THE CENTRE FOR HUMAN RIGHTS AND CITIZENSHIP EDUCATION

Sustainable Energy Authority of Ireland

Evaluation of Education Programme

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Executive summary

Introduction

The Sustainable Energy Authority of Ireland's strategic plan 2010 – 2015 opens with the mission of "transforming Ireland into a society based on sustainable energy structures, technologies and practices, and a vision of making Ireland a "recognised global leader in sustainable energy… a society fully engaged in the sustainable energy agenda and an economy fully exploiting the global opportunities in clear, low carbon solutions" (SEAI, 2010:1). The process of transformation towards a low carbon future will require a fundamental change in Irish society, which is currently highly dependant on fossil fuels, to meet energy needs.

The policy arena which drives societal transformation towards sustainable energy structures, technologies and practices is a complex, multi-faceted one, encompassing fuel security, climate change, and specific measures towards renewable energy. These policy areas, in particular climate change, calls for public participation, education and communication strategies to increase public awareness, knowledge and involvement. Within this wide gambit of public policy, the communication of energy issues to children (4-18 years old) has become an important feature.

National and international research in the disciplines of environmental education, geography, sociology, and education host a wealth of information on best practices in engaging the public, including children, in awareness, education and public participation. This research, which forms the backbone of this report, is considered in depth in Chapter 2. Put briefly here, the literature suggests that education programmes should engender critical, systems thinking; support decision making; link school-community-home environments and provide opportunities for critical real world engagement with energy issues that are age appropriate.

It is in this context that SEAI's education programme has been evaluated. The evaluation set out to analyse and evaluate the SEAI primary and secondary school programme, and in doing so, develop a clear conception of the purpose of the programme, its target audiences and strategic partners. The overall goal of the evaluation was to provide SEAI recommendations on future development of the education programme. The evaluation specifically asks:

1. To what extent does the SEAI education programme achieve its aim to engender energy awareness, education and behavioural change amongst its target audience of primary and secondary teachers and pupils?
2. In what ways could the SEAI education programme become more effective?

Methods

The evaluation of the SEAI education programme took two distinct directions. First, a strategic evaluation of SEAI education programme with policy makers and the wider energy education and environmental education sector was undertaken. Thirteen semi-structured interviews were conducted with these individuals. Second, an in-depth analysis of energy education awareness in primary and post-primary schools was conducted. A quantitative questionnaire was distributed by mail to 100 randomly selected primary and post-primary schools. This was followed by interviews and focus groups in five selected schools.

Key findings

Overall, the findings of the evaluation are positive towards the SEAI education programme, by strategic partners and also primary and post-primary schools. However, when positioned in the context of the literature review, the findings also clearly indicate ways in which the programme can be improved.

In response to the first research question, outlined above, the findings of quantitative questionnaires at both primary and post-primary level suggest that participation by teachers in

SEAI workshops and exposure to SEAI resources does increase teachers' awareness and knowledge of energy education, particularly energy science. Teachers also reported that SEAI resources and workshops increase pupils' awareness and knowledge of energy issues. However, evidence of energy behaviours is a little more difficult to attribute solely to SEAI education programmes, given the complex array of variables responsible for energy behaviour as outlined in the literature review. What is clear, however, is that teachers at both primary and post-primary level are making an effort to engage their students in energy saving behaviours which are specified in SEAI education resources. Additionally, the findings suggest that teachers' motivations and rationales for teaching energy related matters include personal interest in energy conservation and climate change, and the belief that it is important to bring environmental issues into the classroom through the curriculum. Teachers at primary and post-primary level reported their last lack of confidence in teaching various aspects of energy education, most particularly science, such as forces and materials, electricity, and principles of energy conversion. Lastly, all teachers at both primary and post-primary level believe that energy education belongs not only in the classroom, but also at home.

Recommendations

The evaluation analysis and production of recommendations was overseen by the CHRCE team. The team reviewed the results of the teacher's questionnaires, interviews and focus groups, positioning these results within the context of the literature review and their own evaluation of SEAI resources. The key recommendation calls on SEAI to review the education programme with the goal of becoming more learner focused, through the development of Inquiry Based Education (particularly with respect to science) through whole school, action competence approaches to learning. Additional recommendations involve engaging in initial teacher education and continuing professional development and development/strengthening of strategic partnerships both within SEAI and with external agencies.

Chapter 1 Introduction

Supranational policy, globally,[1] and EU level[2] set targets to reduce GHG levels across the EU by 20% (based on 1990 levels) by 2020. Similarly, Irelands has set targets for converting to renewable energy use, for example, 15% of electricity consumed by the county to be sourced from renewable energy by 2010. It is within this policy context that SEAI in coming years is to assist in the transformation of Irish society towards "sustainable energy structures, technologies and practices", with the ambitious vision of making the country "a recognised global leader in sustainable energy" (SEAI, 2010:1).

Societal or behavioural transformation involves a complex interplay of values, situational and psychological factors which play out within social, cultural, political and economic contexts, for the individual and groups of individuals (family, community, schools). As Barr & Glig (2005) have discussed with regard to waste management in the UK, and reiterated by Davies (2003) in Ireland, attention to these wider contexts can reveal barriers and supports required in the transition towards sound sustainable behaviours.

While education is certainly a fundamental feature of societal transition, it is important not to overestimate the potential of environmental education or awareness raising to drive, on its own, societal change as highlighted with respect to energy awareness campaigns by Owens & Driffill (2008). Education practices and institutions are part of, and therefore, can replicate the pre-existing social norms stifling change, or at the very least, providing mixed messages. As Owens & Driffill (2008) point out, the physical structures of social life, such as prices and social networks (e.g. schools and homes) can make it difficult to act on particular environmental messages, particularly when they provide powerful counter-incentives to the environmental

[1] e.g. Kyoto agreement and more recent Copenhagan and Cancun agreements

[2] e.g. the EU Climate Energy Package

information provided. In the energy education context this suggests mixed messages can occur when energy education takes place in schools with no energy policy, ethos or actions. Equally, positive school works around energy can be undermined by behaviours and values instilled outside the school, in the home or community.

This points to the need for coherence and consistency in policy instruments because "the greatest degree of behaviour change occurs when different strategies combine" (Gardner & Stern, 1996). The combination of incentives, regulation, information and public engagement should be sensitive to the (often context-specific) factors that inhibit behavioural change, as discussed above. As Motherway & Halpin (2010) illustrate with respect to motivations for uptake of the SEAI home energy grant schemes: personal change was instigated as a result of economics, energy saving and grant availability, in addition to comfort gains, rather than any real environmental concern. Therefore, designers of energy education programmes, (if their objective is to move towards a sustainable energy society and seek to engender behavioural change) must be cognizant of broader contextual limitations and the necessity for integrated thinking, particularly between education messages, infrastructure and economic supports.

In this context the SEAI education programme evaluation is timely. The evaluation takes two key directions, first, identifying SEAI engagement with the wider energy education/policy sector, and second, evaluating current trends in schools, teacher perception, and use of SEAI resources in the primary and post-primary school environment. Given the research context of this evaluation, a mixed method approach was chosen which incorporates qualitative interview and focus group techniques in conjunction with a quantitative postal survey directly to teachers. The method through which the evaluation was conducted is outlined in Chapter 3.

The substantive body of work, the findings of the evaluation, are presented in Chapter 4. The chapter is divided into primary and post-primary responses. Within each section the results of strategic interviews are examined initially, followed by analysis of teachers responses. Key findings are drawn out at the conclusion of each section. The results chapter is followed by

Chapter 5 which outlines recommendations (in the light of findings) and illustrates actions which SEAI can implement immediately.

Chapter 2 Policy and Literature review

This chapter examines the policy context which underpins the SEAI education programme and key academic literatures which inform the evaluation.

The policy review highlights the role of SEAI in the transition towards a sustainable energy society which embraces energy saving and efficiency. Within this, provision of public information and education on sustainable energy and energy saving behaviours is a central ideal in promoting sustainability and addressing climate change. Key academic literatures from the fields of environmental psychology, environmental education, human geography and science education are drawn on which contribute to analysis of environmental awareness and education programmes.

2.1. Policy context

Energy is a complex policy arena encompassing a number of different policy elements, including climate change, implementation of renewable energy technologies and the achievement of energy policy targets. Climate change is widely recognised as a serious threat to natural ecosystems and human existence (Intergovernmental Panel on Climate Change, 2001), caused mainly by the combustion of fossil fuels (for example coal, oil and natural gas) for the human requirements of mobility, power, heat and light. Responses to this complex, large-scale environmental problem present formidable difficulties. Greenhouse gases, which are the main causal agents of climate change, are not perceptible using human sensory mechanisms. Conventional human learning mechanisms that link cause and effect are likely to be inadequate. Responses to the climate change problem have included political, economic and educational strategies to achieve change. Under the Kyoto Protocol and more recent policy

endeavours (e.g. EU Climate Change Policy) Ireland has agreed to reduce our green house gas emissions by 20% by 2020. One of the many ways to meet this target and also to ensure fuel security into the future is through the provision of, and conversion, to renewable fuel sources, technological advancement in energy efficiency, and energy conservation.

In Ireland the promotion of sustainable energy practices is the responsibility of the semi-state agency, The Sustainable Energy Authority of Ireland (SEAI).

SEAI's strategic plan 2010 – 2015 opens with the mission of "transforming Ireland into a society based on sustainable energy structures, technologies and practices", and a vision of making "a recognised global leader in sustainable energy. A society fully engaged in the sustainable energy agenda and an economy fully exploiting the global opportunities in clean, low carbon solutions" (SEAI, 2010:1). A key objective within the strategic plan is to implement strong energy efficiency actions that radically reduce energy intensity and usage. In addition it calls for accelerating development and adoption of technologies to exploit renewable energy sources and creating and supporting evidence based responses that engage all actors supporting innovation and enterprise for our low carbon future. In essence, as SEAI states "we can expect fundamental change in society during the coming years in where our energy comes from and how we use it" with SEAI stating that its strategic objectives represent an "ambitious agenda that requires considerable adaptation, innovation and commitment" (SEAI, 2010:7). To achieve these objectives SEAI has committed itself to deliver high-quality programmes that work to connect relevant stakeholders, co-ordinate action and lead a process of transformation. This process of transformation towards a sustainable energy future which constitutes a fundamental change in society, requiring adaptation and innovation, equally requiring adequate responses in terms of communication and education. SEAI recognises the necessity of on-going, appropriate communication channels and education programmes, as activating change in society, reiterated in the Strategic Plan through its four modes of action, as highlighted in Box 1, particularly mode three, Activator.

Box 1: SEAI – Four modes of action:

Agency – delivering programmes effectively and efficiently

Academy – training, raising standards and building capacity

Activator – engaging energy consumers, raising awareness and changing behaviours

Authority – informing debates, supporting policy making and leading innovative thinking.

Responses to the move towards a sustainable energy future have included political, economic and educational strategies to achieve change. Many of the SEAI objectives outlined in the strategic plan engage with energy consumers; the plan calls for increased public energy awareness and aims to change behaviour. However, communication, education and awareness raising equally have a role to play in other modes of SEAI action, and therefore can be viewed as a cross-cutting activity across the organisations activities.

In addition to the organisational strategic plan, SEAI's education section produced a planning document encompassing the years 2004 to 2006. The overall aim of the education programme at this time was to instil energy friendly behaviour from an early age and for older pupils to invoke behaviour change. Close examination of this document is warranted at this point.

The first objective aims to educate 5 to 18 year olds on sustainable energy, to raise awareness & modify behaviour through a positive impact on core values. The education methods employed to achieve this objective include curriculum integration, and provision of workshops at primary level which "clearly demonstrate the positive consequences of changing behaviour" (SEAI, 2004). At second level, an annual photo competition was on-going at the time. Within the informal education sector Science Centres in Dublin and Cork were to develop a sustainable energy section, skills focused, to allow rational assessment of choices in life. Education activities were also to be integrated and align with Power of One Campaign.

With regard to objective 2 of the plan, the development of high quality resources for educators, includes needs assessment, and then once needs identified, production of "innovative

resources for shaping children's future behavioural patterns". The resources provide a balance between theory and practical aspects to allow for the formation of positive value sets & beliefs. Teacher professional development is also to be delivered to educators so they can deliver high impact material. Objective 3 & 4 of the plan are related to promotion of resources and dissemination through strategic players. Objective 3 aims to increase awareness of education programme through the promotion of resources/materials through strategic partners and education web portals. Objective 4 aims to identify different players in energy education and their key roles and leverage delivery mechanisms to get products into schools nationwide.

Policy summary

A common thread through both policy documents examined here is the need to change societal behaviours and values for a sustainable energy future. An examination of SEAI documents posits that societal transformation requires new knowledge, skills, and adaptation of social norms, to be partly achieved by SEAI's awareness and education programme. While SEAI's education materials have developed significantly since 2006, particularly at second level, the overall objective to raise awareness & modify behaviour through a positive impact on their core values, has remained constant. In the following literature review the highly contested wealth of information which examines links between awareness raising, education, knowledge values skills and behaviour will be critically analysed in the light of the SEAI missions, vision and objectives.

2.2. Literature review

Given the mission, vision and objectives of SEAI outlined in the Strategic Plan and planning document for the education section, the following analysis focuses on the wide, and contested, literatures relating to the role of information provision, education and precursors of environmental behaviour and behavioural change.

The transformation towards a sustainable energy future is one which necessitates public acceptance and co-operation (e.g. Ekins, 2004). It also requires learning, a process which allows individuals and collectives to build information and knowledge into comprehension, meaning and potentially action. Learning therefore needs to be considered as an ongoing process, subject to change and influenced by a wide variety of factors. Within the process of learning, new knowledge is built on a foundation of pre-existing concepts which individuals have internalised and developed in interaction with their social, cultural, political, economic, lived experience. In this building process "individuals relate new knowledge to relevant concepts that are already known" (Palmer & Suggate, 2004:208), which includes existing knowledge, but also beliefs or norms, related to environmental values and attitudes.

2.2.1. Studies investigating energy awareness and climate change

Studies of Irish publics' knowledge, attitudes and understandings of climate change, sustainable energy, and energy conservation are limited. Equally, research into the manner by which public responses are being conceived and responded to by key stakeholders such as local government, industry and interest groups are equally sparse. However, these factors have implications for patterns of public acceptability and transition towards a sustainable energy future.

An SEAI (2003) study examined public attitudes towards the Development of Wind Farms in Ireland. This study indicated that most Irish adults express some concern about climate change and are aware of the impacts it may have on Ireland. However, few believe that they can personally contribute to reducing climate change and most were not aware of the Kyoto Protocol. Examining understandings of the term 'renewable energy', the report highlighted that just over half of Irish adults are aware of the term, with wind energy being the best-known type of renewable energy. The report also indicates that there is a high level of support for developing more sources of renewable energy in Ireland (84%), making it the preferred option among energy policies measured within the study. There was also support for encouraging the development of renewable energy sources through lower taxes for businesses that use

renewable energy and through government incentives to build wind farms. Among the various energy policies suggested, government incentives to build wind farms is one of the most popular, with 73% saying they would be willing to support such a measure.

Somewhat different results might now be expected. The 2009 Eurobarometer survey into Irish attitudes states that, like other EU respondents "Ireland gives a low priority to the environment in its list of important issues facing the country" (Eurobarometer, 2009). At 2%, the salience of climate change as a priority issue lags behind concerns over the economic situation in general (50%) and unemployment in particular (61%). This Eurobarometer survey points to the sharp increase in the proportion of respondents prioritising economic growth over the environment, with a corresponding decline in the proportion favouring environmental protection over the economy. These shifts in priority have occurred at a faster pace in Ireland than in the EU as a whole (Eurobarometer, 2009).

A recent SEAI study conducted by Motherway & Halpin (2010) illustrates the success in uptake of SEAI home energy grant schemes. Based on a survey of 10,000 individuals, Motherway & Halpin demonstrate how energy conservation has become a mainstream issue, rather than a marginal environmental concern. But the motivation to instigate personal change and avail of home energy upgrades finds its basis in economics, energy saving and grant availability, in addition to comfort gains, rather than any real environmental concern.

Internationally, empirical research focusing upon children's perceptions of global warming, climate change and energy issues has typically been framed around the quality of their scientific knowledge and understanding of the problem (e.g. Boyes & Stanisstreet, 1993; Andersson & Wallin, 2000). This body of work has indicated general awareness of a range of specific environmental problems and consequences but often few links between these problems and consequences (Boyes & Stanisstreet, 1993). Similar misconceptions that have emerged from empirical research with adults, for example perceived links between ozone

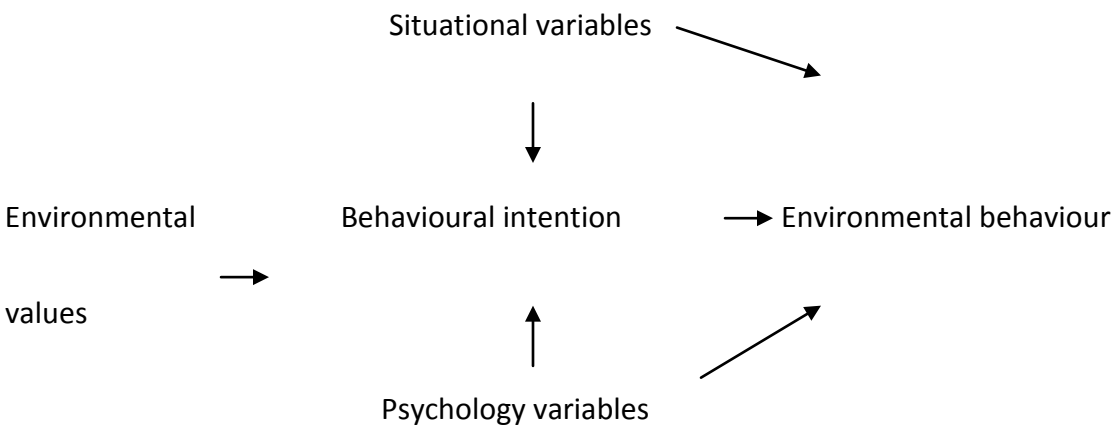
depletion and global warming (e.g. Kempton, 1991) have also been identified with children (Koulaidis & Christidou, 1999).

It is important also to recognise the social, political, cultural and economic contexts in which learning, value creation, and pro-environmental behaviours take place. The following section illustrates the connections between these complex factors, drawing on a wealth of international literature.

2.2.2. Models of environmental behaviour

It is often reported in environmental education and social science literatures that apparently pro-environmental values (expressed, for example, in surveys or in focus groups) are not reflected in significant shifts towards environmentally friendly behaviour. Additionally, it is often evident that values can be inconsistent and at times conflictual. This should not be surprising, given the complexity of values and behaviours, and indeed the relationship between the two, as revealed by a substantial body of research in social psychology (for a review, see Jackson, 2005). A number of models have been presented in the literature which attempt to clarify the link between environmental values, information and education provision and environmental behaviour. These models are explored in depth in Appendix 3 – Models of Environmental Behaviour, but put briefly, they suggest that a variety of variables contribute to environmental behaviour.

One of the most recent models warrants some consideration at this point, as it provides a clear summary of the complexities of environmental behaviour. Barr & Glig (2005) highlight that environmental behaviour is a complex mix of personal, situational, and psychological variables. In this model, environmental values have a fundamental place in contributing to behavioural intention. But behavioural intention is acted upon by situational and psychological variables which intervene in the relationship between intention and behaviour.



Using the framework given by Barr & Glig (2005), 'Appendix 2 - Explaining precursors to environmental behaviour' examines environmental values, situational variables and psychological variables in more depth. A summary of this literature which explains environmental values, psychological and situational variables is provided in Table 2.1.

