overhearing conversations

In addition to direct explanations, several of the children seem to learn about the importance of saving power by overhearing their parents' conversations: "I think she's listened to mine and my partner's conversation about power" (Kelly's mother), or: "When we get a very expensive electricity bill, my husband and I will say, 'Oh my God, look at this', so she [her daughter] would hear us talking about how expensive it is" (Molly's mother). In at least two cases (Mike and Molly), overhearing conversations seems to be an effective source of learning even in the absence of specific explanations. Although his parents make no particular effort to teach Mike about saving electricity, he still cares about switching off appliances "so we can save electricity, and so Mum and Dad don't have to spend money from wasting electricity and the bills" – presumably because "he does listen, you know, he's got ears, so he listens to everything we [the parents] talk about" (Mike's mother). Similarly, Alice's father explained that his daughter's environmental awareness "comes from the family, [but] it comes from outside things too. For example […] our closest friends were climate scientists", and Alice used to overhear their conversations. Grace's father also acknowledged that his daughter "may overhear us talking to a friend or people who are visiting" about energy efficiency. Thus, some of the children seem to have adopted their parents' financial or environmental concerns simply because they form part of the household context, and sometimes even without the need for specific conversations on the topic.

Media: news, television, magazines, books, and internet

As in a variety of previous studies (Garabuau-Moussaoui *et al*., 2009; Halder *et al*., 2011; Solomon, 1992; Zografakis *et al*., 2008), the vast majority of the children are gaining

knowledge about energy from the media, either directly, or by initiating conversations with their parents based on what they have seen or heard. The parents mentioned the news, television shows, and advertisements as a learning source more often than their children, likely because of the latter's inability to relate the fragmented information they obtain from the media – e.g. about topics such as pollution or climate change – to electricity. Where this occurred, the learning source was nonetheless coded, because even such incomplete information may ultimately help the children to understand the environmental and social impacts of electricity consumption.

Many of the children seem to be learning by discussing television news with their parents, with oil spills and pollution from fossil fuels being common examples: "We [the family] watch the news every day [...]. We look at things like oil spills and things getting wasted in that way, like fuel. I think we've talked about issues like the oil will run out one day. We talked about how it's, you know, formed underground" (Alysa's mother). Besides the news, TV documentaries and, in one case, even cartoons (section 6.1.5) provide additional sources of information. For instance, Andy stated that he learnt about the environmental impact of fossil fuels, as well as the benefits of renewable sources, "mainly from documentaries", which is supported by his mother not being aware that Andy has this knowledge. In Amanda's case, watching a show together triggered a family conversation: "We saw a wind farm on the TV once, and we talked about that" (Amanda's mother).

About a third of the children are gaining information (especially about relevant technologies) from the "Energy Spot" advertisements, which promote energy efficiency (Energy Efficiency and Conservation Authority, 2012). Thus, in one of the focus groups, Miles imitated the main actor: "If you want to be warmer and you do not want to use your heater [...], you should do… blah, blah, blah", while in Charlie's family the adverts have been a conversation starter: "The stuff on TV is good, you know, those energy saving ads and all that […]. They [his children] ask, 'What type of insulation have we got?' […] and how double glazing works" (Charlie's father). However, the value of these advertisements as a source of information is not borne out by the small number of children who actually mentioned energy efficient technologies during their interviews, which suggests that they are mostly unable to make the connection between what they see on TV and their own energy consumption. These observations only partially coincide with those of previous studies, which variably either confirmed the role of energy efficiency advertisements as a learning source for children (Toth *et al.*, 2013), or concluded that the media, while important, do not typically provide practical knowledge on how to save energy (DeWaters and Powers, 2011a).

A couple of the children learn directly from reading the newspaper: "Sometimes it [the newspaper] says about wind farms closing down, and about wind farms opening up" (Molly). Some of the children also claim to have learnt about energy production from books and magazines, although, likely owing to the individual nature of reading, or the fact that some of the books were read at school, most of their parents are not aware of it. For instance, Alex explained that: "I've got a book at home that got all these things about electricity, and I just read that at night". Such reading is not always directed (either as part of a school assignment or out of personal interest), with several of the children instead reporting that they come across energy-related information randomly while browsing encyclopaedias, magazines, and even fiction books. Finally, members of two of the families made general reference to the children learning from doing research on the internet, and a single girl (Rachel) said that she reads the recommendations on the power bill ("others" in Fig. 6.2).

Overall, information provided by the media seems to be effective at stimulating family conversations about energy production and associated issues, and, in a few cases, is all that is available to the children. Nevertheless, despite the abundance and varied nature of media outlets, the overall level of knowledge of the children remains surprisingly low, and mostly excludes certain topics, such as social fairness, nuclear and geothermal power generation, energy efficient technology, and possible measures to save electricity beyond what they see at home. This knowledge deficit suggests that the importance of the media in increasing the children's knowledge, far from indicating a particular effectiveness in conveying information, may be little more than an artifact arising from the relative inaction of both the parents, and school: as the potentially most effective sources of learning drop out of the picture, other, less effective sources come to the fore – and perform according to their lower potential (Solomon, 1985).

International and domestic trips

Children's first-hand experience with energy production seems to be a valuable learning tool. Members of all of the families who have lived overseas, and many of the families who travel internationally, made reference to conversations about the contrasting approaches of different countries to energy consumption and production:

> We [the family] talked a lot about the differences, because we moved between how electricity is produced here in New Zealand versus how it is produced [overseas]. [Where we lived before], we could see from our home the coal burning power plant […].We've travelled around the South Pacific, and it's a lot more acute in these island communities talking about things [climate change and energy security], so she [his daughter] has *seen*, not a lot, but she's seen a little more first-hand, the places where people are dealing with these issues (Alice's father).

Previous research has shown that the level of children's energy literacy varies according to where they live (Barrow and Morrisey, 1989; Sudderth, 1984; Zyadin *et al*., 2012). Thus, giving the children the opportunity to observe how energy is produced and consumed within different geographical contexts may help to make the related issues more concrete, and easier for them to understand. At a more local scale, about half of the children have seen, and generally remember, some form of electricity generation, including hydro dams, wind farms and solar panels:

> We go to Queenstown, to Cromwell, and then in Clyde the Clyde Dam, and then I see it, and then I talk about it with my Mum and Dad, and they explain what it is […]. In Kingston, we go there for, like, a fair sort of thing, and then on the hills there were some wind turbines, and we went up to see them. They were massive, and then it said in a booklet about what they did (James).

This interest in local production facilities is not surprising, given their relevance to the children's own daily lives (Buway, 2007). In a few cases, the children managed to make sense of what they observed during a trip by themselves. For instance, Molly learned about solar generation because "when we [her family] go to Alexandra, […] there's one log house, and it's got heaps of big solar panels". Molly recognises that solar panels produce electricity despite never having talked about them with her parents, although her mother thinks that she might have overheard discussions about installing solar panels in their home. However, most of the time trips are more effective at starting family conversations, in which case the learning experience depends on how it is guided by the parents. The children often seem to associate their knowledge with a particular trip, and are generally interested and motivated to learn while they are at the production site:

> We went up to visit the wind farms on the open day [...]. There were lots and lots of questions there about, first of all, the actual 'How is it generating electricity?' [...] Last year we were on holiday in [Europe], and they had big paddocks of solar generation. So, again, that raises questions and discussion (Mark's mother).

However, such conversations are often superficial, focussing only on the energy source itself: "We've been round […] hydropower and things like that, too, and explained 'This is what makes electricity here', you know, and so she [her daughter] has a basic knowledge" (Amanda's mother). In many cases, it might be more productive to make use of the children's

increased attentiveness by guiding them to think about the topic more deeply – for instance, by making the connection with the children's own electricity use and the potential benefits of conserving power, or, as in the following example, in terms of associated problems: "So you get to the Clyde Dam, and we've stopped there […].We've talked about Cromwell being filled up with water, and then I think there's a woman making a documentary about that, so we've talked about that" (Mike's mother).

Conversations such as this are relatively rare, possibly because the children often visit production sites during family holidays, when there are other priorities and distractions. If schools provided similar opportunities (some do, see below), the learning experience could be more structured, and extended to children who do not tend to travel to such sites. This approach might be particularly effective, as many of the children in this study are already learning about energy sources from witnessing them (section 6.1.2). However, first-hand experiences are often limited to production sites that are close by, and therefore generally do not cover regionally undeveloped, yet nationally important production methods, such as geothermal and fossil fuel generation (section 6.1.2). This highlights the need for an integrated approach to teaching children about energy, based on several energy sources and types of information.

School

Although it is not the objective of this research to perform a pedagogical assessment of energy education in schools, the latter are nonetheless an important source of information. In terms of their importance as a source for learning about electricity production and consumption, schools come second only to parents, and were mentioned by about half of the participants (Figure 6.2) – although sometimes this assessment seems to be based more on the participants' expectations than the schools' actual contribution. Nevertheless, all of the teachers, and at least some of the other participants from each of the participating schools, gave examples on how the children learn at school (Table 6.1), and most of their answers complement each other, and, indeed, often coincide.

a) Parents' and children's expectations

Contrary to the parents' expectations, many of the schools actually do not teach energy-related topics. For instance, although Andy's mother thinks her son is learning about energy at "school", Andy made it clear that "not really at school, I haven't heard any […] of the

teachers saying about it or anything". Similarly, almost all of the parents from school D assumed that their children were discussing such matters at school, making reference to the enviroschool programme: "Oh they [her children] will have [studied it] with the enviro group" (Mike's mother) or "School obviously, I think […]. No, I think at school they are quite hot on, well, you know, certainly talking about it [energy consumption]" (Blake's mother). However, so far the environmental programme at that school has not included energy topics, as explained by the teacher: "It's talked about incidentally, but […] not as a planned teaching".

Many of the children also initially identified schools as a source for learning about energy, but often changed their mind after failing to think of specific examples:

> *Researcher*: Where do you learn all of these things? […]
> *Larry*: School.
> *Tom*: School, perfect […].
> *Larry*: Yeah, a lot of it, because that is where you learn a lot of stuff.
> *Researcher*: Do you talk about electricity in school, have you ever done that?
> *Larry*: Not really.
> *Tom*: It's different now [discussing electricity in the research focus group].
> *Eleni*: Yeah, but this isn't school work.

Similarly, after unsuccessfully searching for examples of energy topics discussed at school, the children sometimes resorted to talking about other things they had been taught:

> *Researcher:* And where do you learn all these things? […]
> *Miles*: School, actually school because…
> *Simon*: We've had other people come in and just tell us a bit about […] new stuff and how it works.
> *Miles*: Yeah we had that… and like last year we had this thing, like […] keep the tap off once you've finished [washing] your hand.
> [The rest of the conversation focused on conserving water.]

Examples such as these demonstrate the willingness and expectation of the children to learn about energy at school, as well as their parents' approval for them to do so, while at the same time highlighting a gap in the current curriculum of at least some of the schools. This reflects the results of previous studies, which found that teenagers expected energy education to be taught in school (DeWaters and Powers, 2008; Stubbs, 1985). However, it is important not to over-interpret the willingness of the children in this research, since none of them explicitly commented on wanting to learn more about energy from school (but see quote by teacher, school B, p. 173).

b) Teaching methods

The most common method employed by the teachers is to give them reminders about performing particular electricity saving behaviours, such as closing doors and switching off lights and other electronic equipment: "We learn [at school], like, if we're leaving the classroom for a while, we turn off the lights and we close all the doors […] to keep the heat in" (Mary). The reminders and instructions given by the teachers follow the same pattern as those provided by the parents (section 5.3), and are accompanied by superficial explanations such as: "Turn the lights off, save power, and shut the door. Keep the heat in, because, you know, there's resources going in and heating the school" (teacher, school B). At three of the schools, a particular child is in charge of checking that all of the lights and appliances have been switched off when the children leave the classroom: "We had the lights on in every sort of way. We had this every time, [but then decided] [...]: 'Right! We get someone […]'. They have the job of turning the light off" (Charlie). Sometimes (e.g. in school D), appointing a child to do the monitoring is preceded by a general discussion in class on the importance of saving electricity. Finally, some of the schools also use posters to remind the students to turn off lights. Interestingly, in school D, these posters specifically make reference to environmental guidelines; however, only two (out of six) of the children from this school have made the connection between electricity use and the environment, and only one of them stated that he had learned about it at school – with neither of them mentioning the posters all.

All of the schools regularly require the children to research a topic of their choosing, and to present their findings to the class (Table 6.1). Two of the children used this opportunity to talk about solar and hydro power, respectively, which was later remembered and, indeed, identified as a learning source by some of their interviewed classmates. For instance, Melanie "still remember[s] last year, and learning about… We have our own individual enquiries, and [a classmate] showed up, and he was talking about the Clyde Dam and that […] [it] makes energy". Along similar lines, Ron reported that he had learnt about hydropower by taking part in a reading group organised by his school: "We've got reading groups […]. In that journal book that we were reading, it said that it [electricity] comes from […] rivers, and then it goes into this big station, and then it goes into, like, the transformer, and then the meter box, and then, that's how it gets to our houses".

In giving reminders, requiring individual research, and encouraging the children to read, the schools are not directly teaching their pupils about energy, but are nonetheless providing a relevant context which facilitates their learning.

Table 6.1 Methods and material related to electricity production and consumption taught at each of the schools (based on information from focus groups and interviews with the teachers, parents and children)

	School				
	A	B	C	D	E
Reminders from teachers	✓	✓		✓	
Posters to turn off lights			✓	✓	
Reading groups		✓	✓		
Research projects and presentations		✓	✓		✓
Science module on electricity*		✓			
Extensive module on energy production and consumption*					✓

* Activities performed in the year before the interviews.

Research projects (i.e. self-directed learning) in particular seem effective in helping the children to obtain (and pass on) new information, but the general lack of guidance by the teacher in choosing a topic means that energy is rarely, if ever, picked up – likely because it is outside the children's immediate sphere of knowledge and interest: "Their little brains want to do Olympics, might do Egyptian, want to do dinosaurs, and I have a feeling energy […] doesn't rate highly" (teacher, school D). This issue could likely be addressed by the teachers highlighting relevant options and guiding the choice of project to a greater degree, especially since the children easily seem to develop an interest in electricity-related topics once they are encouraged to think about them (see quote by the teacher of school B below, as well as Buway, 2007; Halder *et al.*, 2011; Solomon, 1992; and The Centre for Human Rights and Citizenship Education, 2011).

In addition to providing more general learning opportunities, some schools teach specific modules focussing, or at least touching, upon energy-related topics. For instance, Jessica attended (and remembers) a unit on "minerals, and resources, and energy […]. She was probably only seven or eight at the time, so it was at a, you know, a fairly basic level, but so they would have homework related to that, and they had to do things like count how many things used electricity in the kitchen in their house" (Jessica's mother). However, most of the other children who have participated in such units do not remember their content: "I think at my old school we were learning about electricity […] for one term […]. I still don't know [the content], because that was a long… [time ago]" (James). Similarly, other children have studied wind turbines (previous school) and climate change (school D), or discussed Earth Hour at school (school D), but did not mention it in the interviews, indicating that these modules were either ineffective at teaching the children about energy production and consumption, or did not even include these topics in their learning objectives.

In addition to the units mentioned above, all of which had been taught two or more years before the beginning of this study, and hence were difficult to assess, two of the schools (B and D) had run specific energy-related modules in the year before the interviews took place. At school B, the children spent several weeks looking at:

> stored electricity, batteries and that type of thing. We've done some activities with wires, making little bulbs work and so on […]. You know, what is electricity, and what's going on with it? It seems a bit mysterious to many people […]. We did journal reading and things around that, which looked at sort of larger forms of electricity generation, you know, things where we couldn't visit it, but we might be able to read a bit about it […]. The experiments were in science, where we could do the hands-on stuff, and the reading we did just in our reading groups, so we're connecting our reading with our theme […]. So we're reading about hydroelectricity and how magnets and, you know, the copper wire and all the things go together, and how they get the electrons moving inside […]. There were a couple of little [online] sites that we went on to […] where you could do an interactive activity. We looked at […] a dynamo where you have the coil and you have the magnet spinning, and how the water comes down a hydroelectricity dam, and where you can turn movement into a different kind of energy, and I think some of them [the children] grasped that (teacher, school B).

Although the teacher is under the impression that the children "loved it" (teacher, school B), only three out of a total of 16 children from that school (Alex, Jessica, Molly) mentioned the electricity module. None of these children seem to know more about energy sources or the environmental impact of electricity production than their peers, and, in any case, for the most part do not trace back what knowledge they have to the school module. Furthermore, only three of the children from this school mentioned hydro power during their interviews, despite the fact that it seems to have come up relatively frequently during the unit.

This apparent lack of impact of the electricity module is surprising, and might be related to: (1) the children not being guided to make the connection between their daily lives and the relatively abstract scientific concepts and experiments the module was based on: "Some of them [the children] might have to meet that idea again before they can assimilate it, you know, into what they understand at the moment" (teacher, school B); (2) the focus of the module being on "wires, making little light bulbs work, and so on. Perhaps not so much in the broader sense, but more in that kind of project sense" (teacher, school B). This is a common pattern, characterising energy units at many schools across the world (DeWaters *et al.,* 2013; El-Salam *et al*., 2009; Gambro and Switzky, 1996; Newborough *et al*., 1991; Stubbs, 1985; Toth *et al*., 2013). Thus although the teacher "probably talked about things that use electricity in the home" (teacher, school B), saving power and learning about the impacts of energy

production were not major objectives. In addition, it is important to remember that the children were not asked about scientific information, which is also part of energy literacy, as part of this research. Thus, it is impossible to assess whether the children who participated in the electricity module know more about topics such as electrons, conductivity, static electricity, and units for measuring energy than might otherwise be expected.

The second energy module, taught for several weeks at school E (an enviroschool), was a comprehensive unit aimed at the broader implications of energy production and consumption. The children involved did research on different energy sources, "got out heaps of books all about it" (Tanya) from the library, designed brochures with their ideas on how to use energy more wisely (e.g. solar-powered buses), and identified technologies and behaviours contributing towards an energy efficient home. In many cases, these activities were accompanied by class discussions. In addition, the children attended a talk by an energy expert from their local community, and visited a wind turbine and a solar-powered home:

> They [the class] went up and visited somebody up the hill who has a wind turbine, and they run their house on wind power and sun power and everything like that […]. I think that was really good, because that was what made them think a lot about that, and, because it's people they [the children] know, it made it really concrete (Tanya's mother).

Unfortunately, school E is attended by very few students, only two of which agreed to participate in this research. Of these, only Tanya had been in the same school the previous year. Tanya clearly remembers the content of the energy module, and is the child with the most knowledge on energy production, reasons to reduce consumption, and energy saving behaviours. She knows that fossil fuels pollute and will run out, and that renewable sources, such as wind and solar power, are more sustainable (section 6.1.2, 6.13, 6.1.4). Tanya is also one of the few children who used vocabulary such as "energy efficient", "fossil fuel" and "environmentally friendly", and the only child able to provide a straightforward list on ways to save electricity – all of which she learned at school:

> I learnt to have quick showers […]. It was one of the things from school. We had a big poster which had an energy efficient house and a non-energy efficient house, and it was differences like leaving the oven on and turning it off, and having the lights on all the time and not having the lights on, and having the old heaters on and [yet to be] in T-shirts and shorts.

Although Tanya's family is part of a community with a strong concern for the environment (section 3.3.1), Tanya relates almost all of her knowledge directly to the school module (p. 153). This was confirmed by Tanya's mother, who explained that her daughter "definitely"

knows about issues related to energy use "because of it being an enviroschool, and it's part of the curriculum and the learning that they've got there".

There are two other children from families with a strong environmental orientation (Grace and Alice; p. 137), both of whom have a strong attitude towards saving electricity and more knowledge on particular energy-related topics than most of their peers, yet seem to lack the appreciation of the 'broader' picture shown by Tanya. For instance, Grace is not aware of any environmental problems related to energy production, whereas Alice, while knowing that using electricity causes pollution, seems unable to explain why, or mention other related problems. Unlike in the case of the more abstract module on electricity taught at school B, it therefore seems that a unit relating the broader context of energy production to the children's everyday lives (e.g. in the form of specific energy saving behaviours, or technologies they are able to observe in their surroundings) may be important in helping them to understand the wider implications of energy production and consumption. Although Tanya is a unique example, her case also indicates that a specific and comprehensive unit combining different practical activities and personal experiences may be a very effective way to increase children's knowledge, thus corroborating the results of several previous studies (e.g. Demeo *et al.,* 2013; Eidelman, 2010; Gifford and Sussman, 2012; Solomon, 1992; Zografakis *et al*., 2008).

c) Environmental programme

Interestingly, and in support of similar findings by Stubbs's (1985), the children attending enviroschools seem to know no more about electricity-related topics than those attending regular schools with no environmental programme. For instance, while the environmental impact of using electricity was recognised by Tanya, Alice, Mike, and Blake (all from enviroschools), as well as Andy, James, Tabatha and Jessica (all from regular schools), this insight is not shared by any of the children from school C (also an enviroschool). There are also no obvious patterns regarding the knowledge of the children attending a particular school, possibly because (1) the material taught at school often overlaps with what is learnt from other sources, such as parents and trips; (2) several of the schools are involved in similar activities; and (3) the schools, with one exception (school E) generally do not focus on the impacts of energy production and consumption.

Nonetheless, the enviroschools seem to be teaching a range of other environmental topics which sometimes can be related to energy production and consumption, although this link is not made explicit by the teacher or understood by the children:

> We don't have an energy study, but it would be incorporated or integrated into a unit that we're doing in terms of… if we're doing space, children might look at the solar energy there. If we're studying ancient civilisations at the moment, children are able to look at the sustainability of the society, or the way they were living. So there is an aspect of, like, we would call it environmental education through whichever inquiry unit we have (teacher, school D).

Similarly, the children from school D had a visitor talking to them about climate change, and some of them even attended a public lecture on the same topic hosted by the university. All of the enviroschools are also involved in activities such as growing vegetables, composting, and recycling, and usually have a team comprising a few children from each class which participates more intensely in environmental exercises, such as making signs reminding their classmates to turn off the lights, attending public talks, volunteering to do environmental work (e.g. reforestation), and suggesting environmental actions for the rest of the school. Additional research is needed to determine whether the environmental framework of these schools is affecting the children's general attitude, thus making them more prone to adopting an environmental rationale for conserving electricity once they understand the connection.

d) Extent of energy education

According to all of the teachers, as well as the national curriculum (Ministry of Education, 2007), the children normally do a science unit in their senior years (4–6, with the children being eight to eleven years old). In New Zealand, primary school teachers "have the freedom to choose the topics" (teacher, school A), with electricity appearing to be a popular option: "I enjoy teaching it. I think that the children are interested in learning, especially when you can put it into terms they understand, and I think it's good for them to understand the links between, you know, what we get from […] [the] environment, and how they use it" (teacher, school B). All of the teachers agree that it is important for children to learn about energy production and consumption at school, because "there's only so much [resources] to go around, and we need to be looking after them" (teacher, school C). Previous research also found that educators generally think that energy topics should be taught at school (Boylan, 2008; Buway, 2007; Morrisey and Barrow, 1984; The Centre for Human Rights and Citizenship Education, 2011).

While the initiative shown by the teachers in incorporating energy-related themes into their lessons is encouraging, the fact that such topics are not a required part of the curriculum makes the extent to which children are exposed to them at school somewhat random: "It definitely is important, and how bad is that that I don't do it!" (teacher, school D). Thus, even

children from the same classroom often described learning about electricity through different experiences, for instance in different classes, previous years, or other schools. As explained by the teacher from school D, only "that cohort of children [who participated in energy discussions] would have known why they were taking that action [switching lights and appliances off]", thus implying that all of the other cohorts would not have acquired that basic knowledge from school. Nevertheless, all of the teachers stated they have taught units related to electricity or energy consumption (schools B, D, and E; p. 173, 174 and 176; Table 6.1), or intend to do so in the future: "Next year we're doing a […] big science unit on electricity and that kind of thing […]" (teacher, school A). Similarly, the teacher from school C explained that the class would be "doing a science inquiry next term, which is going to be focussed on forces, and so there'll be electricity. [It] may be a topic that some classes may take up, like my class is doing magnets". Although it appears that energy conservation will not be covered by either of these modules, they nonetheless demonstrate the potential for it to be included as part of an ongoing programme.

e) Expanding education about energy production and consumption

All but one of the teachers provided several ideas on how the teaching of electricity consumption and production could be expanded. In particular, the teachers from schools B, and D have several years of experience working in enviroschools (the teacher from school B was previously employed in one), and seemed to have no trouble quickly outlining a hypothetical energy unit following the regular steps of a typical enviroschool project (Enviroschools, 2009) and the inquiry project based learning system (Thomas, 2000). Interestingly, the descriptions of a potential energy module by the teachers from schools B and D resemble the unit actually run at school E, which seems to have been effective and used a widely recommended approach (p. 174; e.g. Demeo *et al.,* 2013; DeWaters and Powers, 2011b; Hobson**,** 2003; Newborough *et al*., 1991; Nies and Witt, 1984; Solomon, 1992; Zografakis *et al*., 2008). Thus, the teacher from school D outlined a comprehensive plan for "ten weeks", including:

> A trip to somewhere like Orokonui Sanctuary[1] for them to be able to tell us about […] where they get their energy from, how they use it. There might even be families around here with solar on their houses who would be able to talk to us about it, and so we'd have a visit. We could probably… we'd invite experts in to come and talk to us, whether they worked at a hydro station or installing solar power […]. If the children are interested in other things […], they'd still be able to go off in other directions. And then, at the end, children would have some form of

[1]The Orokonui Ecosanctuary has a visitor information centre employing sustainable, alternative technologies to provide heating and lighting (Orokonui Ecosanctuary, 2010).

> presentation, whether it was a speech or a slideshow or making a model of it, and report back to the class […]. At the very end, […] our last eye is on the inquiry model […]: impact, now that you know this, what will you do?"

The same teacher also could see "the whole school joining us possibly for a shorter amount of time". Similarly, the teacher from school B envisaged:

> Home projects […]. You could make posters about energy savings, you could […] report writing or visual presentations about energy production, and how that connects to our houses […]. [Also], to have somebody come in as a specialist […], because children always pay attention to someone who's coming in and, you know, really knows the subject and they're from that field. Yeah, that would add an extra dimension to it.

She added that, in order for it to have an effect, the topic would have to reoccur at "different ages and stages". All of the current and former enviroschool teachers also think that the energy module they described is feasible, and "definitely" (teacher, school D) feel capable of running it themselves. The teacher from school A shares this opinion: "I don't think it [the energy module] is a one-off, and I think we can do it here", but did not elaborate as much on how to run it, except for having a guest speaker. By contrast, the teachers from the remaining two schools seemed to find it "a bit hard" (teacher, school C) to imagine an energy module on the spot[1], and explained that: "We [the teachers] can't know everything, you know what I mean, and we've got our core subjects we've got to teach" (teacher, school A).

Overall, it therefore appears that at least those teachers who have experience running comprehensive units related to the environment seem comfortable with running a similar one on electricity. Nevertheless, there are a variety of factors which seem to prevent any of them from doing so at the moment, including: (1) not feeling confident in their knowledge of the topic: "I'd have to do lots of learning myself" (teacher, school D); (2) having to give priority to other aspects of the curriculum (previous quote by teacher, school A); (3) children not mentioning electricity when given a say on what they wish to learn (see quote teacher, school D, p. 172); and (4) in one case, not considering saving electricity to be a key issue for the country: "We (New Zealanders) are not using as much electricity as we were […]. It's more efficient, and so we're sort of living within our means as far as electricity goes at the moment" (teacher, school C). Of these, the three first aspects have also been found to be major barriers to running energy consumption and production units at other schools across the globe (Eidelman, 2010; Lawrenz, 1983; Morrisey and Barrow, 1984; Newborough *et al.,* 1991; Solopova, 2008; Stubbs, 1985). Further research is needed to determine how these problems might be overcome, e.g. by offering training for teachers, having the energy module

[1] Although school C is an enviroschool, the interviewed teacher is not involved in the environmental activities.

taught by an external facilitator, creating a specific teaching manual[1], and finding ways to raise the children's curiosity on energy topics.

Overall, the children know very little about electricity production and consumption, except for its financial cost. Some are aware of the main regional power sources, or think that energy might run out, but rather few of them relate electricity production to any environmental issues. The main barrier to children acquiring a broader understanding of electricity seems to be the lack of guidance on the part of both the parents and schools in structuring their knowledge on the topic. Instead, the children are acquiring information from a variety of informal sources, often in an opportunistic fashion and depending on the context. The potential of schools to help structure the children's knowledge is emphasised by their status as the second most important source of learning for the children, the existence of specific modules focussing on electricity (albeit usually not on production and consumption), and the general expectation that such topics ought to be taught at school.

6.2 Attitudes

Almost all of the children have a positive attitude towards saving power (strong in about one third, weak in about half of them), with the remainder not showing any signs of having an attitude whatsoever. These observations broadly corroborate the generally positive attitude towards energy conservation found in previous research (e.g. Chen, 2011; DeWaters and Powers, 2008, 2011b; Kasapoğlu and Turan, 2008; Lay *et al*., 2013; Solopova, 2008; Zydain *et al*., 2012), although the latter did not find attitudes to be weak or completely absent. This is likely a result of the questionnaire-based, quantitative methodology employed by most of these studies, which may have overestimated attitudes by asking participants to choose an answer even if they had never thought about a particular topic before (Krech and Crutchfield, 1948). For the purpose of this research, an attitude is considered to be strong when it is explicitly associated with some level of personal concern: "I realised it was actually really important [to save electricity]" (Grace). By contrast, an attitude is considered to be weak if the children (1) expresses an attitude, but show little or no personal interest: "It would be nice to [save power], but I never think about it" (Malcolm); or (2) claim to make an effort to save electricity, and are able to provide at least one example of how they are trying to do so (Table 4.3, Appendix 1). For example, Karla explained that she switches off lights because otherwise

[1] The enviroschools manual has a section suggesting activities for teaching energy consumption and production to primary school children, but the interviewed teachers were not using it.

the family "will waste the power and we [her family] will have to pay for everything". While the effort itself implies a positive attitude towards saving electricity, it is not obvious in this case whether Karla herself thinks that doing so is important, or simply complies with her parents' instructions.

The attitudes of the majority of the children are derived from those of their parents, but much less clearly developed – even though both of them were asked similar questions, and despite there being several opportunities for the participants to express a strong attitude during the interviews. In general, the children's attitudes are guided by environmental and economic rationales, as well as a desire to help their families (section 5.3.2). Figure 6.3 presents summary of the different (albeit not mutually exclusive) pathways through which parents seem to pass on a positive attitude towards saving electricity to their children. Note that this figure only applies to those families (14 out of a total of 26) in which the children's attitudes towards saving electricity were in some way influenced by their parents.

Whereas attitudes arising out of an environmental rationale or a desire to help the family (see also Garabuau-Moussaoui *et al*., 2009) tend to be strong, the opposite is true for attitudes motivated mainly by financial concerns (Fig. 6.3) This is consistent with the idea that altruistic and internal beliefs create more stable attitudes than those guided by external stimuli (Fishbein and Ajzen, 1975; Pelletier *et al*., 2011). For example, Mike's strong, positive attitude towards saving electricity arises from his wish to help his parents, and avoid wasting money: "I do [care], so we can save electricity, and so Mum and Dad don't have to spend money from wasting electricity". A similar rationale seems to have been adopted by several of the children, and is evident in a significant relationship between the presence of a strong attitude towards saving electricity and the number of children who talked about helping their families in any way (Exact Chi-square, $p = 0.005$, Appendix 3).

In at least four cases (Alice, James, Mike, Tanya), strong environmental values held by the parents seem to have translated directly into an environmental identity in their children, and, consequently, a strong positive attitude towards saving electricity (Fig. 6.3): "She is very much the family environmentalist" (Alice's father); and: "Both [siblings] think of themselves as being quite green […], so we [the parents] can remind them of that [if they waste electricity] (Tanya's mother).

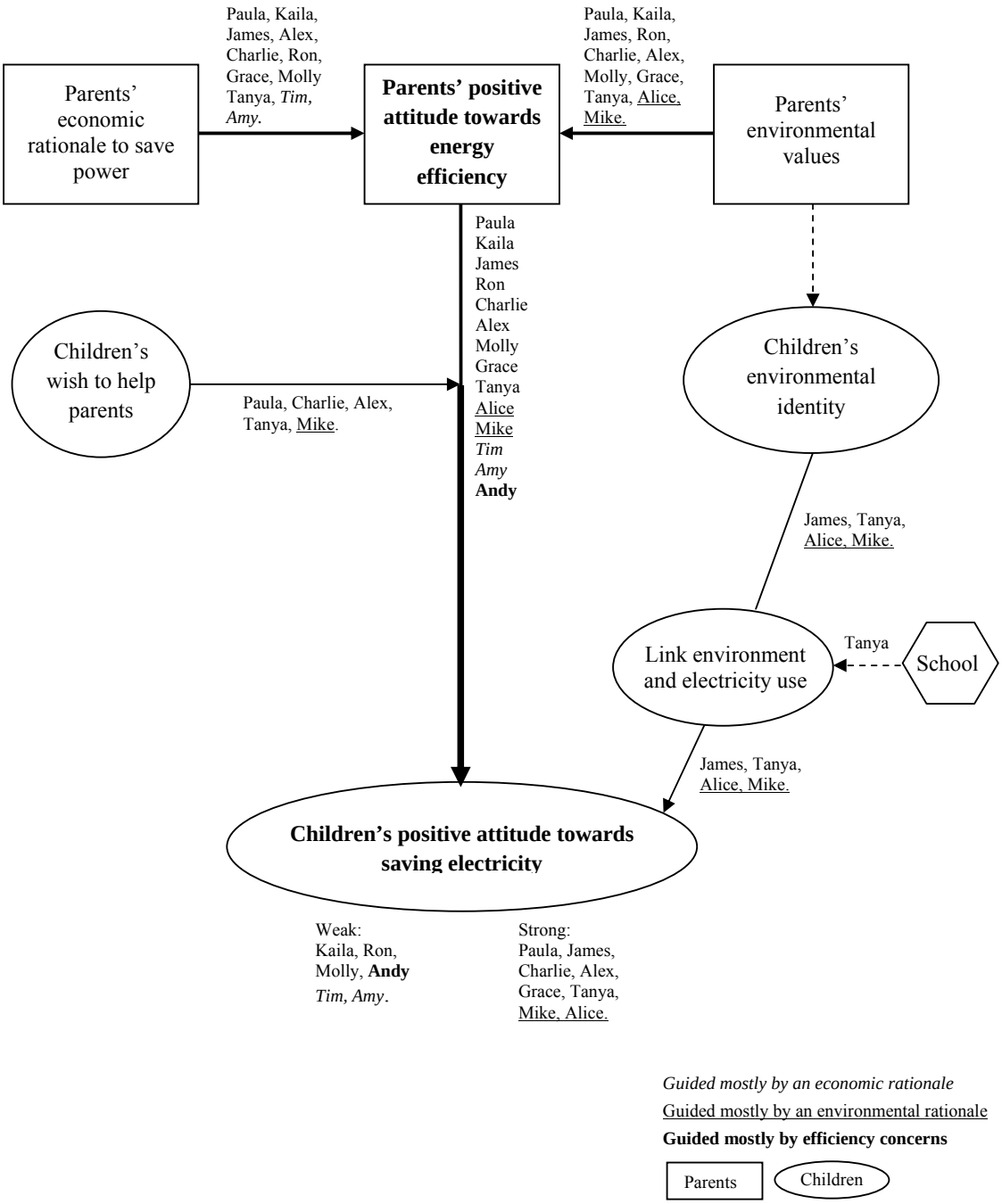

Figure 6.3 Main pathways involved in the children's acquisition of a positive attitude towards saving electricity, based on the parent's surveys on attitudes towards energy efficiency and environmental values (high and medium scores), as well as the children's attitudes (weak or strong) towards saving electricity. All of the variables, except for the survey data mentioned above, are derived from the qualitative analysis (Appendix 2). The categories and processes are not mutually exclusive. Note the absence of feedback loops or agency, discussed further in chapter 7.