Table 2.1 Explaining variables contributing to pro-environment behaviours

Environmental values
• Created through a complex interplay of internal and external factors • Environmental values are malleable and context dependant: e.g. gender, life stage, economic situation, education attainment, dependant on environmental issue under consideration.
Situational factors
• Awareness, knowledge of issues, knowledge of skills to address environmental issue • Perception of constraints and barriers to environmental action e.g. economic, social, cultural political contexts • Access to services i.e. the provision of infrastructure which facilitate and encourage pro-environmental behaviour e.g. provision of door-to-door recycling bin collection
Psychological/ social psychological factors
• Personality factors e.g. altruism • The creation of environmental social norms and creation of social pressure • Perception of constraints e.g. time, money, life style change required

2.2.3. Communicating the message through education: from awareness to environmental action

Generally current policy endeavours which require public behavioural change are underpinned by the 'Awareness–Information–Decision–Action' framework or the 'Information – Deficit Model' (IDM). These posit a very close link between information provision, knowledge, decisions to act and behaviour. Public environmental communication strategies underpinned by this linear understanding of communication have been widely critiqued, for example, Barr's (2003) and Barr & Glig (2005:229) suggest that "there is an implicit assumption that publicity campaigns focused around awareness-raising will result in greater levels of public environmental action". In Ireland similarly styled environmental awareness campaigns in the area of waste have been critiqued by Davies (2003).

Research investigating mass-media approaches to environmental awareness campaigns suggest that they present a limited form of environmental communication given their inability to account for the influences and variables at play in people's lives, such as social, cultural and political contexts (Owens, 2000; Blake, 1999). This is not to say that there is no link, but rather, as Blake (1999) suggests information provision, and increased environmental knowledge or understanding, does not necessarily engender positive behavioural changes. Blake points out that most communication campaigns have limited effect because they assume that humans are rational and make systematic use of the information available to them. The rationalist IDM assumes that "environmental education, drawing from scientific work, will lead to people make the link between policy and action… in order to meet policy objectives" (Eden, 1996:197). Crucially, this assumption has not been borne out in practice. Providing information may in some circumstances influence environmental attitudes but "often has little or no impact on behaviour" (McKenzie-Mohr, 2000). Information – deficit models ignore that environmental problems are constructed in such a way that behaviour is dependent on a greater range of influences than the linear process from 'information to action' can describe.

Analysis of the value action gap and information deficit model in the context of energy awareness campaigns is discussed by Owens & Driffill (2008). These critics suggest that current energy awareness campaigns imply that attitudes and behaviours in the context of energy need to change, and that there exist pre-determined goals around which modified attitudes and behaviours should be shaped. Drawing on research conducted in the field of domestic energy consumption in the UK is useful here. Critics suggest that in spite of successive campaigns the take-up of energy efficiency measures has been disappointing and behaviours have often become more energy-intensive. The most familiar explanations for this relies on market failure, including lack of information, but Devine-Wright & Devine-Wright (2004) suggest that energy conscious behaviour is influenced in complex ways by factors such as price, awareness, trust and commitment, and a sense of moral obligation.

Recent work has also drawn attention to the important influence of cultural norms, routine habits and practices, social networks and fashion (for example, in domestic lighting). It has also highlighted the dynamic interplay between humans and technology in so called 'socio-technical systems', for example, the sometimes taken for granted relationships with energy intensive hardware, such as washing machines and showers (Shove & Warde, 1998). It is also influenced by dominant conceptions of comfort, cleanliness and convenience, which become embedded in the built environment (Shove, 2003).

Owens & Driffill (2008) point out that mixed messages, such as when people are urged to do one thing, but price signals and the constraints of everyday life point to another, can lead to confusion, resentment or hostility. The physical structures of social life, such as prices and social networks, can make it difficult to act on particular environmental messages, particularly when they provide powerful counter-incentives to the environmental information provided. This points to the need for coherence and consistency in policy instruments because "the greatest degree of behaviour change occurs when different strategies combine" (Gardner & Stern, 1996). The combination of incentives, regulation, information and public engagement should be sensitive to the (often context-specific) factors that inhibit behavioural change. Consideration

of these factors applies not only to awareness campaigns targeted at adults, but also to environmental education campaigns around energy for children, who are also subject to mixed messages and confusion in behavioural choice. In the following section strategies for environmental education will be discussed. As Owens & Driffill (2008) note, energy awareness campaigns highlight the importance of engaging young people in environmental issues.

2.2.4. Communicating the message through education: features of successful education programmes

A number of researchers have evaluated the outcomes of environmental programmes in schools, after-school programs and nature centres, measured in terms of young people's increased environmental concern and action. These studies indicate that the most effective education programs exist for an extended duration of time, provide opportunities to learn and practice action skills, and have success in achieving some valued goal(s) (see reviews in Zelezny, 1999; Rickinson, 2001).

Action skills and goal setting are particularly important to the design and implementation of environmental education programmes. Left to themselves, young people can easily feel disempowered by the scale of environmental problems. Commentators (e.g. Räthzel & Uzzell, 2009; Uzzell, 1999) have criticised conventional environmental education for adopting a narrow knowledge-oriented, natural scientific focus, neglecting the situation (economic, political, legal, cultural etc.) or context in which environmental problems are created. Räthzel & Uzzell (2009) demonstrated how such education has limited, and sometimes counterproductive, impacts.

Most programs that show gains in young people's reported environmental behaviours or their stated intention to protect the environment introduce situational variables through an action component such as writing letters to advocate wildlife protection, making nesting boxes for birds, carrying out energy conservation activities, or initiating community projects that

investigate local environmental issues and implement ways to address problems (Jordan et al., 1986; Bogner, 1999).

Moving beyond actions, the Danish educators Jensen and Schnack (1997) have promoted the concept of 'action competence', which involves the capacity to analyze society and everyday life critically in order to understand the sources of environmental problems, and to find and work for solutions to problems at both the individual and societal level. They argue that these skills are essential for students so that they can take responsibility for themselves and the democratic management of their society. Theoretically, the work of Uzzell (1999, 2000), Jensen and Schnack (1997) follow in a similar vein to the whole school approach, advocated for example, by Tilbury and Wortman (2006). These authors suggest that whole school programmes "integrate students with communities both within and outside the school walls, engaging students in participating with teachers, parents, school administrators, community organisations, and government officials in decision-making and action towards sustainability" (Tilbury and Wortman, 2006: 14). Palmer (1998) illustrates how a Scottish school has implemented a 'whole school approach' to environmental education via the Action Competence model. Through action-orientated experience teachers helped students to identify and reflect upon their values and evaluate alternative viewpoints and solutions in the context of the school and also, wider community. Jensen and Schnack (1997) suggest that without action-competence, environmental education has the potential to aim for behaviour modification and offer disconnected activities, in place of opportunities for autonomy and critical analysis. Through a whole school approach the school attempts to behave consistently with what is taught. Within action-competence, or action oriented teaching, it is also critical for young people to see that their efforts are taken seriously by others and that they are able to realize at least some of their ideas[3].

[3] Research by Bull (1992) in two Detroit middle schools serves as a caution in this respect. The middle school students were involved in an 'Action research and community problem-solving' curriculum, but they lacked clearly

Research points out that to achieve action competence a model of education is required that not only aims to produce active citizens but embeds democratic principles within the education process. According to research, children and youth need to take personal ownership of the issues that they work on, choosing personally significant goals and integrating action for the common good into their sense of identity. Education programmes need to provide opportunities for direct experience, beginning with intimately known natural areas, and extending into participation in managing their school and in tackling community projects where they can see for themselves how wider participation in decision making works and feel that they are making meaningful contributions. In the course of these experiences, students need opportunities for discussion, analyzing public issues together, determining shared goals, resolving conflicts and articulating strategies for overcoming challenges and achieving success. In the process, they become role models of success for each other. Devine-Wright, Devine-Wright & Fleming (2004) for example suggest that educational interventions designed to promote children's understanding of, and positive beliefs about, global warming and energy need to emphasise how learning is managed so that active participation and cooperation amongst children is encouraged.

Educators play a critical direct role in encouraging participation and action competence by creating opportunities for the open discussion of issues in the classroom. Discussions within supportive environments enable children and youth to consider a range of perspectives, integrate what they hear, transform it into their own words and think through their own positions. Engendering a sense of competence, or sense of self-efficacy, consists of the belief that one can achieve success in areas of personal significance. Therefore competence is an

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defined roles for decision-making and failed to achieve some of their main goals. Under these conditions, outcome measures showed a decline in their feelings of empowerment related to their ability to solve some environmental problems.

ingredient in the ‘empowerment variables’ identified by Hungerford and Volk (1990) and in the belief that one can have an impact on environmental issues, which Stern (2000) discusses.

A key feature of action competence suggests that the pursuits engaged in are personally significant, that is, reaching the chosen goal matters to the person undertaking the goal. For environmental projects, this means that young people need to play a central role in setting goals themselves. Confidence that one can achieve goals oneself and confidence in achieving goals as a group are mutually reinforcing. People are more likely to contribute to a group when they have confidence in themselves and their capabilities, while at the same time, individuals are more likely to feel self-confident when they are surrounded by a strong, supportive group. Within this, educational research suggests that children need opportunities for collaborative decision-making in everyday life, from early childhood on, in settings including the home, school, after-school activities, and youth clubs. These opportunities enable young people to exercise control of their environment and other elements of their lives. Flekkøy and Kaufman (1997) argue that through these means young people gain autonomy, a sense of self-worth, negotiation skills and respect for other people’s perspectives. Peer activities are only likely to be motivating, however, if a group achieves a level of success that boosts members’ confidence and morale. Therefore it is critical for environmental educators to help groups judge what they can accomplish with the time and resources available.

In a comparative study, the conventional educational approach, typically characterised by the ethos of competition or individualistic goals and a more passive learning environment, was less successful in enabling children to develop positive beliefs about their abilities to ‘make a difference' in relation to serious environmental problems. There is also an additional benefit in collective action, for example, young people often identify the friendships that they forge in their group and opportunities to have fun together as intrinsic rewards of participation, along with the satisfaction of seeing that they can make a difference (Pancer & Pratt, 1999). Mutual support and friendship need to be recognized as not just means to effective group functioning, but from a young person’s perspective, valued ends in themselves.

Table 2.2 Practical application of literature review findings for environmental educators

Role models and mentors
• Engage both peers and adults as role models • Create opportunities for peer group exchanges • Encourage role models to practice instructive modelling by demonstrating skills of graduated difficulty and verbalizing strategies for success
Everyday life experiences
• Practice democratic decision-making in the classroom • Provide opportunities for everyone's voice to be heard and valued • Make time for children to experience nature, individually and as a group. • Enable children to develop bonds with nature
Participation in Organizations
• Build club and organization activities around the shared values of the group and personal interests of individual participants
Discussion
• Make time for the discussion of environmental issues
Achieving success
• Help participants set goals and sub-goals that lead to success
Social network
• Create a supportive social network for children and youth to build trust in others • Have fun during the process
Age–appropriate initiatives
• Determine the scope of environmental activities based on the developmental stage • Focus on the nearby environment with younger children • Expand to the local community by middle childhood and eventually global connections
Development of action skills
• Enable children and youth to test their environmental action skills • Apply the principles of guided practice

Personal significance
• Provide opportunities for children and youth to initiate environmental actions themselves
Parent involvement
• Reach out to parents to convey the importance of democratic parenting • Encourage parents to take an active and supportive role in their child's experiences and participation in community projects

2.2.5. Communicating the message through education: Inquiry based science

Science is commonly perceived negatively, stemming from inappropriate scientific teaching that does not connect to people's experiences. For example, research studies on attitudes to school science since the early 1970s in the UK indicate that attitudes towards science become less positive as pupils progress through school (Moheno 1993), leading to many pupils avoiding studying science at higher levels and the development of an anti-science stance in many adults (Holton 1992; Swindell et al. 2003). Similar concerns have been expressed in Ireland about the declining uptake of science subjects both in the later stages of post-primary school and at tertiary level (TFPS, 2002). In 2006, only 14% of Leaving Certificate candidates took chemistry, and only 14% took physics. Another potentially important purpose of studying science at school is to prepare for life in a highly technological society. The Task Force on the Physical Sciences (TFPS) acknowledges that, "in an era of rapid technological change, the goal of 'scientific literacy for all' has become a primary objective of general education" (2002, p. i). In addition, widely held modernist views of science and inappropriate science teaching rooted in modernist perspectives may lie at the core of problems inhibiting appreciation of what science can offer toward fostering positive responses to the environment.

Table 2.3 Negative perceptions of science

Reasons for confusion, alienation and irrelevance in public perception of science
• Confusion emerges from excessive use of technical terminology and concepts that do not connect with experience • Alienation occurs when pupils are not given opportunity to connect their experiences with the curriculum and teachers are relegated to a technician's role that excludes them from curriculum development. • Irrelevance results when there is no explicit connection within the curriculum to an environmental ethic or when the practices of an institution are incongruous with environmental learning (e.g. learning about energy conservation in an institution with no energy saving policy or with no opportunity to engage in energy saving practices)

A science education for environmental education that avoids these issues needs to connect with experience, empower pupils in their learning and teachers in developing curricula which link to environmental issues. Such education implies the need for explicit attempts to integrate cognitive and affective domains which connect concepts and experiences. Littledyke (2008) proposes that science education can provide a useful conduit between environmental knowledge and action when conditions are employed which develop explicit understanding of environmental relationships through the affective domain of learning. The affective domain has long been seen to be important in environmental education as a way to fostering positive attitudes towards the environment (Iozzi 1989a, b) and is acknowledged to be an important aspect to learning more generally (Kelly 2004; Lee 2005; Cree 2006). There have been a number of studies concerning the affective domain in science education, mainly concerned with attitudes to science and their effect on learning (André et al. 1999; Southerland et al. 2000; Abell 2005; Waters-Adams 2006). This body of research contends that because of its high status in national policy in the UK (which is similarly reflected in Irish policy e.g. Discover Science and Engineering programme) and significant potential in environmental education, the science curriculum offers many opportunities to support environmental awareness (see Littledyke, Ross and Lakin 2000).

Table 2.4 Cognitive and affective domains in science education *(source: Littledyke, 1996)*

Effective (or cognitive) features of learning:
• To educate pupils into the methods and ideas of science so that they can use science to interpret and understand the world. • To assist pupils in creating meaningful personal frameworks for understanding science • To critically analyse ideas and the application of ideas for scientific validity. • To critically evaluate the social and environmental implications of the application of scientific ideas.
Affective features of learning:
• To foster a sense of interest, enjoyment and excitement in learning in science. • To include a sense of beauty, respect, reverence and awe in approaches to the environment and understanding our place in the universe

Notions of participation, action competence and active learning now form core elements within innovative approaches to science teaching. Inquiry-based learning generally includes hands-on activities as a way to motivate and engage students, and at the same time embedding science concepts. “Constructivist approaches emphasize that knowledge is constructed by an individual through active thinking, defined as selective attention, organization of information, and integration with or replacement of existing knowledge; and that social interaction is necessary to create shared meaning, therefore, an individual needs to be actively engaged both behaviourally and mentally in the learning process for learning to take place” (cited Minner et. al. 2010:2/3). Therefore, as Falk (2005) indicates, the process of learning becomes a central consideration, rather than focusing only on the outcome of the learning process. In the latter form of learning via a transmission or knowledge-centred model, individuals are passive recipients of knowledge, whilst the former emphasises a process-based, learner centred model where individuals actively construct knowledge. This shift in emphasis is based on the premise that learning is a personalised, active, multi-dimensional process that is influenced by prior experience, contextual settings (Brody, 2005) and takes place in social situations (Wenger, 1998). Effective learning also occurs when meaningful connections are made with prior

experience (Novak and Gowin 1984). The U.S National Research Council describes the ''essential features of classroom inquiry'' (NRC, 2000:25) to include the following:

Table 2.5 Features of Inquiry based science (National Research Council, 2000)

Features of Inquiry based science (National Research Council, 2000)
• Learners are engaged by scientifically oriented questions. • Learners give priority to evidence, which allows them to develop and evaluate explanations that address scientifically oriented questions. • Learners formulate explanations from evidence to address scientifically oriented questions. • Learners evaluate their explanations in light of alternative explanations, particularly those reflecting scientific understanding. • Learners communicate and justify their proposed explanations.

Even when integration between cognitive and affective domains is achieved, through inquiry based science, contradictory gaps may occur between knowledge, environmental care and action (Kollmuss and Agyeman 2002). However, there is evidence that environmental learning can influence attitudes and behaviour, particularly in informal contexts (Ballantyne and Packer 2005; Brody 2005). Lester et al. (2006) provide evidence that students with science knowledge can be more environmentally active than those with poorer knowledge. They also find that environmental activism increased as students gained more knowledge, this reiterates the importance of an appropriate science education that is compatible with constructive postmodernism and supports environmental education.

2.3. Irish Education Context

In 1999 a new curriculum was introduced into the Irish primary schools. Since its introduction the National Council for Curriculum Assessment (NCCA) has conducted a number of reviews, in 2005 a review of Maths, English and Visual Arts, and in 2008, a second review which focused on Irish, Science and SPHE.

The latter review (NCCA, 2008) indicates where science and SPHE are having valuable impacts on children's learning. With respect to science, the review indicates that the curriculum has increased scientific knowledge, understanding and skills. The SPHE curriculum allowed for the introduction of new, participatory, teaching techniques which support children self-expression and communication.

Despite such positive outcomes, the report found that substantive challenges remain. As had been previously found in the 2005 review, time is of key concern to teachers. "Teachers described two key dimensions of the time issue. One focused on perceived curriculum overload (insufficient time to fully implement all curriculum subjects), while another focused on class size/children's needs (insufficient time to meet the needs of all learners)" (NCCA, 2008:17).

Secondly, resources were identified by teachers as one of the key challenges of curriculum implementation. In the case of science "respondents noted a lack of resources, including teacher resource materials such as teacher manuals" (NCCA, 2008:17). Similarly with regard to SPHE, the review reports that teachers state there is a lack of resources, and also, locating and assembling them proves difficult.

The review also suggests that there should be a renewed focus on developing the child's higher order thinking and problem solving skills in the Primary School Curriculum, particularly in science and SPHE. As the review states in relation to science, these "skills are not being developed to their full potential" (NCCA, 2008:20). Greater consideration should be given to the use of self-directed learning and to project work. In addition, the integrated nature of the Primary School Curriculum should be exemplified for teachers to a much greater extent than it currently is in the curriculum documents. This should help alleviate the time pressures experienced by teachers.

Varley et al. (2008) suggest that greater direction and guidance should be provided for teachers to enable them to extend their repertoire of teaching approaches and methods to include

greater use of collaborative learning including group work and pair work. In their research with children, decisions for liking one subject more than another were linked with the extent to which their curriculum experiences involved collaborative learning, for example, involving decision making in pairs and groups, active learning using hands-on-methods, inquiry-based learning involving research and ICT, and authentic learning through projects and real-world studies.

At second level the NCCA promote five key skills learners need to prepare them for life, learning and work in the 21st century. As the NCCA states "these skills are important for all learners to achieve their full potential, both during their time in school and into the future. They enable learners to participate fully in society, to engage in happy family lives, to prepare for working lives that are likely to change constantly and to engage with and enjoy learning throughout their lifetime." (NCCA, website, accessed 14/03/2011). The skills are information processing, communicating, being personally effective, working with others and critical and creative thinking.

It is in this context that the evaluation of SEAI education material is situated. In the following section a review of good practice examples relevant to SEAI are provided from the UK, the EU and Australia.

2.4. Examples of Good practice

Energy Matters (UK) Evaluation of programme (Heijne, 2003)

Energy Matters is developed and run by the Centre for Sustainable Energy in the UK. It is an energy education programme which, since its launch in 1999, has been used by over 18,000 school pupils in 500 schools in the UK, in partnership with 86 local authorities. It provides curriculum-linked education resources for primary and secondary schools, with training and ongoing support from local Energy Educators. Energy Matters resources cover Home Energy, Sustainable Energy and School Energy. Activities link to a wide range of National Curriculum

subjects, including Education for Sustainable Development, Literacy, Numeracy, PSHE and Citizenship. Not only is Energy Matters designed to fit curriculum initiatives, it also promotes the involvement of young people as environmental decision-makers and build home–school links.

The Home Energy Resource is for Key Stages 2 and 3 (7–14 years). Students complete a Home Energy Survey, analyse data in the classroom and take home energy-saving recommendations. The School Energy Resource starts the process of managing school energy use with teaching materials for Key Stage 1. The Sustainable Energy Resource for Key Stage 3 Geography covers local and global aspects of energy sourcing and the environmental, social and economic impacts. The programme is delivered by Energy Educators, trained and accredited by CSE to deliver Energy Matters at a local level, recruit schools, train school staff and provide ongoing support. A CSE project manager is a point of contact for support and additional resources for Energy Educators and schools.

Some of the key findings of the evaluation of the programme include:

- Energy Matters encouraged schools and families to take energy-saving action and reduce fuel bills. 76% of parents have changed their behaviour to save energy as a result of their children's involvement in Energy Matters.
- Energy Matters increased knowledge and understanding of sustainable energy issues. 54% of parents have subsequently installed energy-saving measures, including low-energy light bulbs, energy efficient appliances and home insulation improvements.
- The findings indicate the potential to develop additional resources to support pupils identifying suitable grants, which was not part of the initial programme.
- The Energy Matters programme appeared to be most effective when it was supported by senior members of staff and when it involved the whole school community (teachers, governors, caretakers, parents and pupils).

Good practice in schools according to the Energy Matters evaluation involves:

- The involvement of representatives from a range of the groups of a school's community, teaching and management staff, governors, pupils and parents in plans and actions aimed at energy saving.
- A positive approach to the empowerment of pupils and their involvement in school management, for example, through a school council.
- Use of energy education materials which highlight the effects of energy use, and the benefits of energy-saving actions. The Energy Matters Home Energy Resource was valued for its focus on actual energy use in the home as a basis for the educational work.
- Links between any energy management planning and activities and other ongoing building-related programmes, such as health and safety inspections or routine maintenance.

Primary Connections Australia (Hackling et. al, 2007)

Concerns about the teaching and learning of science in primary schools in Austrialia heralded a new approach to primary science – Primary Connections. Hackling et al. (2007:12), in their evaluation of this programme, describe it as "a professional learning program of teachers supported with curriculum resources that aims to enhance learning outcomes in science and the literacy's of science by supporting both in-service and pre-service primary teachers to teach science effectively". Hackling et al. have found that science receives the second lowest amount of time in the primary school curriculum in Australia, with students attaining relatively lower levels of science and mathematics competence in international comparative studies.

Many primary teachers reveal low levels of confidence and competence for teaching science (Appleton, 1995; Palmer, 2001) and score poorly on self-efficacy scales that measure their beliefs about being able to teach science effectively (Riggs & Enochs, 1990). The 2001 national

review of the status and quality of science teaching and learning in Australia (Goodrum, Hackling & Rennie, 2001) recommended that primary teachers be given access to quality professional learning experiences supported by rich curriculum resources. It also argued that a collaborative national approach is essential to develop world class resources. The Primary Connections program was developed in response to these concerns.

Key to the success of the programme is the joint approach to upgrade and update science in both pre-service and continuing professional development of teachers. The programme is based on an inquiry based and constructivist approach to learning developed in the 1990's. "Ideas are developed from experiences of science phenomena, prior knowledge, rich discussions, teacher feedback and explanation, and opportunities to represent and represent developing understandings" (Hackling, 2007:13). Via this approach Primary Connections takes an innovative approach to assessment which engages with students' conceptions and mis-conceptualisations around science and enables the teacher to address these. It also links literacy with scientific thinking – the premise being that literacy underpins scientific and everyday thinking and articulation. Science-specific as well as everyday illiteracies are required by students to effectively engage with science, construct science understandings and develop science processes, and to represent and communicate ideas and information about science (Gee, 2004; Norris & Phillips, 2003). In order to facilitate this, students need to be engaged in inquiry based and investigative approaches. The programme also facilitates co-operative learning which has the potential to facilitate higher order thinking, generation of new ideas, and co-construction of meaning.

As a result of the programme teachers reported increased levels of confidence in teaching science, but also, noted more time spent on teaching science, it also has the result of raising the profile of science teaching in the school.

EU Commission – Science Education Now (Rocard et al. 2007)

"The origins of the declining interest among young people for science studies are found largely in the way science is taught in schools… [and while] whereas the science education community mostly agrees that pedagogical practices based on inquiry-based methods are more effective, the reality of classroom practice is that in the majority of European countries, these methods are simply not being implemented" (Rocard et. al, 2007:i). Due to the nature of its practices, IBSE pedagogy is more likely to encourage relationships between the stakeholders of both formal and informal education. And it creates opportunities for involving firms, scientists, researchers, engineers, universities, local actors such as cities, associations, parents and other kinds of local resources. Rocard et al. suggest that science education also often fails to provide young people with space to develop understanding and interest cumulatively, and is in strong danger of "being excessively factual because of the explosion in scientific knowledge and the 'adding-on' of topics to an already excessive content base" (Rocard et al., 2007:8). The authors clearly present the differences between inductive and deductive models for science learning:

Table 2.6 The inductive and deductive approaches to science learning

Deductive approach:	**Inductive approach (inquiry based science):**
Teacher presents concepts	Observation
Outlines logical (deductive) implications	Child led investigation and experimentation
Gives examples of applications	Teacher guided construction by the child of his/her own knowledge.
Experiments are mainly used as illustrations	

These examples of good practice highlight that current thinking in science education, and energy education in the case of Energy Matters, is firmly positioned within the inductive approach or inquiry based science. In addition, Energy Matters provides the opportunity to link schools, families and community, with policy makers or financial grant incentives for energy conservation measures in the home. In this regard, it presents an innovative approach to energy education.

2.6 Summary

- development of environmental behaviours is complex interplay of values, situational, psychology factors; which include the social, cultural, political and economic context
- education is a fundamental aspect of transition towards a sustainable society; but careful consideration of what kind of education is required, such as IBSE/ action orientated approaches
- research suggests that education programmes which engender deliberative, democratic notions; linking school, home and community are affective
- education programmes need to recognise the barriers (internal and institutional) which prevent movement towards pro-environmental behaviour

Type of communication	General Characteristics	Potential uses	Tools / Methods	Application to SEAI
Information provision	One way flow of information, generally top down and expert led (e.g. from teacher to pupil) information can be targeted to specific audiences (e.g. age); Evaluation, assessment and engagement is usually extractive (e.g. through worksheets) with little opportunity for discussion.	Often used at the outset of an environmental awareness process to gain attention of audience; may also be used at subsequent stages to reinforce initiatives or provide feedback; within an education setting way of disseminating large quantities of information quickly	Mass media, for example advertising or public service broadcasting; special events, for example exhibitions, conferences and presentations; written materials such as leaflets or newspaper articles.	SEAI promotional material; presentations; written materials such as leaflets, posters, website, newspaper articles, display boards; expert delivered behavioural goals
Informative education	Limited two way flow of information. Audience usually first provided with information regarding an issue or project but then allowed to comment, clarify or challenge that information. An opportunity exists for audience to bring their own knowledge to debates however there is potential for tokenism if people are presented with options and opportunities to comment but lack the power to insure that their views will be heeded by decision makers. Little opportunity for ownership or empowerment.	Situations where the initiator has limited time but wishes provide learning experience while maintaining control of the education process or provision of information to an audience. Also, provide opportunity for questioning from audience. This approach is often used at the early stages in an education process to aid issue identification and definition. Effectively utilised, these can form part of wider learning process	Discussion, worksheets; Questionnaires, some environmental workshops, one - off education / training initiated by expert, where two way dialogue/ limited. Experiential learning demonstrations; prescribed experiments; Project initiator defines the agenda, and trajectory of the education experience.	Elements of SEAI Primary school workshops e.g. 1st law of thermodynamics demonstration; Elements of SEAI materials such as worksheets and experiment books. But – opportunity for integration into more participatory forms of education and learning

Deliberative events/ education	Two way information flow characterized by listening and learning. Knowledge is exchanged in both directions. Educators work in partnership with audience and contribute expert knowledge if/when necessary. Needs are identified and decisions made through negotiation and joint analysis. Participants may help to determine the trajectory of learning, problem identification; Groups may be empowered to take limited control over learning	Situations where the initiator wishes to develop partnerships, engage in negotiation and joint decision making. Can be used in intermediary towards IBSE type approaches; Ongoing environmental education programmes	Formal deliberative techniques such as citizens' juries & visioning; Focus groups; Active environmental education workshops where learners given opportunity to apply learning to home, school, community environment. Attention to social construction of knowledge learners gain understanding of social, political, economic and cultural positioning of learning; Informal environmental education which provides opportunities for personal reflection.	DEC workshop & SEAI involvement in the Green Schools Programme; One Good Idea; SEAI provide workshops and resources which fit into wider education programmes which provide opportunity for young people to make decisions over learning direction; decide & take individual actions around energy in school environment;
Participatory	Projects initiated by students; involvement in decision making and implementation of project, only seeking teacher/experts where needed; Groups take responsibility for decisions, structure and practices throughout the initiative.	Used in Inquiry Based Science Education (IBSE); participatory project work; TY programmes; CSPE action projects (to an extent)	Adopt techniques detailed in other types of education above, but, students fully engaged in making decisions about learning; engaging in awareness and communication activities	IBSE directed work; One Good Idea projects where students fully embrace own learning

Chapter 3 Methods

This chapter describes the rationale for the design of the study, the strategies and research instruments employed. Detailed information is provided in relation to the strategies used and sampling approaches taken. This is followed by an account of the development of research instruments, including details of piloting, data collection and analytical methods employed.

The evaluation of the SEAI education programme has a dual purpose. First, a strategic evaluation of SEAI education programme was undertaken with policy makers and the wider energy education and environmental education sector. Second, an in-depth analysis of energy education awareness in primary and post-primary schools was conducted, focusing on the views, opinions and perceptions of teachers. This was followed by interviews and focus groups in 5 selected schools.

The evaluation set out to analyse and evaluate the SEAI primary and secondary education programme[4], and in so doing, develop a clear conception of the purpose of the programme, its target audiences and strategic partners. The overall goal was to provide recommendations on the future development of the programme. The evaluation asks:

1. To what extent does the SEAI education programme achieve its aim to engender energy awareness, education and behavioural change amongst its target audience of primary and secondary teachers and pupils?

2. In what ways could the SEAI education programme become more effective?

[4] for the purposes of this research education programmes refers to all resources, workshops, competitions, training and partnerships initiated by SEAI to further energy awareness, education, and behaviour change

To answer these questions research criteria were developed:

Assessment of awareness of education programme	• To what extent are stakeholders (strategic partners & target audience) aware of SEAI and the education programme? • How have stakeholders become aware of the programme? • Identify patterns of stakeholder awareness of SEAI education programme
Assessment of frequency and patterns of use of education programme	• To what extent do stakeholders utilise the education programme? (Frequency) • Identify which aspects of the education programme stakeholders use (website, workshops, lesson plans etc) • Identify patterns of stakeholder use of SEAI education programme (which stakeholders use particular aspects of the programme)
Assessment of quality of the education **delivered** using SEAI material	• In what ways are the teachers using the resources?(How regularly? Once off or how embedded in systematic courses and programmes of work?) • How engaging are the resources as they are currently used?
Assessment of quality of the education **content** using SEAI material	• To what extent do the resources reflect the aims and objectives of SEAI education programme? • To what extent do the resources inform and encourage stakeholders & teachers teach energy and environment? • How appropriate are the resources for stakeholders needs?
Assessment of **overall impact** of resources (how contributes to attitudes, behaviour change)	• How effectively do the resources create awareness, educate and motivate behaviour change, regarding energy use and the environment? • How does SEAI education programme influence attitudes to and values on the environment and energy? • Has there been any change in energy use in schools following use of SEAI materials? If so, to what extent is this attributable to SEAI? • How does SEAI's education programme compare, complement and compete with other environmental education programmes? • How does SEAI's education programme compare, complement and compete with other influences on environmental behaviour?
Strategic development of the education programme	• How could SEAI education materials be better promoted and accessed? • How could use of the materials be increased? • How could the effectiveness of the materials be increased? • What are the needs of teachers in school in relation to teaching about sustainable energy? • How does the SEAI education programme and education division relate and integrate with other sectoral stakeholders

3.1 Research strategies

A quantitative research perspective assumes that there exists a reality waiting to be dissembled and examined, usually expressed numerically and usually with a view to making generalisations or predictions. It involves numerical measurements and statistical relationships. On the other hand, a qualitative research perspective assumes that reality is socially constructed, that is, it is a product of people, their experiences and their interpretation of their experiences. It is descriptive and strives to represent those studied rather than provide generalizations to larger populations (Vanderstoep and Johnston, 2009). Given the research criteria outlined above, and the nature of the evaluation, both approaches were required to fulfil the aims and objectives of this research.

First, qualitative semi-structured interviews were conducted with strategic partners in the energy education and environmental education sector. Second, a quantitative survey was used to collect data on energy education awareness, practices, and resources needs in primary and post-primary schools. In addition, the quantitative study was used to estimate the reach of SEAI resources across the education sector. Once analysed, 3 focus groups and 2 interviews were conducted with teachers to gain qualitative insight into energy education practices in schools. The focus group and interviewees were selected on the basis of their questionnaire returns, providing particularly interesting cases. This adds depth to and provides the opportunity to triangulate with the findings of the quantitative survey.

3.1.1. Strategic interviews

One of the most effective methods for ascertaining people's opinions, thoughts, motivations and attitudes is to ask them. The strengths of interviews have been identified by researchers include probing meanings, understandings and values, exploring contexts and providing rich or in-depth information about the complexities of a situation, which may belie surface appearances (Arksey and Knight, 1999). Semi-structured interviews allow a degree of flexibility in the data collection process, enabling the researcher to steer the research so that information

on particular issues is gathered, whilst at the same time giving the interviewee opportunity to explain, clarify, qualify and add to the information (Rubin and Rubin, 1995).

An initial list of interviewees was drawn up on the basis of suggestions from the client, SEAI, in addition to suggestions from the research team. Individuals were chosen for their involvement or potential involvement in energy education, and also in certain cases, for their familiarity with SEAI and SEAI energy education resources. A full list of interviewees is provided in Table 3.1

Table 3.1 List of Interviewees

Young Social Innovators	SLSS x 2
ECO-UNESCO	DoEHLG
An Taisce Green Schools	NCCA – Primary
BT Young Scientist	NCCA – Post primary
Global Action Plan	Discover Science and Engineering
Real Events	Informal conversations:
Sinead Begley & Associates	Scoil Net

Unless otherwise indicated, each individual was engaged in a semi-structured interview at a venue of their choosing (generally the office in which they work) lasting between thirty minutes to one hour. The interview followed an interview schedule (see Table 3.2) which had previously been piloted with three individuals involved in environmental education. While the question schedule ensured commonality between interviews it also provided scope for probing and questioning, both on the part of the interviewer and the interviewee where clarification of questions and understandings were sought. Each interview was recorded electronically and subsequently transcribed for analysis.

Table 3.2 Question schedule

Theme	***Question***	***Probe***
Characterising place within energy/climate	How does energy awareness and education relate to your work?	

change education sector	Can you tell me a little about the work your organisation does around energy awareness and education?	Intended audience?
Characterise relationship with SEAI: *How is the SEAI organisation, education division, perceived?*	Can you tell me, in broad terms, how your organisation interacts with the SEAI education division? Or any other environmental agencies and organisations? Are there other resources (outside of SEAI) that you utilise around energy awareness, education and behaviour?	How do you feel the relationship between your organisation and SEAI work currently?
Characterise resources and resource use *How is the SEAI programme used by strategic partners?*	What SEAI resources do you currently use? Can you tell me a little about the context in which you use the resources? Which resources do you use most frequently in your line of work, where, and why?	Website, written resources, worksheets, books, information leaflets etc. Teaching tool, public information, information packs etc.
Perceptions of SEAI resource content and impact *What do people think about content; awareness, education, behaviour change*	Considering the aspects of the SEAI education programme that you use most frequently: What kinds of impact do you feel it has on your intended audience? Is this your intended goal? Considering now the aspects of the SEAI education programme that you do not use: Can you suggest reasons why these resources do not meet your needs?	Awareness? Education? Behaviour change?

Future directions for strategic partnership and resource utilisation	Considering all elements of the SEAI education programme, that you use most frequently and those that you do not use, what additional resources/format would you like to see SEAI provide? How would you see the relationship between SEAI and your organisation moving in the future? How do you think it might be better improved in the future?	

The overall goal of analysis was to categorise data into meaningful themes which best fit the experiences and understandings of the interviewees. This was accomplished drawing on the constant comparison method (Lincoln & Guba, 1985). Analysis began with a familiarisation process, which was achieved by listening to tapes, reading the transcripts in their entirety several times and reading the observational notes taken during interview and summary notes written immediately after the interview. The aim was to immerse in the details and get a sense of the interview as a whole before breaking it into parts. During this process major themes began to emerge. Each interview question then formed a category under which individuals' response were filed. Descriptive analysis was then conducted which identified differences and similarities in participants' responses to each question. Following this process, the descriptive analysis was viewed in the context of the evaluation questions. This produced a number of themes which are presented in the analysis chapters. Excerpts from the interviews are presented to illustrate key points in each theme.

3.1.2. Quantitative survey: Sample selection, Instrument Development, Piloting and Data Analysis

A random sample of 100 primary schools and 100 post-primary schools (stratified by location, size, gender mix and recognised disadvantaged status) was identified for participation in the survey. In addition, a stratified sample of 50 schools from the SEAI database were selected for comparative purposes. However, these responses were not utilised comparatively in the final analysis. Instead the primary sample was analysed as a whole. The main primary survey was posted to the principal of each school who was asked to complete the questionnaire, or forward it to a designated other (e.g. Green schools co-ordinator). The smaller SEAI sample was posted to the teacher listed in the SEAI database.

The teacher questionnaire was developed to meet the needs of the evaluation process, including teachers motivations around energy education, energy saving behaviours in the school, curriculum and teaching context and awareness and use of SEAI resources. A number of different methods were utilised to draw responses, such as ranking, Likert scale format, tick boxes and Yes/No answers. The instrument was piloted with 5 teachers. Suggestions from the pilot were incorporated into the final instrument design. Data from questionnaires were coded and entered into Excel for statistical analysis. Results of open ended questions and comments were entered into Word document. This body of responses was analysed in conjunction with quantitative responses, and amalgamated with qualitative data from focus group and interviews with teachers. See Appendix 2 for the questionnaire survey.

3.1.3. Qualitative survey: Sample selection, Instrument Development, Piloting and Data Analysis

A small number of group interviews and semi-structured interviews were conducted with teachers to triangulate and gain a deeper understanding of survey results. The purpose of this qualitative data was access teachers' perceptions towards SEAI materials, their strengths and weaknesses, and use in the classroom. For this reason, SEAI resources acted as props for the discussions with primary school teachers. Post-primary interviews took place over the phone to

discuss use of resources and responses to SEAI post-primary programmes. An interview schedule was designed on the basis of each schools survey response, which allowed the research to capture specific references to the questionnaire, but also commonalities across interviews e.g. age appropriateness and the use of ICT. All interviews and focus groups were taped and transcribed. The teachers' responses were read and re-read to establish and refine units of meaning to be reported in conjunction with quantitative results and to identify any similarities or differences across different school contexts.

3.1.4. CHRCE Team management

This evaluation was conducted by the CHRCE team. Initially desk analysis was conducted, survey instruments were developed and delivered, and initial analysis compiled in conjunction with the research team who inputted, participated in and oversaw the process. The project team met formally four times over the course of the project, and informally on numerous occasions. At these meetings the team were briefed on project development and asked to input on particular matters, e.g. comments on SEAI resource materials; preliminary analysis of teachers responses, previous revisions of desk research.

Over the course of the SEAI education the CHRCE formally evaluated the primary and post-primary resources. The initial evaluation identified key knowledge, attitudes and behaviours supported by the education materials. These knowledge, attitudes and behaviours were later included into the questionnaire design (through definition of energy education – climate change, energy science and energy saving and energy conservation measures). Additionally the team met to formally evaluate the resources. The outcome of these discussions concluded that the resources could be developed further to more deeply engage with IBSE and citizenship/action competence approaches. These comments have been amalgamated with the main research process, and underpin the recommendations made in the final chapter.

3.2 Summary

The two elements of this evaluation included a strategic evaluation with policy makers and the wider energy education and environmental education sector in addition to an in-depth analysis of energy education awareness in primary and post-primary schools. A dual analysis of SEAI education programme was decided upon for this research, requiring a mixed methods approach.