This observation is supported by a significant relationship between the children's attitudes and how often their parents talked about the environment during their interviews (Exact Chi-square, p = 0.019, Appendix 3), as well as a correspondence analysis of the same data clustering children with a strong attitude with parents who frequently mentioned the environment, and vice versa (Fig. 6.4). Surprisingly, however, this relationship did not turn out to be significant when the parents' environmental values (as derived from the surveys) were used instead of the frequency with which they referred to the environment. Possibly, the parents' values are formulated in a way that is too broad to capture the differences between, for example, people with a strong environmental lifestyle, and their concerned, but more moderate peers.

Unfortunately, the degree to which environmental values shape the children's attitudes is difficult to assess directly in the context of this study, as collecting data on the children's values was not one of the original objectives. However, in order for strong environmental values to be rationally translated into a positive attitude towards saving electricity, the children first need to understand that electricity consumption is linked to environmental impacts (Fig. 6.3). As previously explained, this realisation is rather uncommon (section 6.1), thus discounting the adoption of an environmental identity as a pathway to saving electricity for most of the children. However, it is likely that they might still be able to copy their parents' attitudes (which are significantly correlated with their environmental values; Kruskal Wallis, p = 0.013, Appendix 3) directly, even if they do not understand that using power has an environmental impact (Fig. 6.3).

Like rationales (section 5.3.2), attitudes seem to be passed from the parents to their children through frequent or in-depth conversations and explanations about saving electricity, as was also found by previous studies (DeWaters and Powers, 2011a; Eagles and Demare, 1999; Larson *et al.,* 2011). Thus even parents scoring only medium on the survey on energy efficiency are able to inspire a strong attitude in their children, as long as they maintain a high level of communication (e.g. James, Appendix 2), whereas parents with a strong attitude but little communication may fail to pass on their ideas (e.g. Lisa, Appendix 2). This observation is supported by a significant relationship between the children's attitudes and the level of conversation with their parents (Exact Chi-square, p = 0.022, Appendix 3), and specifically the association of strong attitudes with a high level of communication (Fig. 6.5). The lack of such conversations in most of the families may explain why so many of the children have not developed a clear attitude towards saving power.

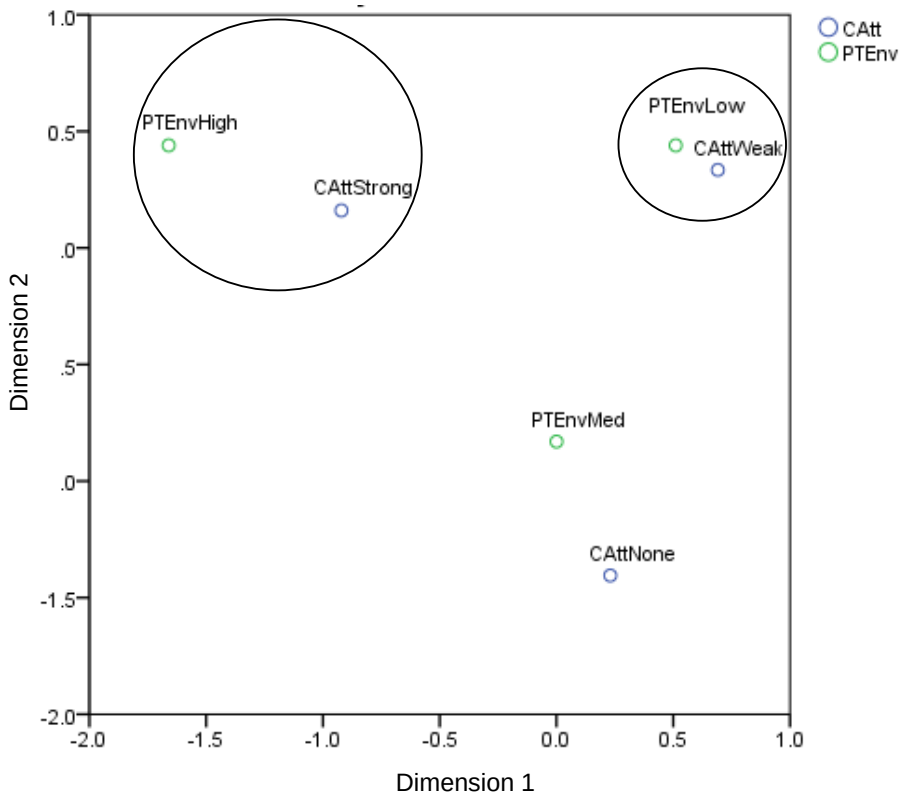

Figure 6.4 Correspondence analysis of the children's attitudes (CAtt) towards saving electricity and the number of times their parents talked about the environment during the interview (PTEnv) (Med = Medium; Appendix 6)

There is no obvious relationship between the children's attitude towards saving electricity, and their actual knowledge about the topic (see also Stubbs, 1985). For example, Grace, who displays the strongest attitude towards saving power, knows very little about energy production and consumption. By contrast, Blake has more knowledge than the rest of the children (section 6.1.2), but does not seem to think that saving electricity is important (section 5.3.1). These observations are not surprising, given the discrepancy between the important role of parents in passing on attitudes, and their comparatively low level of effectiveness in conveying knowledge about electricity production and consumption, and imply that the transfer of a positive attitude towards electricity saving may be more related to talking about the subject in general (whether at home or at school), than the specific content of the conversation. Other possible reasons for the absence of a relationship between the children's attitudes and their knowledge include (1) the limited extent of their knowledge, which is based mostly on the financial cost of power; and (2) the strong effect of the parent's attitudes obscuring any impact their knowledge might have. In order to explore these issues, it would be necessary to analyse examples of children who both know about the environmental and

social impacts of electricity use, and harbour a strong attitude towards saving power, despite the fact that their parents do not. There are no such examples in this study, perhaps because (with one exception) the children have not learnt about energy production outside of the home context.

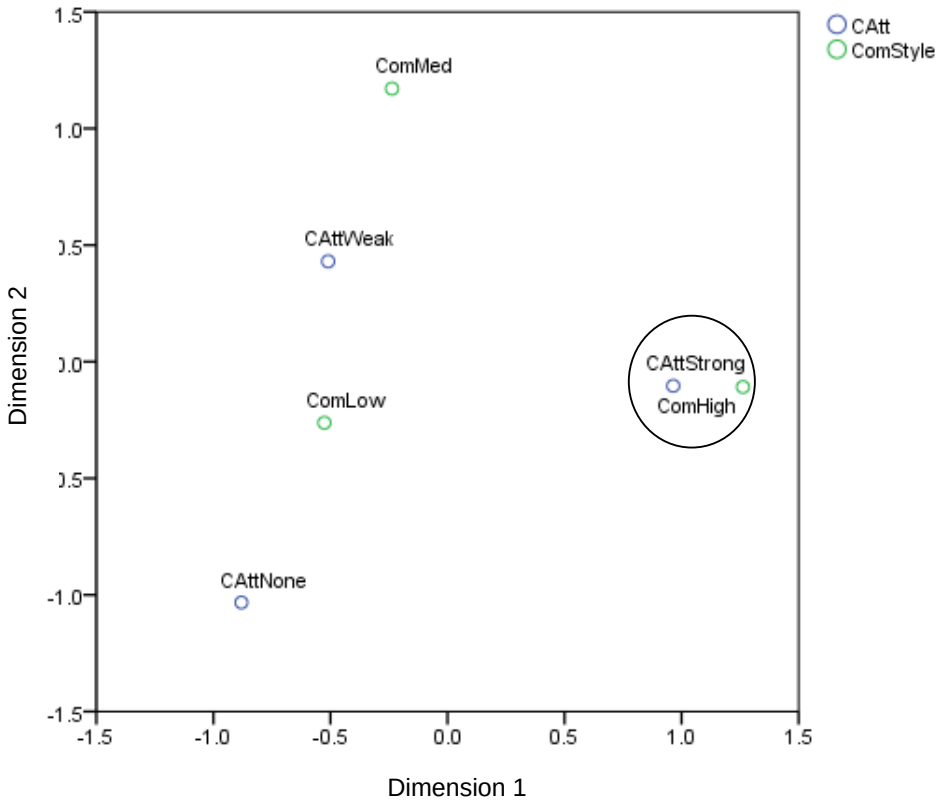

Figure 6.5 Correspondence analysis of the children's attitudes towards saving electricity (CAtt) and the depth and frequency of conversations about energy between the parents and their children (Com) (Med = Medium; Appendix 7)

In line with previous studies (Chen, 2011; Grønhøj and Thøgersen, 2012; Kuhn, 1979), there is a significant relationship between the children's attitudes and their engagement in electricity saving behaviours (Exact Chi-square, p = 0.036, Appendix 3). According to a correspondence analysis of the same data (Fig. 6.6), stronger attitudes seem to be associated with a greater number of behaviours. This pattern may be caused by two independent processes: (1) parents with a strong, positive attitudes towards energy efficiency also engage in more electricity saving behaviours (Kruskal Wallis, p = 0.006, Appendix 3), thus setting an example for their children to follow (see section 5.2); and (2) by engaging in frequent and/or in-depth conversations about saving electricity, the same parents also tend to create stronger attitudes in their children (section 5.3.1).

The qualitative data contain evidence for both of these processes, which often seem to occur simultaneously (e.g. Charlie in section 5.2 and 5.3.1). Alternatively, or in addition, the children might also adopt a positive attitude in order to rationalise being compelled to save energy by their environmentally or economically concerned parents (not engaging voluntarily, Table 4.3). This process has been identified in other studies, where a change of attitude occurred in response to a behaviour driven by external conditions, thereby reducing cognitive dissonance (Wilson and Dowlatabadi, 2007). Conversely, children with little control over electrical appliances engage in very few electricity saving behaviours (section 4.4) and/or might lack the appropriate context to discuss energy-related topics with their parents, thus making them less likely to develop a positive attitude towards saving power than the rest of the children (Exact Chi-square, p = 0.007, Appendix 3, and distribution of the cross tabulation (Table 9.3) in Appendix 9).

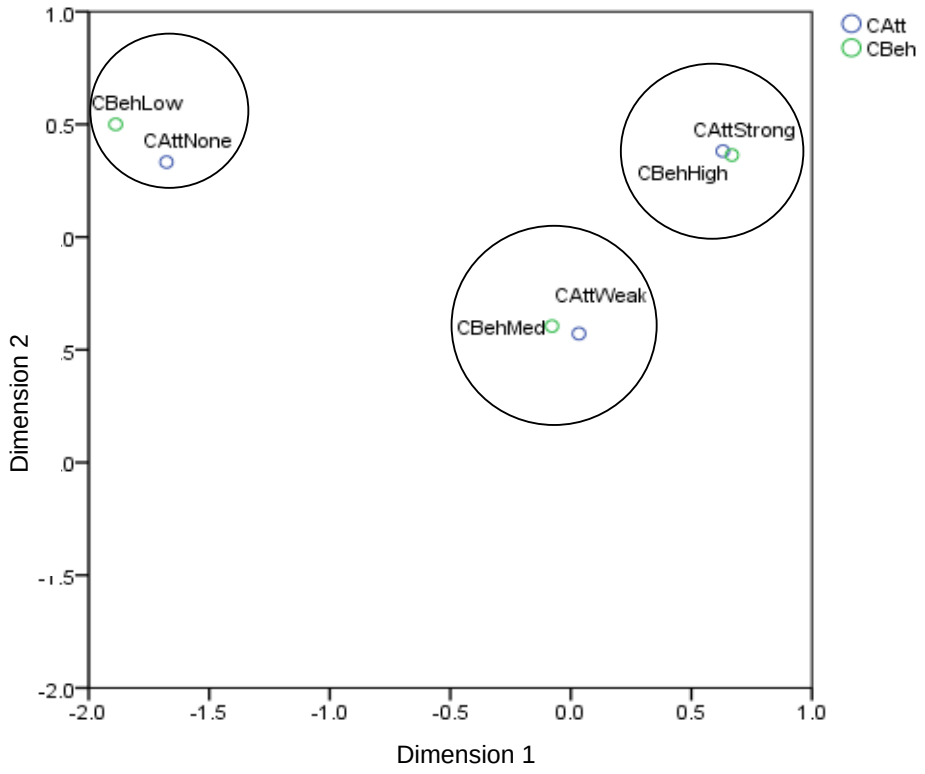

Figure 6.6 Correspondence analysis of the children's attitudes (CAtt) towards saving electricity and the number electricity saving behaviours they engage in (Med = Medium; Appendix 8)

Although this research shows the parents to be by far the most important factor influencing their children's behaviours (chapter 5) and attitudes, there are other forces which could lead a child to develop new ideas even in the absence of parental guidance. Thus, some of the

children might be acquiring a positive attitude towards saving electricity by adhering to a broader social norm, with the idea that conserving power is good being repeated and mutually reinforced by a variety of sources. As explained by Amanda's mother:

> It's becoming a social responsibility, and it's more apparent on the television, and you're hearing it on the news and things like that, and we [the family] watch Close Up, or we watch the other short management... [Energy Spot advertisement] […]. So it's all very much there […], it's getting into somebody's subconscious.

Along similar lines, Jessica reported that she changed her attitude after being told that saving electricity is an important issue by two different teachers, as well as her father:

> It was in this school […] – I think it was Year 3 […] – and I just learned about it [saving power], and then I started using a lot less electricity. Like, sometimes I accidently left the light on in my room […], and my Dad gets mad […]. Then, […] we did that electricity unit [in year 4]. I started to learn a bit, like: 'Oh, it really is important!'. I'm like: 'Who cares? It's just electricity' at the start. I was being a bit stupid, but […] it does actually matter, because we're using lots of the energy and stuff.

Both Amanda and Jessica have a positive attitude towards saving electricity, despite their parents scoring low on the survey on attitudes towards energy efficiency. These results highlight the importance of offering the children diverse sources for learning about the importance of energy conservation (e.g. talks by experts in schools, discussions with teachers, documentaries, or books), either to reinforce, or to complement, the guidance provided by their parents.

Overall, it is encouraging that most of the children have a positive (albeit often weak) attitude towards saving electricity. As shown by that third of the children that harbours a strong attitude, the predominance of a weak or, in several cases, absent attitude is not a matter of the children's lack of care about electricity conservation at this age, but instead depends on their parents' convictions. Children mostly seem to be acquiring a positive attitude towards conserving energy through conversations with their parents, or out of a strong sense of cooperation with their families. However, sometimes they also develop an environmental identity in their own right, made possible by their knowledge of the relationship between electricity consumption and environmental issues.

6.3 Efforts to Save Electricity and Intended Behaviour

6.3.1 Conscious Efforts to Save Electricity

Most of the children seem to make a conscious effort to save electricity (e.g. by switching off lights and appliances), either voluntarily or by following their parents' instructions (section 4.2). In general, the efforts and actual behaviours reported by the children are consistent, as shown by a significant relationship between the children who said they are trying to save power and the number of electricity saving behaviours they perform (Mann-Whitney U exact test, $p = 0.026$; Appendix 3). However, the parents frequently have a different perception of the children's efforts to save power, with over a third of the families providing conflicting answers[1]. In all of these cases, the parents deny any conscious action on the part of their children, even though all of the latter (except one) reported that they engage in a medium or high number of electricity saving behaviours. For example, although Tim claims that he switches off the lights "so it can save electricity for the power bill", his mother thinks that he is "not really, not consciously" trying to save power. The members of most of these families rarely communicate about electricity consumption (Appendix 2), which might explain why the children's consciousness about saving electricity often goes unnoticed. In these, and indeed *all*[2], cases, the parents might be able to increase their children's level of engagement by acknowledging (and thus positively reinforcing) their children's efforts.

Alternatively, the parents might suspect their children of redefining some of their daily behaviours as 'efforts to safe energy' *a posteriori*, without actually being conscious of them on a daily basis: "I don't think he [her son] has consciously thought about turning things off to save electricity. No, I don't think so. He probably said yes [in the interview], but I don't think so" (Andy's mother). In line with this interpretation, previous research found that teenagers do not tend to think about their energy consumption when making daily decisions (DeWaters and Powers 2008, 2011a; Toth *et al*., 2013). Conserving power is not a pressing issue for the children; thus, unless their attention is specifically drawn to the topic (e.g. through communicating about it with their parents), they tend not to think about it, and therefore cannot develop a conscious approach or a particular attitude (section 2.3.3). Exposing the children to the topic, even in the form of a relatively brief, one-off event such as the interview, might therefore be a helpful first step: "I think especially since he [her son] did this [interview and pictures] with you [the researcher], I think he is a little bit more conscious of

[1] The children in this group are: Alysa, Tim, Jessica, Andy, Tanya, Ron, Mike, Amy, and Karla.
[2] There were no examples during the interviews and focus groups of parents telling their children that they notice and appreciate their conscious efforts to save power.

[…] [the] energy we [the family] are using and the power […] he uses and things like that. I think he is becoming more aware of it" (Ron's mother).

Most of the children who agree with their parents on the conscious nature of their energy saving behaviours[1] also frequently talk to them about electricity-related topics, and engage in a high number of electricity saving practices, both of which may combine to make their efforts more noticeable: "They [her daughters] are pretty good when it comes to, you know, saving power […]. They understand things like that" (Kaila's mother); or: "Our children are quite conscious about saving [power], for both the environment and money" (James' mother). Similarly, those children who agree with their parents on not making a conscious effort to save power[2] only engage in a low or medium number of electricity saving behaviours, and all (but one) have little control over appliances, do not show any attitude towards saving power, and rarely communicate with their parents about the topic. These observations are also reflected in a significant relationship between the number of children who stated that they are not trying to save electricity and those who have almost no control over electrical appliances (Exact Chi-square, $p = 0.034$, Appendix 3).

6.3.2 Intended Behaviour

When asked about ideas on how they could help to save more power, most of the children only suggested that they might perform behaviours they are already engaged in more consistently, or to restrict common activities requiring the use of electricity: "Well, I still use the TV quite a lot, when I could be reading a book or something that doesn't actually use power" (Alysa). However, some of the children also have more original ideas, which generally require action by other people, rather than themselves. For example, Amanda suggested that her mother could wash their blankets by hand, Tabatha would like for her mother to tend the fire more carefully (so as to reduce the need for electric heaters), Alice said her family could "unplug things that we are not using [...], instead of just turning them off", and Malcolm thinks that his "Dad could go on his phone and computer less". However, none of these children have actually made an effort to change the behaviour of the other members of their family (section 7.1). Finally, Malcolm contended that the most effective option might be to "make electricity a higher price, because with us [his family], when fuel got up to really expensive, we tried to limit down the fuel." These observations reveal a tendency for the children to delegate the responsibility of saving power, but also hint at an understanding that

[1] The children in this group are: Paula, Grace, Alice, Kaila, Kelly, Amanda, James, Charlie, and Alex.
[2] The children in this group are: Malcolm, Lisa, Mark, and Marion.

their own efforts are not enough: "it's good [to save electricity] if lots of other people do it" (Amy).

Several of the children "have no idea" (Melanie) what else they could do to save electricity, or found the question to be "a hard one" (Charlie). Grace in particular made clear that she does not "really have a chance" to come up with new ideas, because her parents "have thought of all of them". Interestingly, this lack of ideas afflicts both the children who already engage in several electricity saving behaviours, and those who do not, and may reflect earlier findings of teenagers being unable to save energy to a further extent owing to a lack of practical knowledge (DeWaters and Powers, 2008, 2011a; DeWaters *et al*., 2013; Kasapoğlu and Turan, 2008; Zyadin *et al*., 2012). Finally, some of the children also feel that their present efforts are enough: "I reckon I'm doing quite a bit already" (Mark), even if they are not engaging in many behaviours and admit that: "sometimes [I try to save power], but I forget occasionally" (Mark).

Most of the children did not seem to have considered other ways in which they could save electricity before the interview, and did not express any intention to follow up their ideas. This is somewhat surprising, since a majority of them think that their efforts have a positive impact, or "make a big difference" (Amanda), both of which are signs of self-efficacy (see also DeWaters and Powers, 2008, 2011a). This was also expressed in one of the focus groups:

> *Researcher:* Do you think that doing those things [previously discussed electricity saving behaviours] will make a difference?
> *Simon*: Probably, well mine [the family members] will be able to go overseas a lot more.
> *Miles*: [...] Apparently, […] it costs 1.5% a year if you kept it [the lights] on for the whole year!

However, as previously found by Stubbs (1985), some of the children are "not sure" (Paula) whether their behaviours have a positive impact, or think that they only make "a tiny […] speck" (James) or "a teeny bit of difference of about one out of a million, out of a million people more" (Blake). Although it is understandable that individual efforts to save power are perceived to be of little consequence, the children might benefit from realising that their actions form part of a collective effort, and thus have the potential to affect other people's behaviours. Only two of the children seem to be aware of this: "Every little bit counts […]. So if me and my family are all parts, then it will stop pollution, and maybe convince other people to do it, who could do the same" (Alice). Knowledge on how to save power to a further extent, combined with a stronger positive attitude and their (generally) already existing belief

that their efforts have a positive impact might increase their intention to perform more (or more consistent) electricity saving behaviours.

In summary, according to the definition of energy literacy (section 2.2.1), none of the children in this study are literate with regards to electricity, because none of them show an intention to engage in further electricity saving behaviours. To allow for some flexibility, those electricity saving behaviours that children already perform autonomously, consistently, and voluntarily to save power could be considered part of their energy literacy (instead of intended behaviour). Although some of the children who engage in such behaviours might have started to do so unconsciously (e.g. by following an example), or because of being compelled by their parents (e.g. rules and reminders; sections 5.4 and 5.5), by the time of the interview up to six behaviours, and two or more behaviours for about half of the children, had become voluntary and associated with the explicit aim of saving electricity (Table 4.3, Appendix 1).

Accepting (1) the children's efforts to save power as part of their energy literacy, one could regard those children who (2) consider conserving electricity as important (denoting a clear, positive attitude towards it; section 6.2), and who (3) show at least some basic knowledge (section 6.1) by being able to mention at least one energy source and correctly explain at least one problem related to electricity production and consumption (apart from its financial cost), as being energy literate. Only the four children who have developed an environmental identity (James, Mike, Alice, and Tanya; Fig. 6.3) conform to this already lenient definition, indicating that the level of energy literacy is extremely low among the participants of this study. Furthermore, as a group, the "literate" children do not engage in any more electricity saving behaviours than their peers (Appendix 2), indicating that their literacy is not affecting their behaviours.

Chapter 7

Children's Agency

The central goal of energy literacy is to turn people into responsible citizens in regard to their energy consumption (DeWaters *et al*., 2013). In theory, in order for energy literacy to result in action, children need to become agents, and therefore able to decide and act independently to save electricity. To achieve this, they not only need to work on their own efforts to save energy, but convince others to follow suit, thus creating a cycle of continuous and widespread improvement. Following the structure of Figure 1.1, chapters 4 and 5 analysed the actual electricity saving behaviours performed by the children, regardless of their intention to save power, while Chapter 6 presented an overview of their energy literacy. This chapter describes the children's agency in terms of them (1) trying to save power beyond what is required of them by their parents or teachers; (2) attempting to affect the behaviour or attitudes of other people; and (3) bringing home new ideas – for instance, from school. In particular, this chapter emphasises the potential transfer of energy efficient behaviours and attitudes from the school to the home context, owing to the former's status as the children's most important source of information about energy, after their parents (Fig. 6.2). In addition, the structured information provided by school has the most potential to increase the children's energy literacy, and therefore agency, and offers them their best chance to have an effect on the family and, ultimately society as a whole.

7.1 Evidence of Children's Agency

In general, the transcripts reveal few examples of the children's agency as regards saving electricity. Most of the children give reminders to their siblings and parents (section 5.4.2), as was also found by Garabuau-Moussaoui *et al*. (2009), thus demonstrating that they are capable of advocating a particular action. However, these reminders always repeat earlier parental instructions (section 5.4.2), and hence do not necessarily reflect an independent decision to help the family lower its electricity consumption. Nevertheless, a few of the children did indicate that they were devising their own energy saving strategies. For instance, Mary explained: "[I checked that] curtains were closed, and, [if] the heat was getting out and the door was open, I would close it" (Mary). She started doing so after learning about these strategies at school. Likewise, Paula and Kaila decided to time their showers, even though they are not required to do so by their parents: "I just set the time for […] 15min or earlier,

and when the time goes off I have to get out […]. It was my idea" (Kaila). However, the interviews make it clear that both girls are more concerned about ensuring that there is enough hot water for everyone to have a shower, than they are about saving energy.

A few of the children feel a responsibility to serve as role models for their siblings, and acknowledge that, by doing so, they are affecting their sibling's behaviours: "When I do it [save electricity], sometimes my little brother likes to try and help" (Mary), or "he [the older brother] would always turn on the lights in his room. Instead, I open my curtains every morning, so he started doing that […]. Well, like just a wee bit of encouraging him" (Tanya). Similarly, Alice thinks that her own behaviour serves as an example and encouragement to others outside of her family (p. 189).

Finally, only two of the children (James and Amanda) indicated that they tried to influence their parents with new ideas which they had acquired from school (section 7.3), but unfortunately failed to make a lasting impression: "At my old school we were learning about electricity" (James), so James told his parents about "standby [...]. When you've turned the TV off, and the red light is on, you're still consuming power" (James mother), and thus "we [the family] should turn the TVs and the computer switched off [at the wall], so we save more electricity [...]. They [the parents] did it sometimes, [...] [but] yeah, it didn't really [stick]" (James). By contrast, Amanda tried to advocate an environmental rationale, rather than a particular behaviour: "They [her children] actually tell me [about reasons for saving electricity] [...]. They've been doing a couple of things at school. Amanda has, and she goes, 'It will also help save the planet.' Well, if it helps save the planet, that's great – but it also reduces my electricity bill!" (Amanda's mother). Previous research also found reverse socialisation processes in regard to energy conservation to be relatively uncommon (Grønhøj, 2007; Schlossberg, 1992)

Overall, it is hardly surprising that the children in this study are not generally acting as agents of change in regard to saving electricity, given their limited knowledge on the topic (section 6.1), general lack of ideas on how to save power to a greater extent, absence of a clear intention of doing so (section 6.3.2), and, often, lack of a strong, positive attitude (section 6.2). Nevertheless, the examples above, although rare, still demonstrate the children's capacity to take an active interest in saving electricity, and to affect the behaviour and attitudes of others. There are two main factors underlying much of the children's potential to act as agents for change within their respective families: (1) their general ability to convince their parents, which also depends on communication style of the family; and (2) the children's access to new concepts and ideas (for instance through school) that could potentially be

incorporated into the daily lives of the people they interact with. Most of the participants made comments bearing directly on both of these points, but usually not in relation to energy conservation. Despite this, both factors are explored further in the following two sections, in order to assess the children's potential to increase their agency with regard to saving electricity.

7.2 Negotiations and Convincing Parents

At least one participant from all but one of the families provided examples of the children negotiating with their parents, or making suggestions which successfully changed the family routine. Most of the participants seemed to find it easy to recall (often several) instances where this had happened, and apparently regard the process as quite normal: "She [her daughter] has always been trying to tell us what to do, actually. She's ten years old, she's always telling us" (Molly's mother). In many cases, the children managed to introduce new concepts: "I just usually come up with these ideas most of the time. My father always kills mice and rats, which I'm not too happy about. I tried [to change it to a] [...] live trap" (Blake). The children's efforts are helped by the fact that at least some of the parents seem open to new ideas coming from their offspring: "It's a discussion. If they've got any ideas, that's all incorporated" (Tim's mother), or: "Sometimes, I have an idea and my mum does it" (Kaila), especially when they are seen as beneficial, such as playing outdoors, buying books, and cooking. For instance, Paula easily convinced her parents to "letting me go play the sports I want".

The topics of negotiation mentioned by the participants range from more pocket money and buying books, to doing fewer chores, increasing family interaction, and spending time outdoors:

> Lately he [Malcolm] has been wanting to have family night on Saturday nights, and thinks we should have pizza, and [...] we should split up, so we can have either mother-son day, or father-daughter, or vice versa sort of thing. So that's his latest thing that he's been trying to do, and as the weather's getting nicer, too, the kids are wanting to go for walks after dinner (Malcolm's mother).

This is consistent with previous research showing that children purposefully, and successfully, influence household practices and purchases (e.g. Ekström, 2007; Reid *et al*., 2010 Rickinson, 2001; Martensen and Grønholdt, 2008; Swinyard and Sim, 1987; Todd, 2010). However, given the focus of this research, and in line with Gram-Hanssen (2005) and Garabuau-Moussaoui *et al*. (2009) findings, it is particularly interesting that often the children's

negotiations are aimed at longer showers, more time watching television, playing videogames, or using the computer, as well as the purchase of new electronic equipment. When talking to the researcher, the children quickly moved from discussing their own electricity consumption to the apparently more interesting topic of the latest electronic gadgets. Indeed, in one of the focus groups, most of the topics eventually resulted in this type of conversation:

> *Researcher*: So, do any of you try to save electricity in any way, or not really?
> *Becky*: Sometimes, because I try to save electricity for my six touch, I have six touch phones [covers].
> *Tamara*: Have you?
> *Becky*: Yeah, 'cause my aunty buy some for me […]. I've got pink, green, yellow, orange, highlighted orange, and yellow.
> *Tamara*: I've got highlighted green […].
> *Researcher*: Do you think you can save electricity in any way? […]
> *Melanie*: I have no idea.
> *Becky*: By not going on my computer too much on facebook. She… I remember she's [Tamara] been on there [facebook] for 14 hours and 12 minutes.
> *Tamara*: No, was it? My highest is 42 hours!

Many of the participants provided specific examples of the strategies the children use to persuade their parents, such as asking for something several times, offering to do good deeds in exchange, and trying again after some days if they were not successful the first time round. For instance, Alex "tries that all the time, you know, 'Can I play with the computer?' 'Well, no […]'. Oh, but you know, 'If I go and do my homework now, can I?' [...] Always, there's always [negotiation]" (Alex's mother). All of these persuasion strategies are typically employed by children in a variety of other contexts (Williams and Burns, 2000). However, in several cases only the parents were able to recall specific examples, implying that the children might often be negotiating unconsciously.

The capability of most of the children to affect their parents' decisions reveals their potential to do the same with regard to household electricity saving behaviours. Ironically, their interest in electronic gadgets means that most of them currently use their agency to *increase* their electricity consumption – a fact which at least a couple of them openly acknowledge: "I convinced them [her parents] to have a Wii, even though it does use electricity" (Grace), and "I think [my brother] and I use more electricity than Dad and Mum [...], because we spend heaps and heaps of time on electronics and using them" (Malcolm). This pattern is hardly surprising, considering that negotiation is typically a process aimed at gaining, rather than reducing, the best or biggest share of a scarce resource. In addition, such materialistic concerns likely arise from the broader social norm, and as such may be very difficult to change.

7.3 School to Home Transfer

School to home transfer implies that the children adopt an attitude or electricity saving behaviour from school and subsequently introduce it at home, where it is passed on to other family members. In order for this to occur, the children need to be given information and ideas that they generally do not obtain from their parents. The participating schools are generally not providing a variety of new ideas on how to save energy (section 6.1.7), which was described by some of the participants as preventing the children from introducing new ideas at home: "I did [learn at school] only one or two things to save, turn off electrical appliances when you're finished with them […], [but] they [the parents] were already doing it" (Alex). Nevertheless, the only two children who attempted to change their parents' electricity saving behaviours or attitudes did so based on what they had learnt at school (section 4.7.1), despite only having discussed electricity conservation in a very limited fashion (section 6.1.7). Their parents actually considered the children's points, but they did not have a lasting effect.

Although the transfer of electricity saving behaviours seems to be rare, the majority of the children have either adopted a personal behaviour based on knowledge acquired from school (e.g. turning off the tap while brushing their teeth), or have taken home ideas related to other behaviours, such as reducing waste, better recycling practices, recycling batteries, not felling trees, and buying local or healthy food – often after studying topics such as waste management, water conservation, and deforestation. Some of the children also decided to become more involved in certain family activities (e.g. cooking or growing herbs) after learning about them at school. In all of these cases, the parents considered their children's suggestions, and sometimes adopted them as a regular family practice – especially when the children managed to make their point through logical argument (as explained by Miller *et al*., 1975):

> She [her daughter] just made a valid point, so I listened […]. She talked about use of Glad Wrap. One day at school they pieced together bits of Glad Wrap and showed how much Glad Wrap was thrown out. So that's had an impact on the family and I use little plastic Glad bags and I wash them out and reuse them (Amy's mother).

This is in line with previous research showing that general environmental behaviours are sometimes adopted by families after being taught at school (Larsson *et al*., 2010; Reid *et al*., 2010; Rickinson, 2001). It seems that, often, the parents notice the school's attempts to influence their behaviours:

> Parents often come and complain and say, 'What are you teaching my child? They're telling me to get out of the shower. They're timing my showers' or you know, but they [parents] are nice, in a nice way, so that the children are going home and they're are being quite serious about their role and everyone playing their part […]. When we're promoting the recycling children will go home and say, 'Mum, you're not allowed to recycle that,' or, 'It needs to be washed' you know (teacher, school D).

These examples, together with school casually prompting at least two of the children to take home ideas as to how to save power, demonstrate the potential of educational institutions to have an impact on the family's electricity consumption.

7.3.1 Communication

Most of the children regularly talk to their parents about the general topics they are learning at school: "She [her daughter] comments quite a bit [about school]. She comments all the time just about what she watched during the day, or something that she learnt that was new, and she thought that I don't know" (Kelly's mother). Most of these children also mentioned the content of this research project, which, in some cases, led to dedicated conversations about electricity consumption. The ensuing discussions mostly focussed on identifying electrical appliances (section 4.1), but also covered topics related to efficient technology, and the problems associated with hydro dams (see section 6.1.5, Tabatha's case):

> We [the parents] just gave him [his son] the camera, and we said, 'Okay, what are some of the high consumption lines, you know, use the most power'. And we kind of said to him, 'The night store and the heat pump uses a lot, but the heat pump is efficient because of how it works', and he just went around and started taking photos and started asking questions at the same time, you know, like the one with the light bulb. There he said, 'Why is that light bulb different from some of the others?' And we explained that they're energy efficient and all that, and… so he learnt things (Charlie's father).

DeWaters and Powers (2011b) also found that project-based energy education at school tends to increase associated conversations at home. However, with one exception (Lisa), the only families in this study which discussed electricity as a result of the present project were those that already have frequent or relatively deep conversations about electricity consumption.

Considering that this project did not require the children to talk to their parents, and did not provide them with any new information, it is encouraging that most of them nonetheless mentioned it at home – and, in some cases, turned it into a learning experience. Other factors affecting communication according to this study are the children's gender, and the availability

of a direct means of communication between the teachers and the parents. Thus, many of the boys rarely talk about school with their parents: "He [her son] doesn't say much at all […]. No, my boys aren't as academic as they should be, they are more into sport" (Ron's mother). Some of the mothers specifically made reference to their children's gender to explain a perceived lack of communication: "I have to really work out to get any information out of him [her son], and I think that is a boy thing" (Andy's mother). Along similar lines, DeWaters and Powers (2011b) found that girls tend to talk more about energy with their parents than boys. Finally, both the parents and the teachers also mentioned that other sources of information about the children's activities at school, such as the homework sheet, the school newsletter, meetings, and talking to the teacher or to other parents, provide valuable support for the children's learning at home.

7.3.2 Parents' Opinions on the Role of Schools

Including energy education in the curriculum was thought to be "highly controversial" (Morris and Jensen, 1982, p. 19) in the 80s, but, based on the present results, seems to have become accepted now. All of the parents are happy for, and often expect (section 6.1.7), their children to learn about electricity consumption and production at school. Indeed, most of them talked enthusiastically about this topic, and would welcome the children's suggestions on how to save power at home:

> I think it would be great [for children to learn about electricity at school and bring home ideas] [...]! Definitely, definitely. I think that the thing that they [schools] miss out on most is teaching things that they [children] are going to need to know. If you teach them when they are young, they tend to hold on to it. You know, their brains are sponges, they remember, they do remember, and I think that the earlier they can learn things about money and the environment, [the more they are] going to carry with them through life – so I think that is a really good idea" (Marion's mother).

Most of the parents see several benefits in schools providing energy education: (1) the possibility to learn something themselves, or obtain new ideas from their children: "I think it'd be good [...]. To be honest, they [her children] are actually teaching me something as well, something different because it does work both ways" (Karla's mother), or: "You just get caught up in your own busy life, and sometimes they [the children] will come home and, 'Oh that's a really good idea. I should have thought of that'." (Jessica's mother); (2) giving the children the education they need to make better decisions in the future: "I do think that children need to understand as much as anybody else, you know. I mean, they're the growing

future, basically" (Blake's mother); and (3) the school's contribution to creating a social norm around electricity conservation that would strengthen the family efforts:

> It [school] is a good place to learn it [electricity conservation], especially when it's reinforced by kids of the same age; whereas parents sometimes saying it, it can be… I don't know, it's just what parents say. But when the peers are saying it, too, then that can reinforce it. So, I think probably it's quite good coming from schools as well (Tim's mother).

Despite the above comments, many of the parents also have some reservations about schools encouraging particular behaviours (e.g. eating habits), as opposed to only providing information, especially when they feel that their authority might be threatened: "There are some families that don't like to be told what to do, and […] we've had the odd complaint about, 'You [the teacher] can't tell me that I [the parent] can't use Glad wrap in my lunchbox'." (teacher, school D). Similarly, Ekström (2010) and Garabuau-Moussaoui (2011ab) encountered resistance by parents, who felt that their authority at home was being undermined. Some of the parents highlighted the potential for similar concerns in the context of this study: "I think it's okay [for schools to encourage behaviours], as long as it doesn't counteract what you are actually doing at home as well. You know, I don't think it should ever be... if your teacher says this then they [the children] take that as gospel. I am a little irritated by that." (Amanda's mother). However, for most such concerns do not seem to apply to electricity conservation, as summarised by the teacher from school B:

> There are certain areas that parents don't want us [teachers] to tread in – more personal things, sometimes to do with personal safety […][and] religious matters, obviously […]. I think in the context of energy and energy savings, it's something that we [schools] should support. I can't see any reason why we wouldn't. It's not touching on any values that would be controversial, I don't think, it's just practical daily living. It's being economical a) with your own money; and b) with the country's resources, you know, and generating energy. It seems a wise thing to do.

The teachers also recognise that, regardless of the topic, there are always some parents who are at odds with the school's objectives, and that such issues should not prevent the teachers from educating their pupils: "It happens with any area, it's not just electricity. So nah, that's good" (teacher, school A). Instead, the teachers tend to adjust their approach to the topic being taught, and become sensitive to family differences:

> You do sort of think, 'Well, how do I do this so I'm not going to get some parents upset?' So I think we [the teachers] will just try and say it in a way […]: 'If you're still buying wee individual chip packets, then that's how it is for some families, because they're busy and that's the most organised way, and that's okay. But there

> are lots of other ways that we can do it.'[…]. You think about how you're going to say it a little bit, and you tread a little bit more lightly (teacher, school D).

About a third of the parents, although supportive of energy education in schools, also have reservations about the particular way in which schools might try encourage electricity saving behaviours. In particular, these parents seem to fear that they might be pushed to do behaviours beyond their economic means, such as purchasing expensive technology, or be pressured into performing certain behaviours instead of simply being provided with ideas:

> If it [an idea to save power] was brought home and told we [the parents] had to do it, it would get my back up. But if it came home and the notice said, these are some wee 'We've been talking about electricity at school today, and these are some of the suggestions that we've been talking about with the children. Feel free to do these if you would like to' sort of thing, then I would be quite happy to look at them and think, 'Yeah that's a good idea, I've never thought of that,' you know. And I would be willing to try and do those things (Mary's father).

Some of these parents also commented that they would first need to assess the feasibility and practicality of any proposed new behaviours: "If it was feasible and we [the parents] could see that it could save electricity, I'd be all for that" (Molly's mother), or, as also noted by Garabuau-Moussaoui *et al*. (2009), are sceptical about their children's intention to follow up the ideas they bring home: "I'd smile at her [her daughter] and nod my head, but I'd be sitting here thinking, 'How long will this last, Kelly?'." (Kelly's mother). Thus, the children would need to be persuasive in order to affect their family's behaviour, rather than simply giving a suggestion, which could make the adoption process more difficult. However, some of the parents also made it clear that they would adopt the behaviour if the child showed a lot of interest or is "passionate about it" (Mike's mother).

Finally, although of the parents reacted positively to the idea of children discussing climate change at school, about a third also insist that such conversations would need to be "based in science and supported by data" (Amy's mother), and think that the topic should be presented with "at least two sides to climate change, two opinions" (Blake's mother). In Andy's family, such conversations would be "very controversial, and then my husband would probably get very angry about it, because he doesn't believe in climate change" (Andy's mother). Interestingly, although Andy's mother acknowledged that "it would be a bit of an issue", she would also like for her son to be exposed to the debate: "They [her children] need to have a general view as well, you know, pros and cons, or both sides of the argument" (Andy's mother). None of the parents who showed some form of reservation about the school encouraging electricity saving behaviours or teaching climate change have high

environmental values, perform many electricity saving behaviours, or talk frequently or in depth about electricity with their children.

Overall, the children are not acting as agents of change regarding their families' electricity consumption, seemingly because they are not formally learning enough relevant information and behaviours from external sources, such as school. However, there are signs of potential for the children's agency. The children can negotiate with their parents and be persuasive, especially if they are sufficiently motivated and the parents agree with the child's objective. In addition, most of the parents are open to their children's suggestions. Most of the children regularly communicate with their parents about school, and the majority have taken home new ideas, some of which subsequently became incorporated into the family routine. Finally, the schools generally seem happy to encourage behaviours that are aligned with the parents' interests, all of whom would like for their children to learn about electricity consumption and production at school, and would consider their suggestions on how to save power.

Chapter 8

Overview of the Families

The results of this study point to key differences between families in terms of their environmental orientations, energy efficient attitudes, family dynamics, and the children's energy literacy and level of control over appliances, but also to some recognisable groupings. The major patterns are summarised by a multiple correspondence analysis of the data obtained from the interviewed families and all the (quantified) variables identified in this study (including those from the parents' surveys) (section 3.2.2, Appendix 2). The first two dimensions of this analysis reveal four major groups (Fig. 8.1), and account for 42.67% of the total variance – a reasonable result given the complexity of the analysis, which integrates 26 cases (interviewed families) and 22 variables[1].

The main factors defining the family's involvement in saving electricity are indicated by discrimination measures above 0.3 on the first two dimensions of the correspondence analysis (long lines in Fig. 8.2). They all corroborate the qualitative analysis, and include: (1) the children's control over appliances and (2) children's efforts to save power, as well as (3) the children's and (4) parents' positive attitudes towards saving electricity, (5) the parents' pro-environmental values and (6) electricity saving behaviours, and, finally, (7) the depth and frequency of the family's conversations about electricity consumption and production. When the third dimension of the correspondence analysis is included, namely rules, the family's income, the children's knowledge on energy sources, and how often the child talked about the environment during the interview also all become important (Appendix 10). However, other variables, such as children attending an enviroschool, overall level of agreement between parents and children, and financial and safety concerns (talking about the topic during the interview) do not seem to have a strong impact on the family involvement in saving power. This is likely explained by the absence of energy topics from the enviroschool programme (except for one school), as well as the fact that safety and/or money are of equally strong concern to the vast majority of participants across all backgrounds. These results are consistent with those observed in the qualitative analysis, with all of the variables driving the

[1] Children's energy saving behaviours (1) and attitudes (2); their level of conversation in the interview about money (3), the environment (4), helping their family (5), trying to save electricity (6), energy sources (7), and safety (8); parents' environmental values (9), attitudes towards saving energy (10), attitudes towards energy efficient purchases (11), energy saving behaviours (12), and their level of conversation in the interviews about the environment (13), money (14), helping the family (15), and safety (16); finally, the level of agreement between the interview of the child and their parent (17), the frequency of conversations about energy in the family (18), the presence of rules (19), the child's control over energy use (20), the family income (21), and weather the child attends an enviroschool (22) (Appendix 2).

main patterns in the correspondence analysis (except income) also being crucial for understanding the children's behaviours and energy literacy (Fig. 8.3).

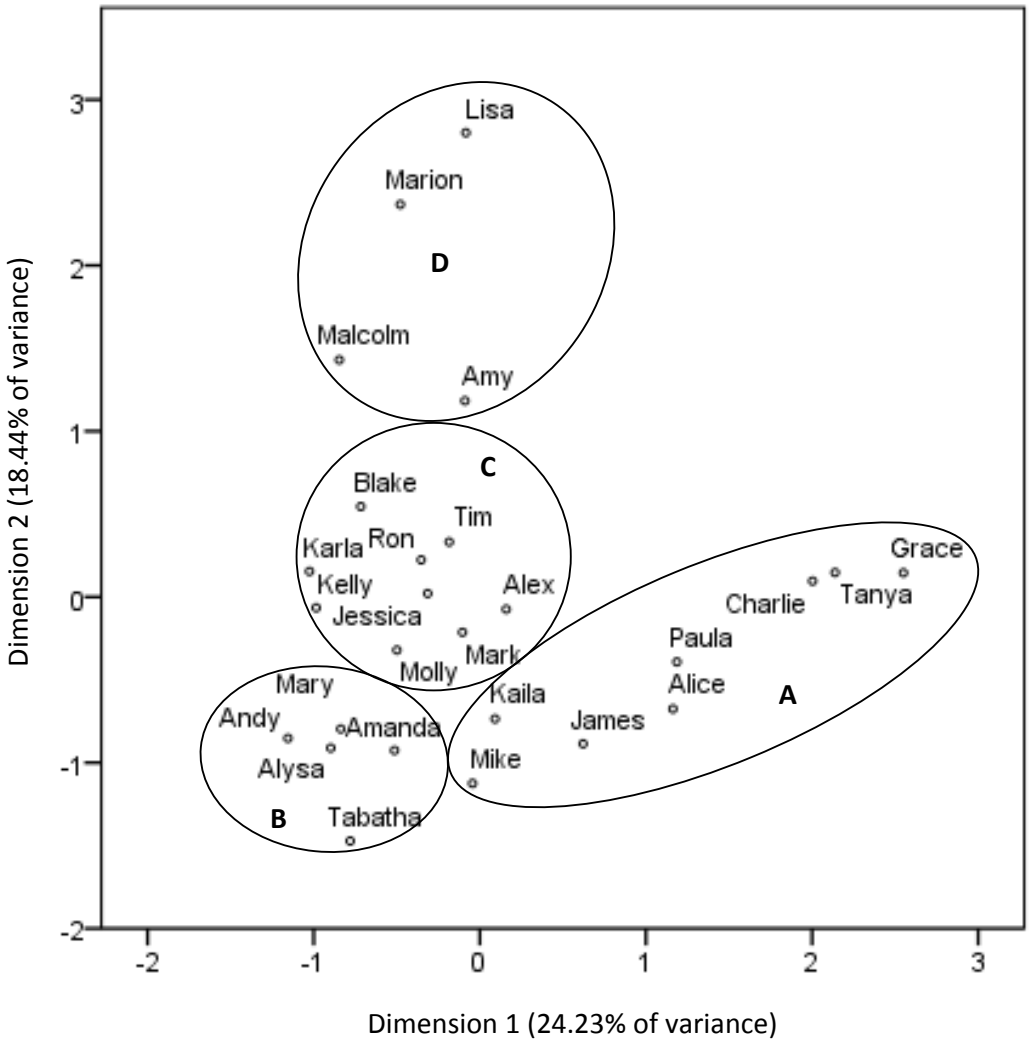

Figure 8.1 Multiple correspondence analysis of all of the interviewed families and quantified variables (Appendix 2 and 10) (A-D denote the four groups discussed in the text)

The emergence of family income as a relevant variable in the correspondence analysis represents one of the few differences between the quantitative and qualitative analyses. Indeed, the only obvious effect of socioeconomic background (i.e. not income as such) evident from the latter seems to be that children from lower decile schools talked more about the risk of power cuts owing to unpaid bills. However, this problem may be expected to arise in the neighbourhood of such schools, and is therefore likely in the minds even of children from wealthier, unaffected families, who heard about it from their classmates.

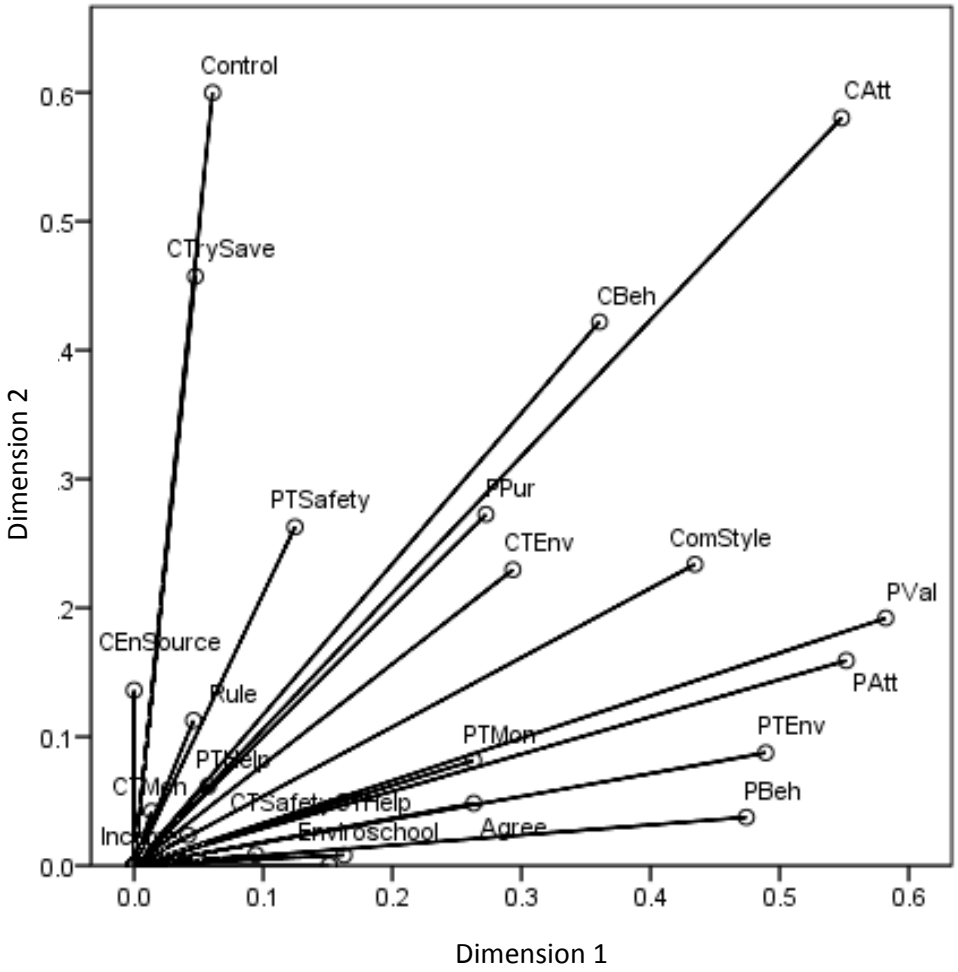

Figure 8.2 Discrimination measures arising from the multiple correspondence analysis. (C = children, P = parents, T = talk about [...], Mon = money, En = energy, Env = environment, Val = environmental values, Att = attitudes towards saving electricity, Beh = electricity saving behaviours, Pur = attitudes towards purchasing energy efficient technology, ComStyle = level of communication about electricity)

Socioeconomic background has often been found to be important in understanding differences in the environmental and energy saving attitudes, knowledge, and behaviours of both adults and children (Barton *et al*., 2013; Bechtel, 1997; Davis, 1985; El-Salam *et al*., 2009; Gambro and Switzky, 1999; Garabuau-Moussaoui, 2011a; Larsson *et al*., 2010; Morris and Jensen, 1982; Robelia and Murphy, 2012; Sudderth, 1984). It is therefore the more surprising that such differences have not become more evident in the context of this study.

One possible explanation is that income alone does not represent socioeconomic background (Hauser, 1994). Other factors, such as the parents' level of education and occupation, could

potentially provide additional insights. For example, some of the parents are highly educated postgraduate students, yet live on a very low income. However, neither of these variables was quantified owing the mainly qualitative focus of this study. In addition, the division of income level into three categories, although following the standard New Zealand government categorisation (section 3.2.2), may be too broad to distinguish between particular groups. The picture is further blurred by the observation that the high income group comprises two distinct types of families: whereas some of them follow an environmental lifestyle with high levels of energy knowledge, attitudes and behaviours (as was also found by El-Salam *et al*., 2009; Gambro and Switzky, 1999; Gifford and Sussman, 2012; Morris and Jensen, 1982; Sudderth, 1984), others did not share those sentiments, resulting in weak attitudes towards saving energy and few energy saving behaviours (see also Bechtel, 1997). Furthermore, reducing energy consumption for economic reasons might not be only related to income but also to a frugal lifestyle, which seems to be common in New Zealand (Todd and Lawson, 2003). Frugality is not the result of economic constraint, but instead a chosen lifestyle which is also embraced by high income earners (Todd and Lawson, 2003). Finally, children from all income groups tend to know relatively little about energy, making it difficult to discern any patterns.

Considering the characteristics of the family groups identified by the correspondence analysis (Fig. 8.1; Table 8.1), it is noticeable that both the children and parents of the families in group A perform many electricity saving behaviours, and have a strong attitude towards saving electricity. In addition, the parents of these families have strong environmental values and engage in frequent or deep conversations about electricity conservation with their offspring, thus making them the most concerned and proactive group of the study. Group B is similar, but characterised by more moderate levels of behaviours and values, weakly held attitudes towards the environment, and fewer conversations about power. Group C seems mostly based on shared characteristics of the parents, who perform few electricity saving behaviours and hold weak attitudes and environmental values. The attitudes and behaviours of the children in this group vary widely (except that most of them do not relate electricity consumption to environmental problems), possibly as a result of being influenced by other learning sources, such as school and the media. Finally, group D is characterised by the children's low level of control over electrical appliances, which is associated to low levels of engagement in electricity saving behaviours, weak or no attitudes towards conserving power, and lack of awareness of the link between the environment and electricity consumption. Apart from not allowing their children to use electrical appliances, there is no obvious pattern underlying the parents' behaviours, attitudes and values within this group. Overall, half of the families

(groups A and B) seem to have some level of awareness and engagement in electricity saving behaviours, whereas the other half shows very little or none (Table 8.1; for a qualitative description of each of the families, see Appendix 15).

Table 8.1 Family clusters identified by the correspondence analysis (Fig. 8.2). (*) signifies the presence of one or two exceptions. (-) denotes the absence of an obvious pattern.

	Level of energy efficiency, literacy, and concern			
	High (A)	Medium (B)	Low (C)	Absent (D)
Number of families	8	5	9	4
Children's control	Yes	Yes	Yes*	No
Parents' level of behaviour	High*	Medium	Medium or low	-
Children's level of behaviour	High*	Medium*	-	Medium or none
Parents' attitude	Strong or medium	Weak*	Medium or weak	-
Children's attitude	Strong*	Weak	-	Weak or none
Parents' environmental values	High or medium	Medium or low	Medium or low	-
Children talked about the environment	-	-	No*	No
Level of family conversations	High*	Medium or low	Low*	Low
Cluster guided by the parents' or the children's variables	Both	Both	Parents	Children (except for parents limiting control)

While the relatively high number of families with energy efficient attitudes and behaviours is encouraging, and evidence that children can be socialised into saving energy at an early age, the lack of interest in saving energy of the parents in the largest group (C), as well as the relatively large number of children with little or no autonomy with regard to their energy behaviour (D), are a matter of concern. Without guidance, examples to follow, and control, children cannot be expected to become energy efficient citizens in the future.

Chapter 9

Discussion

The results of this study make it clear that the formation of children's energy literacy, electricity saving behaviours, and agency is more complex than the original premise of this study (Fig. 1.1). The latter suggests that the children's energy literacy (knowledge, attitudes and intended behaviour) leads to their engagement in energy saving practices, which, through the children's agency, are subsequently adopted by other family members. This chapter demonstrates that such linear processes are not occurring, with the children's energy knowledge, attitudes and behaviours being formed by distinct, parallel, and interacting processes. These trends are then summarised in a simplified model (Fig. 9.1), and explained one by one based on the structure of the model (from top to bottom, and left to right, based on Fig. 9.1). The chapter concludes by integrating the main findings of this research, and discussing the overall processes guiding the children's energy saving behaviours.

9.1 Children's Control

Parents contribute to the formation of their children's energy saving attitudes, behaviours and knowledge through a variety of processes. However, most of the latter depend on, or are facilitated by, the children having some level of control over appliances (Fig. 9.1, element 3), thus mediating the parents' level of influence on their offspring's socialisation into electricity use (Fig. 9.1, elements 2, 3, 7, 8, 11, 14). While higher levels of control facilitate knowledge and attitude-building through family conversations on electricity consumption (Fig. 9.1, element 2, 3, 5, 7), as well as the socialisation of the children through parental instructions, reminders, rules, and modelling (Fig. 9.1, element 11, 3, 12, 14), children with no control regard saving energy as a non-existent topic. These findings corroborate earlier work, which found children to be more responsible in their energy management when they are relatively autonomous (Garabuau-Moussaoui, 2011a), but blissfully unaware when consumption decisions are not up to them (Toth *et al.*, 2013).

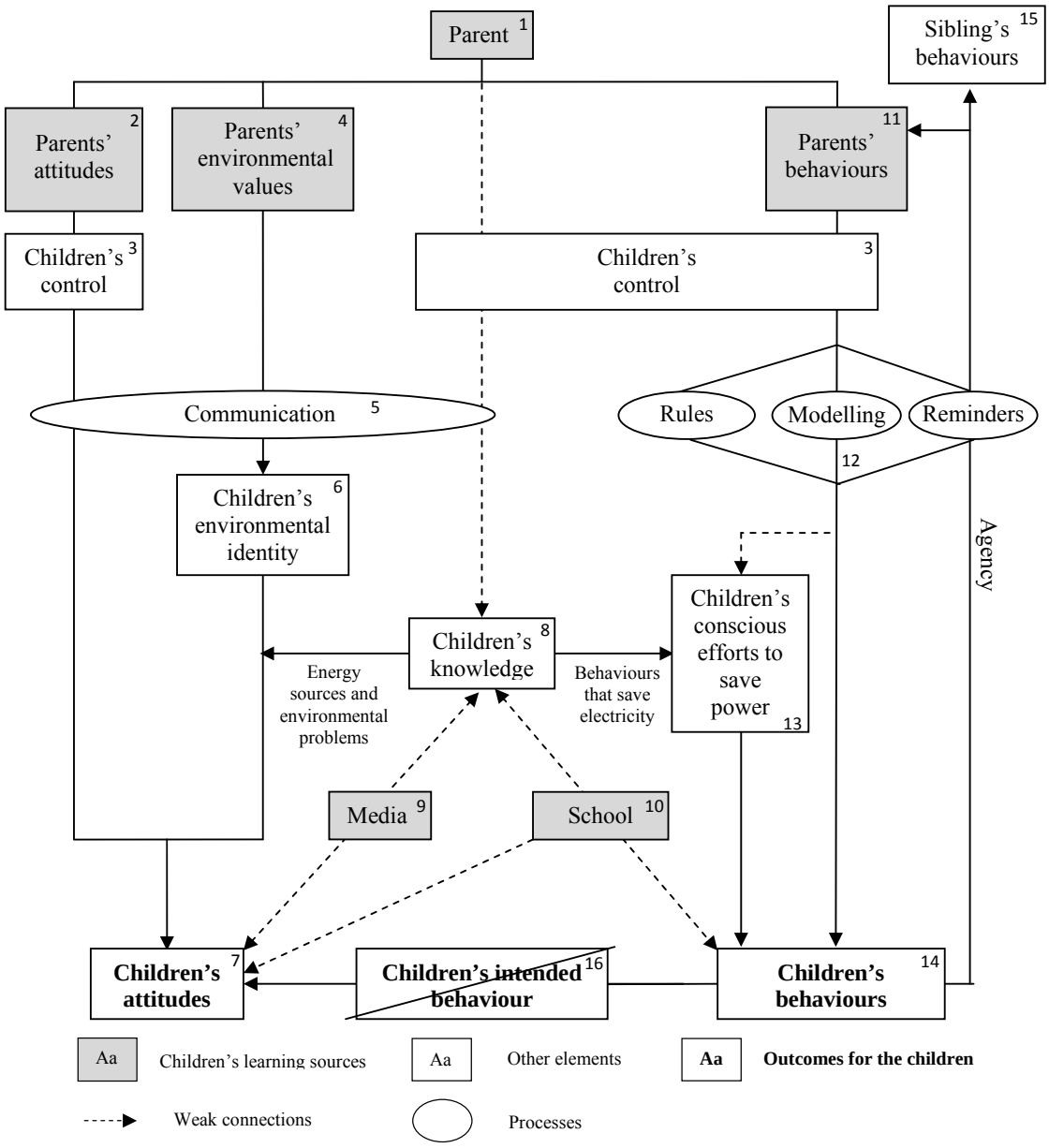

Figure 9.1 Key processes affecting children's socialisation into saving electricity and the development of energy literacy. All of the elements refer specifically to conserving electricity, except for environmental values and environmental identity, which are more general.

The main reason for constraining children's control over electrical appliances is their parents' perception of danger (Garabuau-Moussaoui, 2011b; Garabuau-Moussaoui *et al.,* 2009; Mirosa *et al.,* 2011; Toth *et al*., 2013). This is a natural concern, because "socialization is first directed toward ensuring child survival and second towards socializing the child to family and cultural standards" (Gralinski and Kopp, 1993, p. 581). Such safety concerns should ideally decrease as children grow older (Garabuau-Moussaoui, 2011a; Gralinski and Kopp, 1993), yet it is obvious from this study that this is not always the case, with the parents granting their children very different levels of autonomy, despite their similar age. A further motivation for limiting children's control is to avoid mistakes and consequent waste. While understandable in terms of the parents' desire to save energy, it is precisely this perception of children's incompetence which prevents them from learning (Taylor and Smith, 2009). By thus hindering their socialisation into conserving energy, their opportunity to acquire energy efficient behaviours, knowledge and attitudes before losing interest as adolescents, or leaving the home as young adults, might be lost (Garabuau-Moussaoui, 2011a).

These results highlight the importance of experiential learning, which is dependent on the context and family discussions of practical issues, as well as the observation and imitation of other people's behaviour (Roland-Levy, 2010; Taylor and Smith, 2009). Furthermore, by being able to assess the outcome of their own actions, children can increase their feelings of self-efficacy (Bandura, 1989). In this study, not many of the children seem to be involved in household chores, such as cooking and doing laundry. However, those who are (mostly girls) have gained a high level of practical knowledge on how to perform these behaviours in an efficient manner from working alongside their parents. Perhaps more children could thus benefit from engaging in a wider range of electricity consuming behaviours, and hence higher levels of control.

9.2 Attitudes

Attitudes can be learnt in a way very similar to behaviours (section 2.3.3) and both learning processes are interrelated in regard to saving energy. There are three major processes underlying the development of a positive attitude towards saving energy in the children of this study: 1) family conversations (Fig. 9.1, elements 2, 3, 5, 7); 2) environmental values (Fig. 9.1, elements 4, 5, 6, 7, 8); and 3) attitudes arising from pre-existing behaviours through processes such as cognitive dissonance or mere exposure (Fig. 9.1, elements 7, 12, 14). In addition, children with a strong will to cooperate with their family also have stronger attitudes

towards saving power. These processes are not mutually exclusive, and often complement one other.

Attitudes can be formed very quickly, as happened for example when the children were prompted during the interviews. However, they tend to be weak initially (Vaughan and Hogg, 2010), and only become stronger upon frequent reflection, or the need to defend them (Baumeister and Bushman, 2013). The latter is achieved through family conversations about energy conservation, as shown by the relatively strongly held attitudes of children from families who talk often or in depth about the topic (Fig. 6.5). Such exchanges are often triggered by the use of particular appliances, and thus mediated by the children's level of control (Fig. 9.1, elements 2, 3, 5, 7). Outside this context, the children do not seem to reflect spontaneously on their energy consumption, nor generally discuss it with their peers or at school – although the latter does have a limited effect in some cases (Fig. 9.1, elements 7 and 10). However, this study also corroborates the results of Halder *et al.* (2011), who found that energy is not a popular topic of conversation even within the family context.

Although a variety of factors, such as safety or ensuring that there is enough hot water for everyone to have a shower, may influence the desire to reduce household energy consumption (Aune, 2007), financial and environmental concerns (in that order) are the motivations most commonly cited by both children and parents. These results contradict the common notion that children are not concerned about saving power because they are not responsible for paying the bills (e.g. Toth *et al*., 2013), and mirrors similar findings from France and Germany – except that, in those countries, there seems to exists a much stronger environmental rationale (especially in children), which might reflect an equally strongly developed environmental social norm (Garabuau-Moussaoui *et al*., 2009; Jentsch *et al*., 2011).

As an extrinsic motivation, any desire to save power for financial reasons is likely to change depending on the price of electricity and a person's income (Pelletier *et al*., 2011). By contrast, an environmental rationale (i.e. altruistic motivation) concerned with, for example, energy security issues and climate change, is more likely to create a more stable and stronger attitude (Pelletier *et al*., 2011; see also section 2.3.3). Rather than being a barrier to becoming energy savvy, the fact that children "are not paying the bills" (Amanda's mother) could thus be seen as an opportunity to encourage an environmental rationale at this stage of their lives. Ultimately, economic concerns will follow naturally once they become economically independent from their parents (Garabuau-Moussaoui, 2011a; Toth *et al*., 2013), whereas environmental awareness may not be as easily acquired without guidance.

In some cases (e.g. Alice and Mike), children may develop a strong will to save power as a result of adopting an environmental identity (Fig. 6.3), which in turn is based on internalised environmental values they acquired (alongside their attitudes) from talking to their parents (Fig. 9.1, elements 4, 5, 6, 7, 8). Attitudes stemming from values tend to be stable (Aronson *et al*., 1999), and are more likely to be acted upon in a variety of ways (Pelletier *et al*., 2011) – as shown, for example, by "green teenagers" talking more than their peers about saving energy, and their efforts to do so (Toth *et al*., 2013). However, in order for a green identity to have a positive impact on energy consumption, children need to realise that their energy use has an environmental impact (Fig. 9.1, elements 6, 7, 8). This connection has not been made by most of the children in this study, thus, for the most part, excluding the possibility of such a pathway. Nevertheless, many children seem to be interested in environmental topics, and the latter are often discussed both at home and at school. In addition, children from many different countries have been found to have a positive attitude towards the environment (Gifford and Sussman, 2012), which could reinforce their will to save energy if the environmental benefits of doing so were made explicit.

Finally, a complementary, though in the context of this study likely secondary, pathway for forming attitudes is via pre-existing behaviours. Attitudes towards objects with a utilitarian function, such as energy, tend to be cognitive-based (Aronson *et al*., 1999). However, this mechanism is unlikely to apply in the case of this study, owing to the discrepancy between the children's very limited knowledge on the one hand, and relatively common positive attitudes towards conserving power on the other (Fig. 9.1, elements 7, 8). Thus, pre-existing behaviours (arising from rules or modelling) might have contributed to the formation of some of the children's attitudes through processes such as cognitive dissonance, mere exposure, or self-perception (section 2.3.3). Alternatively, rules (injunctive norm) or the example set by the parents (descriptive norm) might have led the children to develop an attitude based on the norm set by their parents, either through social learning (Grønhøj and Thøgersen, 2012) or, in the case of rules and punishments, operant conditioning (Vaughan and Hogg, 2010).

9.3 Knowledge

The children are learning about energy mainly from their parents, the media and school, but to a very limited extent (Fig. 9.1, elements 1, 8, 9, 10). Most of the children in this study are largely unaware of energy sources and the environmental impact of energy production and consumption, and tend not to use specific terms such as "renewable", "fossil fuels", "peak

oil", or "climate change". Possibly because of its limited and incoherent nature, their energy knowledge seemingly has no clear or direct impact on the children's energy saving attitudes and behaviours (Fig. 9.1, elements 7, 8, 14). This finding corroborates the information deficit explanation forming part of the theory of planned behaviour (Ajzen, 1991) and energy literacy (DeWaters *et al.*, 2007; DeWaters and Powers, 2013). Previous research also concluded the state of children's knowledge to be poor overall (Ayers, 1977; Kuhn, 1979; Lawrenz, 1983; Solomon, 1985; Solomon, 1992; Stubbs, 1985; Toth *et al.*, 2013), but nonetheless often identified higher levels of knowledge than the ones evident in this study.

For instance, some found that the majority of primary school children (1) know that fossil fuels, not electricity (as identified by the children in this study), are a limited resource (Ayers, 1977; Lawrenz, 1983; Solomon, 1985; Solomon, 1992); (2) can name energy sources (Bolyan, 2008; Erdogan and Ok, 2011; Solomon, 1992), while only about half of the children in this research could do so; (3) are aware of the risks of nuclear power (Ayers, 1977; Solomon, 1992), which was not mentioned by the children in this study; (4) know that electricity generation has an environmental impact (Ayers, 1977; Garabuau-Moussaoui, 2011a; Solomon, 1992), which was only mentioned by about a third of the interviewed children; and (5) are aware that energy consumption is increasing (Lawrenz, 1983), which was not discussed at all by the present study's participants. In addition, Solomon (1985) offered some examples of the energy topics discussed by 15-year-old children in her class, including, for instance, the pros and cons of different energy sources, possible solutions, and international politics. By contrast, both the focus groups and interviews of this study were much more superficial. These differences are intriguing, but must be interpreted cautiously, since the methodology, specific age group, and energy education provided by school differed for each study. In particular, most of the previous research was based on multiple-choice surveys, which likely overestimated the children's knowledge compared to the more qualitative approach of this study, which involved less prompting. Thus, for example, the fact that children can name issues related to pollution and climate change does not necessarily mean that they understand them (see also Toth *et al.*, 2013).

To some degree, the children's relative ignorance with regard to energy might be explained by a similar trend evident in the general population (Bodzin, 2012; DeWaters and Powers, 2011b, 2013; Robelia and Murphy, 2012; Southwell *et al.*, 2012), with people struggling to understand the wider consequences of their power use (Gram-Hanssen, 2010). However, it is likely also a result of the mostly informal nature of the sources on which children tend to rely – their parent and, albeit less frequently, the media (documentaries, news, magazines).

Contrary to the results of previous research (Toth *et al.*, 2013; Garabuau-Moussaoui, 2011a), the children studied here are generally not learning about energy sources and related environmental issues from school. Without specific guidance on how to integrate the isolated pieces of information they are able to derive from informal sources, the children have to resort to their own logic, and be motivated, to put them into context.

In the case of relatively straightforward relationships, this may not be a problem. For example, children are well aware, and understand, the implications of the financial cost of electricity, even though they mostly gather this information from comments made by their parents, or overhearing conversations (see also Toth *et al.*, 2013). Since paying for power is a direct consequence, and hence relatively easy for children to understand (Morris and Jensen, 1982), only short and simple explanations are required. However, when it comes to environmental issues, which are often more complex, children's reasoning – left to its own devices – frequently leads to misunderstandings (Solomon, 1992). Besides the many weird and wonderful theories it sometimes produces (p. 154-155), this is maybe best shown by the fact that the few children of this study who *do* understand the environmental impact of energy production learnt about it in a structured way at school, or from a book. This kind of formal knowledge is organised and easier to comprehend, and given priority or emphasis over informal knowledge (Solomon 1992). In addition to providing structure, formal education also provides children with a range of new, context-specific vocabulary. Ultimately, it is this expansion of their linguistic prowess that allows children to formulate and fathom the increasingly complex ideas they are faced with as they grow up (Rieber and Robinson, 2004).