Two key research questions underpinned the development of research strategy, tools and subsequent analysis and recommendation. The evaluation asks:

1. To what extent does the SEAI education programme achieve its aim to engender energy awareness, education and behavioural change amongst its target audience of primary and secondary teachers and pupils?

2. In what ways could the SEAI education programme become more effective?

The following chapter outlines and analyses the results of the research process and addresses these two issues.

Chapter 4 Results

This chapter presents the findings of the evaluation in two sections. The first examines results pertaining to primary education and the second post-primary education. Both sections begin with the results of thirteen interviews conducted with influential members of the primary and post-primary education community involved in energy education. Interview analysis examines the relationship between SEAI and these agencies and their perceptions of SEAI materials and resources. The chapter then examines results of primary and post-primary questionnaires and focus groups. These sections look at the reported energy behaviour in schools, the resources used to teach energy, position within curriculum and the confidence of teachers around teaching these subjects. The quantitative data are supported by qualitative information gathered from three teachers' focus groups and two interviews.

4.1 Primary interviews

Over the course of the interview analysis a number of commonalities and differences arose with respect to interviewees' views through the process of constant comparison. It became clear that all interviewees were aware of SEAI, the work of the SEAI education section and the education material produced. However, interviewees diverged in two ways. First, on the basis of their relationship with SEAI, and the level of interaction between the interviewee (or their organisation) and the SEAI education section. Second, interviewees differed according to their use and perceptions of SEAI resources. Each of these themes will now be discussed in turn.

Organisations and their interactions with SEAI

The relationship between SEAI and organisations involved in this research can be characterised in three ways:

- having very few links or organisational exchanges currently,
- having newly formed work practices and exchanges based on joint understandings and goals
- having informal, ad-hoc but mutually beneficial relationship

Organisations involved in education, but also environmental policy, such as the NCCA and the Department of Environment, Heritage and Local Government (DoEHLG) could be described as having few links with SEAI education around the primary sector at the moment, but as the interviewee illustrates below are open to the opportunity of developing further ties:

"We'd be aware of SEAI, certainly, but w**e don't have a direct link [with SEAI]**... But, from time to time, depending on the particular piece of work that we're doing we would co-opt additional members onto committees. We would also link with key experts in an area, and that could take the form of bi-lateral meetings, [or individuals] commissioned to contribute to a particular piece of work."

Similarly, the DoEHLG, who have recently produced a climate change resource for primary schools, work with SEAI on the Greening Communities committee, a recent multi-stakeholder initiative involving public, private and civil society organisations. In both cases the potential for joint working in the future was discussed. On pointing out the emphasis within SEAI primary school materials on active learning, and as a support to critical thinking by the interviewer, the NCCA respondent suggested that there may be opportunities for greater joint working in the future, as the extract below suggests:

"There's certainly potential there. If there were opportunities to work with other organisations to increase capacity, I think that would be something we would consider. There may be opportunities for science and geography, and also work that we're going on higher order thinking skills, there is a possibility for making connections there".

There are, therefore, channels through which external agencies, such as SEAI can assist in the progressing and further developing teaching practice and curriculum development in a proactive manner, and also informing policy direction. This resonates with the findings of the literature review, which suggests that the development of critical thinking and higher order skills through active learning methodologies forms an essential component of IBSE and is called for by teachers (NCCA, 2008). Working with the NCCA would therefore add value, positioning the material that SEAI currently has available for schools at primary level in terms of teaching practice, e.g. support for higher order thinking, beyond strictly energy education.

The analysis of strategic interviews clearly outlines the range of organisations SEAI education section currently engages with. It would appear that these relationships with external energy education partners are evolving, such as that with the Discover Science and Engineering Programme (DSEP) run by the Department of Enterprise, Trade and Employment. The DESP is a significant agent in the primary school energy education sector. The remit of DSEP is to coordinate national efforts with regards to outreach and support of science at primary and second level, with the overall goal to prepare young people for the knowledge economy. Within this, the DSEP focuses on a number of key themes, chosen for their relevance to young people; one of the most important of these is energy and the environment, as the interviewee from this programme explains:

"Energy and environment is important because it fits well into real life… so then teachers, if they're teaching an enquiry based process they need the real life examples, and what we're trying to do is use the themes that are of interest of kids. I mean there's been 30 years of a [an environmental] message going out there and [its] getting through. Kids, they're altruistic, they want to help people, they want to help the environment, so we use energy and forces as a key theme in the curriculum".

Despite the objectives of SEAI and DSEP diverging, with the former primarily concerned with the transition towards a sustainable energy future, and the latter, engagement with science for economic development, it is clear that the two organisations have a degree of overlap in terms of educational focus. The interviewee from DEPS explains in the extract below that the working relationship between the two organisations has improved recently, as a result of shared building space:

"It's a no brainer for us to work with SEAI, generally, and specifically in primary science. I think it's been more that SEAI [have] used us as a sounding board as they have developed things. And I believe Guzzler is going to focus with our character Molly Cool shortly. The relationship with SEAI has been quite good. On a purely logistical thing, since they moved in here in the last two years has meant that we can just talk. They have always been involved in [events] like Science Week as well".

In addition to this informal work on the content of both programmes, SEAI are also utilising the strong links and existing networks built by DESP. In particular the Discover Science Centres:

Networks. [That's what]I think we offer groups like SEAI. Why would they want to build new networks? And that's what they [SEAI] are doing now, they're using the channels that we have established in terms of networks. We work with the education centres, with our Discover Centres, there are 25 of those, so SEAI have been linking up with them too".

The use of such networks, which are well established, and trusted by teachers, lend strength to SEAI and dissemination of their resources. Long standing programmes such as these have built trust with education providers, such as teachers, offering inroads for the SEAI materials and resources.

With regard to ad-hoc and mutually beneficial relationships, Green Schools provides a key example. One of the important elements of the SEAI education programme has been its support for environmental non-governmental organisations. A key link in this regard at primary level is the An Taisce Green Schools Programme (GSP). The programme is run in 2862 primary schools throughout the country, and creates potential for mainstreaming the overlapping geography and science curriculum theme of environmental awareness and care in a holistic manner in the school environment. The current relationship between SEAI and Green Schools could be described as somewhat **ad-hoc, but certainly mutually beneficial**. As the extract below illustrates the GSP is provided access to materials which support the energy theme of the programme, and SEAI are provided direct access to the network of Green Schools:

"Over the years SEAI would have given us [financial] contribution at various stages to running the programme. We would have ordered bulk [quantities] of the guzzler book, the posters, the game and we would have distributed them to schools that are on the energy theme of Green Schools".

Like the other organisations, both private (e.g. BT Young Scientists) and civil society organisations (e.g. ECO-UNESCO and Young Social Innovators at post-primary level) Green Schools highlight their desire for **further engagement** and support from SEAI, as the following extract shows:

"Traditionally we would have good communication with SEAI. Our relationship has varied. I suppose the one thing we would always have been looking for would have been a more consistent and definite

arrangement in terms of support. We're always looking for supporters and sponsors of particular themes so that we can develop them and make them work best within the school".

Using the example of the travel theme, the Green School interviewee demonstrated where funding for dedicated personnel working with schools on a specific theme has proved highly successful. In the extract below the interviewee gives the example of the **Department of Transport's financial support** for the travel theme, which has resulted in an increased number of GSP staff to support schools from the water theme and into the travel theme. The interviewee goes on to outline the difficulties arising for the energy theme:

"We got substantial funding from the Department of Transport to roll out green schools travel nationwide and as a result of that we took on about 20 staff, and located them regionally. 12 of those staff are working directly on travel and the other 8 are working on water, which is the theme which precedes travel. We've seen huge engagement and great results for schools working on water and travel, especially. Litter and waste, we've the local authority so they're supporting us there. Energy we don't really have anyone and the biggest number of schools that are putting off renewing the flag are schools on the energy theme. It's down to the fact that they don't have that engagement or support".

Figures from Green Schools illustrate this point. 1050 schools are currently on the waste theme, which drops to 668 schools undertaking energy. 500 schools are engaged in water, with 386 schools participating in the travel theme (An Taisce, 2010). These figures indicate that as schools move through the programme, completing the waste theme and moving into energy proves problematic. It should also be noted that as part of the relationship with the Department of Transport, An Taisce are required to provide detailed evaluations and report on progress.

The perception of the current primary schools materials provided by SEAI (Guzzler), and the interaction between this material and the Green Schools programme is illustrated in the following quote:

"Green schools and Guzzler materials link very much together. As in, we present the Green Schools programme material and then the SEAI materials that will help [the school] out with getting the flag".

An addition whole school approach to energy education is exemplified by current work conducted through the DEC (Display Energy Certificate). The DEC is now required for all school buildings 1000 square meters or more, and after 2010 has been applied to all public buildings. The information required to get the DEC includes measuring the building, examining the type of glazing, lights and heating arrangements, in addition to the energy bills over the prior 12 month period. As a contractor of SEAI explains in the extract below, SEAI are piloting potential involvement of students in collecting the data and analysing the data, rather than the entire process being completed by an energy assessor:

"Before you go to the school, you arrange with the teacher and divide [the class] into different teams. For example, architects, get them to measure the building; draw a scale drawing of it, and work out the square meters. Then the engineers, they look the buildings windows, the glazing they have, what kinds of lights. They interview the principal and the caretaker about the boiler and different things. The energy assessor will show them the boiler and the pipes. Then they have a team of scientists who'll sit down with the energy bills for the previous 12 months and figure out kilowatt hours the school has used. Then a team of IT specialists, they go onto the website energyeducation.ie and there's a form they have to go through, and fill out, and it prints out their DEC there and then".

This day long workshop is currently being piloted in primary schools in Roscommon, with positive results according to the consultant involved. There is potential for ongoing whole school approach through this initiative as a new DEC must be generated each year. However, the production of the DEC through this workshop based approach requires trained personnel. SEAI are currently working with GSP staff to conduct this day long workshop, so that the DEC becomes part of the Green Schools energy flag and forms a benchmark from which schools can improve their energy efficiency. As the SEAI contractor states below, collaboration between the two organisations is important:

"It's back to this thing of collaboration, you have to link into Green Schools because there's no point in Green Schools going off and giving people energy flags and then SEAI going off and doing something completely different. So, Green Schools were very amenable to cooperating. We're working with An Taisce [so] that they help with the roll out. Green Schools changes the ethos of the school... you know

when you go into a school if it has a couple of green flags, so it'd be crazy not to try integrate it [with DEC]".

This extract reiterates the sense in interviews of the need for increased co-ordination between organisations operating in the environmental education sector. It also stresses the importance of school ethos which is illustrative of issues raised in the literature review regarding active learning and opportunities for students to participate in decision making.

The Green Schools are similarly enthusiastic about the collaboration:

"They're [SEAI] looking at Green Schools as a model or programme through which to achieve their goals. And it's good, because it's better to be integrated rather than duplicating or possibly fragmenting programmes. It's also good because these are schools starting out in energy, they might be unsure what to do, so they see it as, well, this is someone coming to help us do our review… It's about aligning resources, and avoiding duplication."

But Green Schools also reserve an air of caution because the stringent requirements demanded to produce the DEC, and the requirement for on-going monitoring through the process:

"This approach [the DEC] is more along the lines of monitoring, and it's sensitive. The big thing we have had with schools is building up trust and not putting too much of an emphasis on them to report back to us".

So, while there are obvious links between the DEC and Green Schools, there are concerns that schools will find the DEC off putting, and by proxy, be dissuaded from continuing the Green Schools Programme. This is in contrast to the GSP perception of the Guzzler resources. Since its inception the Green Schools programme has worked to build up trust and support in primary schools by providing scope which allows the school to define its own environmental goals, but also, providing support for schools to achieve these goals. By contrast, the process by which the DEC is achieved differs quite significantly.

There are also possibilities to integrate the wider SEAI education material around the workshop through which schools receive their DEC, as the individual involved suggests in the extract below:

"The website for energy management and energy efficiency [DEC]... when you go into that it will have a section on teacher resources that are available to you if you want to use them and that will bring you into [SEAI's education section]pages".

Organisations' perceptions of SEAI resources

While most the interviewees do not use SEAI recourses directly in their current work, a number have used them as part of previous work or in environmental education workshops. The statements made below are illustrative of the general positive perception of all interviewees towards SEAI's primary schools resources and workshops.

"We'll always point to SEAI as the organisation with the best materials for schools, the best resources. [That's based on] the feedback from our own staff, which has been excellent, in terms of the guzzler pack especially. Our staff are in schools, they'd have good relationships with a lot of the green schools coordinating teachers and the reports from them, anecdotally, are very good".

"I'd promote the [SEAI] resources because they're really good resources. The ones I use a lot are the same ones they use in the SEAI workshops. So, like the alka-seltzer bomb, the balloon race, the basketball and Newton's cradle experiment, I've found [the worksheets] good, but what I tend to do is I tend to use them at the end of the workshop. I wouldn't go through a worksheet with the kids. I'd leave it as something that they start doing as a wrap up. It settles them down and then it's quite easy to wrap up the session, and I can leave them with it to finish up in their own time. They'll have done the learning before hand and it's easier for them. I've also used the vinegar and baking soda reaction in teacher training [Continuing professional development]. That's gone down well."

"I would do a lot of Green schools work, so things like their stickers, magnets, pencils and posters and the resource sheets, I would use them regularly. I'd either give them to schools to use themselves, or give them to kids themselves as part of a slightly more informal workshop. So they might use them as part of Green Week where they can promote energy and make a bit of fuss. They're really useful there."

Interviewees did also highlight the different emphasis between organisations working in the energy education sector. These interviewees suggest that SEAI have a unique way of working, through "one-off" workshops. They also suggest that SEAI materials and workshops are science focused, rather than based around citizenship. There was also suggestion that resources are based on a more passive approach, rather than active, enquiry based learning. Given the emphasis in education research on inquiry based science and problem based learning as highlighted in the literature review, there is some evidence to suggest that on-going, whole school approaches are more in keeping with current trends in primary education and more successful in engendering environmental empowerment. For example, the following interviewee working in the environmental education sector suggests reasons why the Guzzler big book, and SEAI resources more generally, are illustrative of a different kind of learning:

"I don't think I've used the Guzzler story book that much myself. Generally I wouldn't use it. It's just because we, we have a different agenda, it's more about taking action. But you know SEAI does something I don't think anyone else does, which is get across the basic concepts of energy. I'd say a lot of teachers struggle with that because they don't have the background, and it's not easy to get across in a fun way, and SEAI have done that really, really well. That leaves us to do other stuff".

One interviewee (not involved in GSP) suggests that the arrangement between SEAI workshop, materials and the GSP is a very beneficial one.

"There isn't a huge action based side to it [the SEAI workshops]. I think a lot of the schools link it to their Green Schools, which is a very action based programme, which is really effective and real. The kids are actively involved in it and it produces results. [The SEAI workshops and materials] are something that the school can do, on-going, to maintain that enthusiasm, that focus."

The key point these interviewees raise is the distinction between "action" based learning, and their perception of SEAI material as scientific, information provision type educational approach. The action approach draws on notions of students being empowered to decide upon and undertake work towards self defined goals. This resonates with the work of Jensen and Schnack (1997) and Uzzel (2000, 1999). This form of empowered education is positioned in contrast to

passive experiences of information provision, activities and energy saving behaviours from teachers or workshop leaders.

This analysis of primary energy education interviewees suggests that greater co-ordination between agencies working in the sector to define the added-value of programme integration is of key concern here.

4.2. Results of questionnaires and focus groups - PRIMARY

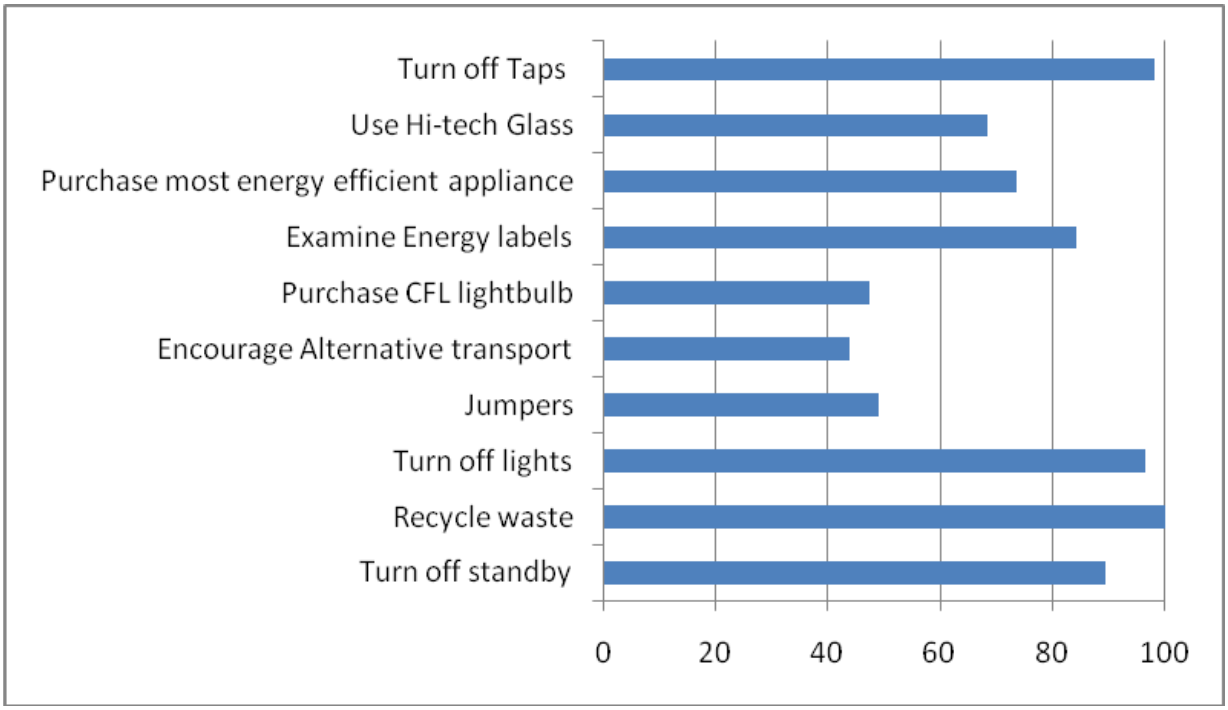
As outlined in the methods section, questionnaires were sent to 100 primary schools, selected from a stratified random sample. For comparative purposes 50 questionnaires were sent to schools drawn from the SEAI database. This sample was similarly stratified and randomly selected. In all 61 primary school questionnaires were returned. This constitutes as return rate of 41%. Excluding the 14 questionnaires returned from the SEAI database, the return rate increases to 47%. Of the 61 questionnaires returned, 54 schools stated that they are members of the Green Schools Programme (GSP). Recent statistics from An Taisce suggest that 90% of all primary schools are now registered for the GSP. Return rates for this evaluation are in line with this proportion, with 88% of schools stating that they are participants in the GSP. Statistics in the following sections are based on the overall returns (61), unless otherwise indicated.

Energy saving behaviours and motivations

Respondents were asked to indicate energy saving behaviours which they regularly engage in throughout the school and/or encourage pupils to carry out. It should be noted, that these results do not constitute actual behaviours, but instead represent reported behaviour, or an intention to act in a particular manner. The findings to this question are presented in Figure 1 below, and correspond well to the reported behaviour suggested in focus groups conducted with primary schools teachers and principals. Figure 1 indicates that schools prioritise the following energy saving activities, such as recycling waste (100%), turning off taps (98%), and turning off lights (96%). Those least practiced are those behaviours which would also involve the parents of children, such as encouraging alternative transport (44%) or have cost

implications for the school, such as purchasing CFL light bulbs (27%) or energy efficient appliances (42%). This strongly suggests that respondents' schools favour low cost activities, before those actions which might incur a cost on the school, either in time or economics.

Fig 1: Reported energy behaviours (as % of total respondents 61)



The results of focus groups around this question also suggest that leadership within the school by an interested teacher is invaluable to the success of energy saving behaviours in school, providing a point of contact, a source of information, and keeping other teachers and staff involved and motivated. One focus group conducted in a newly built school also suggested that new energy saving techologies incorporated in the school design are useful to illustate that the school "practices what it preaches", providing consistancy in learning. Respondents to both questionaires and in focus groups also stated that pupils regularly engaged in energy saving actions. One teacher suggested that:

"Children will remind the teachers to turn off appliances or turn off the lights themselves. They put the stopper in sink when washing. The children feel more accountable".