Nevertheless, informal knowledge, ideally from a variety of sources, can still be highly valuable when used as a basis and input for formal education. Indeed, both types of knowledge coexist and can complement each other (Solomon, 1985). In doing do, it is important to consider the children's own perspective, which is often not illogical, but based on a different rationality and limited information (Solomon, 1992). For example, in the context of this study, this might mean explaining to them that (1) hot water for showering requires energy by comparing the water heater to an electric kettle; (2) some appliances without visible plugs (e.g. heat pump and water heater) use energy by making the effort to find and point out their electrical supply; (3) not all energy saving measures (e.g. closing curtains) need to relate to appliances; and (4) that global warming is not related to fire and the dangers of electricity.

It is widely recognised that energy-related education at school has the potential to increase children's knowledge, as well as their energy efficient attitudes and behaviours (e.g. Collins *et*

al., 1979; DeWaters and Powers, 2011b; Gambro and Switzky, 1999; Morrisey and Barrow, 1984; Zografakis *et al*., 2008). In particular, schools can play an important role in conveying practical knowledge on how to save power, which not only provides children with the possibility to adopt new energy saving behaviours (Robinson *et al*., 2011; Zografakis *et al*., 2008), but also allows them to rationalise, and hence reinforce, those behaviours they are already performing. The present results highlight a need especially for the latter, since many of the children do not seem to realise that some of the behaviours they engage in (e.g. closing curtains and having short showers) help to reduce their energy consumption, thus, in their eyes, essentially rendering them meaningless in this regard. Ultimately, knowledge may create the awareness needed for routine decisions to become conscious (Kahneman, 2011), thus opening the door to saving energy in a deliberate way (Bodzin *et al*., 2013; DeWaters and Powers, 2008, 2011a, 2013; Kasapoğlu and Turan, 2008; Zyadin *et al*., 2012).

Many schools across a range of different countries already regularly teach energy education (e.g. Eastern Bay Energy Trust, 2012; Newborough *et al*., 1991; Vásquez *et al*., 2005; Zyadin *et al*., 2012). This was also the case for one of the schools participating in this study, which offered an interdisciplinary and hands-on energy unit including fieldtrips, research activities, invited talks, and practical information. Like other educational programmes of its kind (e.g. Huang *et al*., 2012; Morrisey and Barrow, 1984; Solomon, 1992; Zografakis *et al*., 2008), this unit seems to have been effective at imparting a variety of energy-related knowledge and attitudes. By contrast, the remainder of the schools ran projects on energy from a science perspective, which is the only one compulsory in the New Zealand curriculum (Ministry of Education, 2007). Ironically, most of these projects focussed on topics such as electromagnetism, which are regarded as mostly irrelevant in this context (Eidelman, 2010). Unsurprisingly (DeWaters *et al.,* 2013; El-Salam *et al*., 2009; Newborough *et al*., 1991; Stubbs, 1985), this approach seemingly did not affect the children's energy saving knowledge, attitudes and behaviours.

The present results thus demonstrate the importance of including energy literacy in the New Zealand primary school curriculum based on an interdisciplinary and practical approach – an opinion shared by all of the interviewed teachers, and reflecting the views of other educators in previous studies (Boylan, 2008; Buway, 2007; Morrisey and Barrow, 1984; The Centre for Human Rights and Citizenship Education, 2011). However, owing to a range of commonly acknowledged structural obstacles, such as an overcrowded curriculum, or lack of specific knowledge and skills amongst teachers, this idea is frequently not put into practice (Eidelman, 2010; Lawrenz, 1983; Morrisey and Barrow, 1984; Newborough *et al.,* 1991; Solopova, 2008;

Stubbs, 1985). Further research on the educational context, and how to integrate relevant issues into the curriculum, is needed to resolve these problems.

9.4 Behaviours

In contrast to the variety of sources affecting knowledge, electricity saving behaviours are almost exclusively passed on from parent to child through modelling, rules and reminders, as long as the child has some control over electrical appliances (Fig. 9.1, elements 3, 11, 12, 14). Energy saving behaviours with a clearly visible consequence, such as turning off lights or computers, are performed more often than those with less obvious effects, such as switching off electric blankets. In addition, some practices might not be clearly noticeable because they are private (e.g. having short showers) or take some time to be felt (e.g. increasing the temperature setting of the heat pump). These behaviours are subject to constant negotiation in some families, whereas they are more strictly regulated by parental rules in others. However, only the more visible behaviours are usually justified based on the need to save energy, with the remainder often being explained another way[1], thus implying that the degree of visibility may affect the underlying rationale. These results mirror those of previous studies, which found that less visible practices, often related to saving energy, are less likely to be socialised than, for example, recycling, because the example to follow is not as obvious (Grønhøj and Thøgersen, 2009; Moore-Shay and Lutz, 1988). Making energy consumption more visible through feedback devices might therefore be an effective way to increase energy saving behaviours in the general population (Abrahamse *et al*., 2007), including children (Caretosave, 2013; Gustafsson *et al*., 2010; Grønhøj and Thøgersen, 2011).

Previous research suggests that children have the potential to engage in a greater variety of energy saving behaviours than observed in this study (2–11 different behaviours), provided they are specifically taught and encouraged. They can, for instance, persuade their parents to buy energy efficient light bulbs, dry clothes on the line, close the fridge quickly, and turn off appliances at the wall (Robinson *et al*., 2011; Zografakis *et al*., 2008), all of which are uncommon among the present participants. At ten years or younger, children are mainly focused on their home and the information they acquire from their families (Bronfenbrenner, 1979; Jentsch *et al*., 2011; Lawrenz, 1983; Piaget, 1977; Solomon, 1985; Toth *et al.,* 2013), thus providing the perfect opportunity for developing household energy saving practices.

[1] For instance, safety, comfort and health with regard to space heating; and conserving water, having enough hot water for all family members, and adjusting to the family schedule with regard to showering.

Habits are most easily created when a new behaviour is first acquired (Verplanken, 2012), and tend to be stable and difficult to modify once formed (Dahlstrand and Biel, 2006). Exposing and socialising primary school children into as wide a variety of energy saving behaviours as possible is thus especially important, since it is at this stage that they are strongly socialised into using energy through a plethora of newly-acquired behaviours, such as cooking, doing laundry, operating heaters, and using computers and mobile phones (see also Garabuau-Moussaoui, 2011a).

By the age of ten, children are reaching the final phase of the main family socialisation process into energy use, and start to make most of their daily energy decisions autonomously (Garabuau-Moussaoui, 2011a)[1]. In this light, the small number of (voluntary and habitual) energy saving behaviours the children in this study tend to engage in is a cause for concern (Tables 4.3 and 5.1), especially when considering their extensive use of electrical appliances (section 4.1). As adolescents, barely a year or two older than the present participants, children generally seem to lose interest in energy topics (Garabuau-Moussaoui, 2011a), and are characterised by a particularly high level of electricity use (Gram-Hanssen, 2005; Grønhøj and Thøgersen, 2009). It is only as young, independent adults needing to manage their own household energy consumption and finances (Toth *et al*., 2013), that they turn back to the practices acquired at home during childhood (Garabuau-Moussaoui, 2011a) – if, indeed, these exist. This highlights the importance of socialising children into saving energy at an early age.

9.5 Socialisation Methods

This research found three main socialisation methods into energy saving behaviours: rules, modelling, and reminders (Fig. 9.1, element 12), all of which are discussed next. Rules controlling the children's electricity consumption are in place in about a third of the studied families, and are very effective in raising the number of energy saving behaviours the children engage in, as was also found by Garabuau-Moussaoui (2008, 2011b). By contrast, when children are allowed to do as they please, they tend to use more energy than their peers (Grønhøj and Thøgersen, 2007). Rules provide clear and explicit guidelines avoiding misunderstandings and constant negotiations, and are therefore considered an important component of child rearing (e.g. Amato and Fowler, 2002; Kremer *et al*., 2010; Nixon and Halpenny, 2010). When accompanied by explanations, as in this study, they are furthermore

[1] Interestingly, the children of this study do not appear to have achieved the same level of autonomy as that identified by (Garabuau-Moussaoui, 2011a), raising questions about potential differences in life stages between France and New Zealand.

characteristic of an authoritative parenting style, which has been found to be the one most beneficial to children (Kremer *et al*., 2010, Nixon and Halpenny, 2010).

Notwithstanding their effectiveness, external constraints can also be interpreted as the antithesis of voluntary action, and therefore bar, or release, children from assuming personal responsibility for their behaviour. To what degree this holds true depends on whether a particular rule is internalised: if so, it may be the first step towards a habit and self-control (Gralinski and Kopp, 1993; Nixon and Halpenny, 2010); if not, removal of the rule may result in a reversal of the behaviour it seeks to constrain – a reaction commonly associated with forceful control, authoritarian parenting, or a child's reactive temperament (Kochanska and Aksan, 1995). In general, the chances of rule internalisation increase with a child's compliance, which in turn is dependent on the presence of a cooperative attitude, as well as a strong parent-child bond (Kochanska and Aksan, 1995). In the context of this study, rule internalisation is thus likely to occur, since none of the families show clear signs of an authoritarian parenting style, and most of the children comply and agree with the rules set by their parents without familial conflict or any need for punishments.

In line with previous research (Garabuau-Moussaoui, 2011a; Grønhøj and Thøgersen, 2009, 2012), children are also being socialised into energy saving practices primarily through the extremely common process of modelling (Bandura, 1989), i.e. the inference of descriptive norms through observation (Grønhøj and Thøgersen, 2012). The example set by parents is therefore extremely important: when parental behaviours are obscure or inconsistent, children struggle to adopt them, regardless of any instructions, reminders, or explanations (see also Grønhøj and Thøgersen, 2012). Because modelling is not related to explanations, it is one of the main processes giving rise to seemingly meaningless behaviours, which first need to be rationalised in light of newly acquired knowledge before they can lead to a conscious effort (Fig. 9.1, elements 8, 12, 13, 14; see also Garabuau-Moussaoui, 2011a). While the fact that mere exposure can lead children to adopt energy saving behaviours is encouraging, their parents' limited efforts to save electricity are often a poor basis to build on. This highlights the need to exploit other, additional socialisation pathways not entirely dependent on the parents' behaviour.

All of the parents in this study give reminders and instruction to their children, suggesting them to be a necessary component of the socialisation process. The existence of reminders can mostly be explained by the children still learning to perform particular behaviours (see also Garabuau-Moussaoui, 2008, 2011a). However, as in some earlier studies (Garabuau-Moussaoui *et al*., 2009; Reid *et al.,* 2010), some of the families have also incorporated

reminders into a shared, cooperative attitude, with the aim of achieving a common goal. In such cases, the children often seem to save energy out of a wish to help their families, rather than because of financial or environmental concerns. In contrast to this peaceful dynamic, constant reminders and instructions (unlike rules and modelling) can also lead to frustration and conflict (e.g. "daily guerrilla", Garabuau-Moussaoui, 2008a, p. 3; Grønhøj, 2006) borne out of a vicious circle of nagging and ignoring. Where this occurs, explicit guidelines in the form of rules might be an appropriate complement to reminders in order to decrease conflict and avoid the creation of negative associations with energy saving practices.

Finally, besides rules, modelling, and reminders, integrating energy saving behaviours into a daily routine (e.g. wake up, turn off electric blanket, open curtains), also seems to increase the consistency with which children perform them. Children's lives are generally organised around several already established routines, such as getting to school, dinner, or bedtime (Rebello-Britto *et al*., 2002), which provide an ideal and relatively effortless opportunity to include energy efficient practices. In general, routines are effective precisely because they decrease the tensions of making decisions about mundane tasks, thus reducing family conflict and ensuring stability (Kremer *et al*., 2010; Rebello-Britto *et al*., 2002).

In conclusion, a visible and consistent example set by parents, rules accompanied by explanations as to why they exist, energy saving behaviours embedded in established daily routines, and cooperative reminders, are all effective means of socialising children into using energy wisely. They all complement and reinforce each other, and ideally ought to be employed at the same time. By contrast, nagging and inconsistent behaviour on the part of the parents are unhelpful and potentially even detrimental, and should be avoided wherever possible.

9.6 Social Norm

The practices and discourses of the household constitute the collective social norm within which children's own norms are developed, and are the strongest influence on their energy attitudes and behaviours (Grønhøj and Thøgersen, 2012). Thus, the more parents talk about energy conservation, the stronger their children's attitudes towards it. Social norms created at school can also affect the household context, and lead to an increased number of family conversations on, for example, energy (DeWaters and Powers, 2011b). Therefore, social norms can be considered a part of the context in which children are socialised into saving electricity, and do not occupy a specific position in the model (Fig. 9.1).

As explained by Bourdieu (1994), children internalise the mentality, norms and behaviours that surround them: "Between the child and the world the whole group intervenes [...] with the whole universe of ritual practices and also of discourses, sayings, proverbs, all structured in concordance with the principles of the corresponding habitus." (p.163). However, in common with families from across the world (e.g. Bodzin, 2012; DeWaters *et al*., 2013; Lutzenhiser, 1992), many of the present participants know or care little about energy, and have adopted few energy saving practices, thus creating a social norm that is not conducive to the socialisation of children into saving energy.

Paradoxically, different social norms can contradict each other, as is the case with the desire to purchase more electrical appliances as a symbol of identity, status and modernity (Garabuau-Moussaoui, 2011b; Gram-Hanssen, 2005), while trying to save energy at the same time (Garabuau-Moussaoui, 2011b; Spaargaren and Van Vliet, 2007). This issue was apparent in the children's interviews and focus groups, with several of them beginning by explaining their energy saving efforts, but finishing by describing with pride their ownership of electronic devices or the will to purchase them, as well as how they tried (often successfully) to convince their parents to do so.

Overall, it cannot be expected that children will develop energy consciousness if it is not part of their culture or social world (Bourdieu, 1994). It is extremely difficult, if not impossible, for children to become energy efficient citizens through a purely rational approach, without an accompanying social norm exemplified by the parents, school, the media, and the community. Encouragingly, this support structure seems to be emerging at least in some parts of society, as shown by (1) the existence of a group of families with high levels of energy efficiency (Group A, Table 8.1); (2) all parents and teachers agreeing that children should learn how to save power, and that schools should, and indeed are expected, to provide energy education for citizenship; and (3) the apparent willingness of parents to listen to their children's suggestions on how to curtail electricity consumption. In addition, although the environmental rationale for saving energy is relatively recent, it complements the desire of the older generation to reduce waste and cost (Garabuau-Moussaoui, 2011a). Together, these indications imply that energy efficient practices, although still not extensively incorporated, are becoming part of the wider social norm of the country. This is particularly important, since, owing to the propagation of social norm at the meso-level (Reid *et al*., 2010), even children from families which lack a strong internal norm can potentially still be affected through the media, school, and their peers.

9.7 Agency

Although the social framework (or context) shapes individuals, it also provides them with the tools to change existing structures through their agency (Giddens, 1976). In order for this to occur, implicit or intersubjective everyday practices need to be made explicit, and challenged through a conscious and rational approach (Bourdieu, 1994; Hobson, 2003; Schutz and Luckmann, 1973). Effecting a change in social norm is a slow process, and, given its usual focus on adults, takes time to be passed on to the next generation. It could, however, potentially be accelerated by promoting children's energy literacy and agency directly, thus encouraging them to extend the existing (and implicit) social norm they adopt from their parents. This is a major challenge, since the present results suggest that children's agency is currently limited (Fig. 9.1, elements 11, 14, 15) or non-existent, as shown by their overall lack of intended behaviour (Fig. 9.1, element 16). The basic reasons for this are likely their limited knowledge on how to save power, preventing them from being innovative in this regard, a lack of care about the subject, and little or no self-efficacy, which "plays a central role in human agency" (Bandura, 1989, p.42).

Many of the children in this study do indeed think that their actions have a considerable positive impact, but only in terms of their financial benefits, and at an individual or family, rather than the collective, or social, level. Even when children are aware of the socio-environmental impacts of energy production and consumption, their lack of practical knowledge leads them to believe that they cannot improve the situation (see also DeWaters and Powers, 2008, 2011a; DeWaters *et al*., 2013; Kasapoğlu and Turan, 2008; Solopova, 2008; Zyadin *et al*., 2012). Finally, even if all of the prerequisites for intended behaviour were in place, there is no guarantee that they would be acted upon.

Despite this apparently discouraging situation, the results of this study provide some indications that children can indeed become agents for energy efficiency, if sufficiently guided. For instance, most of the children in this study reciprocate their parents' reminders or repeat them to their siblings (Fig. 9.1, elements 11, 14, 15), thus playing a role in keeping the energy saving practice alive in the family. In addition, one child shared an idea with his parents on how to save power after learning it at school, and several of the children started conversations about energy as a result of participating in this study. These observations corroborate previous research, which found that children can successfully promote energy conservation within their families (Garabuau-Moussaoui *et al*., 2009; Robinson *et al*., 2011; Zografakis *et al*., 2008) and incorporate new environmental practices through reverse

socialisation after learning about such topics at school (e.g. Ekström, 1995, 2007; Easterling *et al.,* 1995; Larsson *et al*., 2010; National Ethical Investment Week, 2008).

9.8 School to Home Transfer

Environmental education targeting specific practices is becoming more accepted and common in schools, especially by taking an action competence approach (Jensen and Schnack, 1997). Nevertheless, the transfer of knowledge, attitudes and behaviours from school to the home context was found to be very limited in this study (Fig. 9.1, elements 7, 8, 10, 14). However, schools have the potential to act as catalysts for energy efficient practices (Zografakis *et al*., 2008) and add a rational element to the socialisation of children into saving energy. Despite being able to affect both attitudes and social norms (Eagles and Demare, 1999; Ekström, 2010; Hogg and Vaughan, 2011; National Ethical Investment Week, 2008), neither the media (Solomon, 1992) nor the home context provides the structure needed to effectively develop true energy literacy, leaving school as the best candidate to facilitate its formation, and encourage agency.

Unfortunately, only one of the children in this study received energy education for citizenship at school, making it impossible to judge its effect on the children as a whole. However, if schools were to incorporate energy education with the aim of influencing social change, it would be important for them to foster critical thinking (DeWaters and Powers, 2011ab, 2013; Gambro and Switzky, 1996; Garabuau-Moussaoui, 2011b; Solomon, 1985), as well as the specific development of the children's agency by increasing their self-efficacy and empowering them to act (Bandura, 1989; DeWaters and Powers, 2011b; Jensen, 2002; Solomon 1992). In addition, potential issues such as the ethics of indoctrinating children (Darnton, 2008) and the danger of overwhelming them with problems (Garabuau-Moussaoui, 2011a) would need to be taken into account.

Finally, the household situation at the receiving end of children's agency must be carefully considered. All of the parents said they would listen to their children's suggestions, but several of them also expressed concerns about school contradicting household behaviours, or encouraging children to impose particular practices at home. One of the teachers even reported occasional resistance on the part of the parents regarding other environmental behaviours, corroborating similar findings by Garabuau-Moussaoui *et al.* (2009). Thus, it is important for teachers to acknowledge the existence of different family dynamics, so as to

provide a practical household component to energy education while at the same time avoiding the creation of domestic conflict. Arguably, schools should be able to encourage and facilitate children's agency and literacy without forcing the process, by providing a wide range of possibilities without imposing any particular one.

9.9 Overall Processes Guiding Energy Saving Behaviours

According to this research, and in line with the findings of previous studies (Garabuau-Moussaoui *et al*., 2009; Grønhøj, 2007), parents seem to be the main factor behind their children's energy-related attitudes and behaviours (Fig. 9.1, element 1). This result is not surprising, as the socialisation process of children in general tends to be guided by parents (e.g. Bandura, 1989; Cialdini and Goldstein, 2004; Ekström, 2010). Children's attitudes and behaviours are formed by two distinct, parallel processes: while conversations guide the former (Fig. 9.1, elements 1, 2, 3, 5, 7), indirect (e.g. modelling) and direct socialisation methods (e.g. rules, instructions, and reminders) combine to inspire the latter (Fig. 9.1, elements 1, 3, 11, 12, 14). Although the children's energy saving behaviours and attitudes are correlated, their behaviours are completely dependent on their parents, as shown by their lack of intention to engage in further energy saving practices (Fig. 9.1, elements 7, 14, 16). By contrast, the parents' attitudes and behaviours are not only related (Appendix 3), but associated with signs of intended behaviour (e.g. purchasing energy efficient equipment out of an interest to save electricity). This indicates that the parents have developed a more rational approach characterised by internal consistency between knowledge, attitudes and behaviours (DeWaters *et al.*, 2007; Kahneman, 2011), with attitudes guiding behaviour to a greater extent.

Because the children's attitudes are neither developing their intention to save power, nor have a clear effect on their actual electricity saving behaviours (Fig. 9.1, elements 7, 14 16), the correlation between the children's attitudes and behaviours is likely best explained by a combination of rule-driven energy saving practices and imitation of their parents, thus creating a positive attitude towards curtailing electricity use through cognitive dissonance, experience, self-perception, operant conditioning, or the inference of injunctive and descriptive norms from their parents' instructions and behaviours (section 2.3.3; Bandura, 1989; Baumeister and Bushman, 2013; Breckler *et al*., 2006; Fishbein and Ajzen, 1975; Wilson and Dowlatabadi, 2007). In addition, most parents with a strong attitude towards conserving energy also tend to engage in more energy saving behaviours, thus simultaneously

influencing their children's attitudes through conversations, and their behaviours through setting an example themselves, reinforced by rules and reminders. Nevertheless, the possibility that children's attitudes, especially when strongly held, may at least have a minor effect on their behaviour cannot be completely excluded, as any such relationship is likely obscured by the overwhelming influence of the parents. Based on a range of age groups, similar findings were reported by Garabuau-Moussaoui (2011a), who furthermore concluded that behaviours are formed early in life, before being rationalised and complemented with an appropriate attitude at a later stage. However, it was not possible to identify such differences in the current study, with ten-year-old children undergoing both processes at the same time.

Although knowledge may be important in terms of children's agency (section 9.7), this study provides no evidence for it having a direct effect on their attitudes or behaviours. Indeed, even those children who are well informed about at least some energy sources and their environmental impacts do not necessarily show an affective response, nor seem willing to reconsider their own energy consumption. However, it is important to differentiate between different types of knowledge, since knowing basic facts does seem to have an effect in particular situations:

1) Knowing that electricity has a financial cost is a strong reason for children to think that saving it is important (positive attitude).
2) For children with an environmental identity, awareness of the environmental impact of energy consumption is needed to develop a positive attitude towards reducing it.
3) Knowing what type of behaviours help to conserve electricity allow children to realise their own efforts to save power, and thus develop a sense of responsibility in this regard.

Previous studies using energy literacy as a starting point (DeWaters and Powers 2008, 2011a; DeWaters *et al*., 2013; Kasapoğlu and Turan, 2008; Zyadin *et al*., 2012) found children's positive attitudes towards conserving energy to exceed their behaviours, and concluded that the children's efforts are hindered mostly by a lack of knowledge on how to save power (DeWaters and Powers 2008, 2011a; DeWaters *et al*., 2013; Kasapoğlu and Turan, 2008; Zyadin *et al*., 2012). However, the absence of a clear relationship between attitudes and knowledge in this research allows for a different interpretation, namely that daily behaviours are not conscious or internally consistent (Kahneman, 2011), and are often performed habitually (Verplanken and Wood, 2006). Children in particular do not tend to learn behaviours consciously and voluntarily, but through conditioning (i.e. direct socialisation; Aronson *et al*., 1999) and modelling (Bandura, 1989), as was found in this thesis.

On the whole, the present results indicate the relationship between knowledge, attitudes and behaviour is weak or non-existent, yet also complex and non-linear – a finding widely acknowledged by previous research (e.g. Aune, 2007; Darnton, 2008, Davis, 1985; DeWaters and Powers, 2008; Dholakia *et al*., 1983; Gifford and Sussman, 2012; Grønhøj and Thøgersen, 2009; Hungerford and Volk, 1990; Larson *et al*., 2011; Lutzenhiser, 1992; Sudderth, 1984; Wilson and Dowlatabadi, 2007). Energy saving behaviours can be, and often are, formed without a conscious effort, relevant knowledge, or a particular will to save power, indicating that children can contribute to saving electricity even if they have low levels of involvement. Although unconscious behaviours can be manipulated (which is potentially unethical), they are more difficult to influence (Kahneman, 2011; Kollmuss and Agyeman, 2002), cannot become the subject of agency, and are more likely to be randomly abandoned (Kollmuss and Agyeman, 2002). For instance, although habits are relatively stable, they also depend on the context (Verplanken *et al*., 1997), which tends to change as children grow up and leave home. Without an underlying positive attitude and the will to carry them on, such habits run the risk of disappearing. Similarly, rules, reminders, and instructions are extrinsic motivations (Pelletier *et al*., 2011) dependent on the parents, and the behaviours they reinforce hence liable to reversal in the latter's absence, or when their influence begins to wane (e.g. teenagers' rebellious attitude) (Kochanska and Aksan, 1995). Arguably, the key to ensuring the stability of energy saving practices throughout life is therefore the internalisation of both the behaviours themselves and the (environmental) reasons behind them (Kochanska and Aksan, 1995). Ultimately, this might inspire the continuation of practices acquired during childhood, and allow the application of originally unconscious behaviours in a new, meaningful, and ideally altruistic context.

All of the previous points underpin the definition of energy literacy by DeWaters and Powers (2013), who argue that knowledge, attitudes, and an intention to act, are prerequisites to save energy consciously and voluntarily. None of the children of this study can be considered energy literate under this definition, since they have neither developed an intention to increase their energy saving efforts, nor always care about their energy consumption, or know how and why to save power. While none of the children in this study meet all of its preconditions, the present results do not necessarily exclude the potential for such a consistent and linear pathway. Nevertheless, they do suggest that energy literacy and its translation into behaviours may not occur naturally without guidance and reinforcement. Becoming energy literate relies on the interplay of consciousness, attitudes, and knowledge, and thus seems to be more complicated than acquiring a particular behaviour through modelling and conditioning. Ideally, rational (energy literacy) and unconscious (modelling and conditioning) strategies

should thus complement each other, with the engagement of children in energy conservation practices (for any reason) and energy conversations providing the opportunity and the context to create energy literacy in an integrated way (section 9.1).

Overall, Fig. 1.1, which served as a starting point for this research, is based on the definition of energy literacy (DeWaters *et al.,* 2007, 2013) and the theory of planned behaviour (Ajzen, 1991), both of which explain behaviour through linear and causal relationships. This is also the most traditional view of the mechanisms involved in environmental education (Hungerford and Volk, 1990). Some of the findings of this thesis can indeed be explained through Fig. 1.1. For instance, the children's agency seems to be very limited because children cannot be considered energy literate (owing to their very fragmentary knowledge and lack of intended behaviour), which is the first step guiding behaviour and, ultimately, agency. This pathway was therefore incorporated in the model arising from the present findings (Fig. 9.1 elements 7, 8, 16, 14).

According to the definition of energy literacy and the theory of planned behaviour, if children are not energy literate, they cannot develop conscious and voluntary energy saving behaviours. However, the children in this study did engage in energy conservation practices, sometimes voluntarily, and often being aware that such behaviours help to reduce electricity consumption. The existence and formation of these behaviours is explained in the model arising from this thesis (Fig. 9.1) through a variety of processes and relationships connecting the children's and parents' knowledge, attitudes, and behaviours in a complex network of relationships. In this sense, the model (Fig. 9.1) is more similar to the one introduced by Bandura (1989) for social cognitive theory. This is not surprising, since both models aim to explain learning processes for acquiring information, behaviours and attitudes in both a conscious and an unconscious manner. By contrast, more linear models of behaviour (e.g. Fig. 1.1, Hungerford and Volk, 1990) only encompass conscious, voluntary, and purposeful actions, which represent only a relatively small proportion of practices (Gram-Hanssen, 2013; Kahneman, 2011).

Research on everyday-life environmental behaviours (including energy saving practices) that are not performed consciously or purposefully is not very common (Rickinson, 2001; Wilson and Dowlatabadi, 2007). However, understanding both conscious and unconscious, and rational (i.e. internally consistent in terms of knowledge, attitudes and behaviours) and non-rational energy behaviour is important in developing strategies to create conscious and rational energy saving practices, which are more stable and easy to influence (Kahneman, 2011; Kollmuss and Agyeman, 2002). The model developed in this thesis (Fig. 9.1) reflects

the complexity of the relationships between attitudes, behaviour, and knowledge, and encourages their simultaneous development as a system (Stephenson *et al*., 2010a), rather than solely relying on directionality, causality, and single, linear pathways. However, it does not exclude the possibility that the latter might exist, or else be developed in the future, even though they are not presently in place.

Overall, the children's energy knowledge, attitudes, and behaviours are mostly dependent on those of their parents, who pass them on through communication, modelling, reminders and rules. However, the children's own behaviour, as well as the media and school, can sometimes also influence the children's energy attitudes (Fig. 9.1). Some of these processes have been identified in previous energy research (e.g. Garabuau-Moussaoui, 2011a, Grønhøj and Thøgersen, 2012, Solomon, 1992), but have not (1) been integrated with either each other or socialisation theory through empirical research; (2) targeted primary school children; or (3) been investigated using an interdisciplinary approach. Therefore, this thesis provides the first comprehensive model explaining the development of children's energy saving practices, and provides an original perspective of their energy behaviour through many parallel, interrelated, and not always linear, processes. Apart from the model, this thesis makes a methodological contribution by using photo elicitation methods and combining thematic and statistical exploratory analyses, creates a preliminary baseline for future comparisons, provides insights into the naive ideas children have about energy production and consumption, and is the first study on energy literacy in New Zealand. Thus, this research is at the forefront of a pioneering effort to develop the research area of children's socialisation into saving energy.

Chapter 10

Conclusions

This final chapter summarises the main findings of the study, and uses them to formulate a series of practical recommendations. In addition, this chapter outlines directions for possible future research, acknowledges the boundaries within which the present findings should be interpreted, and outlines the contributions of this study to the fields of child and energy research.

The thesis aimed to shed light on children's electricity use in the household context; their energy literacy; their socialisation into saving power; and their potential to act as agents for social and environmental change – with the ultimate goal of developing knowledge that can be used to increase their involvement in energy conservation. The wide range of data collection methods (photographs, drawings, children's focus groups, surveys with parents, and interviews with parents, children and teachers) employed in this research, as well as the use of mixed-method analyses integrating data from interviews and surveys, are both uncommon for a single study (Guest *et al*., 2012), and therefore constitute a methodological contribution.

Besides gathering data, the photo elicitation method, a relatively new and non-traditional technique (Corsaro, 2011), proved essential for recruiting participants by motivating their interest, and helped to guide the discussions with the children. The interviews and focus groups generated different, yet complementary information. In addition to those differences already discussed in the literature[1], the focus groups provided insights into the children's thinking processes, since they encouraged them to explain their ideas to each other. On the other hand, the individual interviews allowed a more detailed analysis of household practices from different perspectives, without the parents affecting their children's answers through their presence. Finally, employing different types of analyses not only increased the validity and reliability of this research through triangulations, but also generated complementary information, thereby enriching the results. Overall, the methods used in the thesis provided detailed, rich, and sophisticated information on the children's electricity use.

The children in this study use a wide range of electrical appliances, but usually only realise that they consume (and therefore can save) power when there are highly visible effects – e.g.

[1] E.g. focus groups making children feel more at ease and being more suitable for collecting a variety of experiences and perspectives than interviews (Curtin, 2001; Kennedy et al., 2001).

when using lights, the television, or computers, but not when having a hot shower. The majority of the children do not engage in many energy saving behaviours, and rarely try to conserve power consciously and voluntarily. Their socialisation into saving power is mediated by their level of control over electrical appliances, with greater freedom in this regard often leading to more knowledge on how to use energy wisely. In contrast, those children whose use of appliances is severely restricted (mainly for safety reasons or to avoid waste) often do not know how they might conserve energy, thus highlighting the importance of experiential learning.

The children's energy knowledge, attitudes and behaviours, although related, are formed by distinct, parallel, and ultimately interacting processes (Fig. 9.1). Overall, their knowledge about energy is limited, and based on opportunistically collected, disconnected pieces of information derived informally from parents, the media, and, to a lesser extent, school. In the absence of formal guidance, the children have to use their own logic to make sense of the fragmentary information available to them, which often leads to misinterpretations. Although the children are generally aware that using power costs money, and have a vague idea that it might run out, only about half of them could mention at least one (mostly renewable) energy source. Furthermore, only a third of the children know that producing and consuming electricity has an environmental impact, and very few of them understand why.

Except with regard to the financial cost of power, the children's level of knowledge does not determine their attitude towards energy efficiency. Instead, the latter is acquired mostly from talking to parents, with more communication on the topic leading to more strongly held views. While the children also acquire most of their energy saving behaviours from their parents, they do so through different pathways. In particular, setting a good example (which often leads to modelling), creating rules, integrating electricity saving behaviours into daily routines, and fostering a cooperative attitude within the family, all seem to be effective and harmonious ways for parents to convey energy saving practices to their offspring. By contrast, both nagging and parents behaving inconsistently often lead to frustration and conflict.

On the whole, the children have no apparent intention to increase their efforts to save power, likely owing to their frequently weak or non-existent attitudes towards conserving energy, and because they neither have enough practical knowledge on how to save electricity, nor understand that their energy consumption has broader implications. Taken together, these observations show that the children cannot be considered energy literate, and hence neither follow a rational approach to saving power, nor act as agents of social and environmental

change in this regard. However, the results of this study also confirm that children are capable of agency:

(a) Most of the children imitate their parents' reminders by reciprocating them, or by repeating them to siblings. Thus, although not adding to the family's practices as a whole, the children still actively maintain them.
(b) A few of the children have strong attitudes towards energy efficiency, knowledge of environmental and social aspects of energy production and consumption, ideas on how to save power to a further extent, and even an understanding that their energy consumption forms part of a collective process with a wider environmental impact. Although these characteristics are rare and there is not a single child displaying all of them together, their mere existence is proof that children are capable of acquiring them.
(c) At least one girl suggested a (new) environmental rationale to save power to her mother after learning about it at school, while one of the boys asked his family to unplug appliances at the wall. These are isolated cases, and neither of them was ultimately successful. Nevertheless, they show that children can use their agency to promote energy efficiency when guided by school.
(d) Many of the children have learnt a variety of behaviours at school (e.g. cooking, recycling, eating healthily, and reducing waste) and later applied them home. Their families are generally supportive of these practices, and in some cases have even adopted them themselves.
(e) Taking part in this study (especially taking pictures) sparked conversations about energy consumption in some of the families, and apparently affected the attitudes of some of the children. This shows that even a small trigger, which in this case was not even meant to be an educational tool, has the potential to raise family communication on the topic, which in turn could be seen as a first step towards agency.
(f) Some of the children proactively ask questions about energy-related topics, thus showing a degree of interest which could be exploited to develop their energy literacy and agency.

Thus, although energy literacy (relying on the consistent set of knowledge, attitudes and behaviours) may not come naturally to children, they still can still act as advocates for energy efficiency, if appropriately guided and informed.

The model arising from the present findings (Fig. 9.1) identifies and illustrates several parallel, interconnected, and not usually linear processes contributing to the development of the children's energy knowledge, attitudes, and behaviours. Although the model shows parents to be the main influence on children's socialisation into saving energy, many of them

are not acting in a very energy efficient manner themselves, and neither care about, nor try to convince their offspring of, the benefits of saving power. If the goal is to raise children to become energy efficient citizens in the future, or agents for change in the present, an alternative and complementary route aimed at developing the children's energy literacy, electricity saving behaviours, and agency directly would therefore be the best way forward. The next section will make some practical recommendations, based on the present model, on how this could be achieved.

10.1 Recommendations

The results of this study could help parents, educators, the media, product designers, and government campaigns to improve children's energy literacy, energy saving behaviours, and ultimately, their agency. This section presents a list of specific, albeit preliminary, recommendations, many of which (especially as regards schools and energy education) are consistent with and have been suggested by other studies focussing on different countries (see sections 2.4, 2.8, 2.9).