In this sense it appears that where schools are actively engaging pupils to take on energy saving actions, it creates a social norm within the school, and to an extent, the interviewee below suggets, within the wider community and home environment also:

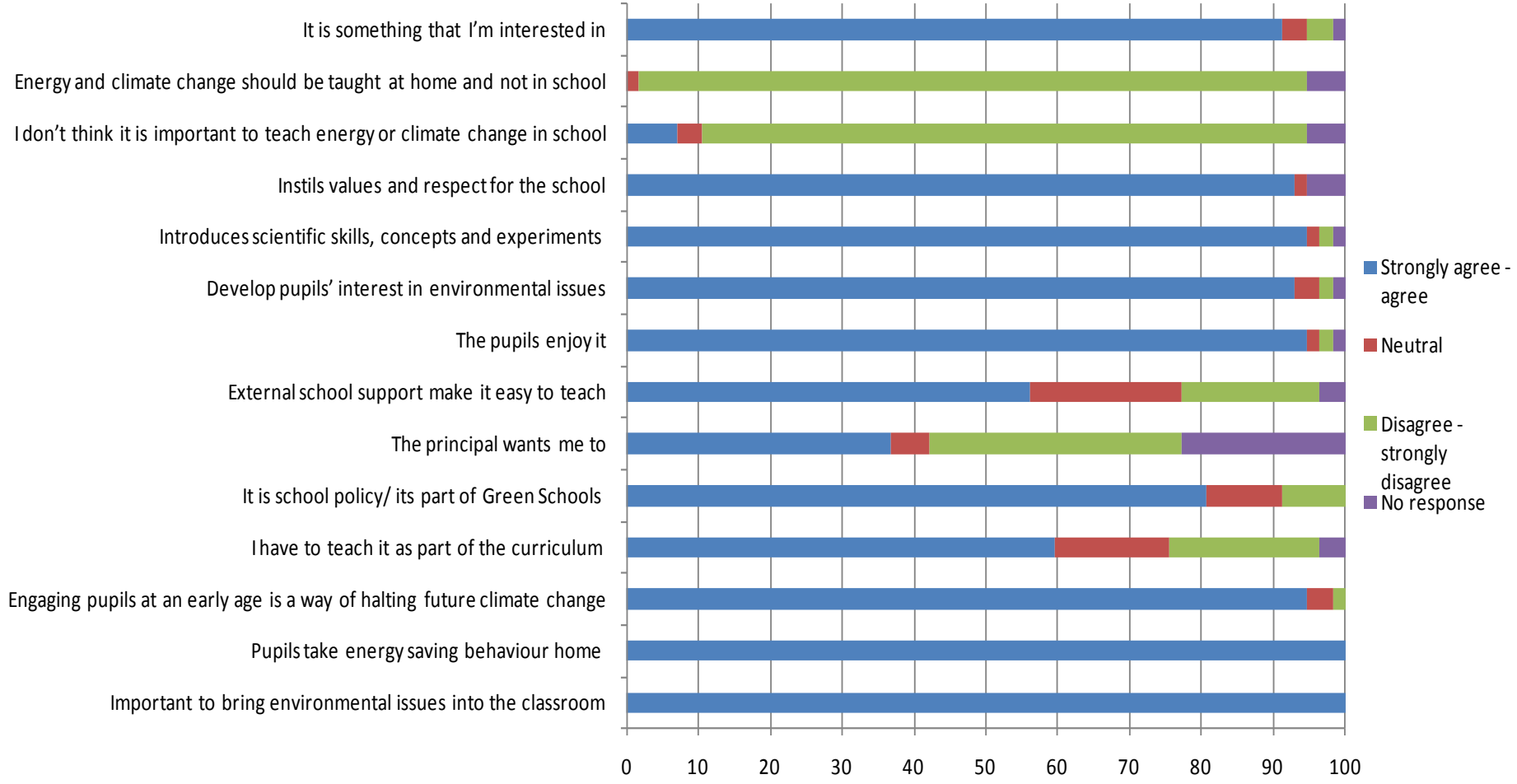
"By educating pupils in any one or all of the above area you create a consciousness in the broader community but particularly in homes where parents get involved in assisting with home work and with projects. This impact I often believe is completely under valued".

Figure 2 (overleaf) presents the motivations teachers have to teach energy in the classroom. Teachers were asked to respond to 14 statements on a five point scale from strongly agree to strongly disagree. For clarity this was amalgamated into strongly agree and agree, neutral, disagree and strongly disagree and no response. Results from this question clearly indicate that teachers feel it is important to bring environmental issues into the classroom. Over 90% of respondents indicated that environment and energy are topics they are interested in, and passionate about teaching. This would suggest that teachers' primary motivation to teach these subjects stems from interest, rather than practical or coercive driving forces, such as encouragement from the principal, as the following extract illustrates:

"I think that teachers' and staff need to be enthusiastic within themselves if they are to convey an interest in energy saving to their students. Teachers who are passionate about energy saving will pass on those values to their students. Teachers need to care."

However, leadership from the principal is an important factor in galvanising staff around energy saving behaviours, and providing the teaching priorities or ethos which underpin the school learning environment. For example, 81% of respondents suggested that they are encouraged to teach energy when it is embedded in school policy or the GSP. Additionally 60% of respondents agreed that integration with the curriculum is also a favourable rationale for teaching energy education. These results correspond very favourably with the results of focus groups with three primary schools.

Fig 2: Reported motivation for teaching energy education (as % of total respondents 61)



Participants of the groups strongly stated that integration with the curriculum is key as it defines their work plans, objectives and reports to the principal and school management. They went on to say that due to an ever burgeoning workload and time consideration integration of energy education with the curriculum is essential.

When considering the relationship between school and home, 100% of respondents suggested that pupils take energy saving behaviour home. Similarly, no respondents answered positively to statement that energy and climate change should be taught at home and not in school. While the results of focus groups broadly agree with this, one participant of a focus group was a home school liaison officer. In an informal conversation following the focus group this individual highlighted that while information and behaviour does transfer between the school and home, it is just one factor within a family's life; social, economic and cultural influences and priorities are also important. In addition, a focus group in an inner city Dublin DEIS school revealed that energy education would take somewhat less of a priority due to the imperatives of teaching basic literacy and numeracy skills, such as English, Irish and Maths. This latter point calls into question two issues. First, while SEAI materials such as the Guzzler big book provides ample opportunity to introduce literacy into early years classes, this was overlooked by these teachers. Second, it suggests that a wider remit in terms of basic literacy and numeracy skills could be fulfilled by SEAI materials, if appropriate instruction was provided.

Teaching practice and energy education in primary schools

In this section a number of factors pertinent to energy education are addressed; this includes the current practice of energy education in schools, perceptions of curriculum integration, teaching context, current sources of energy education material and requirements for additional resources, and lastly, teachers' confidence levels in teaching energy education.

Energy education teaching in schools

Respondents were asked to report on the type of energy education the school undertakes. For the purposes of the evaluation energy education was divided into three subjects, climate change, energy science and energy saving. Table 4.1 presents the results to this question.

Table 4. 1: Schools undertaking energy education (as % of total respondents 61)

Climate change	**91%**
Energy science	**82%**
Energy saving	**95%**

Table 1 (above) indicates teachers' preference for teaching energy saving behaviours and climate change with slight fall off in numbers of schools teaching energy science. This corresponds well with research conducted in Ireland which suggests that primary teachers find the science portion of the SESE curriculum problematic (NCCA, 2007). These findings correspond well to teachers' motivations (Fig. 2) to educate pupils about energy as a way of halting future climate change and engaging them in environmental issues more generally.

Drawing on the findings of the motivation question indicates some discrepancies between perceptions of energy science and teaching practice. In Figure 2, 95% of respondents indicated that they consider energy education an important way to introduce scientific skills, concepts and experiments into the classroom, while 82% of respondents state that they actually teach energy science. This discrepancy would suggest that further assistance may be required to fully embed energy science into classroom teaching practice. In addition, these individuals, and others indicated slight unease in trying new activities or areas of learning in the classroom. This finding is to be expected given research undertaken by NCCA (2007) into the science curriculum which suggests that teachers find it difficult to find engaging material and hard to manage practical work with large classes. This finding corresponds well with one of the focus groups in particular, participants of which suggested that teaching science was difficult and off putting for

some teachers, particularly those with no formal experience of learning science themselves, as the extract below suggests:

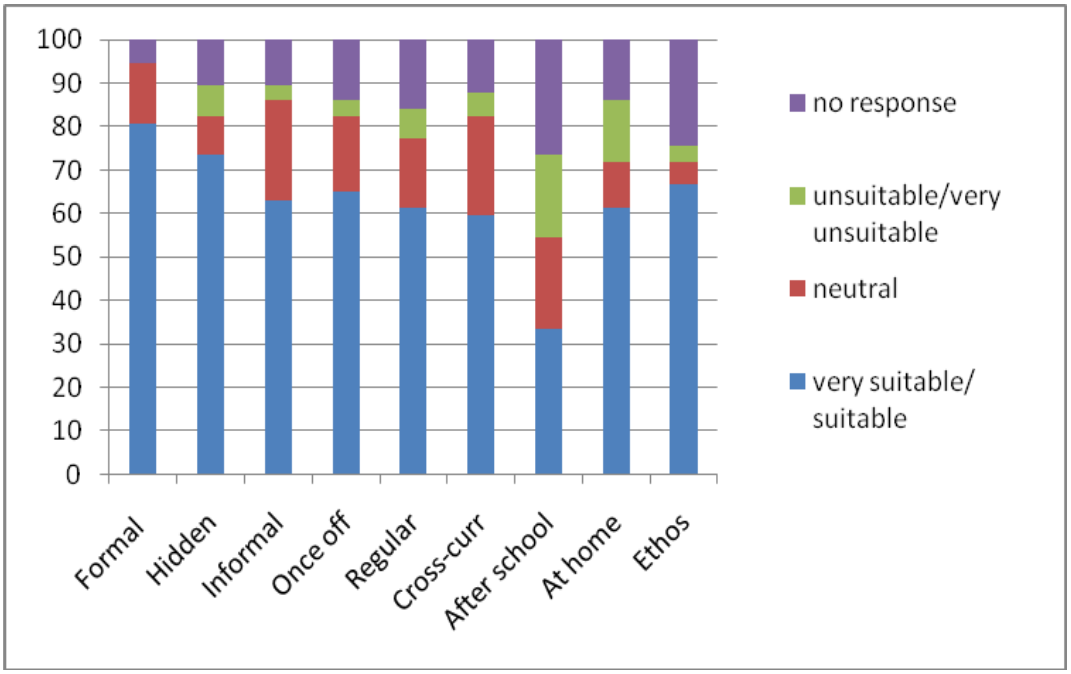
"You could nearly draw a line between the younger members of staff and those older. Like myself, I never did science in school, I was very anxious. So when science came on the curriculum it was an area I taught, but with no background information really, whereas younger teachers are much more comfortable with it".

In contrast, energy saving behaviours, such as turning off the lights or closing doors, are actions derived from economic, pragmatic concerns or values, rather than scientific understandings, and therefore not reliant on perceptions of special expertise.

Teaching context

Questions concerning teaching context were devised to investigate how teachers teach energy education, for example, if it should be conducted on an ongoing or one off basis. The results across the three energy education areas were remarkably similar.

Fig 6: Teaching context climate change (as % of total respondents 61)



There are three common trends across the results of the teaching context question. The first is the positive responses to integration of energy education within the formal curriculum. This is supported by qualitative results from this study which indicate that teachers require close integration of energy education with the curriculum in order to justify their teaching it. It also corresponds to the most recent NCCA primary school curriculum review (2008) which states that one of the key considerations of teachers is curriculum overload. This places severe time restrictions and constraints on teaching outside the formal curriculum.

A second common feature across figures 6, 7 and 8 is the low positive response to activities after school. This may be as a result of teacher time and also difficulties in gaining commitment from students after school hours.

The third theme relates to teachers' perceptions to once off, regular, home and ethos teaching context for energy education. The relatively uniform responses here across climate change, energy science and energy education would indicate that teachers feel that energy education is suitable for integration with different teaching contexts. This is significant given the discussion in Chapter 2 pertaining to whole school approaches to environmental education, and potential for integrating schools environmental education within the wider community as advocated by Uzzel (1999, 2000) and Tilbury & Wortman (2006).

The results of qualitative investigation would support this finding, but would also suggest that each teaching context provides a different benefit. Teachers in two focus groups suggested that once-off workshops, particularly from external agencies, are important as they provide motivation and excitement, a finding also suggested by Varley et al. (2008) in their discussions with primary school science pupils. In addition, the Educate Together focus group also emphasised the importance of on-going regular engagement with energy education throughout the school year and the benefits of its integration across the curriculum. They suggested this as the most beneficial approach to reinforce learning, providing different learning contexts for energy education (e.g. the learning about energy in English and science would be different, but also potentially complementary).

In contrast individuals from the inner city DEIS school focus group suggested that a one week block, for example, during Science Week would be the appropriate approach for teaching energy education, particularly science and climate change. Participants for the DEIS school focus group stated that they try to integrate energy saving behaviours within the overall ethos of the school.

This represents two very different approaches, teaching energy education through curriculum integration versus block teaching.

Fig 7: Teaching context energy science (as % of total respondents 61)

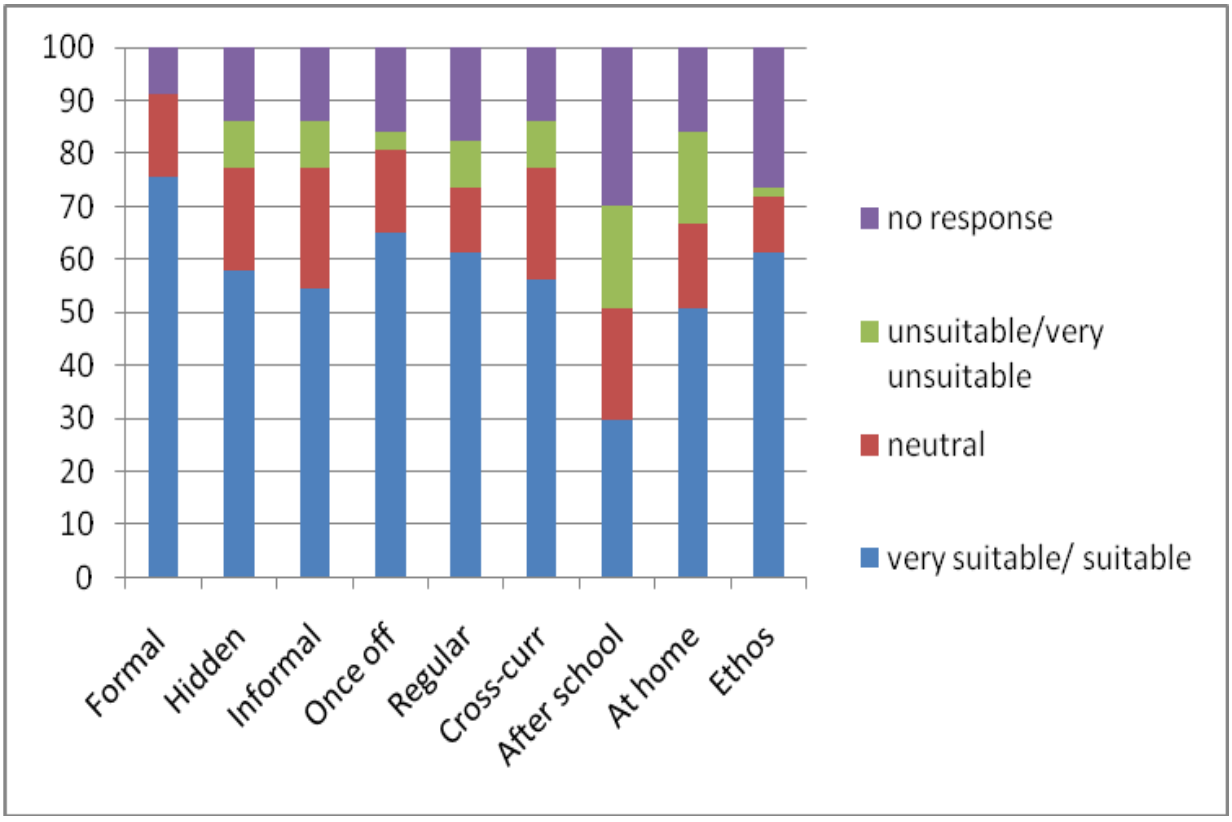
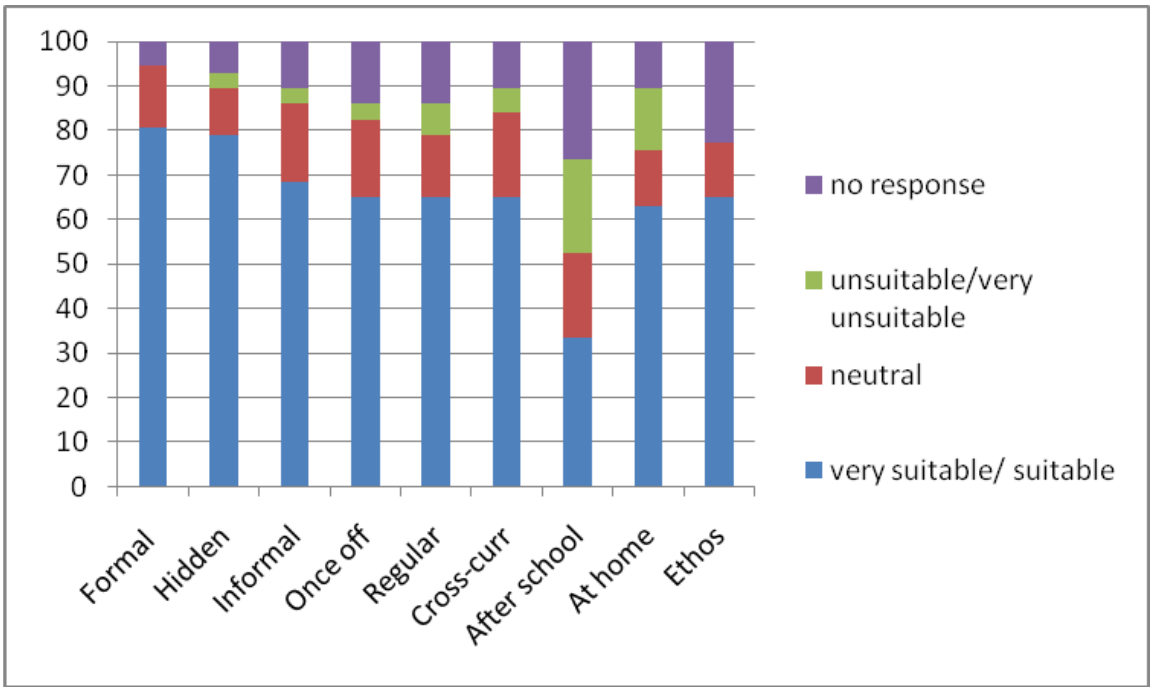


Fig 8: Teaching context energy saving (as % of total respondents 61)



Current sources of energy education teaching material

Respondents were asked about current sources of teaching material for energy education, including written resources, external speakers to schools and programmes that they engage in. Teachers were asked to identify resources used under each category. Teachers had the opportunity to indicate more than one resource under each category.

Table 4.2: Sources of written material (as % of total respondents 61)

Sources of written resources	Climate change	Energy science	Energy saving
Curriculum exemplars	63	58	61
Internet	72	60	72
NGO _ Dev	54	16	19
NGO_Env	12	9	9
Green schools	60	49	70
SEAI	35	39	60
Discover Science	32	39	33

Table 4.2 indicates that the most popular source of written material for teachers is gathered from the internet, particularly in the case of climate change and energy saving. Two focus groups indicated that they widely use the internet to source material on energy education, drawing primarily on international resources, such as Energy Matters (UK) or the US EPA. However, all three focus groups also stated that other teachers and their suggestions of useful resources is an additional source of information. Additionally, one focus group suggested that they utilised resources which they were in some way familiar with, and knew that the resources worked well in the classroom, such as science packs provided by DEPS. These issues of trust in the resource, the resource provider and personal recommendation are of pertinent to the promotion of SEAI materials.