> The strong impact of dominating family norms identified in this study suggests that this group [children] might [...] effectively, be reached through their parents, and through making parents more aware of their role in fostering a sustainable development, both directly and as role models. Hence, campaigns directed at parents may emphasize that they do function as role models in this area (Grønhøj and Thøgersen, 2012, p. 300)

Parents could potentially be influenced thorough school campaigns and bulletins, as well as the media. In addition to stressing their importance as role models, it should be made clear that setting a consistent and visible example, introducing rules, including energy saving practices in a daily routine, and allowing children some control over appliances, are all effective ways of socialising their children into saving energy. Positive reinforcement of the children's efforts to save power currently seems to be uncommon, but could help to develop the children's self-efficacy and improve the consistency of energy saving behaviour. Parents might further benefit from knowing that talking about energy and developing a cooperative discourse may help to foster a positive attitude in their children, create an energy efficient social norm within the family, diminish conflict, and improve their children's practical knowledge and awareness of the socio-environmental impacts of energy production and consumption. Finally, parents could exploit their children's general curiosity to encourage their interest in energy, for example by visiting electricity generation sites.

The ‘formal education system’ includes government, schools, other educational institutions (e.g. the Enviroschools Foundation), and providers of learning material, all of which have the potential to reach large numbers of children. The most obvious and effective way for formal education to contribute to energy conservation would be to include energy education for citizenship in the New Zealand primary school curriculum, in addition to the provision of relevant teaching guidelines, supporting material, and training. Ideally, energy education for citizenship should be tailored to the New Zealand context, including topics such as insulation, the use of electric blankets, and the use of electricity for space and water heating.

Schools in particular could contribute by developing interdisciplinary and practical units, for example by involving children in reducing school energy consumption through a guided, rational approach including goals and measured outcomes, thus developing their self-efficacy through experiential learning and positive experiences. Similarly, they could organise field trips to electricity production sites, and to households with advanced energy efficient technology. Teachers could also motivate children to learn about energy themselves by suggesting it as a potential research topic for school projects, and by making available a variety of child-friendly, informal material related to energy (e.g. books, webpages, magazines, documentaries). However, in doing so it is important to remember that teachers also need to help the children integrate this informal information into structured knowledge.

Finally, schools could contribute to the creation of a social norm around energy efficiency by encouraging communication on the topic between the children, their peers, and their families. This could be achieved through projects and homework requiring interaction with parents, which might be especially important for boys, as they seem to communicate less with their family about school. In addition, parents could be involved via newsletters, meetings, and even casual conversations between themselves on matters relating to school. For instance, if parents were to discuss their children’s level of control over appliances, some of the more cautious among them might be convinced to allow their offspring somewhat more freedom.

The potential of the media to influence children’s energy literacy and behaviours to a further extent was not explored in this research. However, the media were found to have some impact on the children’s understanding of energy, and, in the future could thus aim to target children directly. This could be achieved by covering topics relating to energy production and consumption, as well as household electricity use, in cartoons, children’s magazines, story books, advertisements, family documentaries, and web pages, among others. Ideally, they should explicitly show the connection between energy production and household consumption, stress social and environmental consequences, and provide practical knowledge

on how to save power. In doing so, the media could contribute to the creation of an energy efficient social norm, strengthen the children's attitudes towards saving power, and increase their energy knowledge.

Overall, parents, school, and the media need not place any further emphasis on the already well-understood financial cost of power, and should instead focus on other, complementary types of knowledge. They can, for instance, provide clear information about electricity sources, the socio-environmental impacts of energy production and consumption, and energy security, and make sure to explain the connections between them. They can also help children understand the context of electricity production in New Zealand. For instance, children might find it reassuring to learn about the benefits of renewable sources and the extent to which the country relies on them, but also need to understand that some of the power they use is still being produced by coal and gas, and the consequences this implies. Parents, school and the media should also make an effort to expose children to specific terminology, such as "energy security", "energy efficiency", "renewable sources", and "fossil fuels". In addition, they should aim to explain to them how technology works, from electrical appliances all the way to power plants (in which children seem particularly interested), and encourage children to think critically about their own energy use and the consequences of constantly increasing the consumption of electrical devices. Furthermore, they can provide children with practical knowledge, ideally through experiential learning, on how to save power beyond turning off appliances, such as using efficient technology, limiting the temperature of heaters, line drying clothes, putting on warm clothes when cold, doing full batches of laundry, and rinsing dishes in cold water. For instance, some of the schools offer occasional cooking lessons, of which relevant energy efficient behaviours could form a part. Finally, parents, school, and the media could point out the benefits of those energy saving behaviours that children might already be engaging in despite being unaware of their implications (e.g. having short showers, closing curtains) in order to reinforce them and empower children to expand their efforts.

Children might, to a small extent, also learn about energy from a variety of other sources which were not being exploited by the participating families, and which often depend on technology that has not been well developed, or is not widely available. For example, children might be able to learn about energy, ironically, from video games or energy-based competitions, involving either the setting of personal goals or playing directly against others (e.g. Brewer *et al*., 2011; Caretosave, 2013; Geelen *et al*., 2010; Gronhoj and Thogersen, 2011; Gustafsson *et al*., 2010). However, most of this technology tends to focus on teenagers and young adults. Owing to the technological orientation of children, and the variety of

devices they use, there is scope for designers to develop household and communication technology encouraging children to be energy efficient. For instance, many of the children in this study use mobile phones, thus providing an opportunity to create applications that give children reminders, help them to set goals, and allow them to self-assess their behaviour (e.g. through checklists). Finally, given the children's widespread use of many electrical appliances, these could include child-friendly features advising on their proper use, such as visible reminders to "turn off" light switches, signs on heaters stating the recommended temperature, or automatic messages asking users to switch off and unplug computers when not in use for a long period of time.

10.2 Limitations of the Study

Like any research, this thesis has some limitations, and should be interpreted cautiously within its qualitative and exploratory framework, as well as its New Zealand context:

a) The present results must, to some degree, be subjective and based on interpretation, which is an inherent characteristic of qualitative and exploratory research, especially in the absence of blind or cross-coding (Guest *et al*., 2012). To make the research as robust as possible, the data were subjected to rigorous thematic analysis, a mixed-methods approach, and several triangulations (Table 3.1).
b) Interviews and focus groups can, and often do, elicit responses based on social desirability biases (Collins *et al*., 2005), some of which are noticeable thanks to the triangulations, and discussed in the results. To minimise this bias, all of the participants were told that there are no right or wrong answers, ensured of the confidentiality of the information they provided, and treated as collaborators. In addition, the interviewer was empathetic to the answers, avoided a judgmental tone, and made an effort to reduce power imbalances (e.g. by sitting on the floor with the children). However, social desirability cannot always be deciphered and particularly affects children, who are used to pleasing adults by providing the correct answer, especially in the school context (Collins *et al*., 2005; Punch, 2002).
c) Only one child had taken an energy unit for citizenship in school. Although this result is important in itself, it hinders the assessment of school to home transfer, as well as the potential role of schools in developing children's energy literacy and behaviours.
d) Practical and time constraints prevented the inclusion of more than one parent per family as a proxy for the influence of the latter on the child. However, couples may differ in their

attitudes or parenting styles, and all family members likely play a role in the children's socialisation into energy use.

e) Only one age group is included in this study, even though habits, behaviours, literacy, attitudes, and family dynamics change through life. The present results should thus not be interpreted as static or the final stage of the children's development in this regard.

f) Because of the depth of the analysis, its sample of families is not representative of either Dunedin or New Zealand, with the families and schools being chosen for their diversity instead. Thus, the results, although relevant for other populations, apply only to the studied group, and should not be extrapolated without further testing.

g) The topics, questions and methods were chosen and guided by the researcher, based on the examination of a wide range of existing literature. This is the first step in involving children in research through 'supportive listening'. Ideally, if the study were to be extended or continue, children themselves should be involved in making decisions about which topics and methodologies are to be included (Davis, 2010; Smith *et al.,* 2000).

10.3 Further research

As the first New Zealand-specific contribution to the emerging research area on children's energy consumption in everyday life, this study opens avenues for further research – in particular (1) quantitative follow-ups testing the present model (Fig. 9.1) based on a sample representative of the New Zealand population; and (2) the development and assessment of the recommendations presented above. In addition, owing to the exploratory nature of this thesis, there are many topics needing further investigation which arose from the literature review, as well as the results and the discussions. Thus future work might explore:

1) The influence of other variables on children's energy literacy, behaviours, and agency. For instance, the effects of children's age, personality, and gender.
2) The children's socialisation into the efficient use of mobile phones, cooking appliances, and heaters.
3) The role of emotion, motivation and involvement in children's energy saving behaviours, and their development through the life span. For instance, rational routes for developing energy literacy and electricity saving behaviours might increase during adolescence and adulthood, while emotional ones might prevail during childhood.

4) Through longitudinal studies, the amount of time needed for children to develop an energy saving habit from the moment they first perform a particular behaviour.
5) The effects of different parenting styles on children's socialisation into energy use, and the specific influence of different family members.
6) The immediate and long term effects of energy education for citizenship, for example by comparing schools which offer a dedicated unit on this topic with others that do not, or by analysing the effects of such units (taken during childhood) on teenagers and adults.
7) The effects of energy education on children's level of anxiety and guilt in regard to environmental issues and limiting their own consumption.
8) The processes facilitating the school to home transfer of various environmental behaviours (e.g. saving energy, recycling, conserving water), including the parents' acceptance and adoption of their children's suggestions, as well as the family negotiations involved.
9) The effect of the media on energy literacy and behaviours (e.g. through content and discourse analyses of energy-related messages).
10) Through longitudinal studies, the stability and development of energy literacy and behaviours acquired during childhood, for instance by following children as they become independent from the parents, and analysing the internalisation processes of energy saving rules and attitudes.
11) Inter-generational differences, for example by observing change across energy practices and attitudes of several generations of the same family.
12) Baselines against which to judge children's energy literacy and behaviours, by comparing different countries (including New Zealand), as well as rural vs. urban settings. This could be achieved using the energy literacy survey of DeWaters *et al*. (2013).
13) The relative contribution of children to household energy consumption, and the amount of electricity families might be able to save if children were involved in energy efficient practices.

In summary, this research adds to existing knowledge on energy and children by creating the first model explaining the development of children's energy saving behaviours. This model is grounded on empirical data, and includes rarely studied unconscious and non-rational approaches to developing environmental behaviours (Rickinson, 2001, Wilson and Dowlatabadi, 2007). The study offers an original and comprehensive interpretation of children's energy use based on the integration of concepts from social cognitive theory, energy literacy, education, social psychology and sociology. In addition, it provides insights into the energy consumption of primary school children, a group generally underrepresented in environmental and energy research (Boylan, 2008, Lawrenz and Dantchik, 1985,

Newborough *et al*., 1991, Rickinson, 2001), especially in the home context (section 2.2.1) This study also unveils the processes shaping children's energy knowledge, attitudes and behaviours, and demonstrates their naivity with regard to energy issues – which is important, since the kind of qualitative research able to make such assessments is uncommon in environmental education and energy literacy (Rickinson, 2001; Table 2.2). Finally, this thesis represents the first study into children's energy literacy and practices in New Zealand, creates a preliminary baseline for comparing children's energy saving behvaviours in the future and across cultures, makes a methodological contribution, and provides practical recommendations and ideas for further research. Therefore, the findings, model, and recommendations of this research make a contribution that can help to address energy issues now, and in the future.

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Appendices

Appendix 1

Electricity saving behaviours

Table 1.1 Self reported electricity saving behaviours from the children's interviews (S = voluntary behaviours to save electricity; H = habit)

	Lights off		TV off		
	Sometimes	Always	Sometimes	Always	At the wall
Alex		1		1 HS	
Malcolm	0.5 S			1 H	
Charlie		1 HS		1	
Mark		1S		1 S	
Alysa	0.5 S			1 S	
James		1		1	1
Molly		1 HS		1 H	
Amanda		1 HS		1 HS	
Tim		1 HS		1 HS	
Jessica	0.5 S				
Mary	0.5 S				
Tabatha			0.5		
Lisa		1			
Kelly	0.5			1 S	
Kaila		1 H		1 HS	
Andy	0.5			1	
Marion	0.5		0.5		
Tanya		1 HS		1S	
Alice		1 H		1 H	
Ron		1			
Karla	0.5 S		0.5 S		
Mike	0.5 S			1 S	
Grace		1 HS		1S	
Blake		1		1	
Amy		1 H		1 HS	
Paula		1 HS		1	

Table 1.1 (Continued)

	Computer off			Short showers	
	Sometimes	Always	At the wall	Medium (5-10min)	Short (5min)
Alex		1 HS	1		1
Malcolm		1			1
Charlie		1 H			1
Mark					1
Alysa		1			
James		1	1		1
Molly		1 H			1
Amanda		1 H			1
Tim	0.5				1 H
Jessica	0.5			0.5 H S	
Mary					
Tabatha	0.5				
Lisa	0.5				
Kelly					1
Kaila					
Andy					1
Marion					
Tanya					1 HS
Alice		1 HS			1 H
Ron				0.5	
Karla				0.5	
Mike		1 HS			1
Grace		1 HS	1 H	0.5	
Blake		1 H			
Amy			1 H		1
Paula		1 HS	1	0.5 S	

Table 1.1 (Continued)

	Heating					Other general appliances off[2]
	Off	'Low'	Clothing[1]	Close doors	Close curtains	
Alex		1	1		1	
Malcolm		1 S				1
Charlie	1 H	1	1	1 H	1 H	
Mark		1				
Alysa	1 S		1 H	1 HS	1	
James	1	1			1	
Molly	1 H	1		1	1	
Amanda	1 HS		1 H		1 H	
Tim	1	1	1 H		1	1
Jessica			1 HS		1 H	
Mary			1 HS	1 S	1	2
Tabatha			1		1	
Lisa					1	
Kelly					1 H	1
Kaila			1 H		1 H	1 S
Andy					1	1
Marion			1		1	
Tanya	1 H	1 H	1 H		1 H	1 S
Alice			1 H			
Ron					1 S	
Karla			1			1
Mike		1			1	
Grace	1 HS			1	1 H	1 HS
Blake					1	1
Amy						
Paula	1 S		1		1	

[1] Wearing extra clothing (or using a blanket) before turning up the heating.
[2] Such as stereos, key boards and electric blankets.

Table 1.1 (Continued)

	Other appliances off at the wall	Avoid dryers and do full loads of laundry	Turn off lights and TV for other people	Others[3]
Alex	1S			
Malcolm				
Charlie				
Mark				
Alysa				
James	1 HS			
Molly	1 S			
Amanda	1 H		1	1
Tim				
Jessica				1 S
Mary	1 HS			
Tabatha	1 H			
Lisa				
Kelly				1
Kaila	1 HS	1 H		1
Andy				
Marion				
Tanya				
Alice				
Ron	1			
Karla	1 HS			
Mike				
Grace	1 HS			1
Blake			1	
Amy			1	
Paula	1 S	1 H	1	1

[3] Use the oven to bake several things at the same time, rinse dishes in cold water, and close doors which have light sensors.

Table 1.1 (Continued)

	Total behaviours	Total S	Total H
Alex	9	3	5
Malcolm	5.5	1.5	1
Charlie	9	1	5
Mark	4	2	0
Alysa	6.5	3.5	2
James	10	1	1
Molly	9	2	5
Amanda	10	3	7
Tim	8.5	2	3
Jessica	4.5	3	3
Mary	6.5	3.5	2
Tabatha	4	0	1
Lisa	2.5	0	0
Kelly	4.5	1	1
Kaila	8	3	6
Andy	4.5	0	0
Marion	3	0	0
Tanya	8	4	7
Alice	5	1	4
Ron	3.5	1	0
Karla	4.5	2	1
Mike	5.5	2.5	1
Grace	10.5	6	7
Blake	6	0	1
Amy	5	1	4
Paula	10.5	4.5	3

Appendix 2

Variables for statistical analysis

Table 2.1 Matrix of the variables analysed with Mann-Whitney U exact test, Kruskal-Wallis test, and Chi square exact test (2-sided). The data was obtained from the interviews with parents and children and from the surveys from parents (C = Child, P = Parent, Beh = Behaviour, Pur = attitude toward energy efficient purchases, Att = Attitude, Val = Values, T = Talked about, Env = Environment, Mon = Money, Con = Level of depth and frequency of conversations and explanations, Med = Medium).

Child Name	**Electricity saving behaviours done by children**			
	Number of behaviours	Classification	Classification in two groups: High vs. Low and Medium	Classification in two groups: Low vs. Medium and High
Kelly	5.5	CBehMed	CBehLowMed	CBehMedHigh
Mary	6.5	CBehMed	CBehLowMed	CBehMedHigh
Paula	10.5	CBehHigh	CBehHigh	CBehMedHigh
Marion	3	CBehLow	CBehLowMed	CBehLow
Kaila	9	CBehHigh	CBehHigh	CBehMedHigh
Tabatha	4	CBehMed	CBehLowMed	CBehMedHigh
James	10	CBehHigh	CBehHigh	CBehMedHigh
Karla	4.5	CBehMed	CBehLowMed	CBehMedHigh
Alysa	6.5	CBehMed	CBehLowMed	CBehMedHigh
Charlie	9	CBehHigh	CBehHigh	CBehMedHigh
Mike	5.5	CBehMed	CBehLowMed	CBehMedHigh
Tim	8.5	CBehHigh	CBehHigh	CBehMedHigh
Amanda	10	CBehHigh	CBehHigh	CBehMedHigh
Lisa	2.5	CBehLow	CBehLowMed	CBehLow
Ron	3.5	CBehLow	CBehLowMed	CBehLow
Alice	5	CBehMed	CBehLowMed	CBehMedHigh
Andy	4.5	CBehMed	CBehLowMed	CBehMedHigh
Malcolm	5.5	CBehMed	CBehLowMed	CBehMedHigh
Mark	4	CBehMed	CBehLowMed	CBehMedHigh
Grace	10.5	CBehHigh	CBehHigh	CBehMedHigh
Blake	6	CBehMed	CBehLowMed	CBehMedHigh
Tanya	8	CBehHigh	CBehHigh	CBehMedHigh
Alex	9	CBehHigh	CBehHigh	CBehMedHigh
Molly	8	CBehHigh	CBehHigh	CBehMedHigh
Amy	5	CBehMed	CBehLowMed	CBehMedHigh
Jessica	4.5	CBehMed	CBehLowMed	CBehMedHigh

Table 2.1 (Continued)

Child Name	Electricity saving behaviours done by parents			
	Survey points	Classification	Classification in two groups: High vs. Low and Medium	Classification in two groups: Low vs. Medium and High
Kelly	41	PBehMed	PBehLowMed	PBehMedHigh
Mary	42	PBehMed	PBehLowMed	PBehMedHigh
Paula	53	PBehHigh	PBehHigh	PBehMedHigh
Marion	46	PBehHigh	PBehHigh	PBehMedHigh
Kaila	44	PBehHigh	PBehHigh	PBehMedHigh
Tabatha	43	PBehMed	PBehLowMed	PBehMedHigh
James	44	PBehMed	PBehLowMed	PBehMedHigh
Karla	45	PBehMed	PBehLowMed	PBehMedHigh
Alysa	43	PBehMed	PBehLowMed	PBehMedHigh
Charlie	47	PBehHigh	PBehHigh	PBehMedHigh
Mike	45	PBehMed	PBehLowMed	PBehMedHigh
Tim	43	PBehMed	PBehLowMed	PBehMedHigh
Amanda	42	PBehMed	PBehLowMed	PBehMedHigh
Lisa	42	PBehMed	PBehLowMed	PBehMedHigh
Ron	43	PBehMed	PBehLowMed	PBehMedHigh
Alice	43	PBehMed	PBehLowMed	PBehMedHigh
Andy	41	PBehMed	PBehLowMed	PBehMedHigh
Malcolm	44	PBehMed	PBehLowMed	PBehMedHigh
Mark	43	PBehMed	PBehLowMed	PBehMedHigh
Grace	50	PBehHigh	PBehHigh	PBehMedHigh
Blake	42	PBehMed	PBehLowMed	PBehMedHigh
Tanya	50	PBehHigh	PBehHigh	PBehMedHigh
Alex	39	PBehLow	PBehLowMed	PBehLow
Molly	40	PBehLow	PBehLowMed	PBehLow
Amy	40	PBehLow	PBehLowMed	PBehLow
Jessica	39	PBehLow	PBehLowMed	PBehLow

Table 2.1 (Continued)

Child Name	Parents' attitude towards energy efficient purchases			
	Survey points	Classification	Classification in two groups: High vs. Low and Medium	Classification in two groups: Low vs. Medium and High
Kelly	53	PPurMed	PPurLowMed	PPurMedHigh
Mary	51	PPurMed	PPurLowMed	PPurMedHigh
Paula	58	PPurMed	PPurLowMed	PPurMedHigh
Marion	46	PPurLow	PPurLowMed	PPurLow
Kaila	52	PPurMed	PPurLowMed	PPurMedHigh
Tabatha	55	PPurMed	PPurLowMed	PPurMedHigh
James	46	PPurLow	PPurLowMed	PPurLow
Karla	56	PPurMed	PPurLowMed	PPurMedHigh
Alysa	42	PPurLow	PPurLowMed	PPurLow
Charlie	65	PPurHigh	PPurHigh	PPurMedHigh
Mike	57	PPurMed	PPurLowMed	PPurMedHigh
Tim	66	PPurHigh	PPurHigh	PPurMedHigh
Amanda	60	PPurMed	PPurLowMed	PPurMedHigh
Lisa	63	PPurHigh	PPurHigh	PPurMedHigh
Ron	54	PPurMed	PPurLowMed	PPurMedHigh
Alice	58	PPurMed	PPurLowMed	PPurMedHigh
Andy	55	PPurMed	PPurLowMed	PPurMedHigh
Malcolm	50	PPurLow	PPurLowMed	PPurLow
Mark	57	PPurMed	PPurLowMed	PPurMedHigh
Grace	70	PPurHigh	PPurHigh	PPurMedHigh
Blake	51	PPurMed	PPurLowMed	PPurMedHigh
Tanya	67	PPurHigh	PPurHigh	PPurMedHigh
Alex	49	PPurLow	PPurLowMed	PPurLow
Molly	60	PPurMed	PPurLowMed	PPurMedHigh
Amy	61	PPurHigh	PPurHigh	PPurMedHigh
Jessica	62	PPurHigh	PPurHigh	PPurMedHigh

Table 2.1 (Continued)

Child Name	Parents' attitudes towards energy efficiency			Children's attitudes towards saving electricity	
	Survey points	Classification	Classification in two groups: High vs. Low and Medium	Classification	Classification in two groups: Strong vs. Weak and None
Kelly	29	PAttLow	PAttLowMed	CAttWeak	CAttWeakNone
Mary	32	PAttLow	PAttLowMed	CAttWeak	CAttWeakNone
Paula	40	PAttHigh	PAttHigh	CAttStrong	CAttStrong
Marion	36	PAttMed	PAttLowMed	CAttNone	CAttWeakNone
Kaila	37	PAttMed	PAttLowMed	CAttWeak	CAttWeakNone
Tabatha	32	PAttLow	PAttLowMed	CAttWeak	CAttWeakNone
James	35	PAttMed	PAttLowMed	CAttStrong	CAttStrong
Karla	28	PAttLow	PAttLowMed	CAttWeak	CAttWeakNone
Alysa	32	PAttLow	PAttLowMed	CAttWeak	CAttWeakNone
Charlie	39	PAttHigh	PAttHigh	CAttStrong	CAttStrong
Mike	33	PAttMed	PAttLowMed	CAttStrong	CAttStrong
Tim	35	PAttMed	PAttLowMed	CAttWeak	CAttWeakNone
Amanda	27	PAttLow	PAttLowMed	CAttWeak	CAttWeakNone
Lisa	42	PAttHigh	PAttHigh	CAttNone	CAttWeakNone
Ron	36	PAttMed	PAttLowMed	CAttWeak	CAttWeakNone
Alice	35	PAttMed	PAttLowMed	CAttStrong	CAttStrong
Andy	37	PAttMed	PAttLowMed	CAttWeak	CAttWeakNone
Malcolm	35	PAttMed	PAttLowMed	CAttNone	CAttWeakNone
Mark	31	PAttLow	PAttLowMed	CAttStrong	CAttStrong
Grace	44	PAttHigh	PAttHigh	CAttStrong	CAttStrong
Blake	32	PAttLow	PAttLowMed	CAttNone	CAttWeakNone
Tanya	41	PAttHigh	PAttHigh	CAttStrong	CAttStrong
Alex	37	PAttMed	PAttLowMed	CAttStrong	CAttStrong
Molly	37	PAttMed	PAttLowMed	CAttWeak	CAttWeakNone
Amy	43	PAttHigh	PAttHigh	CAttWeak	CAttWeakNone
Jessica	31	PAttLow	PAttLowMed	CAttStrong	CAttStrong

Table 2.1 (Continued)

Child Name	Parents' environmental values			
	Survey points	Classification	Classification in two groups: High vs. Low and Medium	Classification in two groups: Low vs. Medium and High
Kelly	26	PValLow	PValLowMed	PValLow
Mary	26	PValLow	PValLowMed	PValLow
Paula	32	PValMed	PValLowMed	PValMedHigh
Marion	34	PValMed	PValLowMed	PValMedHigh
Kaila	30	PValMed	PValLowMed	PValMedHigh
Tabatha	30	PValMed	PValLowMed	PValMedHigh
James	32	PValMed	PValLowMed	PValMedHigh
Karla	27	PValLow	PValLowMed	PValLow
Alysa	32	PValMed	PValLowMed	PValMedHigh
Charlie	36	PValHigh	PValHigh	PValMedHigh
Mike	30	PValMed	PValLowMed	PValMedHigh
Tim	25	PValLow	PValLowMed	PValLow
Amanda	33	PValMed	PValLowMed	PValMedHigh
Lisa	35	PValHigh	PValHigh	PValMedHigh
Ron	30	PValMed	PValLowMed	PValMedHigh
Alice	31	PValMed	PValLowMed	PValMedHigh
Andy	27	PValLow	PValLowMed	PValLow
Malcolm	28	PValLow	PValLowMed	PValLow
Mark	31	PValMed	PValLowMed	PValMedHigh
Grace	36	PValHigh	PValHigh	PValMedHigh
Blake	28	PValLow	PValLowMed	PValLow
Tanya	38	PValHigh	PValHigh	PValMedHigh
Alex	33	PValMed	PValLowMed	PValMedHigh
Molly	32	PValMed	PValLowMed	PValMedHigh
Amy	29	PValLow	PValLowMed	PValLow
Jessica	29	PValLow	PValLowMed	PValLow

Table 2.1 (Continued)

Child Name	Child talked about the environment in relation to electricity use	Parents talked about the environment in relation to electricity use			
	Yes (1) or No (1)	Times mentioned	Classification	Classification in two groups: High vs. Low and Medium	Classification in two groups: Low vs. Medium and High
Kelly	0	0	PTEnvLow	PTEnvLowMed	PTEnvLow
Mary	1	0	PTEnvLow	PTEnvLowMed	PTEnvLow
Paula	0	1	PTEnvMed	PTEnvLowMed	PTEnvMedHigh
Marion	0	1	PTEnvMed	PTEnvLowMed	PTEnvMedHigh
Kaila	0	0	PTEnvLow	PTEnvLowMed	PTEnvLow
Tabatha	1	0	PTEnvLow	PTEnvLowMed	PTEnvLow
James	1	3	PTEnvHigh	PTEnvHigh	PTEnvMedHigh
Karla	0	0	PTEnvLow	PTEnvLowMed	PTEnvLow
Alyssa	0	0	PTEnvLow	PTEnvLowMed	PTEnvLow
Charlie	0	1	PTEnvMed	PTEnvLowMed	PTEnvLow
Mike	1	1	PTEnvMed	PTEnvLowMed	PTEnvMedHigh
Tim	0	1	PTEnvMed	PTEnvLowMed	PTEnvMedHigh
Amanda	0	1	PTEnvMed	PTEnvLowMed	PTEnvMedHigh
Lisa	0	2	PTEnvMed	PTEnvLowMed	PTEnvMedHigh
Ron	0	2	PTEnvMed	PTEnvLowMed	PTEnvMedHigh
Alice	1	5	PTEnvHigh	PTEnvHigh	PTEnvMedHigh
Andy	0	0	PTEnvLow	PTEnvLowMed	PTEnvLow
Malcolm	0	0	PTEnvLow	PTEnvLowMed	PTEnvLow
Mark	0	1	PTEnvMed	PTEnvLowMed	PTEnvMedHigh
Grace	1	5	PTEnvHigh	PTEnvHigh	PTEnvMedHigh
Blake	0	2	PTEnvMed	PTEnvLowMed	PTEnvMedHigh
Tanya	1	5	PTEnvHigh	PTEnvHigh	PTEnvMedHigh
Alex	0	0	PTEnvLow	PTEnvLowMed	PTEnvLow
Molly	0	0	PTEnvLow	PTEnvLowMed	PTEnvLow
Amy	0	0	PTEnvLow	PTEnvLowMed	PTEnvLow
Jessica	1	1	PTEnvMed	PTEnvLowMed	PTEnvLow

Table 2.1 (Continued)

Child Name	**Children talked about money**			
	Times mentioned	Yes (1) or No (0)	Classification	Classification in two groups: Low vs. Medium and High
Kelly	1	1	CTMonMed	CTMonMedHigh
Mary	1	1	CTMonMed	CTMonMedHigh
Paula	1	1	CTMonMed	CTMonMedHigh
Marion	0	0	CTMonLow	CTMonLow
Kaila	1	1	CTMonMed	CTMonMedHigh
Tabatha	4	1	CTMonHigh	CTMonMedHigh
James	3	1	CTMonHigh	CTMonMedHigh
Karla	1	1	CTMonMed	CTMonMedHigh
Alysa	3	1	CTMonHigh	CTMonMedHigh
Charlie	3	1	CTMonHigh	CTMonMedHigh
Mike	2	1	CTMonMed	CTMonMedHigh
Tim	2	1	CTMonMed	CTMonMedHigh
Amanda	3	1	CTMonHigh	CTMonMedHigh
Lisa	2	1	CTMonMed	CTMonMedHigh
Ron	3	1	CTMonHigh	CTMonMedHigh
Alice	0	0	CTMonLow	CTMonLow
Andy	0	0	CTMonLow	CTMonLow
Malcolm	3	1	CTMonHigh	CTMonMedHigh
Mark	4	1	CTMonHigh	CTMonMedHigh
Grace	1	1	CTMonMed	CTMonMedHigh
Blake	1	1	CTMonMed	CTMonMedHigh
Tanya	3	1	CTMonHigh	CTMonMedHigh
Alex	2	1	CTMonMed	CTMonMedHigh
Molly	1	1	CTMonMed	CTMonMedHigh
Amy	1	1	CTMonMed	CTMonMedHigh
Jessica	0	0	CTMonLow	CTMonLow

Table 2.1 (Continued)

Child Name	Parents talked about money				Talked about help	
	Times mentioned	Classification	Classification in two groups: High vs. Low and Medium	Classification in two groups: Low vs. Medium and High	Children Yes (1) or No (0)	Parents Yes (1) or No (0)
Kelly	2	PTMonMed	PTMonLowMed	PTMonMedHigh	0	0
Mary	2	PTMonMed	PTMonLowMed	PTMonMedHigh	0	0
Paula	2	PTMonMed	PTMonLowMed	PTMonMedHigh	1	1
Marion	3	PTMonHigh	PTMonHigh	PTMonMedHigh	1	0
Kaila	4	PTMonHigh	PTMonHigh	PTMonMedHigh	0	0
Tabatha	3	PTMonHigh	PTMonHigh	PTMonMedHigh	0	0
James	3	PTMonHigh	PTMonHigh	PTMonMedHigh	0	0
Karla	4	PTMonHigh	PTMonHigh	PTMonMedHigh	0	0
Alysa	6	PTMonHigh	PTMonHigh	PTMonMedHigh	0	1
Charlie	1	PTMonMed	PTMonLowMed	PTMonMedHigh	1	1
Mike	0	PTMonLow	PTMonLowMed	PTMonLow	1	1
Tim	4	PTMonHigh	PTMonHigh	PTMonMedHigh	0	0
Amanda	3	PTMonHigh	PTMonHigh	PTMonMedHigh	0	0
Lisa	4	PTMonHigh	PTMonHigh	PTMonMedHigh	0	0
Ron	3	PTMonHigh	PTMonHigh	PTMonMedHigh	0	0
Alice	1	PTMonMed	PTMonLowMed	PTMonMedHigh	0	0
Andy	0	PTMonLow	PTMonLowMed	PTMonLow	0	0
Malcolm	1	PTMonMed	PTMonLowMed	PTMonMedHigh	0	0
Mark	4	PTMonHigh	PTMonHigh	PTMonMedHigh	0	0
Grace	2	PTMonMed	PTMonLowMed	PTMonMedHigh	0	0
Blake	4	PTMonHigh	PTMonHigh	PTMonMedHigh	0	0
Tanya	2	PTMonMed	PTMonLowMed	PTMonMedHigh	1	0
Alex	1	PTMonMed	PTMonLowMed	PTMonMedHigh	1	0
Molly	3	PTMonHigh	PTMonHigh	PTMonMedHigh	0	0
Amy	2	PTMonMed	PTMonLowMed	PTMonMedHigh	0	0
Jessica	5	PTMonHigh	PTMonHigh	PTMonMedHigh	1	0

Table 2.1 (Continued)

Child Name	Children mentioned at least one energy source. Yes (1) or No (0)	Children said they are trying to save electricity. Yes (1) or No (0)	At least one rule present in the family. Yes (1) or No (0)	Children who have no control over appliances (1)
Kelly	0	1	0	0
Mary	1	1	0	0
Paula	0	1	1	0
Marion	0	0	0	1
Kaila	0	1	1	0
Tabatha	1	1	0	0
James	1	1	1	0
Karla	0	1	0	1
Alysa	1	1	0	0
Charlie	0	1	1	0
Mike	1	1	1	0
Tim	0	1	1	0
Amanda	0	1	1	0
Lisa	0	0	0	1
Ron	1	1	0	0
Alice	1	1	0	0
Andy	1	1	0	0
Malcolm	1	0	0	1
Mark	1	0	1	0
Grace	1	1	0	0
Blake	1	0	0	0
Tanya	1	1	0	0
Alex	0	1	1	0
Molly	1	1	1	0
Amy	0	1	0	1
Jessica	1	1	0	0

Table 2.1 (Continued)

Child Name	Talked about safety		Households with no heat pump (1)	Overall agreement between parents and children		
	Children Yes (1) or No (0)	Parents Yes (1) or No (0)		Classification	Classification in two groups: High vs. Low and Medium	Classification in two groups: Low vs. Medium and High
Kelly	1	0	1	AgreeLow	AgreeLowMed	AgreeLow
Mary	0	1	1	AgreeMed	AgreeLowMed	AgreeMedHigh
Paula	1	1	0	AgreeMed	AgreeLowMed	AgreeMedHigh
Marion	1	0	0	AgreeMed	AgreeLowMed	AgreeMedHigh
Kaila	1	1	1	AgreeHigh	AgreeHigh	AgreeMedHigh
Tabatha	0	1	1	AgreeHigh	AgreeHigh	AgreeMedHigh
James	0	0	0	AgreeMed	AgreeLowMed	AgreeMedHigh
Karla	0	1	0	AgreeMed	AgreeLowMed	AgreeMedHigh
Alyssa	1	1	0	AgreeMed	AgreeLowMed	AgreeMedHigh
Charlie	0	0	0	AgreeHigh	AgreeHigh	AgreeMedHigh
Mike	1	1	1	AgreeMed	AgreeLowMed	AgreeMedHigh
Tim	0	0	0	AgreeMed	AgreeLowMed	AgreeMedHigh
Amanda	1	1	0	AgreeHigh	AgreeHigh	AgreeMedHigh
Lisa	1	0	1	AgreeMed	AgreeLowMed	AgreeMedHigh
Ron	1	0	0	AgreeHigh	AgreeHigh	AgreeMedHigh
Alice	0	0	1	AgreeHigh	AgreeHigh	AgreeMedHigh
Andy	1	1	0	AgreeLow	AgreeLowMed	AgreeLow
Malcolm	0	0	0	AgreeLow	AgreeLowMed	AgreeLow
Mark	0	0	0	AgreeMed	AgreeLowMed	AgreeMedHigh
Grace	0	0	1	AgreeHigh	AgreeHigh	AgreeMedHigh
Blake	0	1	1	AgreeHigh	AgreeHigh	AgreeMedHigh
Tanya	0	0	0	AgreeHigh	AgreeHigh	AgreeMedHigh
Alex	1	1	0	AgreeMed	AgreeLowMed	AgreeMedHigh
Molly	1	0	0	AgreeLow	AgreeLowMed	AgreeLow
Amy	1	0	0	AgreeMed	AgreeLowMed	AgreeMedHigh
Jessica	1	0	0	AgreeMed	AgreeLowMed	AgreeMedHigh

Table 2.1 (Continued)

Child Name	**Level of Conversations and Explanations**		**Household income**		Attending an enviroschool (1)
	Classification	Classification in two groups: High vs. Low and Medium	Classification	Classification in two groups: Medium vs. Low and High	
Kelly	ConLow	ConLowMed	IncLow	IncLowHi	0
Mary	ConLow	ConLowMed	IncLow	IncLowHi	0
Paula	ConHigh	ConHigh	IncLow	IncLowHi	1
Marion	ConLow	ConLowMed	IncLow	IncLowHi	0
Kaila	ConHigh	ConHigh	IncLow	IncLowHi	0
Tabatha	ConMed	ConLowMed	IncLow	IncLowHi	0
James	ConHigh	ConHigh	IncLow	IncLowHi	0
Karla	ConLow	ConLowMed	IncLow	IncLowHi	1
Alysa	ConMed	ConLowMed	IncMed	IncMed	0
Charlie	ConHigh	ConHigh	IncMed	IncMed	0
Mike	ConLow	ConLowMed	IncMed	IncMed	1
Tim	ConLow	ConLowMed	IncMed	IncMed	0
Amanda	ConMed	ConLowMed	IncMed	IncMed	0
Lisa	ConLow	ConLowMed	IncMed	IncMed	0
Ron	ConLow	ConLowMed	IncMed	IncMed	1
Alice	ConHigh	ConHigh	IncHigh	IncLowHi	1
Andy	ConLow	ConLowMed	IncHigh	IncLowHi	0
Malcolm	ConLow	ConLowMed	IncHigh	IncLowHi	0
Mark	ConHigh	ConHigh	IncHigh	IncLowHi	0
Grace	ConHigh	ConHigh	IncHigh	IncLowHi	1
Blake	ConLow	ConLowMed	IncHigh	IncLowHi	1
Tanya	ConLow	ConLowMed	IncHigh	IncLowHi	1
Alex	ConLow	ConLowMed	IncHigh	IncLowHi	0
Molly	ConLow	ConLowMed	IncHigh	IncLowHi	0
Amy	ConLow	ConLowMed	IncHigh	IncLowHi	1
Jessica	ConMed	ConLowMed	IncHigh	IncLowHi	0

Appendix 3

Statistical significant analysis

Table 3.1 All the significant p values (considered as p<0.04) obtained from running a Mann-Whitney U exact test, Kruskal-Wallis test, and Chi square exact test (2-sided) comparing all the possible variables from Appendix X. The most appropriate test is identified with **bold** numbers (NS = Not Significant). The variables in *italics* were obtained from the survey points or are the children's number of electricity saving behaviours.