Table 4.3: Sources of external speakers (as % of total respondents 61)

Sources of external speakers	Climate change	Energy science	Energy saving
County Council	19	23	35
Science Bus	2	7	7
SEAI	16	21	28
Green Schools	46	44	61
NGO _ Dev	14	11	11
NGO_Env	4	4	5

Clearly, Green Schools provides an important visiting resource for schools followed by the County Council. The findings above are substantiated through the qualitative research whereby teachers indicated that they enjoyed external speakers visiting the school as a way of motivating and increasing enthusiasm towards energy education in the classroom. The results of Table 4.3 illustrate that teacher have most contact with GSP for climate change, energy science and energy saving, followed by external speakers visiting from the county council.

Table 4.4: Sources of programmes (as % of total respondents 61)

Sources of programmes	Climate change	Energy science	Energy saving
Teacher education CPD	11	16	14
Green Schools	56	60	70
Discover science	28	35	30
Science Week	47	47	53
Young Scientist	2	2	7
Change.ie	4	2	4

In terms of the programmes teachers access in order to teach energy education the GSP proves most popular across climate change, energy science and energy saving. This is followed by Science Week. In contrast CPD have proved significantly less popular in terms of providing support to teachers. One potential explanation for this lies in teachers' lack of awareness of CPD opportunities in energy education, an issue raised by two of the focus groups. This finding is quite significant in the light of the following question, which examines teachers perceptions of additional teaching resource requirements.

Additional teaching resources

Respondents were asked to indicate additional resources and supports required to enable them begin to develop their teaching or energy education. The results of this question follow in a similar vein to results discussed thus far in this section, with common patterns emerging across climate change, energy science and energy saving. Figures 9, 10 and 11 indicate that the support of other teachers and the principal are important. While this would appear to contradict results presented in Section 4.3.1 regarding motivation, results from the focus groups clarify this discrepancy. Participants indicated that motivation to teach was not primarily driven by principals, but that the support and understanding of both principals and other teachers are required in prioritising energy education. In addition, principals and other teachers were identified in focus groups as sources of information, pointing out useful resources, and providing advice on teaching practice.

Fig 9: Additional teaching resources required climate change (as % of total respondents 61)

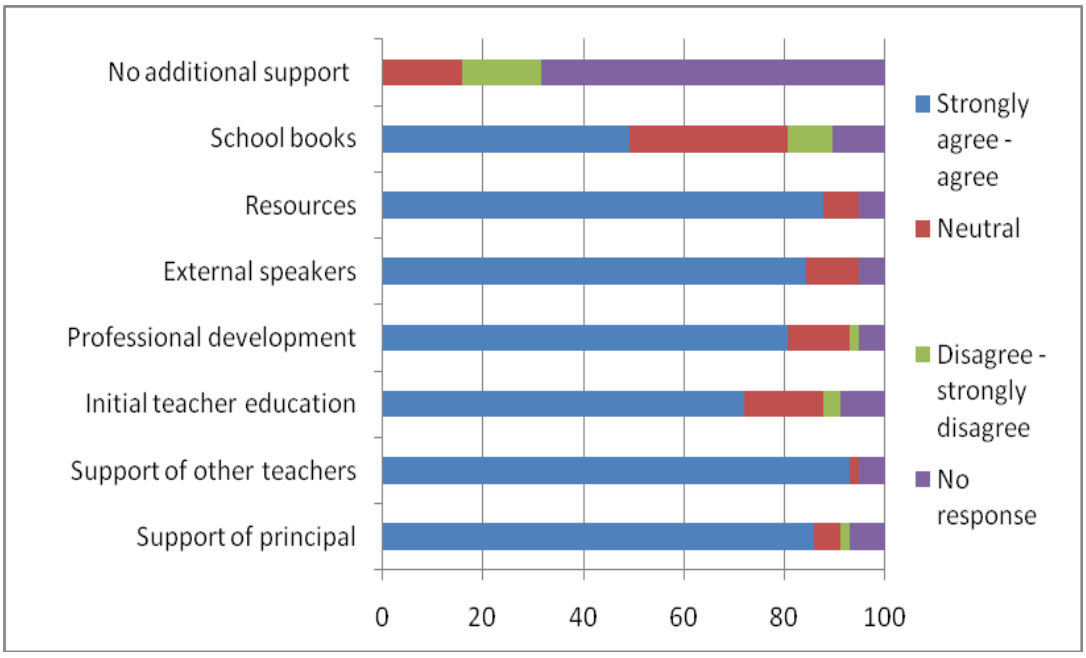


Fig 10: Additional teaching resources required energy science (as % of total respondents 61)

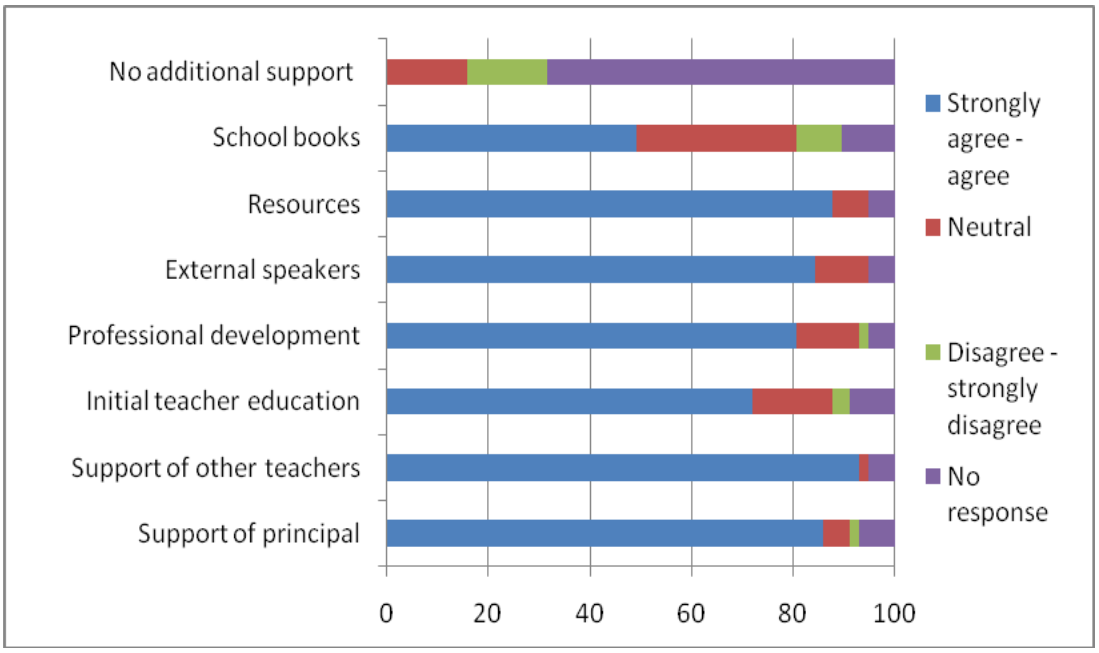
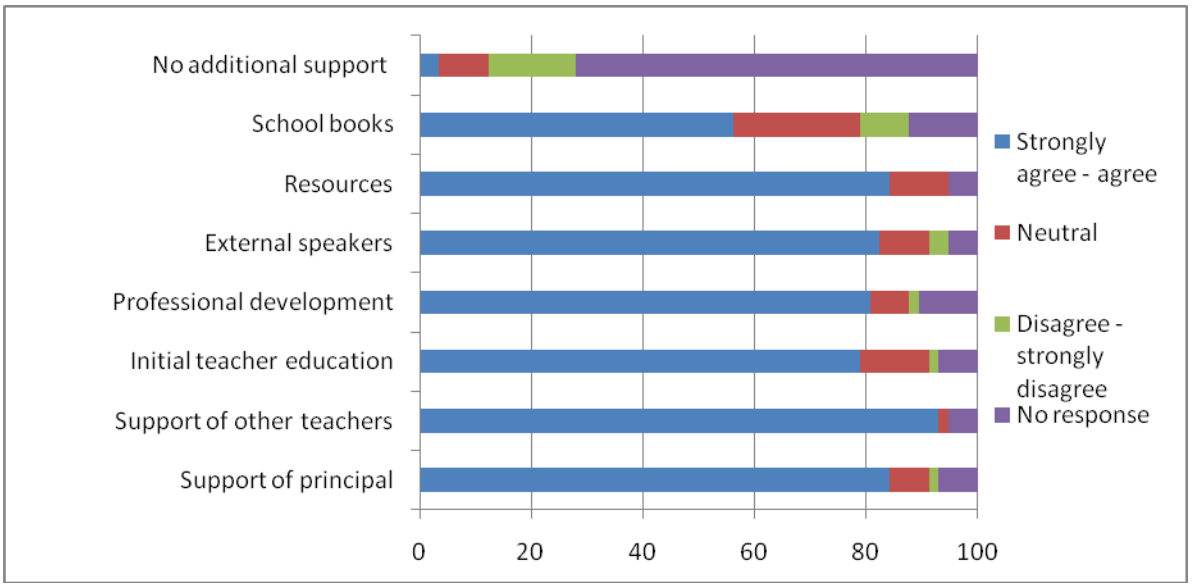


Fig 11: Additional teaching resources required energy saving (as % of total respondents 61)



Teacher requirements in initial teacher education were slightly increased in energy science when compared with climate change and energy saving (79% against 72% & 72% respectively). Although, this is not a substantial increase, it may indicate the need for increased attention to science, in particular, IBSE in initial teacher education. In terms of CPD, both climate change and energy science scored 81% against 74% in energy saving. This would indicate that teachers feel more comfortable teaching the latter, and necessitate additional climate change and energy science education through continued professional development. Despite these minor differences, the overriding conclusion from these findings points to teacher's requirements for increased support through ITE and CPD across energy education. These findings are interesting when positioned against the previous question which indicates that teacher education does not currently constitute significant source of information to teachers on energy education, although here, the findings suggest that it is clearly warranted.

Ranking highly across the three elements of energy education are the external supports to teachers, such as written resources and external speakers. In contrast school books were generally not viewed as supporting energy education when compared to other resources. This may indicate a key trend noted in the NCCA review of the science curriculum (2008), namely, that teachers require assistance in active education techniques and methods which engender

higher thinking skills which are called upon in environmental education. However, there is a difficultly here, as the NCCA review, interviews conducted as part of this evaluation, and the results of one focus group indicate, teachers remain heavily reliant on text books to teach the primary curriculum. Teacher requirements for professional development and teacher education were slightly increased in energy science when compared with climate change and energy saving.

Teacher confidence in energy education

As the following graphs indicate, teachers' levels of confidence are generally high with respect to teaching energy. However, teachers appear to be least confident about teaching energy science (16%), when compared with climate change (2%) and energy saving (2%). It also suggests that further assistance is required to enable teachers develop this area of practice, and to link it with existing confidence in teaching climate change and energy saving behaviour.

Fig 12: Level of Confidence – Climate change (as % of total respondents 61)

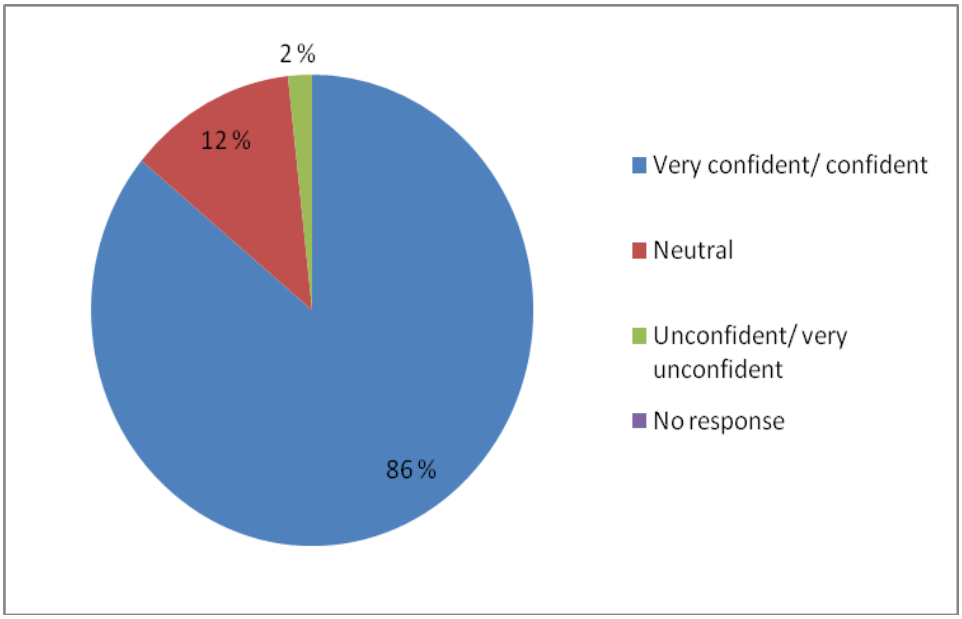


Fig 13: Level of Confidence – Energy saving (as % of total respondents 61)

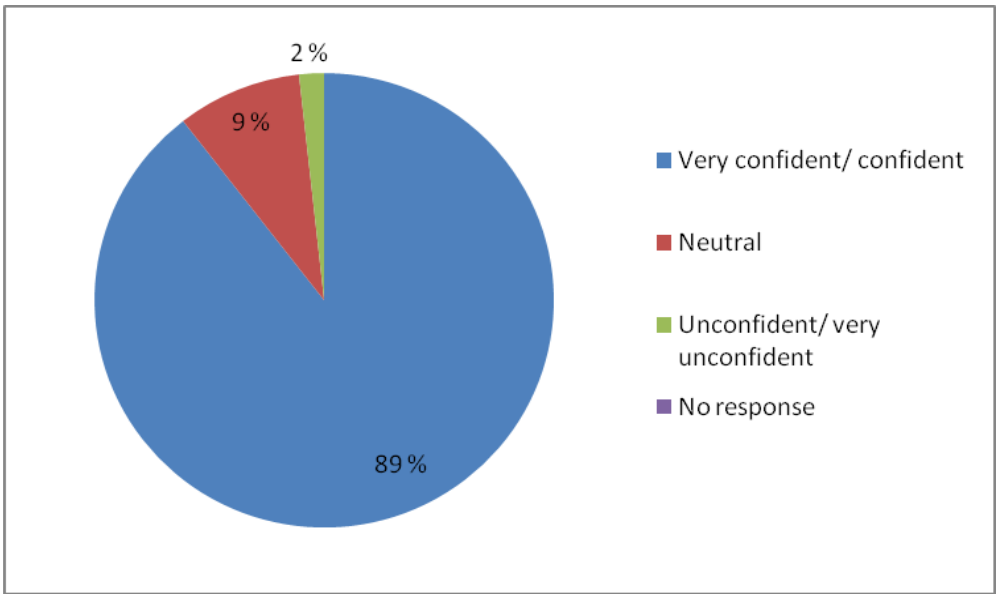
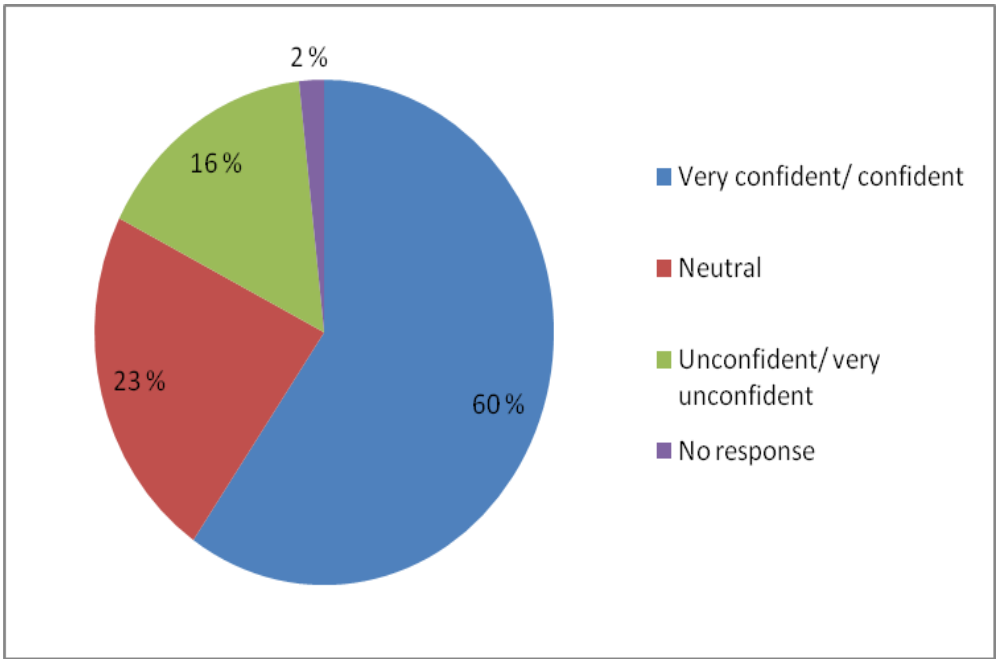


Fig 14: Level of Confidence – Energy science (as % of total respondents 61)



Perceptions of curriculum integration

The findings above indicate that teachers are least confident in teaching energy science, when compared with climate change and energy savings. However, over 80% of respondents indicated that the most appropriate area of the curriculum for teaching climate change, energy science and energy saving is science. With regard to the integration of energy education into the curriculum, teacher's perceptions were mixed. Responses across the three subject areas, climate change, energy science and energy saving behaviour were very similar, as figures 3, 4 and 5 will indicate.