		P values				
		Exact Chi Square		**Kruskal-Wallis**		**Mann-Whitney U exact test**
Variable A	**Variable B**	Three groups (Low, medium, high)	Classification in two groups (High or Low vs. the rest)*	Variable A in three groups. Variable B in survey points.	Variable A in survey points. Variable B in three groups.	One variable has only two possible groups
Parents' values	*Parents' attitudes*	0.001	0.001	**0.013**	0.023	
Parents' values	*Parents' behaviours*	NS	0.01	NS	**0.017**	
Parents' values	*Children's behaviours*	0.028	NS	NS	**0.006**	
Parents' values	Children talk about help	NS	NS			**0.035**
Parents' values	*Efficient purchases*	0.002	0.002	**0.009**	NS	
Parents' attitudes	*Efficient purchases*	0.003	0.002	**0.007**	0.043	
Parents' attitudes	*Parents' behaviours*	0.027	0.013	NS	**0.006**	
Parents' attitudes	*Children's behaviours*	NS	NS	NS	**0.023**	
Parents' behaviours	Children talk about help	**0.008**	0.028			NS
Parents' behaviours	*Children's behaviours*	0.039	0.018	NS	NS	
Children's behaviours	Children try to save electricity	0.026	NS			**0.026**
Children's behaviours	Children's attitudes	**0.036**	NS		NS	
Children's behaviours	Rules in the family	0.001	0.001			**0.003**

Table 3.1 (Continued)

		P values				
		Exact Chi Square		**Kruskal-Wallis**		**Mann-Whitney U exact test**
Variable A	**Variable B**	Three groups (Low, medium, high)	Classification in two groups (High or Low vs. the rest)*	Variable A in three groups. Variable B in survey points.	Variable A in survey points. Variable B in three groups.	One variable has only two possible groups
Children's behaviours	Children have no control	0.026	NS			**0.015**
Children's attitudes	Children have no control	**0.007**	NS			
Children try to save electricity	Children have no control		**0.034****			
Children talk about help	Children's attitude	**0.006**	0.005			
Parents talk about help	*Parents' behaviours*	NS	NS			**0.039**
Children's attitudes	Parents talk about the environment	**0.019**	0.019			
Children talk about the environment	Parents talk about the environment	**0.005**	NS			
Agreement	Parents talk about the environment	**0.038**	NS			
Children talk about environment	Children mention energy sources		**0.007****			
Conversation level	*Parents' attitudes*	**0.027**	NS	0.044		
Conversation level	*Parents' behaviours*	NS	**0.032**	0.041		
Children's attitudes	Conversation level	**0.022**	0.009			

* Two groups (out of low, medium, and high) were collapsed based on the patterns observed in the cross tabulations for the three original groups. Thus, sometimes both variables are turned into two groups (i.e. cross tabulation of 2x2) and sometimes only one variable is turned into two groups (cross tabulation of 2x3).

** There was no need to collapse groups because in these particular cases there are only two possible groups (Yes or No) for each variable.

Appendix 4

Correspondence analysis data: Parents' and children's level of engagement in electricity saving behaviours

Data for the correspondence analysis presented in Fig. 5.1

Table 4.1 Contingency table for parent's (P) and children's (C) level of engagement in electricity saving behaviours (Beh) (Med = Medium).

PBeh	CBeh			
	CBehLow	CBehMed	CBehHigh	Active Margin
PBehLow	0	2	2	4
PBehMed	2	11	3	16
PBehHigh	1	0	5	6
Active Margin	3	13	10	26

Table 4.2 Summary of the correspondence analysis for parent's and children's level of engagement in electricity saving behaviours.

Dimension	Singular Value	Inertia	Chi Square	Sig.	Proportion of Inertia		Confidence Singular Value	
					Accounted for	Cumulative	Standard Deviation	Correlation 2
1	.588	.345			.932	.932	.124	-.358
2	.158	.025			.068	1.000	.064	
Total		.370	9.632	.047[a]	1.000	1.000		

a. 4 degrees of freedom

Table 4.3 Overview of the row points of the correspondence analysis for parent's (P) and children's level of engagement in electricity saving behaviours (Beh) (Med = Medium).

PBeh	Mass	Score in Dimension		Inertia	Contribution				
					Of Point to Inertia of Dimension		Of Dimension to Inertia of Point		
		1	2		1	2	1	2	Total
PBehLow	.154	.150	.930	.023	.006	.840	.088	.912	1.000
PBehMed	.615	-.536	-.147	.106	.301	.084	.980	.020	1.000
PBehHigh	.231	1.329	-.228	.241	.694	.076	.992	.008	1.000
Active Total	1.000			.370	1.000	1.000			

Table 4.4 Overview of the column points of the correspondence analysis for parent's children's (C) level of engagement in electricity saving behaviours (Beh) (Med = Medium).

CBeh	Mass	Score in Dimension		Inertia	Contribution				
					Of Point to Inertia of Dimension		Of Dimension to Inertia of Point		
		1	2		1	2	1	2	Total
CBehLow	.115	.146	-1.099	.024	.004	.880	.062	.938	1.000
CBehMed	.500	-.732	.118	.159	.456	.044	.993	.007	1.000
CBehHigh	.385	.908	.177	.188	.540	.076	.990	.010	1.000
Active Total	1.000			.370	1.000	1.000			

Appendix 5

Correspondence analysis data: Parents' attitudes and level of energy communication

Data for the correspondence analysis presented in Fig. 5.2.

Table 5.1 Contingency table for parent's attitudes on energy efficiency (PAtt) and the level of depth and frequency of conversations about energy between the parents and their children (Com). (Med = Medium).

Communication Style	PAtt			
	PAttLow	PAttMed	PAttHigh	Active Margin
ComLow	4	8	3	15
ComMed	4	0	0	4
ComHigh	1	3	3	7
Active Margin	9	11	6	26

Table 5.2 Summary of the correspondence analysis for parent's attitudes on energy efficiency and the level of depth and frequency of conversations about energy between the parents and their children.

Dimension	Singular Value	Inertia	Chi Square	Sig.	Proportion of Inertia		Confidence Singular Value	
					Accounted for	Cumulative	Standard Deviation	Correlation 2
1	.598	.358			.899	.899	.128	.075
2	.201	.040			.101	1.000	.214	
Total		.398	10.345	.035[a]	1.000	1.000		

a. 4 degrees of freedom

Table 5.3 Overview of the row points of the correspondence analysis for parent's attitudes on energy efficiency and the level of depth and frequency of conversations about energy between the parents and their children (Com). (Med = Medium).

Communication Style	Mass	Score in Dimension		Inertia	Contribution				
					Of Point to Inertia of Dimension		Of Dimension to Inertia of Point		
		1	2		1	2	1	2	Total
ComLow	.577	-.201	-.366	.029	.039	.384	.474	.526	1.000
ComMed	.154	1.773	.222	.291	.809	.038	.995	.005	1.000
ComHigh	.269	-.582	.657	.078	.152	.578	.700	.300	1.000
Active Total	1.000			.398	1.000	1.000			

Table 5.4 Overview of the column points of the correspondence analysis for parent's attitudes on energy efficiency (PAtt) and the level of depth and frequency of conversations about energy between the parents and their children (Med = Medium).

PAtt	Mass	Score in Dimension		Inertia	Contribution				
					Of Point to Inertia of Dimension		Of Dimension to Inertia of Point		
		1	2		1	2	1	2	Total
PAttLow	.346	1.060	.045	.233	.650	.003	.999	.001	1.000
PAttMed	.423	-.510	-.432	.082	.184	.393	.806	.194	1.000
PAttHigh	.231	-.655	.725	.084	.165	.604	.708	.292	1.000
Active Total	1.000			.398	1.000	1.000			

Appendix 6

Correspondence analysis data: Children's attitudes and parents' environmental communication

Data for the correspondence analysis presented in Fig. 6.4

Table 6.1 Contingency table for children's attitudes towards saving electricity (CAtt) and the number of times their parents talked about the environment during the interview (PTEnv). (Med = Medium)

CAtt	PTEnv			
	PTEnvLow	PTEnvMed	PTEnvHigh	Active Margin
CAttNone	1	3	0	4
CAttWeak	9	3	0	12
CAttStrong	3	3	4	10
Active Margin	13	9	4	26

Table 6.2 Summary of the correspondence analysis for the children's attitudes towards saving electricity and the number of times their parents talked about the environment during the interview.

Dimension	Singular Value	Inertia	Chi Square	Sig.	Proportion of Inertia		Confidence Singular Value	
					Accounted for	Cumulative	Standard Deviation	Correlation 2
1	.555	.308			.698	.698	.127	.124
2	.365	.133			.302	1.000	.190	
Total		.441	11.467	.022[a]	1.000	1.000		

a. 4 degrees of freedom

Table 6.3 Overview of the row points of the correspondence analysis for children's attitudes towards saving electricity (CAtt) and the number of times their parents talked about the environment during the interview.

CAtt	Mass	Score in Dimension		Inertia	Contribution				
					Of Point to Inertia of Dimension		Of Dimension to Inertia of Point		
		1	2		1	2	1	2	Total
CAttNone	.154	.230	-1.405	.115	.015	.831	.039	.961	1.000
CAttWeak	.462	.691	.334	.141	.397	.141	.866	.134	1.000
CAttStrong	.385	-.921	.161	.185	.588	.027	.980	.020	1.000
Active Total	1.000			.441	1.000	1.000			

Table 6.4 Overview of the column points of the of the correspondence analysis for children's attitudes towards saving electricity and the number of times their parents talked about the environment during the interview (Med = Medium).

PTEnv	Mass	Score in Dimension		Inertia	Contribution				
					Of Point to Inertia of Dimension		Of Dimension to Inertia of Point		
		1	2		1	2	1	2	Total
PTEnvLow	.500	.511	.440	.108	.235	.265	.672	.328	1.000
PTEnvMed	.346	.000	-.830	.087	.000	.654	.000	1.000	1.000
PTEnvHigh	.154	-1.660	.440	.246	.765	.081	.956	.044	1.000
Active Total	1.000			.441	1.000	1.000			

Appendix 7

Correspondence analysis data: Children's attitudes and level of energy communication

Data for the correspondence analysis presented in Fig. 6.5

Table 7.1 Contingency table for the children's attitudes (CAtt) towards saving electricity and the level of depth and frequency of conversations about energy between the parents and their children (Com) (Med = Medium).

CAtt	ComStyle			
	ComLow	ComMed	ComHigh	Active Margin
CAttNone	4	0	0	4
CAttWeak	8	3	1	12
CAttStrong	3	1	6	10
Active Margin	15	4	7	26

Table 7.2 Summary of the correspondence analysis for the children's attitudes towards saving electricity and the level of depth and frequency of conversations about energy between the parents and their children.

Dimension	Singular Value	Inertia	Chi Square	Sig.	Proportion of Inertia		Confidence Singular Value	
					Accounted for	Cumulative	Standard Deviation	Correlation 2
1	.597	.357			.847	.847	.150	.107
2	.254	.064			.153	1.000	.118	
Total		.421	10.944	.027[a]	1.000	1.000		

a. 4 degrees of freedom

Table 7.3 Overview of the row points of the children's attitudes (CAtt) towards saving electricity and the level of depth and frequency of conversations about energy between the parents and their children.

CAtt	Mass	Score in Dimension		Inertia	Contribution				
					Of Point to Inertia of Dimension		Of Dimension to Inertia of Point		
		1	2		1	2	1	2	Total
CAttNone	.154	-.881	-1.032	.113	.200	.646	.631	.369	1.000
CAttWeak	.462	-.510	.431	.093	.201	.337	.768	.232	1.000
CAttStrong	.385	.964	-.104	.215	.599	.016	.995	.005	1.000
Active Total	1.000			.421	1.000	1.000			

Table 7.4 Overview of the column points of the children's attitudes (CAtt) towards saving electricity and the level of depth and frequency of conversations about energy between the parents and their children (Com) (Med = Medium).

ComStyle	Mass	Score in Dimension		Inertia	Contribution				
					Of Point to Inertia of Dimension		Of Dimension to Inertia of Point		
		1	2		1	2	1	2	Total
ComLow	.577	-.526	-.262	.105	.267	.156	.905	.095	1.000
ComMed	.154	-.237	1.171	.059	.014	.832	.088	.912	1.000
ComHigh	.269	1.262	-.108	.257	.718	.012	.997	.003	1.000
Active Total	1.000			.421	1.000	1.000			

Appendix 8

Correspondence analysis data: Children's attitudes behaviours

Data for the correspondence analysis presented in Fig. 6.6

Table 8.1 Contingency table for the children's attitudes (CAtt) towards saving electricity and the number electricity saving behaviours they perform (CBeh) (Med = Medium).

CAtt	CBeh			
	CBehLow	CBehMed	CBehHigh	Active Margin
CAttNone	2	2	0	4
CAttWeak	1	7	4	12
CAttStrong	0	4	6	10
Active Margin	3	13	10	26

Table 8.2 Summary of the correspondence analysis for the children's attitudes towards saving electricity and the number electricity saving behaviours they perform.

Dimension	Singular Value	Inertia	Chi Square	Sig.	Proportion of Inertia		Confidence Singular Value	
					Accounted for	Cumulative	Standard Deviation	Correlation 2
1	.588	.344			.933	.933	.159	.604
2	.158	.025			.067	1.000	.192	
Total		.369	9.582	.048[a]	1.000	1.000		

a. 4 degrees of freedom

Table 8.3 Overview of the row points of the children's attitudes (CAtt) towards saving electricity and the number electricity saving behaviours they perform.

CAtt	Mass	Score in Dimension		Inertia	Contribution				
					Of Point to Inertia of Dimension		Of Dimension to Inertia of Point		
		1	2		1	2	1	2	Total
CAttNone	.154	-1.677	.333	.256	.738	.108	.990	.010	1.000
CAttWeak	.462	.034	-.429	.014	.001	.538	.022	.978	1.000
CAttStrong	.385	.631	.381	.098	.261	.355	.910	.090	1.000
Active Total	1.000			.369	1.000	1.000			

Table 8.4 Overview of the column points of the children's attitudes towards saving electricity and the number electricity saving behaviours they perform (CBeh) (Med = Medium).

CBeh	Mass	Score in Dimension		Inertia	Contribution				
					Of Point to Inertia of Dimension		Of Dimension to Inertia of Point		
		1	2		1	2	1	2	Total
CBehLow	.115	-1.888	.500	.246	.702	.183	.981	.019	1.000
CBehMed	.500	-.078	-.395	.014	.005	.495	.127	.873	1.000
CBehHigh	.385	.668	.364	.109	.293	.322	.926	.074	1.000
Active Total	1.000			.369	1.000	1.000			

Appendix 9

Contingency tables

Table 9.1 Cross tabulations for calculating the exact Chi-square (p = 0.038) of the overall level of agreement between parents and children during their interviews in relation to the parents mentioning the environment as a reason to save energy at least once.

		Agreement			Total
		High	Low	Medium	
Parent talks about the environment	No	2	4	5	11
	Yes	7	0	8	15
	Total	9	4	13	26

Table 9.2 Cross tabulations for calculating the exact Chi-square (p = 0.005) of the frequency in which parents talk about saving energy for environmental reasons in relation to children mentioning the environment as a reason to save energy at least once.

		Parent talks about the environment			Total
		High	Low	Medium	
Child talks about the environment	No	0	9	9	18
	Yes	4	2	2	8
	Total	4	11	11	26

Table 9.3 Cross tabulations for calculating the exact Chi-square (p = 0.007) of the children's attitudes towards saving electricity in relation to the children having control over electrical appliances.

		Control		Total
		No	Yes	
Children's Attitudes	Strong	0	10	10
	Weak	2	10	12
	None	3	1	4
	Total	5	21	26

Appendix 10

Multiple correspondence analysis data

Data for the correspondence analysis presented in Fig. 8.1

Table 10.1 Model's summary.

Dimension	Cronbach's Alpha	Variance Accounted For		
		Total (Eigenvalue)	Inertia	% of Variance
1	.851	5.332	.242	24.235
2	.789	4.058	.184	18.444
Total		9.389	.427	
Mean	.824[a]	4.695	.213	21.340

a. Mean Cronbach's Alpha is based on the mean Eigenvalue.

Table 10.2 Discrimination measures and percentage of variance for four dimensions (only dimensions 1 and 2 are included in Fig. 8.1).

	Dimension				Mean
	1	2	3	4	
ComStyle	.434	.237	.024	.099	.199
PVal	.582	.198	.254	.166	.300
PAtt	.552	.158	.019	.061	.197
PPur	.273	.272	.022	.059	.156
PBeh	.474	.036	.066	.498	.269
CTEnv	.293	.223	.345	.027	.222
PTEnv	.489	.082	.352	.349	.318
CTMon	.014	.043	.082	.334	.118
PTMon	.263	.081	.098	.258	.175
CBeh	.360	.416	.302	.146	.306
Agree	.263	.047	.171	.217	.175
Income	.042	.025	.439	.110	.154
CTHelp	.163	.007	.162	.090	.105
PTHelp	.057	.067	.264	.004	.098
PTSafety	.125	.268	.059	.004	.114
CTSafety	.094	.007	.255	.134	.122
CEnSource	.000	.128	.336	.113	.144
CTrySave	.047	.459	.003	.186	.174
Rule	.046	.121	.437	.007	.153
Control	.061	.602	.003	.005	.168
CAtt	.548	.582	.003	.102	.309
Enviroschool	.151	.000	.058	.000	.053
Active Total	5.332	4.058	3.755	2.969	4.028
% of Variance	24.235	18.445	17.067	13.496	18.311

Appendix 11

Thematic analysis codes

Table 11.1 Codes used in the thematic analysis (most codes are further divided into several nodes and themes).

Family dynamics Negotiations Explanations Instructions Reminders Rules Punishments Involvement in decision making Control over appliances Habit Routine Parent being strict Parent open to ideas Chores Parent self criticism Lack of consistency between speech and action	Reasons to save power Save money Avoid waste Environment Help the family Washing Turning off lights Turning off appliances Showers Wearing extra layers Heating Curtains Closing doors Turning off appliances at the wall
Reasons to perform energy saving behaviours Save electricity Save time Comfort Health or safety Routine Social responsibility Effort Dislike of technology	Communication about energy Context of conversations Topics of conversations Person initiating the conversation Frequency of conversations
Material culture Easy to use Out of reach Complicated Dangerous Automatic	Child development Child too young Understanding money Recently acquired practice Old practice
Efforts to save power Yes No Sometimes Attitude towards saving power Behaviours performed voluntarily to save electricity Ideas on how to save power to a further extent Personal efforts make a difference Group efforts make a difference	Knowledge Identification of electricity use Practical knowledge Thinking processes Energy efficient technology Energy sources Production and consumption issues Topics learnt at school Learning sources Barriers to learning about energy

Table 11.1 (continued)

School Enviroschool characteristics Projects on energy production and consumption Science projects on electricity Environmental activities	Opinion on the role of school Importance of providing energy education Reasons for providing energy education Critical thinking Indoctrination Challenging parental authority Encouraging specific behaviours
School to home transfer Child communicating with parents about school Parent learning from child Behaviours learnt at school and performed at home Parent's adoption of behaviours suggested by children Means of communication between the school and the parent Conversations arising from the photograph exercise	Gender Differences in the role of mothers vs. fathers Amount of communication of girls vs. boys
Others Personality Personal interests Materialism / consumerism Comments on this research project Physical activity vs. use of TV and gaming	

Appendix 12

Information sheets and consent forms

CHILDREN'S ELECTRICITY CONSUMPTION IN NEW ZEALAND HOUSEHOLDS

INFORMATION SHEET FOR CHILDREN

Thank you for showing an interest in this project. Please read this information sheet carefully before deciding if you want to participate.

Who are we?
We are a research team from the University of Otago. We are trying to understand how children use electricity and how they talk about it with their family. We plan to work with children aged 9-11 years old, their parents, and their teachers.

What do we ask you to do?
If you agree to take part in this study, you will be asked to take 5 to 10 photos on how you use electricity in your home. You will also be asked to have a conversation with a researcher OR to be part of a group activity (drawing and chatting) in school. You will be asked to explain your pictures and describe how you use electricity in your home, as well as how you talk about it with your family. At the end we will give you a small thank you gift.

Important notes.
The personal information you give us will be kept private. This means that we will not publish them or show them to anyone outside our research team. If you decide to participate, please sign the consent form. If you do not want to participate, that's not a problem and you don't need to worry about the consent form.

We look forward to working with you

Ikerne Aguirre
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Dr. Janet Stephenson
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This project has been reviewed and approved by the University of Otago Human Ethics Committee

Reference Number 11/40

CHILDREN'S ELECTRICITY CONSUMPTION IN NEW ZEALAND HOUSEHOLDS

CONSENT FORM FOR CHILDREN

I have been told about this study and understand what it is about. All my questions have been answered in a way that makes sense.

I know that:

1. I do not have to take part if I don't want to and nothing will happen to me. I can also stop taking part at any time and don't have to give a reason.

2. Anytime I want to stop, that's okay.

3. The researcher will video-tape or audio-tape me so that she can remember what I say, but the recording will be erased after the study has ended.

4. If I don't want to answer some of the questions, that's fine.

5. If I have any worries or if I have any other questions, then I can talk about these with the researcher.

6. The paper and computer file with my answers will only be seen by the researcher and the people she is working with. They will keep whatever I say private.

7. I will receive a small gift as thanks for helping with this study.

8. The researcher will write up the results from this study for their University work. The results may also be written up in journals and talked about at conferences. My name will not be on anything the researcher writes up about this study.

☐ I agree to take part in a conversation with the researcher for this study.

OR

☐ I agree to take part in a group activity for this study.

....

Name Date

August 2011

CHILDREN'S ELECTRICITY CONSUMPTION IN NEW ZEALAND HOUSEHOLDS

INFORMATION SHEET FOR PARTICIPANTS

Thank you for showing an interest in this project. Please read this information sheet carefully before deciding whether or not to participate. If you decide to participate, we thank you. If you decide not to take part there will be no disadvantage to you and we thank you for considering our request.

What is the Aim of the Project?
This project seeks to identify and understand the different factors influencing children's electricity usage in NZ households by exploring children's energy literacy, electricity usage in everyday life, and family dynamics and negotiations. The project is being undertaken for a PhD thesis in Human Geography.

What Type of Participants are being sought?
The project will involve children age 9-11 years old in school year 5, their parent/guardian, and their teachers.

What will Participants be Asked to Do?

Children and Parents/Guardians. Should you agree to take part in this project, you will be asked for permission for your child to participate in a discussion group OR for yourself and your child to participate in an individual interview. Children will also be asked to take photographs on how they use electricity in their home. The questions in the interviews and discussion groups will focus on how children use electricity in their home and how they communicate about electricity use within their family. All the interviews will be audio recorded.

Children's pictures: Children will be asked to take 5 to 10 digital pictures on how they use electricity in their household, and send those pictures to the researcher via email (aguik412@student.otago.ac.nz) with the help of their parent/guardian, or to give the files to the teacher before the interview or focus groups. The researcher will provide disposable cameras for those children who do not have access to a digital camera (or cell phone with a camera). Children and parents/guardians do NOT need to print the pictures.

Children's discussion group: The discussion groups will take place in school and will involve six children in a group explaining their pictures, and producing drawings on how they use electricity. The discussion groups will last approximately one hour and will be video recorded. The children will receive a small thank you gift (e.g. a small plant).

Children's interviews: Children will be interviewed individually in school and will also be asked to explain their pictures. The interview will last approximately 30 minutes.

Parent/Guardian interviews: Interviews will be timetabled to suit the parent/guardian and will take place in a venue of their choice. The researcher will also conduct a short survey at the end of the

interview about house appliances, the family structure, attitudes and values. The interview and the survey together will last approximately one hour. The children and their parent/guardian will receive a thank you gift (e.g. energy efficient light bulb, chocolate and small plant).

Teachers. Should you agree to take part in this project, you will be asked to participate in an interview at a time and a venue of your choice. The questions will be about how energy efficiency is taught in your school. The interview will last approximately 30 minutes and will be audio recorded. The school will receive a voucher for library books as a thank you gift.

This project involves an open-questioning technique. The general line of questioning includes children's electricity usage in everyday life, family dynamics and negotiations around electricity use, and energy literacy. The precise nature of the questions which will be asked have not been determined in advance, but will depend on the way in which the interview develops. Consequently, although the University of Otago Human Ethics Committee is aware of the general areas to be explored in the interview, the Committee has not been able to review the precise questions to be used.

In the event that the line of questioning does develop in such a way that you or your child feel hesitant or uncomfortable, you are reminded of your right to decline to answer any particular question(s) and also that you may withdraw from the project at any stage without any disadvantage to yourself of any kind.

What will be the use of the collected data?

The results of the project may be published and a copy of the final thesis will be available in the University of Otago Library (Dunedin, New Zealand) but no participants will be identified. You are most welcome to request a copy of the results of the project should you wish.

The data collected will be securely stored in such a way that only those mentioned below will be able to gain access to it. The photographs, videos, and audio recordings will not be published in any way. Data obtained as a result of the research will be retained for **at least 5 years** in secure storage. Any personal information held on the participants may be destroyed at the completion of the research even though the data derived from the research will, in most cases, be kept for much longer or possibly indefinitely.

Please be aware that you may decide at any stage not to take part in the project without any disadvantage to yourself of any kind.

What if Participants have any Questions?

If you have any questions about our project, either now or in the future, please feel free to contact either:

Ikerne Aguirre-Bielschowsky
Centre for the Study of Agriculture, Food and the Environment (CSAFE)
University of Otago
Telephone. (03) 479 2804
Email. aguik412@student.otago.ac.nz

And/or
Dr. Janet Stephenson
Centre for the Study of Agriculture, Food and the Environment (CSAFE)
University of Otago
Telephone. (03) 479 8779
Email. janet.stephenson@otago.ac.nz

This study has been approved by the University of Otago Human Ethics Committee. If you have any concerns about the ethical conduct of the research you may contact the Committee through the Human Ethics Committee Administrator (ph 03 479 8256). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.

Reference Number 11/140
September 2011

CHILDREN'S ELECTRICITY CONSUMPTION IN NEW ZEALAND HOUSEHOLDS

CONSENT FORM FOR PARENTS/GUARDIANS

I have read the Information Sheet concerning this project and understand what it is about. All my questions have been answered to my satisfaction. I understand that I am free to request further information at any stage.

I know that:-

1. My child's and/or my own participation in the project is entirely voluntary;

2. I am free to withdraw my child and/or myself from the project at any time without any disadvantage;

3. Personal identifying information [photographs, video and audio tapes] will not be published in any way and will be destroyed at the conclusion of the project but any raw data on which the results of the project depend will be retained in secure storage for at least five years;

4. This project involves an open-questioning technique. The general line of questioning includes children's electricity usage in everyday life, family dynamics and negotiations around electricity use, and energy literacy. The precise nature of the questions which will be asked have not been determined in advance, but will depend on the way in which the interview develops. Consequently, although the University of Otago Human Ethics Committee is aware of the general areas to be explored in the interview, the Committee has not been able to review the precise questions to be used;

5. My child and I will not be harmed in any way;

6. My child and I will receive a small plant, chocolate and energy efficiency light bulb as a thank you gift for helping with this study;

7. The results of the project may be published and will be available in the University of Otago Library (Dunedin, New Zealand) but every attempt will be made to preserve my child's and my own anonymity.

IF YOU DECIDE TO PARTICIPATE PLEASE CONTINUE TO SIGN ON THE BACK OF THE PAGE

☐ I agree to my child and myself taking part in an individual interview for this project.

OR

☐ I agree to my child taking part in a discussion group for this project.

....
(Signature of parent/guardian) (Date)

Name of parent/guardian.....

Name of the child .....

Telephone: ..... Email .....

Do you need a disposable camera for your child to take the pictures?

☐ Yes

☐ No

IF YOU DECIDE TO PARTICIPATE PLEASE RETURN THIS FORM TO THE TEACHER

This study has been approved by the University of Otago Human Ethics Committee. If you have any concerns about the ethical conduct of the research you may contact the Committee through the Human Ethics Committee Administrator (ph 03 479 8256). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.

Appendix 13

Interviews and Focus Groups Guides

Focus Group Guide

Set up (20min previous)
[5min] Talk to teacher.
[15min] Set up the room.

Focus group (1 hr)
[5 min] Hello
- Informal hello and hand out name tags.
- Ask children to sit around the board.
- Explain the project.
- Explain that how they use electricity might seem obvious to them, yet could be very different to what other people do.
- Explain that, as a child, I used electricity in a different way. For instance we did not have computers at home.
- Tell the children that this is why I am so curious to know how they use electricity, and what they think about it.

[5min] Introductions
- Introduce myself, and ask the children to follow my example (e.g. "You can call me Iki. I am from Mexico. I am very excited to be here and to be able to listen to you").

[5min] Instructions
- Explain that:
  1) This is not school work, and there will be no grades.
  2) The children can stop at any time and return to their classrooms if they wish without any problems.
  3) There are no right or wrong answers, and that they can say whatever they want.
- Explain about the recording: "We will record your voice with the Dictaphone and take video so we can remember what you said. We will not be showing the recordings to anyone so don't worry about it. Is everyone okay with that?"
- Turn on the Dictaphone and the video cameras, and ask the children to "Say hello to the camera".
- Explain the general outline:
  1) "Show your pictures and talk about them, and how you talk about electricity with your parents."
  2) "I'll ask a question and all of you can answer. If you remember something else, or you want to add something at any time, just say it without interrupting."
  3) "Any questions?"
- Give them their pictures.

[5 min] Show pictures
- "All the pictures you gave me are wonderful. Very interesting, you are all great photographers – I am very impressed."

- "How about each of you shows one of your pictures to the rest of the group, explains it, and then puts it on the board with blue tack. Then everyone else that has a similar picture can put up their picture around it. Would someone like to start?"
- "Who has something different?"; repeat this exercise until all of the pictures are shown and organised.
- "How did you find taking the pictures? Was it difficult?"

[5 min] Extra items
- "Do you use electricity in your house in any other way (even if you don't have pictures)?"
- "That is great. Would you like to do a quick sketch of that so we have it on the board, too?"

[10 min] Practices + rules
- Ask the children how the use the items shown in the pictures, e.g. "Do you turn on/ off heat pumps or heaters?" Let every child have his say.
- Other prompts: "Do you set the temperature? If so, for the whole house?"
  "Do you have a heater in your room? Do you use it? How?"
  "Does anyone else do that?"
- "How did you learn to do use the heater/ set the temperature?" [If parents/siblings etc., "Why did they tell you that?"]
- "How come you use it in that way?"
- "Do you talk about how to use heaters with your parents? What do they tell you?" [prompt on rules]
- If there are rules: "Who set up the rule?"
  "Why is there a rule? Did your parents explain it?"
  "Do you agree with it?"
- "What about your siblings? Do they tell you how to use things? Are they older?"
- "Do you tell your siblings how tu use things? Why?"
- Repeat this exercise for shower times and appliances (lights, tv, computer, gaming)

[5 min] Saving electricity
- "Please think about all of these things that you use and that we talked about. Do you try to save electricity when you use any of these?"
- "How do you try to save electricity/power when you use appliances, heaters, showers?"
- Have all of the children have their say and prompt them about heaters and showers if needed.
- "Anything else you can think of?"

[5-10 min] Communication
- "Do you talk about saving electricity with your parents? What do they tell you?"
- "Do you tell them how to save power? Can you think of any examples and share one with us?"
  If so: "How did they respond?"
  "Were they ok with that?"
  "Do they do that now?"
- "How about your siblings? Do they tell you how to save power? Do you tell them?"

[10 min] Energy knowledge
- "Okay, that is all fantastic. Now, we have been talking about saving electricity or saving power – but why do you try to save electricity?"
- "Are there any problems with using electricity? What problems? Anything else you can think of?"

- "How do you think we could solve that?"
- "Where do you think electricity comes from? How do we generate power?"
- "Great, where have you learnt all of this?"
- "Where else do you learn about how to save electricity?"
- "Do you have any other ideas on how you and your family can save electricity at home?"
- "Do you think all these efforts will make a difference? How come?"

[5 min] Wrap up
- "You have all been amazing, this is very interesting for me. Thank you so much!"
- Hand out the plant, "thank you" certificate, and another set of pictures for them to keep.
- Ask them to return to their classrooms.

Afterwards [20min]
- Take essential notes
- Pack up
- Thank the teacher and set up the interview sessions with the children

Children's Interview Guide

[1 min] Hello
- Explain the project.
- Explain that how he/she uses electricity might seem obvious to him/her, yet could be very different to what other people do.
- Explain that, as a child, I used electricity in a different way. For instance we did not have computers at home.
- Tell the child that this is why I am so curious to know how he/she uses electricity, and what he/she thinks about it.

[1 min] Instructions
- Explain that:
  1) This is not school work, and there will be no grades.
  2) The children can stop at any time and return to their classrooms if they wish without any problems.
  3) There are no right or wrong answers, and that they can say whatever they want.
- Explain about the recording: I will record your voice with the dictaphone. I will not show these recordings to anyone. Is that okay?
- Turn on the Dictaphone.