Fig 3: Curriculum integration with climate change (as % of total respondents 61)

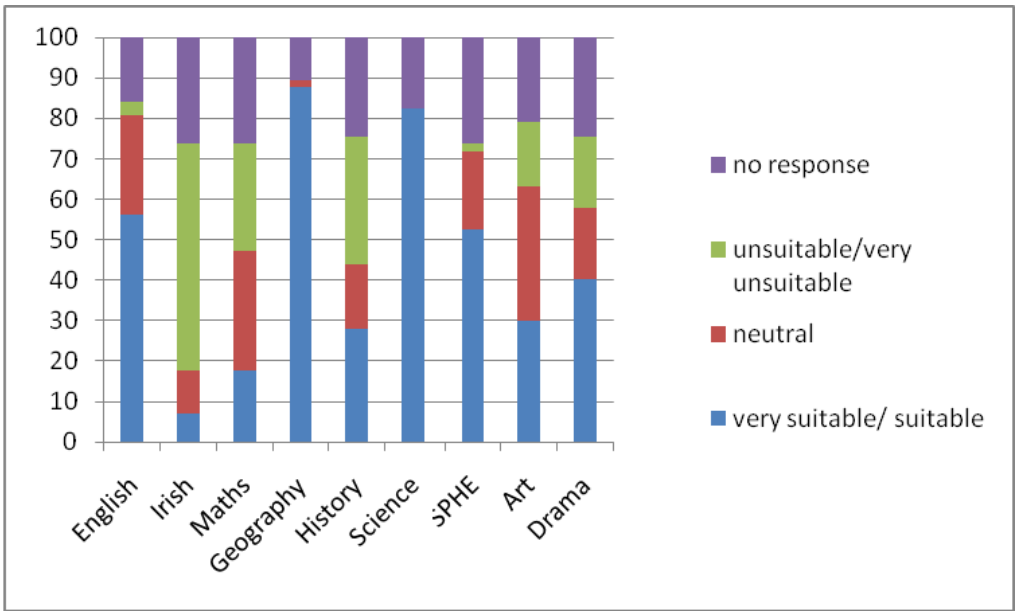


Fig 4: Curriculum integration with energy science (as % of total respondents 61)

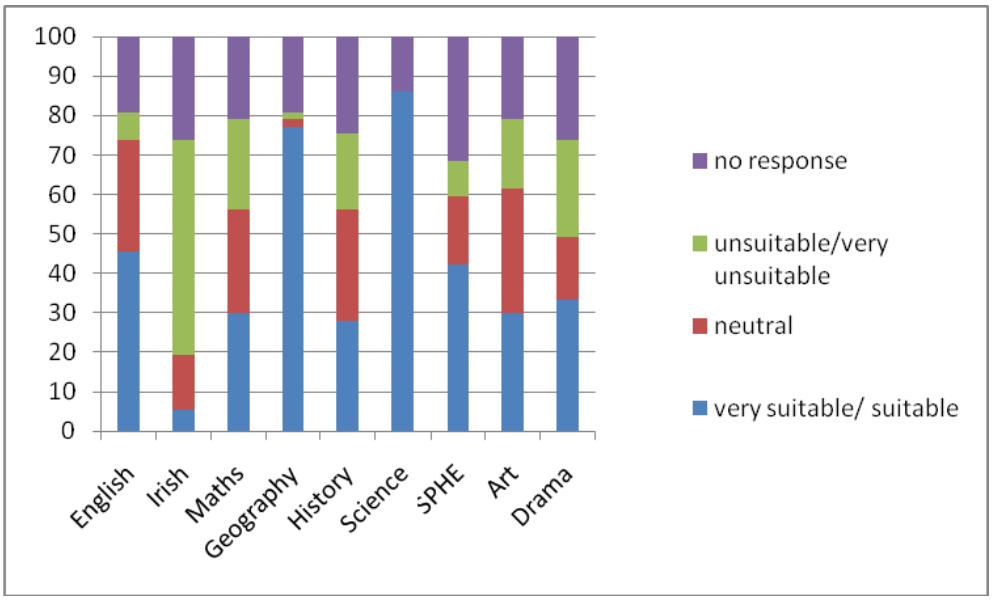
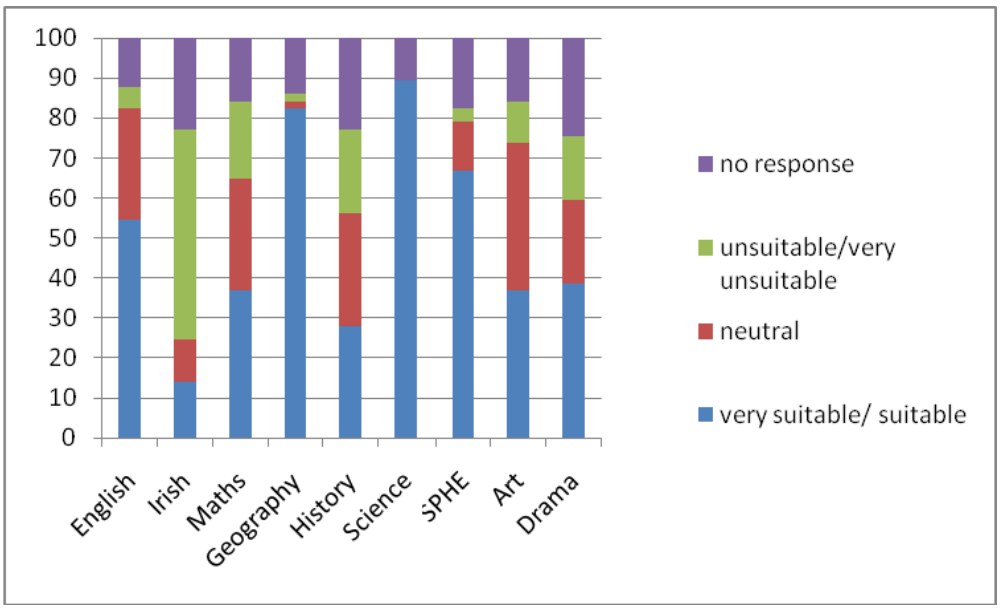


Fig 5: Curriculum integration with energy saving (as % of total respondents 61)



Figures 3, 4 & 5 indicate that teachers see energy education most closely aligned with science and geography curricula. The results also indicate that history and Irish were perceived as the most unsuitable subjects for teaching energy education. However, SPHE figures indicate a possible route through which to teach climate change (53%) and energy saving (67%). Two focus groups (one an Educate Together school and the second a Green School; both DEIS) on

having access to the SEAI resources (Guzzler big book, posters, lesson plans) stated that they could see the cross-curricular possibilities for the materials. These individuals indicated that the resources could be adapted for use in all subjects, including Irish and Maths. However, importantly, the cross curricular application of SEAI resources was not realised by the teachers until prompted by the interviewer through the focus group discussion. This indicates that SEAI should engage directly with teachers around the issue of curriculum integration, and make explicit where energy education can be applied in a variety of primary curricula.

Respondents awareness of SEAI and use of SEAI materials

All respondents indicated that they were aware of SEAI, or had heard of the organisation in some respect before the questionnaire. The following table shows how respondents come to hear about the organisation. It should be noted that respondents frequently mentioned two sources, in conjunction, for example, both GSP and internet searches.

Table 4.5: Respondents awareness of SEAI – sources of information (as % of total respondents 61)

Green Schools	60%	**TV/media - home research**	14%
Internet search	49%	**Colleague**	7%
Letter from SEAI	21%	**School newsletter**	5%
Teacher education	4%	**DEC information**	2%
Environmental Awareness officer			18%

The most popular source of awareness of SEAI comes from the GSP, with 60% of respondents indicating that it was through the GSP that they became aware of SEAI and the materials. 49% of respondents suggest that they had heard of SEAI through an internet search, while looking for education materials, and also, for personal matters, such as home energy improvement grants or after hearing about SEAI through media advertisements.

Table 4.6: Respondents awareness of SEAI – use of SEAI services (N = 61)

	All respondents	Primary School respondents	SEAI database respondents
Workshops	25	15	10
Resources	42	29	13
Website	41	29	12

Table 4.6 presents the number of schools who stated that they had previously used SEAI services, either having received a workshop (25 schools), used resources (42 schools) and/or used the website (41 schools). This suggests that 68% of schools which responded to this evaluation had used SEAI education resources at some stage in the past, with 40% indicating that they had received a workshop previously.

Rationales for the use of SEAI education material were diverse. When asked why they would seek to use SEAI resources, respondents strongly agreed or agreed that links to the curriculum (77%), links to GSP (70%) and the fact that they are free (72%) make SEAI materials attractive. In addition, 72% of respondents indicated that they are useful resources when looking for ideas on energy saving behaviour. Focus group data adds to these findings. Participants suggested that SEAI resources, particularly Guzzler big book and posters were attractive and engaging because of their colour, age appropriate nature and versatility. However, they also suggested that information outlining how the resources could be used together, or interlinkages, within one lesson to specifically address curriculum units, was required. Individuals also suggested that greater integration of workshops and materials would be beneficial to progress post-workshop activities. Two schools participating in the focus groups used interactive white boards in their classrooms. These individuals called for more interactive resources in this medium.

"SEAI workshops in the school was some years ago and I wasn't involved in class at the time. I would love more external speakers to school, someone who could speak to junior infants to 6th equally. I mean the resources are excellent but access to speakers and workshops for the whole school would be much appreciated. Hands on interactive material that we could use with the white board would be great too."

Fig 14: Reasons provided for use of SEAI materials (as % of total respondents - 61)

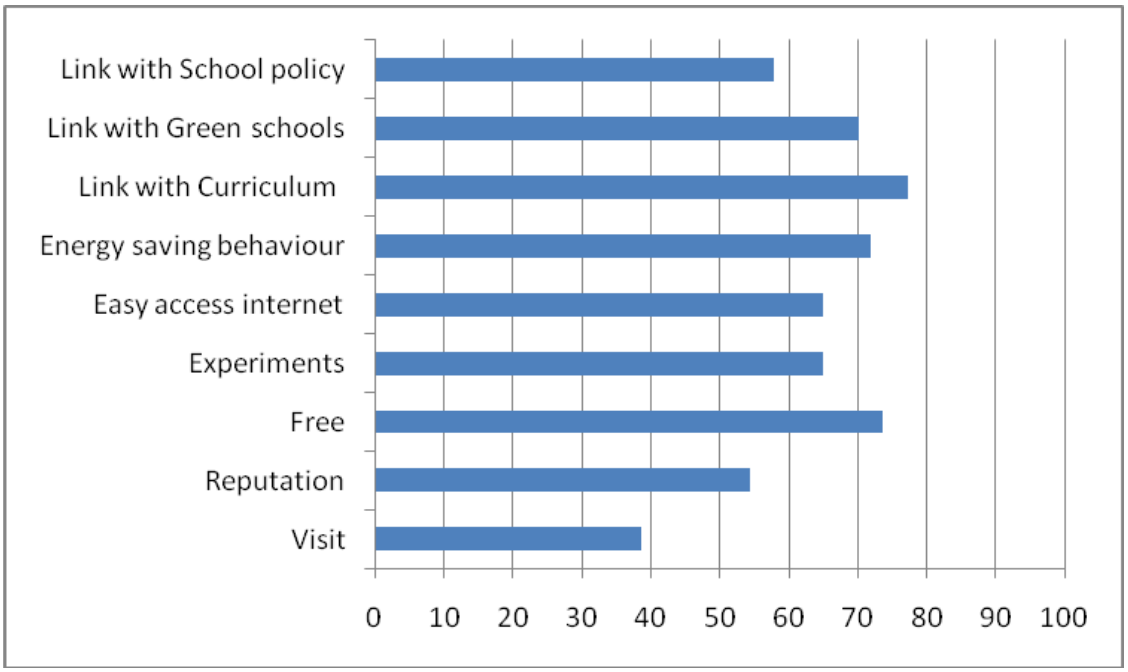


Figure 15a outlines respondants satisfaction with SEAI resources. Those who did not respond to this question are indicated in the non-response column for comparison purposes. Figure 15b presents results of those who were satisfied/very satisfied with the resources as a percentage of respondents who had used SEAI resources in the past (i.e. 42 respondents). As the following quote illustates, SEAI resources are thought by some teachers to have an impact on knowledge, attitudes and behaviour:

"We use SEAI worksheets, experiments, posters sometimes and Green Schools material. We don't use standard text books that much... Energy saving behaviour changed for a brief spell, but needs to be constantly checked on a whole school basis."

"As a result of the floor game children were more aware of how to save energy and its importance. They became more aware of the choices they make in their own lives [how] that affects the environment."

Fig 15a: Satisfaction with resources (as % of total respondents - 61)

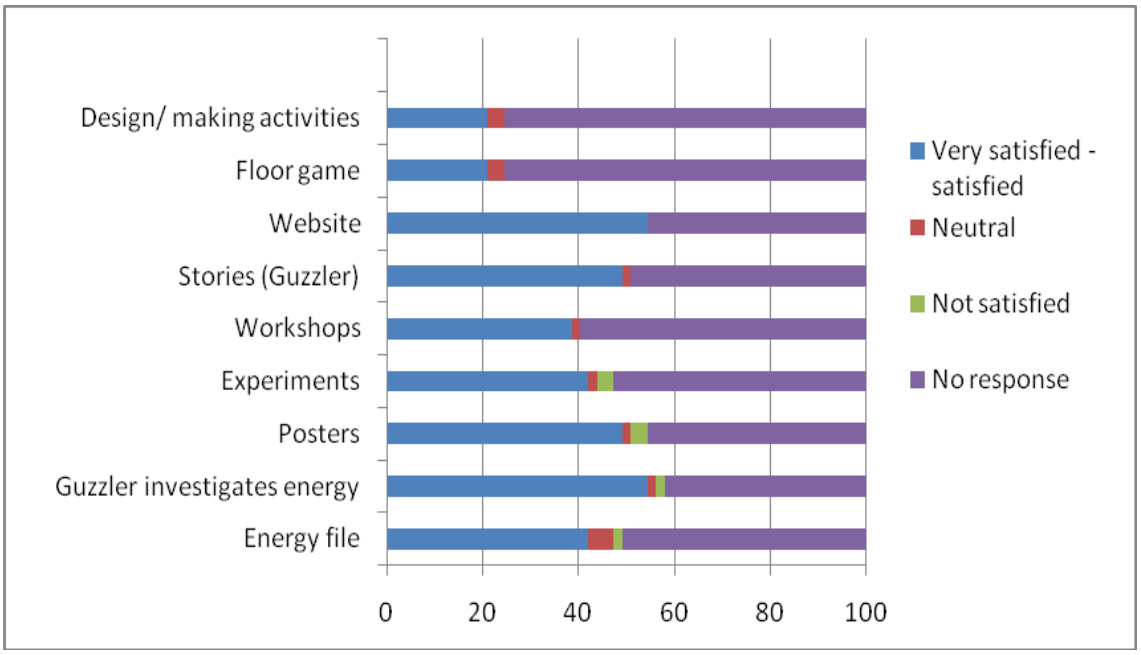
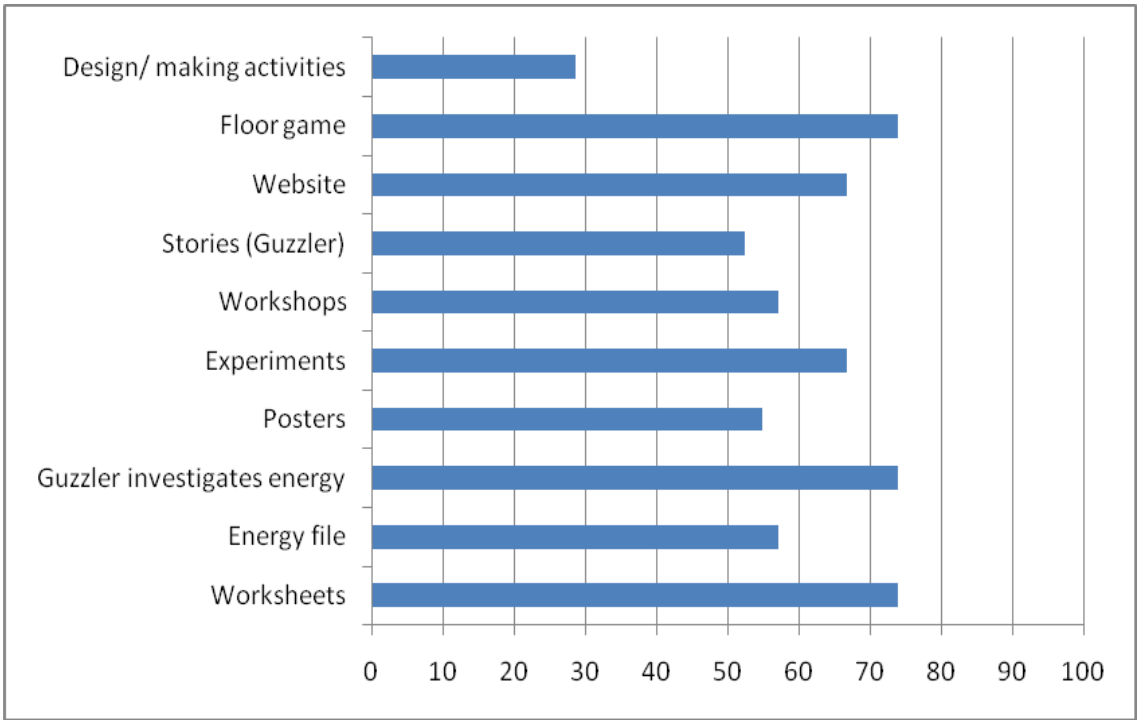


Fig 15b: Satisfaction with resources (as % of total respondents indicating use of SEAI resources - 42)



Finally respondents were asked if they felt that SEAI resources had an impact on pupils knowledge, awareness and behaviour. As the following figures indicate, teachers were favourable towards the impact SEAI energy education has on young people.

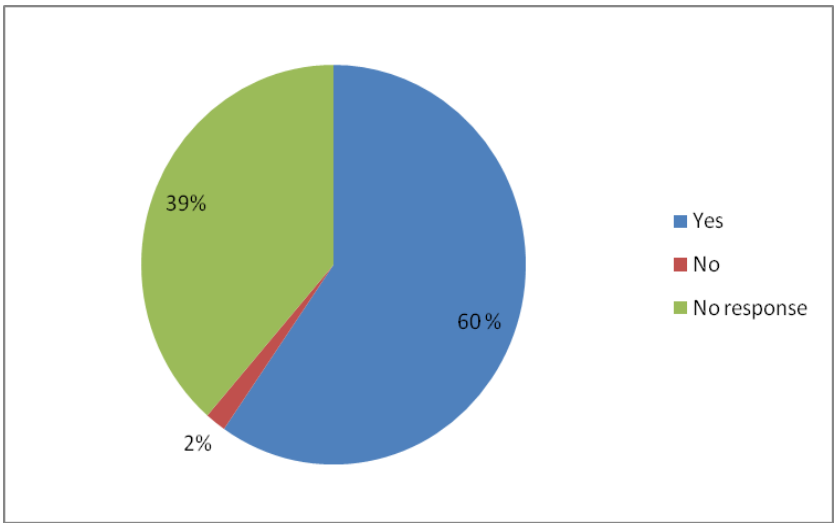
Some clearer analysis of these graphs can be provided through comparison with SEAI workshop feedback forms between 2007 – 2009 which are provided to teachers' post-SEAI workshop. The feedback forms pose a series of quantitative questions based on a Linkert scale which assess teachers' perceptions of the quality of facilitators, the age appropriateness of materials and workshop presentation, the overall benefit of the workshop to the students learning. In response to all quantitative questions over 90% of teachers responded positively or very positively, with additional qualitative comments indicating that the experiments, energy game and Guzzler book were very appropriate to the different age groups, and very enjoyable for the pupils involved.

Perhaps of greater note, are the additional qualitative responses within which teachers were asked to note advances in learning made by their classes over the course of the SEAI workshop. A content analysis of these responses reveals four key themes which were frequently mentioned by teachers.

Post – workshop, teachers most frequently mentioned energy science, or more specifically, the First Law of Thermodynamics as new learning introduced to their classes. Within this theme teachers described this law as "energy cannot be created or destroyed, but changed" or indicated that the workshop taught students that "there are different kinds of energy" or described the concepts being taught e.g. "that the (stored energy) potential energy of a ball can be changed into sound, vibration and heat energy". Teachers also indicated that the manner in which these concepts are taught through demonstration was also very important, for example, through the 'ball game'[5] and 'balloon race'[6] demonstrations. 60% of respondents to the questionnaire felt that SEAI materials increased pupils knowledge of science.

[5] htttp://www.seai.ie/Schools/Primary_Schools/Activities/Experiments/Sporting_collisions.pdf

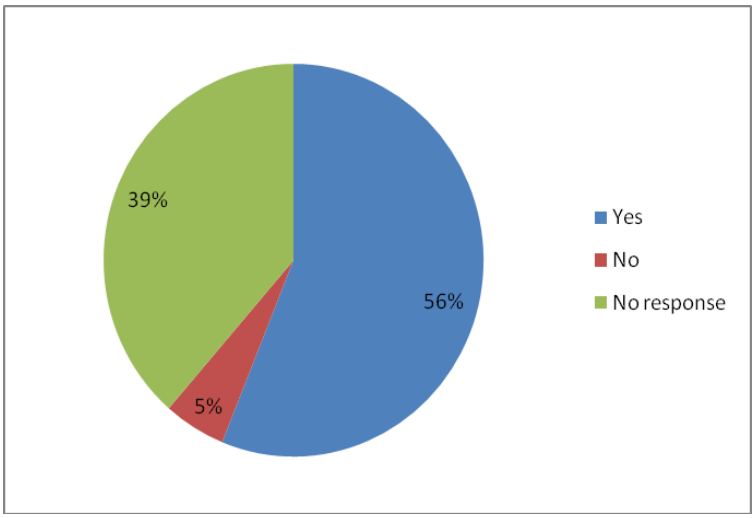
Fig 17: Knowledge of energy science



Teachers also mentioned learning related to fossil fuels/non-renewable energy and renewable energy, as key learning outcomes for their pupils from the workshops. These two themes were generally discussed in tandem, with the sources of both non-renewable and renewable energy particularly drawing attention. These terms were generally isolated or not considered in light of the learning process. Climate change and the origins and consequences of green house gas production were also generally mentioned together as key learning outcomes, with some teachers suggesting that the workshops were "very clear on climate change and the underlying reasons [for it]" or indicated on the feedback forms as "facts about climate change and global warming".