[3 min] Background
- "To begin with, I would like to ask you a few very general questions, and then we can talk about your pictures."
- "What class are you in?"
- "Who is your teacher?"
- "How old are you?"
- "How long have you been attending this school?"
- "Where are you from originally?"

[10 min] Electricity use
- Give her/ him the pictures.

- "All the pictures you gave me are wonderful. Very interesting, you are a great photographer – I am very impressed."
- "Can you please show them to me? We can arrange them all here by topic." [Make comments and ask for explanations until they are all arranged]
- Ask specific questions about the pictures, e.g. about the heater or heat pump:
  - "How do you use it?"
  - "Do you turn on/off the heat pump/heater? When?"
  - "Do you set the temperature? How? For the whole house?"
  - "Do you have a heater or heat pump in your room? Do you use it? How?"
  - "How did you learn to do use the heater/ set the temperature?" [If parents/siblings etc., "Why did they tell you that?"]
  - "How come you use it in that way?"
  - "Do you talk about how to use heaters with your parents? What do they tell you?" [prompt on rules]
  - If there are rules: "Who set up the rule?"
    "Why is there a rule? Did your parents explain it?"
    "Do you agree with it?"
  - "What about your siblings? Do they tell you how to use things? Are they older?"
  - "Do you tell your siblings how tu use things? Why?"
- Repeat this exercise for shower times, drawing curtains, laundry, wearing extra layers, using appliances (lights, tv, computer, gaming), and turning off appliances at the wall
- "Is there any other way in which you use electricity in your house? How?"

[2 min] <u>Saving electricity</u>
- "Do you try to save electricity or energy in your home? How? Why?"
- "Please think about all of these things that you use and that we talked about. Do you try to save electricity when you use any of these?"
- "How do you try to save electricity/power when you use appliances, heaters, showers?"
- "Do you think that what you do to save electricity makes a difference? How?"
- "Do you have any other ideas on how you and your family can save electricity at home?"

[5 min] <u>Communication</u>
- "Do you talk about saving electricity with your parents? What do they tell you?"
- "Do you tell them how to save power? Can you think of any examples and share one with me?"
  If so: "Where did you get that idea?"
  "How did they respond?"
  "Were they ok with that?"
  "Do they do that now? If so, how did you convince them"
- "How about your siblings? Do they tell you how to save power? Do you tell them?"

[2-5 min] <u>Energy knowledge</u>
- "Okay, that is all fantastic. Now, we have been talking about saving electricity or saving power – but why do you try to save electricity?"
- "Are there any problems with using electricity? What problems? Anything else you can think of?"
- "How do you think we could solve that?"
- "Where do you think electricity comes from? How do we generate power?"
- "Great, where have you learnt all of this?"
- "Where else do you learn about how to save electricity?"

[2-5 min] Transfer school to home
- "Is there anything else you have learnt in school about energy or electricity? What?"
- "Do you learn things about electricity in school that you can do in your home? What?" [If not – "Anything else that you have learnt in school and started doing at home?"]
- "Are you doing it? Do your parents help you to do so?"
- "Have your parents started to do it, too? If so, how did that come about?"

[3 min] Wrap up
- "Thank you very much. This is very fascinating."
- "Do you have any questions for me, or would you like to add anything else?"
- Give him/her the plant, pictures, and "thank you" certificate.
- Ask the child to return to his/her classroom and call in the next child to be interviewed.

Parents' Interview Guide

[5 min] Introduction
- Explain the project.
- Eplain that the interview will be followed by a short survey, partially filled in by me.
- Explain that the session will last a maximum of 1 hour, that there are no right or wrong answers, and that he/she can stop at any time.
- Reassure him/her that the interview and survey will remain confidential.
- Explain that the interview will be audio recorded and ask for permission to do so. [Turn on Dicatphone]

[15 min] Electricity Use
- "How does your child (X) use the shower/ heaters/ lights/ the TV/ gaming devices?"
  For heat pump or heaters:
    - "Does X use it?"
    - "Does X turn it on/off? When?"
    - "Does X set the temperature? How?"
    - "For the whole house?"
    - "Does X have one in his room? Does X use it? How?"
  For showers: "How long does X normally take in the shower?"
  For lights: "Does X turn off the lights when leaving a room?"
- For all of the above:
    - "Is there a way in which X is supposed to use it? How? Why?"
    - "Are all the members of the family supposed to use it in the same way? If not, why?
    - "Are there any rules for X on how to use it? What are they?"
    - "Who decides how to use it?"
    - "How do you talk about it with X?"
    - "Do you explain to X why he/she should use it this way? What do you say?"
    - "Does X agree with this way of using it? If not, why? What does X say?"
    - "What happens if X does not follow the rules?"

[5 min] Communication
- "Has X made any suggestions to the family on how to save electricity?"
- If not: "Is there any other thing related to the environment that X has asked the family to do? If so, what? How? Who is meant to do it? In what context?"
- "Where did X get this idea from?"
- "Does X do the things he/she suggests?"

- "Have you tried to do what X suggests? Why (not)?"
- If yes:
  - "How did X convince you?"
  - "How long did it take?"
  - "Has it become part of your family's regular practice?"
- "Does X tell his/her sibling(s) how to save electricity?"

[2 min] Saving electricity
- "Do you think that X is trying to save electricity?"
- "Do you try to save electricity in your home? How? Why?"
- "Do you think that what you do to save electricity makes a difference? How?"

[8 min] Energy knowledge
- "Does X know about problems related to energy use or energy sources?"
- "Does X ever talks about these topics? How? What does X say?"
- "Where do you think X learnt these things?"
- "Do you talk to X about energy-related topics (e.g. peak oil, energy savings, energy efficiency, renewable energy, climate change, green technology)? In what way? How often? In what context?"

[10 min] School to home transfer
- If X in enviroschool: "Did the enviroschool programme form part of the decision to enrol your child in that school? Why?"
- "Do you know if X is learning about topics related to energy efficiency at school? How do you know? What is X learning? Are you happy with that? Why?"
- "Has X learnt things about electricity or energy at school that he/she can try to do at home? "
  - If not: "Has X brought home from school any other ideas on the environment that he/she can do?"
    - If not: "has X ever tried to change something about the family daily routine? What?"
- For the three previous questions:
  - "Has X been able to do it?"
  - "Did you support that?"
  - "Did you or any other member of your family started doing it, too?"
  - "If so, how did that happen?"
- "What is your overall opinion on schools:
  - Encouraging particular behaviours in children (e.g. eating healthily, recycling)?"
  - Teaching topics related to energy production and consumption (e.g. climate change)?"
  - Encouraging children to introduce energy saving practices at home?"

[2min] Picture exercise
- "Did X ask for any help when taking the pictures? If so, what did he/she need help with?"
- "Did X ask any questions related to electricity as a result of taking the pictures? If so, what?"

[5 min] Survey - I ask the questions.
[10 min] Survey - Parent fills in the answers.
[3 min] Wrap up
- "Is there anything else you would like to talk about?"
- "Do you have any questions for me?"
- Thank the parent and hand over the "thank you" gift.

Teachers' Interview Guide

[2 min] General background
- "How long have you been a teacher?"
- "How long have you been teaching at this school?"
- "How long have you been teaching Year 5?"

[13 min] Teaching about energy efficiency
- "Are energy topics included in the curriculum? If so, in what way?"
  If yes:
  - "In what year do children learn about this topic? What are they taught?"
  - "Do you have a general idea of what the children learn about energy in each year?"
  - "What are the subjects (e.g. science, social sciences, environmental education) in which such topics are included? Why?"
- "Have you taught anything related to energy or electricity this year? Why? What?"
- "Have you taught any other related topics (e.g. air pollution, global warming/climate change, renewable energy, energy crisis, oil peak, green technology advances, energy savings, transport, etc.)? Why?"
  If yes:
  - "How do you teach these topics?"
  - "What methods (activities) do you use?"
  - "Do you teach these topics yourself, or are the activities/discussions run by someone else?"
  - "Are these topic taught as part of a particular unit/project? Or are they taught throughout (much of? the year?"
  - "Do the children seem interested?"
- "Do children seem to know/understand how energy is produced, and the problems associated with it?"
- "Are children encouraged to save electricity in the school (e.g. by turning off lights)? If yes, how/what are they told? In what context?"
- "Do some children actually try to save electricity in the school?" If so, how? Is this common?"

[15 min] Environmental Education
- "Does your school run a particular programme for environmental education (e.g. enviroschools)?"
  If so:
  - "Are you involved in the programme?"
  - "Are any of your students involved in the programme?"
  - "What activities does it include?"
  - "Does it include energy efficiency included? In what way?"
- "Does your school receive any special support (e.g. teacher training, funding, support material like videos or books, talks for the children) to teach energy or related topics?
  If so, how does that work?"

[10 min] Communication with the children
- "When you discuss topics related to energy (if not: environmental topics), what comments do children make?"
- "Have you had any debates arise in class when discussing these topics?" If so, about what? In what context? Can you give me an example?"

- "Have the children made any suggestions on how to use electricity in the school?" If not, have they suggested any other environmental behaviours? Which ones, and in what comtext?"
- "Do children ever mention how they use electricity at home? What do they say?"
- "Do they ever mention what their parents tell them about saving energy? What do they say?"

[10 min] Communication with parents
- "Are children encouraged to discuss what they learn at school with their parents? If so, how?"
- "In general, are parents aware of what their children are learning at school?" If so, how do they know?"
- "Have you had any comments from parents on energy-related topics taught in school? If so, what did they say?"
- "Do you ever encourage children to behave in an environmentally friendly way at home (e.g. saving electricity, having short showers, walking instead of using the car, recycling, composting, gardening)?"
- If not:
  - "Do you encourage any other type of behaviour, e.g. related to health and safety or being helpful? If so, how?"
  - "Are there any signs of children actually doing these things at home afterwards?"
- "In general, are parents supporting activities/behaviours suggested by schools for children to do at home? If so, which ones, and how?"
- "What is your overall opinion on the role of school in encouraging household behaviour?"
- "Have you ever had a parent disagreeing with an activity/behaviour/or topic taught or encouraged at school? If so, which topic? How did you handle it?"
- "Is parenets disagreeing with what is taught a concern when teaching energy efficiency or related topics?"

[8 min] Energy literacy in schools
- "What is your overall opinion on teaching energy efficiency topics to children in Year 5?"
- "Do you think there should be more education related to this topic in schools? Why?"
  If so:
  - "What could be done?"
  - "How could it be arranged in a feasible way?"

[2 min] Wrap up
- "Is there anything else you would like to talk about?"
- "Do you have any questions for me?"
- Thank the teacher and hand over the "thank you" gifts for both the teacher and the school.

Appendix 14

Survey

(The researcher asks the questions)

Household Situation

26. Do you rent or own the dwelling you live in?*
    - ○ Rent
    - ○ Own
    - ○ Other, please specify

27. How long have you lived in your current house? *

	Time
Years	
Months (if LESS than one year)	

Dwelling Characteristics

1. When was your house built?*
    - ○ Before 1978
    - ○ Between 1978 - 1999
    - ○ After 2000
    - ○ Don't know

2. How many rooms does your dwelling have and which ones do you heat regularly? *
(please write the number of rooms in the boxes provided)

	NUMBER OF ROOMS OR AREAS	NUMBER HEATED REGULARLY
Bedrooms		
Lounges or living rooms		
Dining rooms or kitchen/dining areas		
Separate kitchens		
Studies or offices		
Bathrooms		
Separate toilets		
Laundries		
Other rooms		

3. Do the children have their own bedroom?*
    - ○ Yes
    - ○ No

4. How many hours of direct sunshine would your house get on a clear winter's day in June-July? *

Household Heating

5. Can you apply a temperature setting to your main living area (e.g. with a thermostat for heat pump or central heating)? *

- ○ Yes
- ○ No

6. What temperature do you set your main living area at in degrees Celsius? (°C)

How do you heat your home?

7. Which of the following methods do you use for heating your house? Please indicate which items you use. *

	HAVE & USE
Heat pump	☐
Electric night-store	☐
Portable electric heaters	☐
Electric heaters fixed in place	☐
Enclosed coal burner	☐
Enclosed wood burner	☐
Open fires	☐
Portable gas heater	☐
Gas heaters fixed in place	☐
Other	☐

8. If other, what method of heating do you use?

Which one is the main method? Which one follows?

9. Which of the heating methods you selected earlier are your main methods of heating? Please rank them starting with one as the most used method

Heat pump	☐
Electric night-store	☐
Portable electric heaters	☐
Electric heaters fixed in place	☐
Enclosed coal burner	☐
Enclosed wood burner	☐
Open fires	☐
Portable gas heater	☐
Gas heaters fixed in place	☐
Other	☐

What rooms can you heat with your main methods?

14. Please indicate how many rooms or areas are heated by your main method of heating by placing the number in the corresponding box*

	NUMBER OF ROOMS OR AREAS
Bedrooms	☐
Lounges or living rooms	☐
Dining rooms or kitchen/dining areas	☐
Separate kitchens	☐
Studies or offices	☐
Bathrooms	☐
Separate toilets	☐
Laundries	☐
Other rooms	☐

10. How satisfactory is your main method of heating? (please choose one)

- ○ I am happy with it and don't want to change
- ○ I like it but would like to get something better if the opportunity arose
- ○ I am unhappy with my current method and want to get something else

11. Why are you unhappy with your main method of heating?

12. Is the rest of the family happy with your main method of heating?*

- Yes
- No

13. If not, why is the rest of the family unhappy with your main method of heating?

How do you heat you water?

	HAVE & USE
Cylinder - Solar	
Cylinder - Electric (resistive or heat pump)	
Cylinder - Gas (reticulated or bottled)	
Cylinder - Wood (wetback)	
Instant - Electric	
Instant - Gas	
Combinations (e.g. solar with instant gas or electric backup)	
Other	

16. If known, what temperature do you set your hot water cylinder to? (degrees Celsius)

- Don't know
- Temperature in degrees Celsius

Energy Use and Health

17. Does your child suffer from an illness that requires additional use of energy? *

- ○ Yes
- ○ No

18. Please indicate below what extra health related energy use is required for:
(tick all that apply)

- ☐ Washing
- ☐ Heating
- ☐ Drying
- ☐ Operating health or medical appliances
- ☐ Other, please specify

Who lives in this house and how old are they?
In a normal weekday, how long does each person spend away from home (hrs)?

	Male Female	Age	Hours Away
Yourself (Adult 1)			
Adult 2			
Adult 3			
Adult 4			
Child interviewed (1)			
Child 2			
Child 3			
Child 4			

Household Appliances

19. Please indicate which of the following appliances you have, and which ones are used only by adults or only by your children*

	HAVE & USED BY ALL FAMILY MEMBERS	HAVE & USED ONLY BY ADULTS	HAVE & USED ONLY BY CHILDREN	HAVE & DO NOT USE	DO NOT HAVE
Electric heater	☐	☐	☐	☐	☐
Heat pump	☐	☐	☐	☐	☐
Dehumidifier	☐	☐	☐	☐	☐
Dishwasher	☐	☐	☐	☐	☐
Separate deep-freeze unit	☐	☐	☐	☐	☐
Fridge/freezer	☐	☐	☐	☐	☐
Clothes dryer	☐	☐	☐	☐	☐
Plasma screen TV	☐	☐	☐	☐	☐
LCD or LED Large screen or monitor	☐	☐	☐	☐	☐
Tubular TV	☐	☐	☐	☐	☐
Set top box (e.g. Free-to-air)	☐	☐	☐	☐	☐
DVD player	☐	☐	☐	☐	☐
Games console	☐	☐	☐	☐	☐
Home computer – Desktop	☐	☐	☐	☐	☐
Laptop	☐	☐	☐	☐	☐
Heated towel rail	☐	☐	☐	☐	☐
Electric blanket	☐	☐	☐	☐	☐
Rechargeable small vehicles; including mobility scooters or ride-on "toys"	☐	☐	☐	☐	☐
Water bed	☐	☐	☐	☐	☐
Spa pool or heated swimming pool	☐	☐	☐	☐	☐

(The participant fills in the questions)

Energy Behaviours

The following is a list of possible energy-saving behaviours. Please indicate how often you (personally) do each of the following actions

	NEVER	RARELY	SOMETIMES	OFTEN	ALWAYS
Turning appliances off at the wall (not just leaving on standby)	○	○	○	○	○
Rinsing the dishes with cold water	○	○	○	○	○
Reduce heating in unoccupied rooms	○	○	○	○	○
Switching off lights in unused rooms	○	○	○	○	○
Wait for a full load before using washing machine	○	○	○	○	○
Put on more clothing before turning up heating	○	○	○	○	○
Keep household heating low to save energy (below 18 ° C)	○	○	○	○	○
Line drying of laundry	○	○	○	○	○
Taking shorter showers	○	○	○	○	○
Doing dishes by hand	○	○	○	○	○
Pulling curtains at night	○	○	○	○	○

Please indicate how likely you (personally) would be to consider the following energy related changes

	NEVER	UNLIKELY	WOULD POSSIBLY CONSIDER	WOULD ACTIVELY CONSIDER	ALREADY DO
Cooking on gas	○	○	○	○	○
Installing double glazing	○	○	○	○	○
Buying an energy-efficient fridge/freezer	○	○	○	○	○
Purchasing an energy-efficient washing machine	○	○	○	○	○
Installing energy saving light bulbs	○	○	○	○	○
Insulation of hot water pipes	○	○	○	○	○
Reduce hot water temperature	○	○	○	○	○
Applying hot water cylinder insulation	○	○	○	○	○
House insulation for: -Ceiling	○	○	○	○	○
-Walls	○	○	○	○	○
-Under floor	○	○	○	○	○
Seal drafts around doors and windows	○	○	○	○	○
Installing an energy-efficient heating system (such as a heat pump)	○	○	○	○	○
Buying a smaller refrigerator	○	○	○	○	○

Energy Attitudes

Do you (personally) agree or disagree with the following energy statements?*

	DISAGREE STRONGLY	DISAGREE	NEITHER	AGREE	AGREE STRONGLY
I only buy appliances with high energy efficiency ratings even if they cost more	○	○	○	○	○
I don't think very much about ways of saving energy in my own home	○	○	○	○	○
I don't pay much attention to what my energy bill is each month	○	○	○	○	○
I find it hard to find information about being energy efficient around the home	○	○	○	○	○
It's difficult to know what information to trust in regards to energy efficiency	○	○	○	○	○
Making choices about energy efficiency in the home is complex	○	○	○	○	○
I am confident I can invest the time and effort to make changes towards being energy-efficient	○	○	○	○	○
I am confident that I have the right skills to make informed decisions in energy efficiency	○	○	○	○	○
I know where to find the right information about energy efficiency	○	○	○	○	○

Select ONE of the following statements that best describes your (personal) overall attitude to energy usage.*

- ○ I would like to reduce my consumption in order to save money
- ○ I would like to reduce my consumption in order to help conserve the environment
- ○ I am happy with my current level of consumption and don't want to change what I do
- ○ I am happy with my current level of consumption, but would like to use it more efficiently
- ○ I would like to increase the amount of energy that I consume

Personal Values

To what level do you (personally) agree or disagree with the following statements?*

	DISAGREE STRONGLY	DISAGREE	NEITHER	AGREE	AGREE STRONGLY
The balance of nature is very delicate and easily upset	○	○	○	○	○
Modifying the environment for human use seldom causes serious problems	○	○	○	○	○
Plants and animals exist primarily to be used by humans	○	○	○	○	○
The earth is like a spaceship with only limited room and resources	○	○	○	○	○
There are limits to economic growth even for developed countries like ours	○	○	○	○	○
Humans were meant to rule the rest of nature	○	○	○	○	○
Technology will solve many environmental problems	○	○	○	○	○
Exploitation of the earth's natural resources should be stopped	○	○	○	○	○

Energy Bills

What are your households approximate monthly energy bills in the SUMMER?*

	Do Not Use	Less than $50	$51 - $100	$101 - $150	$151 - $200	$201 - $250	$251 - $300	$301 - $350	Over $350
Electricity	○	○	○	○	○	○	○	○	○
Gas	○	○	○	○	○	○	○	○	○
Coal	○	○	○	○	○	○	○	○	○
Wood	○	○	○	○	○	○	○	○	○
Other	○	○	○	○	○	○	○	○	○

What are your households approximate monthly energy bills in the WINTER?*

	Do Not Use	Less than $50	$51 - $100	$101 - $150	$151 - $200	$201 - $250	$251 - $300	$301 - $350	Over $350
Electricity	○	○	○	○	○	○	○	○	○
Gas	○	○	○	○	○	○	○	○	○
Coal	○	○	○	○	○	○	○	○	○
Wood	○	○	○	○	○	○	○	○	○
Other	○	○	○	○	○	○	○	○	○

What is the approximate annual income of your household (before tax)?

- ○ Less than $20,000
- ○ $20,000 - $29,000
- ○ $30,000 - $39,000
- ○ $40,000 - $49,000
- ○ $50,000 - $59,000
- ○ $60,000 - $69,000
- ○ $70,000 - $79,000
- ○ $80,000 - $89,000
- ○ $90,000 - $99,000
- ○ $100,000 - $109,000
- ○ $110,000 - $120,000
- ○ Over $120,000

Would you be willing to take part in future research?

- ○ Yes
- ○ No

Appendix 15

Description of the families

Description of the interviewed families as case studies (in alphabetical order)

Alex

Child Interview: 20 min. School library.
Mother Interview: 35 min. Participant's home.
School: Large school role, high decile, no environmental programme.

Family and household context
Alex is ten years old and lives with his father, mother (who works part-time), and younger brother. They have a high household income and live in an old house with a heat pump and a wood burner.

Practices
Alex is consistent in turning off lights, the TV, and gaming devices, and switches off appliances at the wall. He also wears extra clothing instead of turning up the heating, has short showers, and closes curtains, but he does not seem to know that these are energy saving behaviours. He is aware that his family could potentially also save power by turning off electric tools at the wall.

Family dynamics
Alex is mostly following his mother's example and instructions – which are usually given in reference to the financial cost of power. Alex's mother expects him to engage in energy saving behaviours, and gets angry when he does not. Alex sometimes reminds his parents and brother to switch off lights and appliances. There are rules regarding safety, limiting TV and computer times, and forbidding children to use electric heaters and heat pump owing to previous misuse. The family talks regularly about avoiding waste with regards to food, water and electricity.

Attitude and intended behaviour
Although Alex seems to be engaging in energy saving behaviours mostly to avoid conflict with his mother, "he's starting to think about [energy consumption]", and recognizes that his efforts help the family to reduce the power bill. Alex's mother does not usually think about her energy consumption, and engages in energy saving behaviours because she dislikes waste in general.

Knowledge
Alex knows that electricity has a financial cost, but he is not aware of any other problems related to energy production and consumption. Alex has learnt that electricity is produced by hydro dams after visiting several power plants with his father. He is also learning from reading books on the topic, and has discussed energy saving behaviours in previous years at school.

School to home transfer
Alex says that he started being more careful about switching off appliances at home after discussing it at school, but his parents say that they did not notice. In general, Alex does not talk about school with his mother. She likes it when schools encourage environmental behaviours in children, and would be "fine" with Alex bringing home energy saving ideas.

Alice

Child Interview: 17 min. School staff room.
Father Interview: 34 min. Centre for Sustainability, University of Otago.
School: Small school role, high decile, enviroschool.

Family and household context

Alice turned nine years old recently, and lives with her mother, father, and her two siblings. The family moved to New Zealand less than a year ago, has a very high household income, and lives in an old house with a wood burner.

Practices

Alice is consistent in switching off lights, the TV and the computer. She also wears extra clothing instead of turning up the heating. Alice is aware that the family could potentially save more power by switching off appliances at the wall.

Family dynamics

Alice frequently reminds others to switch off appliances - she is "very much the family environmentalist, so she will lecture other people on it". There are no rules in the house regarding energy use, and there is no need to give Alice reminders. She seems to have formed her habits from following her parents' example. Alice's parents have explained to her how certain behaviours help to conserve natural resources, and the family has weekly conversations on general environmental topics. They often talk about energy production and climate change, especially when faced with it; for instance, they used to live in front of a coal plant, and have seen hydro dams and wind farms in New Zealand. In addition, they are adjusting their home for the winter, and Alice takes part in the conversations regarding energy efficiency. Alice's parents also talk to her "a little bit" about the financial cost of power.

Attitude and intended behaviour

Like her father, Alice is "very conscientious" about saving energy for environmental reasons. She thinks that her efforts make a difference because "every little bit counts".

Knowledge

Alice is aware of the connection between energy production and consumption, as well as some of its environmental impacts. During the interview, she talked about solar, wind and nuclear power, but she is unaware of her learning sources. Alice has not studied energy-related topics at school, and she seems to be learning mostly from her parents.

School to home transfer

Alice has brought home ideas from school and tried them out; for instance, she closes the tap when brushing her teeth, and sometimes raises the issue of buying local food with her father. Her father thinks all schools should teach energy topics and climate change, following through from theory in science to practical decision making. He thinks it is appropriate to discuss these topics at school, because energy usage is a "community decision" and children "are probably more strongly influenced by their peers" and the school context than by their parents.

Alysa

Child Interview: 19 min. School library.
Mother Interview: 49 min. Participant's workplace.
School: Large school role, high decile, no environmental programme.

Family and household context
Alysa is ten years old and lives with her mother (who works full-time), her father (who at the moment is staying at home), and her older brother. They have a medium household income and live in an old house with a heat pump.

Practices
Alysa is consistent in switching off lights. She usually also turns off heaters, the TV, and the computer, closes doors and curtains, and wears extra clothing instead of turning up the heating. She is aware that she could save more power by reading books instead of watching TV.

Family dynamics
The only family rules are regarding safety. Alysa's parents constantly remind her to save energy, and frequently explain how their family practices (e.g. closing doors, doing full loads of laundry, having short showers) help to reduce the power bill, avoid wasting electricity, and keep a healthy home. These explanations can sometimes be very specific, and include, for example, details on how much the family pays for power each month, and how heating water has the biggest impact on the electricity bill. Sometimes, Alysa also gives reminders to her mother. The family watches the news every night, which has sparked conversations on the energy crisis, fossil fuels, air pollution, and oil spills. However, Alysa does not seem to relate those topics to electricity consumption.

Attitude and intended behaviour
Alysa's mother engages in energy saving behaviours to reduce their power bill, and to avoid waste in general. She thinks that her daughter is "quite conscientious" of her energy usage, but that her efforts to save power are not "very noticeable", and are motivated by a will to please her parents. Alysa seems conscious of the fact that saving power is important for economic reasons, and thinks that her efforts make a difference.

Knowledge
Alysa knows that electricity is produced by windmills and hydro dams. She thinks of electricity as a resource and seems to relate it to social fairness, commenting that people who waste power prevent those in need from having it. Alysa has not discussed energy topics at school, and is not aware of the environmental impact of using electricity. She seems to be learning mostly from the news and her parents' reminders.

School to home transfer
Alysa sometimes gets ideas on activities from school, and tries them out at home with her mother's support. Alysa's mother thinks that it is "wise" to teach children about ways to save energy at school because it is a matter of "practical daily living. It's being economical with your own money and with the country's resources".

Amanda

Child Interview: 20 min. School library.
Mother Interview: 41 min. Centre for Sustainability, University of Otago.
School: Large school role, high decile, no environmental programme.

Family and household context
Amanda is nine years old and lives with her mother (who works part-time), father, and older brother. They have a medium household income, and live in an old house with a heat pump.

Practices
Amanda is consistent in turning off lights, heaters, the computer and the TV. She also has short showers, closes curtains, turns off appliances at the wall, and wears extra clothing instead of turning up the heating.

Family dynamics
Her parents have told Amanda to follow specific energy saving behaviours, making reference to the financial cost of power. There is a rule about having 5 minutes showers that applies to everyone in the family - they time each other and "turn the water off" if it takes longer. There are other rules about safety when using appliances. Amanda is in charge of closing curtains and controlling the heater in her room, with her father having explained to her how to use it in an energy efficient way. Amanda "does tell you off if you've left something on" and gives plenty of reminders to the rest of the family. Amanda often asks questions on environmental topics after watching the news, but the family has not discussed any topics related to energy production.

Attitude and intended behaviour
Amanda voluntarily turns off her parents' bedroom lamps if they fall asleep, and turns off the TV at the wall. Like her mother, Amanda seems to be making a conscious effort to reduce her electricity usage in order to save money, and thinks that she is making a difference.

Knowledge
Amanda is not aware of any problems related to energy production and consumption, apart from the financial cost. She does not know how electricity is produced, but has a vague notion that using energy may have an impact on the environment. Amanda is learning from her parents, books and comments on energy saving behaviours made by her teacher. Her mother thinks she is getting a feeling of "social responsibility" from the news and advertisements on TV.

School to home transfer
Amanda did a unit on static electricity at school, but it was not related to saving energy. Following a reminder of the financial cost of power by her mother, Amanda once replied to her that saving electricity "will also help save the planet", after being told by her teacher to switch off appliances for environmental reasons. Amanda has also picked up recycling and healthy eating habits from school. Her mother only helps Amanda to adopt a new behaviour if she tries it first and it "doesn't counteract what you're actually doing at home". She gets "irritated" when teachers have more influence on children than parents. However, she would be fine with Amanda bringing home energy saving ideas, "as long as [they are] workable".

Amy

Child Interview: 20 min. Spare classroom.
Mother Interview: 46 min. Participant's home.
School: Medium school role, high decile, environmental programme.

Family and household context
Amy is nine years old. She lives with her mother, father and younger sister. They have a high household income and live in an old but insulated big house with a heat pump.

Practices
Amy is consistent in switching off lights and the TV, turning off the computer at the wall and having short showers. She also closes curtains but is not aware that this is an energy saving behaviour. She thinks that the family could save more power if they watched less TV, use less electronic games, and unplugged appliances.

Family dynamics
Amy's mother is in charge of the energy saving behaviours at home because she does not trust her daughter. Amy's father reminds her daughters to turn lights off, and her mother gives them constant reminders to close doors. Amy's mother has explained to her daughter that having long showers uses energy which is expensive, and instructs her to shower in less than 5 minutes. Apart from that there are no conversations in the family regarding energy usage. Amy sometimes turns off lights for other people and reminds her sister to turn off the heater. Her mother feels that Amy is not interested in discussing energy production. Her father once explained how hydro dams produce electricity while driving past them but Amy did not pay attention.

Attitude and intended behaviour
Amy does not seem to be making a conscious effort to save energy. Her mother thinks that Amy has not developed a social or environmental conscience yet. Amy's mother is engaging in energy saving behaviours mostly for financial reasons but she is also aware of not wasting non-renewable natural resources.

Knowledge
Amy does not know how electricity is produced, is not aware of any problems related to energy production and consumption apart from the financial cost, and has not discussed energy topics at school.

School to home transfer
Amy talks very little about school with her mother except for the environmental activities they do, such as recycling and composting. The family has, for instance, stopped using glad wrap after Amy learned at school that it is bad for the environment. Her mother thinks that schools can be very helpful in encouraging social behaviours in children, especially when they are lacking the example at home. She thinks that it would be "great" if Amy would learn about energy efficiency and associated topics (e.g. climate change) at school and bring energy saving ideas home as long as the content they are taught is based in science.

Andy

Child Interview: 19 min. School staff room.
Mother Interview: 30 min. School staff room.
School: Large school role, medium decile, no environmental programme.

Family and household context

Andy is nine years old. He lives with his stay-at-home-mother, father, and two younger siblings. They have a very high household income, as well as a modern, big house with insulation, central heating, and low electricity bills.

Practices

Andy is consistent in turning off the computer and the TV, but needs reminders to switch off the lights. He also reminds his siblings about switching off gaming devices. In addition, Andy closes curtains and has short showers, but he is not aware that these can be energy saving behaviours, and has no other ideas on how to save power.

Family dynamics

Saving energy is not a big concern for the family, there are no discussions about it apart from reminders and occasional "yelling" from parents if appliances are left on. Rules only exist to ensure safety, and to limit TV, gaming, and computer time.

Attitude and intended behaviour

Andy's mother engages in some energy saving behaviours because she "hates waste", and wants to keep down the power bill. She thinks that her son is not making any effort to save power, and although Andy is conscious that turning off appliances saves electricity, he says he only really thinks about it "after there is a power cut".

Knowledge

Andy knows that energy is produced by hydro dams, wind turbines, and fossil fuels, that fossil fuels "harm the environment", and that renewable sources are "better". Andy's mother is not aware that her son knows that there are problems related to energy production. Except from talking with his parents about the flooding caused by hydro dams while driving past them, they are not talking about it as a family, and he is not being taught about it at school. Family conversations on other general environmental topics happen less than twice a year. Andy seems to be learning mostly from documentaries, energy saving advertisements on TV, and books.

School to home transfer

Andy's mother thinks it would be good if he would learn about energy production and efficiency at school and bring energy saving ideas home, but is doubtful as to whether the latter would actually work. Although she is concerned about the school potentially sparking debates on climate change (her husband is a sceptic), she thinks that it would be beneficial for her son to learn both sides of the argument. However, Andy generally does not talk about school with his parents, and has not brought home any new ideas.

Blake

Child Interview: 23 min. Spare classroom.
Mother Interview: 57 min. Participant's home. The father was also present.
School: Medium school role, high decile, environmental programme.

Family and household context
Blake is nine years old. He lives with his stay-at-home-mother and father. They have a high household income, and live in an old house with a wood burner.

Practices
Blake is consistent in closing curtains, and turning off the computer and the TV. He also switches off lights.

Family dynamics
Blake's mother "nags" his son to turn off lights but does not give any reasons. The only rules in the family are about limiting computer and TV times. There are no instructions or expectations regarding shower times and switching off appliances, and Blake is not interested in using heaters. Blake's mother has made passing comments on the cost of power, and Blake and his father have talked about hydro dams while driving past them. Saving energy is not a big concern for the family and there are no discussions about it.

Attitude and intended behaviour
Blake does not seem to try to save power, he thinks that his effort "make a teeny bit of difference of about one out of a million". He says he does not like electricity in general because he feels it is artificial. His mother thinks that Blake "has a certain understanding about [...] saving energy but [...] it doesn't necessarily translate into action at home". Blake's mother is engaging in energy saving behaviours due to "the money aspect" and an "eco kind point of view".

Knowledge
Blake knows that electricity is produced by "oil, sun, wind, water", and that energy sources such as gas and "ground electricity [...] will run out", but that hydropower and wind energy will not. He also talked about dolphins being disturbed by the noise of ocean drilling. Blake seems to be learning mostly from books, hearing the news in the radio, and his teacher's comments.

School to home transfer
Blake's teacher tells children to save energy by switching off the computers. They have also discussed several environmental topics at school including climate change, and the threats to hector dolphins, but the teacher has not explained the connection between these issues and energy production and consumption. Blake's mother thinks it is important for children to be educated about energy topics so they can "eventually make up their own minds" but if Blake were to bring energy saving ideas home she would not like to "be put under pressure [...]" on how they run their lives. She also thinks that if they discuss climate change in school they should learn both sides of the argument.

Charlie

Child Interview: 21 min. School library.
Father Interview: 35 min. Participant's workplace.
School: Large school role, high decile, no environmental programme.

Family and household context

Charlie is ten years old and lives with his father, stay-at-home-mother, and two sisters. They have a medium household income and live in an old house with a wood burner and a heat pump.

Practices

Both father and son seem to do as much as possible to save energy. Charlie is consistent in turning off lights, the computer and the TV. He also has short showers, and closes doors and curtains. Charlie is in charge of turning on and off the heat pump in the mornings; he keeps it under 20 degrees, and wears extra clothing instead of turning up the heating.

Family dynamics

Charlie's father has "not a great need" to give his son reminders. Charlie seems to be acting mostly out of habit, formed by following his parents' example, and the only rule is regarding shower times. In addition, the siblings are "forever" giving each other reminders about lights and doors. Overall, Charlie's parents seem to encourage their children to help the family and work as a unit. They often have conversations during meal times on how their family practices (e.g. closing doors, having short showers, using an energy efficient heat pump) help to save power and money, and Charlie "usually generates the discussion". Charlie also frequently asks questions about topics such as double glazing, insulation, and the globally rising demand for energy, often sparked by watching the news and TV advertisements. His father encourages his interest, and sometimes they "look up bits and pieces" on the internet. Although they have talked about hydro dams and windmills while driving past them, including topics such as habitat destruction by dams and air pollution by burning coal, Charlie did not mention those topics during the interview.

Attitude and intended behaviour

Charlie seems to engage in energy saving activities voluntarily. He thinks that he is contributing to keep a low power bill, and that he is helping the family in general. Charlie's father engages in energy saving behaviours to help conserve the environment.

Knowledge

Charlie does not seem to know how electricity is produced, and is not aware of any problems related to energy production and consumption, apart from its financial cost.

School to home transfer

Charlie sometimes starts environment-related conversations at home by sharing what he learns at school (e.g. recycling). Last year, at his old school, Charlie discussed energy saving behaviours. He had already been turning off lights and appliances, but says he became more conscious about switching off the computer. His father thinks that it would be helpful for parents if children discussed ways to save energy at school.

Grace

Child Interview: 28 min. Spare classroom.
Father Interview: 55 min. Participant's home.
School: Medium school role, high decile, environmental programme.

Family and household context

Grace is nine years old and lives with her mother and father. Both parents are professionals and have a high household income. The family (including Grace) built their own solar passive house.

Practices

Both father and daughter seem to do as much as possible to save energy. Grace is consistent in turning off lights, the TV, computer, and appliances at the wall, and closing doors and curtains. She would also like to switch off the microwave at the wall but she is not tall enough.

Family dynamics

Grace's family has always engaged in energy saving practices and Grace has learned from following her parents' examples. Occasionally, Grace and her father give each other reminders to switch off lights. Although Grace is very careful in saving electricity she often forgets to switch off her stereo, her father gives her gentle reminders and switches it off for her. Grace says she is making a strong effort to remember and her father does not want her to stress about it. Grace says she does "not really have a chance" to come up with energy saving ideas because her parents "have thought of all of them". Grace and her father talk about energy efficiency often, her father explains how different technologies work and how certain behaviours help to save energy - Grace finds it interesting. The family also has weekly conversations on how to live sustainably but they have not talked about energy production and associated problems.

Attitude and intended behaviour

Grace is very conscious of saving electricity, she thinks it is "precious" and is proud of their family's solar passive house. Grace thinks it is very important to save electricity so it does not run out. Her father's motivation to save energy is based on a concern for climate change and waste of natural resources.

Knowledge

Grace is aware of energy efficient technologies. During the interview she talked about their solar passive home, mud bricks, energy-saving light bulbs, small ovens, and rechargeable batteries. She knows that electricity costs money and thinks that it is a finite resource. However, Grace is not aware of how electricity is produced and its possible environmental impacts. She is learning mostly from her father, overhearing her parents' conversations, and the news.

School to home transfer

Grace often brings ideas from school on how to help the environment. Her father finds it "brilliant" and thinks that "schools could do more" to encourage children to save energy and resources.

James

Child Interview: 22 min. School library.
Mother Interview: 50 min. Participant's home. The father was also present.
School: Large school role, high decile, no environmental programme.

Family and household context
James is ten years old and moved to Dunedin two year ago with his father, mother (who is a student), and two older siblings. They have a low household income, high electricity bills, and live in an old, rented house with a heat pump and an open fire.

Practices
James is consistent in turning off lights, the computer and the TV. He also closes curtains, keeps the heating at a low temperature, turns off appliances at the wall, and sometimes has short showers and turns off heaters.

Family dynamics
James's parents occasionally remind their son to switch off appliances, and frequently remind him to have short showers, followed by an explanation about wasting electricity and money. James's mother, after talking to her friends, is thinking of setting up a shower timer. James and his siblings also give each other reminders. In addition, James's parents talk "a lot" about the financial cost of power, and sometimes about its environmental impact. The family has weekly conversations on environmental topics (e.g. ozone layer depletion, eco-sanctuaries, oil spills), which usually start by talking about school, watching the news or documentaries, and/or are triggered by James's questions.

Attitude and intended behaviour
James says that he tries to avoid wasting electricity in order to save money. He also thinks that his efforts make "a tiny" difference in having a "better sort of environment". Although James's mother is concerned about the environment, her main motivation is to reduce the power bill.

Knowledge
James learnt that electricity is produced by hydro dams, which affect the river's habitat, by talking to his parents while driving past them. They have also visited wind farms and talked about them. Overall, James is making the connection between electricity production, consumption and environmental issues. He seems to be learning mostly from conversations with his parents, but also from the news and, to some extent, from school.

School to home transfer
James discussed energy topics at his old school a couple of years ago, but he does not remember much of the content. However, it did trigger him to tell his parents that they should turn off the TV and the computer at the wall – his parents tried it, but it did not last for long. On the other hand, the family stopped using glad wrap after James had learnt at school that it is bad for the environment. James's mother thinks that "it's excellent" when schools encourage environmental behaviour, because "the more information and options you have to choose from, the better".

Jessica

Child Interview: 24 min. School library.
Mother Interview: 1 hr. Centre for Sustainability, University of Otago.
School: Large school role, high decile, no environmental programme.

Family and household context
Jessica is ten years old. She lives with her mother, father, and younger brother. They have a very high household income and live in an old house with a heat pump.

Practices
Jessica sometimes turns off lights and the computer, has short showers, and closes curtains.

Family dynamics
Jessica's parents sometimes explain to her that leaving lights and appliances on is wasteful and costs money. Her mother "nags" her about turning off lights and the computer, and her father gets "mad" when she forgets. They also explain how certain behaviours (e.g. wearing extra clothes and keeping clothes clean) help to save electricity. Jessica "keeps reminding [her]self" to switch off lights and appliances in order to avoid her parent's comments, she also sometimes reminds her younger brother. Jessica also "picked up" some practices such as having short showers from the family routine. Jessica has talked about energy efficiency regarding heating water and light bulbs with her mother. The family talks about environmental issues about once a month but these topics are not related to energy production and consumption.

Attitude and intended behaviour
Jessica has a strong notion that using too much energy is bad. She engages in energy saving behaviours in order to avoid wasting power and to please her parents. Although her mother describes her as "hopeless" in switching off lights, she also acknowledges that she is "responsible" in turning other appliances off. Jessica's mother engages in some energy saving behaviours because waste is "pointless".

Knowledge
Although Jessica's parents talk to her about the financial cost of power Jessica did not mention it. She is learning energy saving behaviours from her parents, school, and books. She knows that solar panels produce electricity, and that using too much energy is "not very good for the planet" but does not understand how energy use and production can cause environmental problems.

School to home transfer
Jessica did an energy saving unit at school two years ago where she "learned quite a lot". Now she is more conscious of the importance of saving electricity and is more careful in switching off lights and the TV. Jessica is also in charge of checking "that everyone in school is behaving responsibly" because she is an "environmental monitor". Jessica often gets ideas on activities from school and tries them out at home with her mother's support. Jessica's mother expects school to encourage positive behaviours in children and thinks that "it would be great" if her daughter were to bring home ideas on how to save power. They would choose together a list of things that they could do "realistically".

Kaila

Child Interview: 22 min. School staff room.
Mother Interview: 30 min. Participant's home.
School: Large school role, medium decile, no environmental programme.

Family and household context

Kaila is nine years old. She lives with her mother, who works part-time, and older sister. They have a very low household income and live in an old, but insulated rented house with a wood burner.

Practices

Except for having long showers both mother and daughter seem to do as much as possible to save energy. In particular, Kaila is consistent in turning off lights and the TV, closing curtains, and wearing extra clothing instead of turning up the heating. Furthermore, she turns off appliances at the walls, rinses dishes in cold water, only does full loads of washing, and avoids using the clothes dryer.

Family dynamics

Kaila's family has always followed energy saving practices and there is no need for reminders. Kaila and her mother have frequent conversations on why those behaviours help to save electricity. These conversations usually happen in the context of one of these practices (e.g. doing the laundry), or are sparked by Kaila's questions (e.g. why is the hot water running out?). Kaila is not allowed to turn on the lights in the bathroom during the day, and there are additional rules about using electric heaters (safety concerns) and limiting TV times.

Attitude and intended behaviour

Kaila and her mother save energy for financial reasons. Kaila is aware that this is important, and is making a personal effort to help: on top of following the family practices, she reminds others to turn off lights, and voluntarily limits her showers to 15 minutes.

Knowledge

Kaila knows that electricity comes from power plants and cables but does not know how energy is produced, and is not aware of any associated problems apart from the financial cost. Although she has conversations with her mother about general environmental topics, and they watch the news and talk about them, she is not making the connection between those topics and energy production. Kaila's teacher has told them to turn off all appliances at home, but they have not discussed anything else related to energy consumption at school.

School to home transfer

Kaila and her mother talk about school every day, and Kaila's mother often learns about interesting topics from her daughter. Kaila's mother thinks it would be good for children to learn about energy production and efficiency at school, and sees it as very important for her daughter's own future family life. She would be willing to try new energy saving ideas at home, and regards it as an opportunity to learn about energy efficiency and climate change through her daughter.

Karla

Child Interview: 17 min. Spare classroom.
Mother Interview: 40 min. University of Otago Library.
School: Medium school role, high decile, environmental programme.

Family and household context
Karla is nine years old and she moved to Dunedin from a Pacific Island last year. She lives with the family of a relative. They have a low household income and live in a rented home with two heat pumps and an open fire.

Practices
Karla sometimes switches off lights, the TV, the computer, and appliances at the wall. She also has short showers, and wears extra clothing instead of turning up the heat but she is not aware that these are energy saving behaviours.

Family dynamics
Karla's guardian is trying to engage her in energy efficient practices and Karla has been improving. Karla is learning how to save power through reminders (e.g. switching off lights and the TV), following instructions (e.g. shower times), and her guardian's example (e.g. switching off appliances at the wall). However, Karla's guardian finds it easier to engage in energy saving behaviours herself than to double check on her children. Karla's guardian does give reminders followed by superficial explanations (e.g. wasting power in general, comfortable temperature, and running out of hot water), and also simplifies information, for instance, she says that water for showers cost money and avoids making the link to electricity use. In general, Karla is "very good at reminding, but she's not very good at doing". Karla's guardian is not consistent in saving electricity and yet tells Karla to do it - she feels that Karla has noticed and this is preventing her to try to save power.

Attitude and intended behaviour
Karla does not seem to be making a conscious effort to save electricity. Her guardian thinks this is because she is not given responsibility for an energy saving behaviour. Karla's guardian is not very motivated to save energy herself because her husband is paying the bills.

Knowledge
Karla has learned that using power has a financial cost from overhearing her guardian's conversations; she also thinks that power cuts during storms are a problem. However, she does not know how energy is produced and is not aware of any other problems related to energy production and consumption.

School to home transfer
Karla helps with the recycling at home after she learned to do it at school. Her teacher reminds children to switch off lights but Karla has not learned anything else related to energy. Her guardian would be happy if Karla discussed energy related topics in school and brought home ideas on how to save power because it would be an opportunity to learn about energy efficiency and climate change through. However, Karla talks very little about school with her family.

Kelly

Child Interview: 11 min. School staff room.
Guardian Interview: 36 min. Participant's home.
School: Large school role, medium decile, no environmental programme.

Family and household context
Kelly is ten years old and lives with her older sister. They have a very low household income and live in an old, rented house with a wood burner.

Practices
Kelly is consistent in turning off lights. She also sometimes turns off the TV, and tries to have fewer hot drinks in order to save power. She has short to medium showers and helps to close curtains, but she is not aware that these are energy saving behaviours, and has no other ideas on how to save power.

Family dynamics
There are no rules in the home regarding energy usage. Kelly's mother used to talk to her about the cost of electricity, and gave her constant reminders to switch off lights and appliances. Her sister has also explained to her that power costs money, but they usually only seem to talk about it when Kelly makes a mistake.

Attitude and intended behaviour
Both Kelly and her sister try to save energy for financial reasons and to avoid a power cut. Kelly's reminders to her sister about turning off lights, switching off the oven at the wall, and closing the fridge could be an indication of her concern regarding energy savings.

Knowledge
In addition to the comments made by her mother and sister, Kelly is learning about the financial cost of power by overhearing some of her sister's conversations. Nonetheless, she does not know how energy is produced, and is not aware of any of the associated problems. Kelly's sister assumes Kelly is learning about energy topics at school, and probably from books. Kelly remembers discussing energy usage at school some year ago, but does not recall what she was taught.

School to home transfer
Kelly likes school and talks about it with her sister but has never brought home any new ideas. Her sister thinks that it is good for schools to encourage positive behaviours in children but is doubtful that Kelly would really adopt any new energy saving behaviours.

Lisa

Child Interview: 16 min. Teacher's office.
Mother Interview: 37 min. Café.
School: Large school role, medium decile, no environmental programme.

Family and household context

Lisa is nine years old and lives with her mother, father, and younger sister. Both parents are professionals and have a medium household income. They recently moved to their own new house which has insulation, energy efficient appliances, and a wood burner.

Practices

Lisa's mother engages in some energy saving behaviours, but her daughter is one of the participants who did the least to save energy. Lisa says she turns off lights and sometimes the computer but her mother describes her efforts as "hopeless". Lisa also closes the curtains in her bedroom to keep in the heat.

Family dynamics

Lisa's mother has recently decided to get everyone in the family to turn off the lights - she has "become the light police". She gives constant reminders to Lisa (who dislikes it), and explains how long it takes her to earn the money to pay for the electricity bill. Lisa has also started to remind her parents to switch off lights. In general, Lisa has little opportunity to control her electricity usage, as the family does not use electric heaters and she is not involved in household chores. In addition, he parents randomly tell her to get out of the shower, and turn off the TV and the computer.

Attitude and intended behaviour

Lisa has started to switch off lights in order to avoid constant reminders from her mother, but does not show a personal interest in engaging in energy saving behaviours. Although Lisa's mother is conscious of the environmental impact of energy use, she is trying to save electricity only to reduce the power bill.

Knowledge

Lisa is aware of the financial cost of power and has a vague notion that it could run out. She seems to be learning mostly from her parents, and has not discussed energy topics at school. Lisa has weekly conversations with her family about general environmental topics, and they watch the news and talk about them. In addition, Lisa has asked questions regarding hydro dams and wind farms while driving past them, but does not seem to make the connection between those topics and energy production or associated problems.

School to home transfer

Lisa is easily influenced by school and has, for instance, picked up some healthy eating behaviours. Although Lisa's mother is sometimes annoyed by her daughter trying to change family practices, she would be open to energy saving ideas coming from school, and thinks that it might give children more options to make their own decisions in the future.

Malcolm

Child Interview: 21 min. School library.
Mother Interview: 28 min. Participant's workplace.
School: Large school role, high decile, no environmental programme.

Family and household context
Malcolm is ten years old and lives with his mother, father, and younger sister. Both parents work full-time and have a very high household income. The family moved to Dunedin two years ago and lives in an old, rented house with a heat pump.

Practices
Malcolm is consistent in turning off the TV and the computer, and sometimes has short showers. He is aware that the family could potentially save power by unplugging chargers, watching less TV, and getting his father to use the computer less.

Family dynamics
Malcolm is forbidden from cooking for safety reasons, and must keep the heat pump below 22 degrees. Malcolm's mother is in charge of all the energy saving behaviours at home, because she does not trust her son, and feels it is easier to do it herself. She does not give explanations regarding energy usage to her son, and there are no conversations about the topic. Malcolm is constantly asking questions about how things work, but his mother sometimes finds it difficult to answer those related to electricity (e.g. How does a nuclear plant create radiation?). He has also sparked conversations about climate change after watching documentaries, but they have not discussed the topic in relation to electricity consumption.

Attitude and intended behaviour
Malcolm is not trying to save power, and says that his family "never think(s) about it at all". He also thinks that he uses more electricity than his parents because he is "always using electronics". His mother is "forever going around and turning off lights and things" to keep the power bill down, but is happy with their current level of electricity consumption and does not want to change her practices.

Knowledge
Malcolm is aware of the financial cost of power from hearing his parents' conversations, and thinks that if "we make electricity a higher price" his family would use less because "when fuel got up to really expensive we tried to limit down the fuel". Malcolm also thinks that there could be technical problems if everyone used too much power. He "forgot" how energy is produced, but learnt that nuclear power is related to electricity production from a science fiction book. He has not discussed energy topics at school.

School to home transfer
Malcolm's mother thinks that it would be good for children to learn about the energy crisis at school because "adults aren't necessarily well educated", and regards it as an opportunity to learn about it through her son. Malcolm sometimes talks to his mother about school, but has not brought home any new ideas.

Marion

Child Interview: 18 min. School staff room.
Mother Interview: 21 min. Phone interview.
School: Large school role, medium decile, no environmental programme.

Family and household context
Marion is nine years old. She moved to Dunedin over a year ago with her stay-at-home-mother, and younger sister. They have a very low household income and live in an old, rented house with a heat pump and an open fire.

Practices
Marion needs reminders to switch off lights and the TV. She helps to close curtains, and wears extra clothing instead of turning up the heating. However, she is not aware that these are energy saving behaviours – instead she does these things following her mother's example. In contrast to her mother, Marion is one of the participants who did the least to save energy.

Family dynamics
Marion's mother is in charge of all the energy saving behaviours at home because she does not trust her daughter and thinks that using appliances is dangerous. There are no conversations in the family regarding energy usage. Marion's mother gives some reminders to turn off lights and makes reference to the cost of electricity, but Marion does not seem to recall any reasons for saving energy. Marion's mother is planning to talk to her daughter about the financial and environmental costs of using electricity. So far there are no rules regarding energy usage, but Marion's mother is about to limit shower times to 5 minutes.

Attitude and intended behaviour
Marion's mother's main reason for saving energy is reducing the power bill, but she is also thinking about environmental impacts. Although Marion makes an effort to help the family, she does not understand why it is important to save energy; she is not trying to reduce her energy consumption, and her mother is "sure that it will only get worse".

Knowledge
Marion knows that electricity comes from cables but does not know how energy is produced. She is not aware of any problems associated with energy production, and did not mention its financial cost. Although she has conversations with her mother about general environmental topics, and likes to watch nature documentaries, energy-related issues are usually not mentioned. Marion is not learning about energy-related topics at school either.

School to home transfer
Marion's mother considers it very important for children to learn about energy efficiency, climate change, and "money and the environment" at school. Marion seems interested in what she is being taught at school and talks about it at home, trying to get the "point across". However, she has not brought home any new ideas.

Mark

Child Interview: 12 min. School library.
Mother Interview: 36 min. Centre for Sustainability, University of Otago.
School: Large school role, high decile, no environmental programme.

Family and household context
Mark is nine years old and lives with his mother, father, and two older brothers. They have a very high household income, and live in their own large house with a heat pump.

Practices
Mark sometimes turns off lights, the TV, and gaming devices, and has short showers. He has no other ideas on how to save power.

Family dynamics
Mark's parents often talk to him about the financial cost of power, expect him to switch off appliances, and give him constant reminders. Mark is not allowed to change the temperature setting of the heat pump because he has misused it in the past. There is also a rule about closing doors, and time limits on the use of the TV and the computer. Mark often asks his parents about their reasons for engaging in certain behaviours, which taught him that heating water requires energy, and that closing curtains helps to conserve heat. The family talks about general environmental issues about once a week, often sparked by the news, and these conversations sometimes include energy production (e.g. Japan's nuclear reactor accident).

Attitude and intended behaviour
Mark thinks that his efforts to save electricity make a difference in reducing the power bill. He says that, although he "forgets occasionally" to switch off appliances, he "is doing quite a bit already". His mother does not think that Mark is trying to save energy because he is "not paying the power bills", which is her main motivation to save electricity.

Knowledge
Mark knows that electricity is produced by hydro dams and wind turbines because he has seen them and asked his parents several questions about how they work. The family has also talked about nuclear and solar power, but Mark does not remember those energy sources. He does not seem to be making a connection between energy production and his own electricity use, and is unaware of any problems related to energy production and consumption apart from the financial cost. However, he thinks that he "may find out something else when [he] get(s) a bit older". Although Mark assumes that they have discussed energy topics at school, he does not recall what he was taught, and seems to be learning mostly from his parents.

School to home transfer
Mark sometimes gets ideas on activities from school and tries them out at home with his mother's support. Mark's mother thinks that schools should encourage children to "have a wider understanding and explore different ways of doing things" (including energy usage at home), but without encouraging particular behaviours. If Mark were to bring energy saving ideas home, she would find it useful as a prompt to talk about their own electricity usage.

Mary

Child Interview: 18 min. Teacher's office.
Mother Interview: 43 min. School staff room. The father was also present.
School: Large school role, medium decile, no environmental programme.

Family and household context
Mary is ten years old. She lives with her stay-at-home-mother, her father (who is a student), and her two siblings. They have a very low household income and live in an old house with a wood burner.

Practices
Mary engages in several energy saving behaviours and is consistent in switching off lights, heaters, the TV, and the computer. She also switches off appliances at the wall, and closes doors and curtains.

Family dynamics
Mary is mostly following her parent's examples and instructions - which are usually given without explanations. Her parents also give her some reminders to switch off lights and make reference to the financial cost of energy. In turn, Mary reminds her younger brother. Apart from this there are no conversations in the family regarding energy usage or production.

Attitude and intended behaviour
Mary mentioned several times that she engages in energy saving practices for environmental and financial reasons. Her mother knows that Mary is engaging in energy saving behaviours, but is unaware of her motivations. She has not talked to Mary about the environment, and personally "admits" that she saves power only because of the "cost".

Knowledge
Mary knows that electricity costs money, that energy comes from the sun, and that using power has an environmental impact. Nonetheless, she does not understand the relationship between environmental problems, energy production, and energy usage. She learned from her teacher that turning off lights and closing doors are energy saving behaviours, but apart from that she is unaware of her learning sources and says she "learns at home" by herself and "just figure(s) it out".

School to home transfer
Mary claims that she has started to be more careful in closing doors at home after being reminded to do so by her teacher but her parents have not noticed. Mary's parents think that, if children were to learn energy efficient topics at school the teachers should be careful to provide only suggestions, and to avoid "forcing" opinions. They also pointed out that "not all families can afford to do particular things". Mary does not seem to talk often about school with her parents, and although she has brought a few ideas home, her mother does not usually have the time to support such activities.

Mike

Child Interview: 27 min. Spare classroom.
Mother Interview: 56 min. Participant's home.
School: Medium school role, high decile, environmental programme.

Family and household context

Mike is nine years old. He lives with his stay-at-home-mother, father, and two younger siblings. They have a medium household income, and live in an old house with a wood burner.

Practices

Mike is consistent in turning off the computer, having short showers, and closing curtains. He also switches off lights and the TV. He thinks that his family could save more energy if they used their cell phones less often.

Family dynamics

For safety reasons, Mike's is not allowed to use heaters without his parent's instructions, plug and unplug appliances, and use cooking appliances and the computer unsupervised. He is also not allowed to watch TV or read and watch the news because he could be exposed to "violent" and inappropriate content. In general, Mike is given instructions by his parents (e.g. having short showers or closing curtains) followed by brief explanations (e.g. wasting hot water or keeping the heat in). Mike's parents also give him constant reminders to switch off lights. However, these reminders and instructions are rarely followed by an explanation on saving power. Mike also gives his younger siblings reminders. Mike's mother avoids talking to his son about the financial cost of power because she thinks that Mike does not understand money, however, Mike is trying to help his parents to reduce the power bill. The family has talked about hydro dams and wind farms while driving past them and after watching a documentary on the topic, Mike showed interest and asked several questions.

Attitude and intended behaviour

Although Mike is conscious that his efforts help the family to save electricity, reduce the power bill, and make a difference in conserving the environment, his mother says "he's not thinking about it". Mike's mother engages in a few energy saving behaviours for environmental reasons.

Knowledge

Mike is aware that electricity is produced by hydro dams and that using energy has an environmental impact (pollution, causing fires) but does not understand why. Mike "pick(s) bits up from lots of things [...] and put (s) them together". He is learning from books, his teacher's reminders and his parent's comments.

School to home transfer

Mike says that his teacher's reminders to save electricity have helped him to understand that saving power is important. Mike was also part of the "enviro group" at school last year, and is constantly talking about school with his parents. Mike's mother thinks it would be good for Mike to learn about energy topics and associated issues (e.g. climate change) at school and bring ideas home on how to save power as long as "it was doable and he [Mike] was passionate about it".

Molly

Child Interview: 24 min. School library.
Mother Interview: 35 min. Participant's workplace.
School: Large school role, high decile, no environmental programme.

Family and household context
Molly is ten years old and lives with her mother, father, and older brother. Both parents work full-time and have a very high household income. They live in an old house with a heat pump and central heating, and pay high electricity bills.

Practices
Molly is consistent in turning off lights, heaters, the computer and the TV. She also closes curtains, keeps the heating at a low temperature, and turns off appliances at the wall. Molly is aware that her family could potentially pay less for power if they installed solar panels, but she has not talked about it with her parents.

Family dynamics
Molly's parents tell her when she is wasting electricity, and remind her that it has a financial cost. Molly says her parents set up a rule to always turn off lights and appliances - if she forgets she does "not get any pocket money", thus she "turn(s) them off now". Molly's mother times her daughter's showers, and tells her to get out after 5 minutes. In addition, Molly has the task of closing the curtains on certain days of the week. Molly sometimes reminds her brother to switch off lights and appliances. The family has talked about hydro dams and wind farms while driving past them, and has discussed saving electricity "because the water levels are down" after watching it on the news. During those conversations, Molly usually asks questions and makes suggestions.

Attitude and intended behaviour
Molly is "not sure" of the reason for saving electricity, and does it because she is told to do so by her parents. Molly's mother is aware of the importance of conserving resources, but is primarily trying to reduce the power bill.

Knowledge
Molly is aware of the financial cost of power, has a vague notion that it could run out, and does not know that energy consumption and production have an environmental impact. She has seen solar panels, learnt from a classmate's presentation how they work, and has overheard her mother talking about them. Molly has learnt from the newspaper that electricity is produced by wind farms and comes from "underground". Molly studied "static electricity" at school, and they discussed energy saving behaviours, but she does not remember them.

School to home transfer
Molly is "always bringing stuff home from school" and telling her parents what they should do (e.g. recycling). Molly's mother thinks it is good for schools to encourage behaviours that follow their own family beliefs. She would be happy if Molly brought home "feasible" ideas on how to save electricity.

Paula

Child Interview: 17 min. Spare classroom.
Mother Interview: 41 min. University of Otago Library.
School: Medium school role, high decile, environmental programme.

Family and household context

Paula is nine years old. She moved to New Zealand from Asia last year with her stay-at-home-mother, father (who is a student), and younger brother. They have a low household income and live in a rented house with a heat pump.

Practices

Paula and her father seem to do as much as possible to save energy. Paula is consistent in turning off heaters, the TV and the computer. She also switches off lights, appliances at the wall, closes curtains, wears extra clothing instead of turning up the heat, avoids using the clothes dryer, and times her showers voluntarily.

Family dynamics

Paula's family has always engaged in energy saving practices and Paula is learning from following her parent's examples, constant reminders, and explanations. Her father is doing his "level best" to engage Paula in energy saving practices, and thinks that "she is still on the learning curve". Paula's parents always explain to her how certain behaviours (e.g. temperature settings on heaters, short showers) help to save power, including the household chores that Paula is involved in (e.g. avoid using the clothes dryer). They have also explained that power costs money, and that not everyone is fortunate enough to have electricity. Paula sometimes gets upset with her parent's reminders, but she also gives reminders to her younger brother and her parents. The family has weekly conversations on environmental topics (usually around the activities they are doing), including climate change and pollution, but they have not discussed how these topics relate to electricity consumption.

Attitude and intended behaviour

Paula is conscious about saving power because she wants to help her family reduce the power bill and save electricity for the winter. Paula's father is trying to save power for economic reasons and also acting out of habit - which possibly stems from growing up in a country were electricity is not taken for granted.

Knowledge

Although Paula's father said his daughter studied energy sources in her old school, Paula does not remember how energy is produced, and is not aware of any problems associated to energy production and consumption apart from the financial cost.

School to home transfer

Paula often brings ideas home from school (e.g. cooking and concern about trimming trees). Her father thinks that children need to learn "how to cope" with a world that is "changing rapidly" due to climate change and depletion of natural resources. Thus, he "would love" for Paula to discuss energy efficiency and climate change at school, and bring energy saving ideas home.

Ron

Child Interview: 19 min. School reading room.
Mother Interview: 34 min. Participant's workplace.
School: Large school role, medium decile, enviroschool.

Family and household context

Ron is ten years old, and lives with his mother, father and three siblings. Both parents work full-time, and have a medium household income. The family lives in an old house with a heat pump and a wood burner.

Practices

Ron sometimes turns off lights and the TV, has short showers, and switches off appliances at the wall. He has no other ideas on how to save power.

Family dynamics

The only energy-related rule in the family is for children to unplug their portable play station at night. Ron's parents are constantly reminding him to switch off lights and appliances, and often explain to him that power costs money. Ron sometimes reminds his younger brother to switch off the TV, and reminds his parents to turn off the heat pump before leaving the house. When Ron's parents give him reminders, they occasionally mention that using energy has an environmental impact. In addition, the family talks about climate change and other general environmental issues about once a month, often sparked by watching the news together. However, there are no conversations regarding energy production and associated problems, mostly because his mother thinks Ron is "a little bit too young to grasp the big picture".

Attitude and intended behaviour

Rob's mother is trying to save electricity in order to reduce the power bill, and Ron engages in energy saving behaviours "because it wastes our [family] money and that's all". Although his mother thinks that "he is becoming more aware" of his own energy consumption, she also says that Ron has "no interest" in saving power.

Knowledge

Ron learned from reading a magazine at school that energy is produced by hydro dams, and understands the link between energy production and consumption. Nonetheless, he is not discussing energy topics at school, and is not aware of the environmental impacts of using energy, despite his parents' occasional comments.

School to home transfer

Ron generally does not talk about school with his parents and has not brought home any new ideas. His mother thinks that it is important for schools to encourage positive behaviours in children if they are in line with their own family values. She would be happy for children to discuss energy efficiency at school and bring home energy saving ideas. If Ron were to talk about climate change at school she would "make sure he would have a well-rounded response to see all sides of the issue".

Tabatha

Child Interview: 28 min. Teacher's office.
Mother Interview: 42 min. Participant's home.
School: Large school role, medium decile, no environmental programme.

Family and household context
Tabatha is ten years old. She lives with her stay-at-home mother and often visits her grandparents. They have a very low household income and live in an old rented house with an open fire.

Practices
Tabatha is consistent in switching off the computer and cooking appliances, wears extra clothing instead of turning up the heating, turns off some appliances at the wall, and also helps to close curtains. She also sometimes switches off lights and the TV.

Family dynamics
Tabatha's mother is constantly "nagging" her about turning lights off and reminds her of the financial cost of power. The only rules in their family are regarding safety when using electric heaters.

Attitude and intended behaviour
Tabatha's mother tries to save electricity because they "haven't got the money". Although Tabatha finds it annoying to switch off lights, she turns off more appliances at the wall than her mother and would like to save power by keeping the fire going instead of switching on electric heaters (however she is generally forbidden from doing so by her mother).

Knowledge
During the interview, Tabatha talked about a wide range of appliances and energy-related issues, including, for example, hydro dams and their impact on the landscape, electric fences and power boxes. Although she seems to understand the connection between energy production and consumption, she is not aware of any environmental problems. Tabatha talks about environmental issues with her mother about once a month, sometimes sparked by watching the news together, but these conversations do not include energy production. She is not learning about energy-related topics at school either, although her mother assumes that she is. Tabatha is constantly asking questions, and her mother often finds it challenging to answer those related to electricity (e.g. How does a power box work? Why is it necessary to disturb rivers with dams?). Overall, Tabatha seems to be learning by putting together different experiences, ranging from cartoons (e.g. the smurfs building a dam) to road trips, her grandfather's comments on power bills, and the energy spot advertisements.

School to home transfer
Tabatha's mother likes it when schools encourage positive behaviours in children because "they can change things more at a younger age", and would find it helpful if Tabatha were to bring home energy efficient ideas that could save money. Tabatha often gets ideas on activities from school and tries them out at home with her mother's support.

Tanya

Child Interview: 24 min. Teacher's office.
Mother Interview: 43 min. Participant's home.
School: Small school role, high decile, enviroschool.

Family and household context

Tanya is nine years old and lives with her stay-at-home-mother, her father, and her two siblings. They have a very high household income and live in their own old, but renovated, house, with insulation, passive solar arrangements, and four heat pumps.

Practices

Tanya and her mother engage in several energy saving behaviours. Tanya is consistent in switching off lights, heat pumps, the TV, and having short showers. She also closes curtains, avoids using the clothes dryer, and wears extra clothing instead of turning up the heating.

Family dynamics

Tanya's parents have explained to her the financial cost of power. At the moment there is very little need to give Tanya reminders, and her parents encourage her helpfulness. When Tanya does need some reminders, her parents talk about the environmental impact of energy use and make reference to her "green" identity. Tanya sometimes also reminds her older brother to turn off lights and close curtains. The family has conversations on general environmental topics about once every fortnight, and sometimes these include climate change and energy production topics.

Attitude and intended behaviour

Tanya is trying to save energy to reduce the power bill, and to avoid "using all the oil and fossil fuels". She regards herself as "being quite green", and feels that her efforts in saving energy are making a difference. However, her mother thinks that she is not conscious of saving power, and that she is simply following her parents' example. Although Tanya's mother leads an environmentally friendly lifestyle, she is primarily trying to reduce the power bill.

Knowledge

Tanya did an energy project at school the previous year, and clearly remembers the content. During the interview, she talked about fossil fuels, energy security, oil spills, and "environmentally friendly" energy sources, such as solar and wind power. She also remembers the energy saving behaviours they discussed at school, which reinforced her household practices. At home, she reads environmental magazines, which sometimes feature energy topics, and talks about the news with her parents.

School to home transfer

Tanya has had short showers for a long time, but became even more conscious about them after learning at school that they help to save energy. Although Tanya "came home [from school] with all these ideas about how you could use energy", she is "very self-contained" and rarely tries to change the family routine. Tanya's mother thinks children should gain information about climate change and energy efficiency at school, but that they should decide by themselves which behaviours are appropriate.

Tim

Child Interview: 11 min. School library.
Mother Interview: 47 min. Centre for Sustainability, University of Otago.
School: Large school role, high decile, no environmental programme.

Family and household context
Tim is nine years old and lives with his mother (who works full-time) and three older sisters. They have a medium household income, and live in an old house with a heat pump and a wood burner.

Practices
Tim is consistent in turning off lights, heaters, the computer and the TV. He also has short showers, closes curtains, keeps the heat pump at a low temperature, and wears extra clothing instead of turning up the heating. Tim is aware that the family could potentially save more power by watching less TV and turning on their electric blankets for a shorter period of time.

Family dynamics
Tim's mother has explained to him that using electricity costs money, and gets "growly" if her children waste power. However, there is little need to give Tim reminders. Tim seems to be engaging in energy saving behaviours by following his mother's example - he is "learning by osmosis" and "just picked it up". Tim's mother also told her children over dinner that they need to limit their shower times in order to reduce their gas consumption, and sometimes threatens to install a timer. While driving past hydro dams, Tim's mother pointed out that dams "ruin" the rivers, and that, if "everyone saved electricity", there would be no need to build more hydro dams. However, she thinks that Tim does not comprehend her explanations, and is "tuned out and not listening".

Attitude and intended behaviour
Tim switches off lights and appliances in order to save money, and thinks that his efforts are making a difference in reducing the power bill. However, his mother does not feel that he is making a conscious effort to save power. Tim's mother is trying to save energy mainly for financial reasons, but she is also concerned about not wasting the countries' natural and economic resources.

Knowledge
Tim does not know how electricity is produced, and is not aware of any problems related to energy production and consumption, apart from its financial cost. He has not discussed energy topics at school, and seems to be learning mostly his mother's comments. His mother also thinks that he is learning from advertisements on TV.

School to home transfer
Tim usually does not talk about school. His mother thinks that schools can help to create habits in children, because they are being "reinforced by [...] kids of the same age". If Tim were to bring home energy saving ideas, she would consider them, and try them out if they made "no change to what we're doing".