[6] http://www.seai.ie/Schools/Primary_Schools/Activities/Experiments/Rocket_balloon_race.pdf

Fig 16: Knowledge of climate change

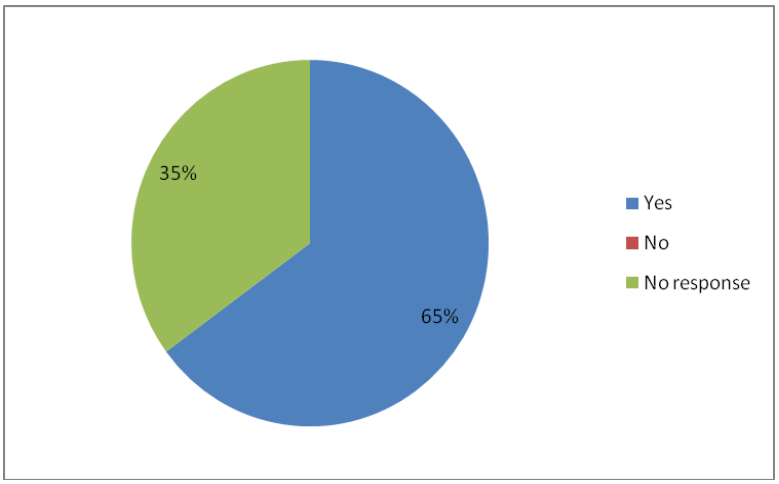


Lastly, teachers mentioned energy saving information and actions alongside energy efficiency actions and suggestions as important learning from the workshops. For example, teachers suggested these concepts in the following manner: “different ways to save energy and alternatives such as energy saving light bulbs” or “created new energy saving ideas” or “potential ways at home they can save energy”.

A smaller number of individuals highlighted how the workshops engaged pupils in the concepts of electricity production (through the Lemon Battery)[7], forces and Newtons Law and the physical properties of gases. , However, from the feedback form comments it is clear that a number of misconceptions have arisen in the minds of a small number of teachers, particularly around the details and purpose of some of the SEAI workshop demonstrations. 10 teachers indicated on their feedback forms that they thought learning Newtons Law related to “changing energy, different types of energy” or that pupils had learnt “about Newtons Theory on energy not being created or destroyed”. This indicates, as highlighted in the NCCA primary science review (2008), that teachers have difficulty with the ‘Forces and Materials’ strand of the curriculum.

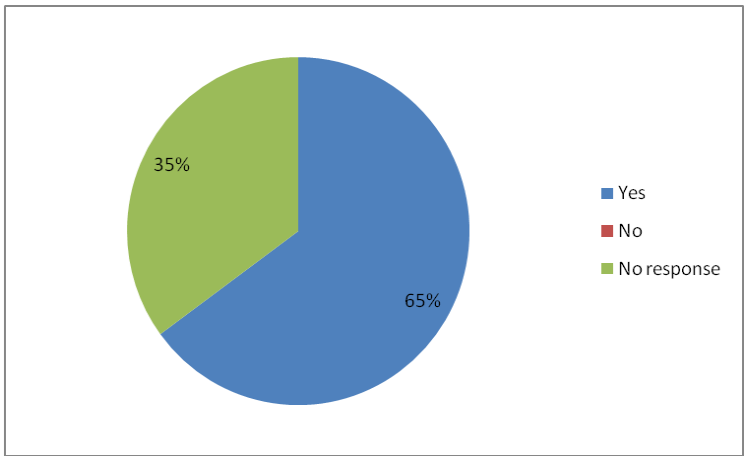
[7] http://www.seai.ie/Schools/Primary_Schools/Activities/Experiments/Lemon_battery.pdf

Fig 18: Awareness of energy saving



Figures 18 and 19 point to an increased awareness of and improved behaviour towards energy saving as a result of SEAI energy education. As the literature review points out, there are many reasons for pro-environmental behaviour, and teasing out the many causes are notoriously difficult. Given this, teachers are very positive with regard to the impact SEAI education resources can have on children with regard to energy saving behaviour, as the following quotes illustrate:

Fig 19: Energy saving behaviour



"As a result of SEAI [resources] I think the overall awareness of climate change and the need conserve energy has been raised, particularly with the Green schools committee. They've become motivated to check lights, taps etc. It almost became a crime to spend too long washing your hands."

"Younger classes refer to energy guzzlers following the SEAI workshop. It retained knowledge better than if it had just been presented in a class. It's about positive reinforcement for the energy saving school programme and ethos, resulting in better follow through. Often they report energy saving behaviour to the Green Schools co-ordinator and remind teachers to turn off appliances, turn off lights and put the stopper in the sink when washing. "

It should be noted, that in both extracts above, SEAI workshops and their impact were positioned within the Green Schools programme, which integrates the once-off workshops into an on-going and whole school programme.

4.3 Primary Summary and Conclusions

The results of the primary level evaluation present a number of important themes which will be addressed and developed in the recommendations:

- The research indicates that teachers are interested and well motivated towards teaching energy education, with motivations derived from personal interest, and need to pass information on energy issues to their classes
- While all participants viewed SEAI materials positively, teachers appear to view the resources, and workshops in particular, as very beneficial in motivating students, introducing an 'external voice' to the school environment. Teachers viewed the one-off instances of workshops as positive, but would like more interaction with SEAI.
- Interviewees singled out for comment the experience of SEAI and competence of education resources in the area of physical sciences. It was also suggested that these resources could be better utilised within the school environment through whole school approaches, IBSE and via cross-curricular integration (e.g. literacy and numeracy).
- Findings from the evaluation are in line with international research which suggests that teachers have little confidence in teaching science and in this instance, energy science. However, teachers viewed very positively the knowledge gained by their class in relation to science concepts through SEAI workshops (e.g. explaining the 1st law of thermodynamics, the physical properties of gases and electricity).

- Responses from teachers via questionnaire and focus group indicate the absence of cross curricular thinking and utilisation of SEAI resources. Also teachers were unclear how to use different resources in an integrated fashion (e.g. Guzzler big book, Story of energy, energy experiments, with lesson plans or SEAI website information). This runs parallel to the NCCA primary review findings which highlights that teachers are having difficulty in working across curricular areas contributing to teaching load and time difficulties. Teachers see energy education primarily in terms of science and geography, and may need assistance in moving beyond these subjects to see how energy education resources can be used in literacy, numeracy and wider curricular contexts.
- Teaching context questions illustrate that energy education fits into a range of teaching contexts, while research suggests that whole school action orientated education which links the school the wider community teaches energy education from a broader perspective. This research suggests that there are ample opportunities in existence for SEAI to further integration of energy education from a whole school perspective, but also, make and substantiate links between home and school.
- Given the above discussion, teacher education through CPD and initial teacher education is vital to increase confidence in science teaching and promote the resources of SEAI. However, teachers do not appear to currently access CPD as a way of up-skilling around energy education. Further research may be required to pin-point the reason for this, as teachers also clearly indicated that they would like further education in energy education. This suggests that there may be a gap between information about SEAI teacher education and provision of CPD to interested teachers.

4.4 Post – primary Interviews

As with the analysis of primary strategic partners, over the course of the interview analysis a number of commonalities and differences arose with respect to interviewees' views through the process of constant comparison. It became clear that all interviewees were aware of SEAI, the work of the SEAI education section and the education material produced. However, interviewees diverged in two ways. First, on the basis of their relationship with SEAI, and the level of interaction between the interviewee (or their organisation) and the SEAI education section. Second, interviewees differed according to their use and perceptions of SEAI resources. Each of these themes will now be discussed in turn.

Organisations and their interactions with SEAI

The relationship between SEAI and organisations involved in this research can be characterised around two themes, the first is programme/policy development and the second is through resources and funding. Within the first theme interviewees discuss their relationship with SEAI through their personal involvement in developing SEAI materials or programmes, such as One Good Idea. They also discuss their relationship in terms of potential for policy/curriculum development work in the future. Within the second theme of resources and funding, the first interviewees discuss their relationship with SEAI in terms of funding, while the second group of interviewees relationship can be characterised as seeking resources and funding from SEAI.

Programme and policy development

Two individuals in the second level support service were interviewed who were specifically involved in developing materials with SEAI. Their primary role and responsibility within the SLSS is to assist schools and work with staff, school management, teachers, in terms of developing and supporting curriculum at second level. The two individuals have no specific remit in promoting energy education or the work of SEAI specifically. While both individuals suggested that their work did not directly engage with issues of energy conservation or efficiency, the

overall ethos of the CSPE and TY programme runs parallel with the work of the SEAI education section, particularly the One Good Idea Programme, as one interviewee suggests below:

"There's a lot of different strands associated with the TY programme, which appear in One Good Idea, but one of them would be the whole idea of getting students to be more responsible through new experiences. Looking at issues that are relevant to society today, the whole idea of climate change, global warming, is hugely relevant to them. Then there's the other spin off, it exposes the students to environmental issues/energy awareness/ scientific thinking and maybe career options or even inform students of what subjects to pick for their leaving cert. Because part of TY is help students make informed choices for the leaving cert. So, as a spin off of getting students involved it might have also helped them to decide to take a science subject for leaving cert".

Secondary to their responsibility with schools is the work that these individuals conduct with external agencies, such as SEAI, in terms of developing material that are suitable for use within TY and CSPE. In this regard both individuals had had prior experience of working with SEAI on the One Good Idea programme. As such, the two interviewees from the second level support service reported good working relationship between themselves and SEAI. This relationship was specifically in relation to the One Good Idea programme, which they were asked to comment on during its initial consultation phase. They also have on-going contact with SEAI through their role as judges of the One Good Idea competition entrants, a relationship they believed to be beneficial to them in terms of keeping them abreast of developments of the programme. As the following extract illustrates:

"I was involved at the early stages, when the idea was first tossed around I was asked what I thought of it. I was at a couple of meetings and then I was a judge for its conclusion."

Less frequently mentioned within interviews was the role of post-primary SEAI resources outside the TY and CSPE programmes. As the SEAI website shows, post-primary resources have been developed for a 7 additional curriculum areas such as Architectural Technology, Home Economics, Geography, Science and Physics. One interviewee from the NCCA has specific responsibility for review of the science curriculum at senior cycle level and co-ordination of on-

going consultation related to this. In the extract below the interviewee explains the shift in emphasis and gaps in the traditional ways of teaching science through information provision:

"Traditionally the science syllabus has been seen as a body of knowledge that we want children studying science to come out the other end knowing. Unfortunately what that has led to is that they know quite a lot of unrelated facts but what's missing, very much, is the context between their science and the application to real day life."

From this background, the science syllabus is moving away from information provision model, towards one which has at its core, the five key skills of the NCCA. As part of this, as the interviewee suggests below, personal responsibility related to energy, sustainability, citizenship, environmental awareness and care, is now seen as a core component of the new syllabus:

"We've been reviewing them [senior cycle curriculum] for 4 years. One of the main things in terms of the sciences, was to get them [the curricula] up to date. Firmly embedded in them are the key skills, but also an awareness of what is going on with the planet, an awareness of the whole energy question. So by studying physics, by studying chemistry, by studying biology students are looking at the science in a context that gives them a real understanding of what their role is as citizens, and what their role is in terms of sustainability".

The integration of lived experience, critical systems thinking, scientific literacy and personal responsibility into the science syllabus at senior cycle is a marked departure to previous science teaching at this level.

While the interaction between SEAI and different elements of NCCA could be currently characterised as ad-hoc and informal, as the following extract indicates, there is potential for SEAI engagement within the review of the senior cycle:

"I worked quite a bit with Aoife Cannon, when they were developing their resources [for junior certificate], we kept in quite close touch. I'm very keen on that sort of relationship and it would be brilliant to develop that sort of relationship in moving out with this [senior certificate science].

As the interviewee suggests above, there is room for greater engagement between SEAI and the NCCA in the context of senior cycle science in particular, given its increased focus on context, critical thinking, critical systems thinking, scientific literacy and personal responsibility. The following extract below illustrates this point further:

"Now, more than ever, we desperately need external agencies. Education is now a responsibility for all these external agencies, and we need to tap those resources. We want students to get their message, we want that connect. I would say it's vital. "

NCCA works with Discover Science and Engineering in a project which looks at inquiry based science. It will generate materials that will support the consultation for the senior cycle science. As the interviewee above clearly indicates, there are important opportunities for SEAI to feed into the syllabus development at this point.

Resources and funding

One individual was interviewed from the Department of Environment, Heritage and Local Government (DEHLG) with responsibility for policy and environmental awareness. With regard to energy education, the Department has a keen interest in climate change, evidenced by the Change.ie awareness campaign, the production of recent climate change resource material for primary schools and promotion of a carbon calculator which is hosted through the Environmental Protection Agency (EPA) website. The interview from the DEHLG characterised the relationship between the awareness section of the department and SEAI also in terms of their involvement with the One Good Idea programme, suggesting that they provide financial resources for the programme. The level of finances to be provided for 2011 is currently under review due to budgetary constraints.

"We wouldn't really use [their] resources. We'd more be about disseminating resources. We work together with them [SEAI] on the One Good Idea campaign. They steer it and we support them, we provide funding and evaluate of some of the projects and things like that."

There is also on-going in formal contact between the DEHLG awareness section through the Green Communities initiative. These contacts, both formal and in-formal provide opportunities for on-going shared learning and collaboration between the agency and the DEHLG on matters of energy and climate change.

In terms of civil society and private sector education programmes, a number of individuals were interviewed who are involved in the administration of programmes such as the BT Young Scientist, the Eco-Unesco Young Environmentalist Awards (YEA) and Young Social Innovators (YSI). All seek greater engagement with SEAI, particular with respect to SEAI providing support or sponsorship for these awards or aspects of these programmes. However, the emphasis on energy within these programmes varies, as the interviewee below discusses in relation to YSI:

"We have a challenge in young social innovators to make the world greener, so under that we'd see, energy, environmental, sustainability, all sorts of different areas coming under it. The participation is probably our lowest participation, but I would like to see it increased".

The reasons for the low participation in YSI environmental themes could be due, in part, to competition between organisations for participants in the environmental area. As the interviewee from YSI suggests in the following extract:

"It could be because a number of things, because Eco-Unesco, Young Scientists, or other bodies doing projects with young people, but it's certainly one that I'd like to see increasing. The whole area of climate justice, I want to see that young people think about it and the justice issues around it".

While the ethos behind the YSI is justice and participation orientated, the ethos behind the BT Young Scientist is somewhat different:

"The Young Scientists is in its 47th year this year. So the focus has always been to engage students in science and technology; get them to love science. But it's all around that interaction and that social interaction as well, giving them confidence"

The number of energy related projects in the BT Young Scientist have increased in recent years, focusing primarily on technological innovation, but also science behind energy use and systems,

and energy saving. The key consideration for entry to the Young Scientist is the scientific approach used in the project. In this way, it shares a similar ethos to the DSEP at primary level.

ECO-Unesco also run a number of different energy related programmes for the 12 – 18 age group, including the Energy Watchers training programme and as part of the Young Environmentalist Awards. The overall ethos behind ECO-Unesco is the integration of environmental awareness and care with the lives of young people through a holistic and participatory, empowerment framework, as the following extract illustrates:

"We've always tried to take a holistic type of approach, linking up many different aspects of energy awareness, climate change, taking action, climate justice, the science side as well. We want to get to a place that people are actually reducing their energy consumption, where we're getting energy from, and looking at alternatives and clever design moving forward with technology."

As the extracts above reveal each organisation has a slightly different focus with regard to energy education. However, in common, they all support greater links and integration with the activities of SEAI.

Organisations' perceptions of SEAI resources

In the following section, interviewees discuss their perception of SEAI resources. It should be noted at this point, that interviewees were quite unfamiliar with SEAI resources beyond the One Good Idea Programme. Therefore, the emphasis in this section is on perceptions towards One Good Idea, the overall ethos of which is explained in the following extract by a consultant who was heavily involved in its inception:

"We wanted something that would be appealing across ability ranges and subject area. Because the Power of One brand was so strong we thought we could leverage a bit of support for the programme [OGI] through that. People could identify with it. The idea was that students in their own community, at the own level, that they could find out what people think about energy efficiency and climate change, and come up with their own way of making a change. The idea was that one person can make a

difference. We felt it lent itself well to CSPE and TY and they'd have a bit more flexibility in getting out of school and working in their local community."

The One Good Idea is viewed very positively by the SLSS as the following interviewee states:

"The One Good Idea Programme? Well I think it's fantastic. The students like getting involved in it. It's very important for students to be involved in an initiative like that. The emphasis on project work too is good. In a lot of cases they have to interview people, do their presentation, carry out research, so there's research skills, teamwork, communication and interpersonal skills. There's a lot to it. And then if they go further with it and present the project on the day, they have to do in front of adjudicators, so there's confidence building. And then there's the very obvious ones like meeting deadlines and time management. It ticks all the boxes."

Other interviewees were similarly positive about the OGI programme. However, while part of the OGI success is in its integration with TY and CSPE, there are two issues for the programme. First, according to Real Events, the programme exists with very tight branding and is not integrated with the rest of the SEAI post-primary material. This strategy has proved advantageous in some respects with high levels of participation in the programme (235 schools registered for 2011 programme), but also it limits the added value which could potentially arise from closer integration with other SEAI resources. The second issue was raised by all interviewees working at post-primary level, that of competition between organisations in getting participants into their programmes. The following two extracts from the SLSS and a private consultant are illustrative of the general feeling towards lack of co-ordination of programmes at post-primary level:

"You know, there's a lot of stuff out there. You've got Concern, Trocaire, YSI, EPA, Forfas, Discover Science... there's a lot of stuff happening in isolation. I've always said that I'd love to bring all the groups together to look at the issues we want to address with schools, to sit down and come up with a common policy on it, [develop] a more collaborative approach as opposed to being in competition with one another for getting into schools. I think it would be very useful now and again to bring all the groups together and ask how can we support schools in a more collaborative way? That's the one issue for me.

To me the bottom line is the students' overall development and we should all be working together for that."

"The thing would be to establish what's there, what's used and then build partnerships of people doing similar things to allow co-funding, rather than this thing of, lets all do a pack. I think, particularly with public agencies or others that want to get specific messages across, they need to display joined up thinking, get together, identify what's needed and develop it from there. There's just so much stuff out there."

Integration of programmes and resources, interviewees believe would assist in a more targeted approach in reaching teachers, with a more favourable outcome for students and the environment.

4.5. Results of questionnaires and focus groups: POST - PRIMARY

As outlined in the methods section, questionnaires were sent to 100 post-primary schools, selected from a stratified random sample. 35 post-primary school questionnaires were returned, in addition to 5 e-mails/phone calls from Colleges of Further Education that wished to contribute but did not feel the questionnaire reflected their educational interest. For the purposes of the questionnaire analysis these five schools were not included, but their contribution was considered as part of the qualitative analysis. The return rate for post-primary was therefore 35%. Of the 35 questionnaires returned, 12% of schools stated that they are members of the SEAI One Good Idea Programme. 60% of the returned questionnaires participate in the GSP. Recent statistics from An Taisce suggest that 86% of post-primary schools are now registered for the GSP. Return rates for this evaluation are therefore slightly less than this. Statistics in the following sections are percentages based on the overall return rate of (35), unless otherwise indicated.

Energy saving behaviours and motivations

Respondents were asked to indicate energy saving behaviours which they regularly engage in throughout the school and/or encourage pupils to carry out. It should be noted, that these

results do not constitute actual behaviours, but instead represent reported behaviour, or an intention to act in a particular manner. The findings to this question are presented in Figure 20 below, and correspond well to the reported behaviour suggested in focus groups conducted with both primary teachers and principals and post-primary interviews. Figure 20 indicates that schools prioritise the following energy saving activities, such as, turning off taps (100%), turning off lights (100%) and recycling waste (92%) The least practiced are reported behaviours encouraging alternative transport (32%) and purchasing CFL light bulbs (60%). However, post-primary schools reported that they not only examine energy labels (92%) but also purchase energy efficient appliances (80%). This represents a notable increase in purchasing when compared to primary schools (42%). The results of focus groups follow in a similar vein to that found at primary schools, with participants suggesting that leadership within the school by an interested teacher is important to the success of energy saving behaviours in school. As one of the teachers intervieweed states:

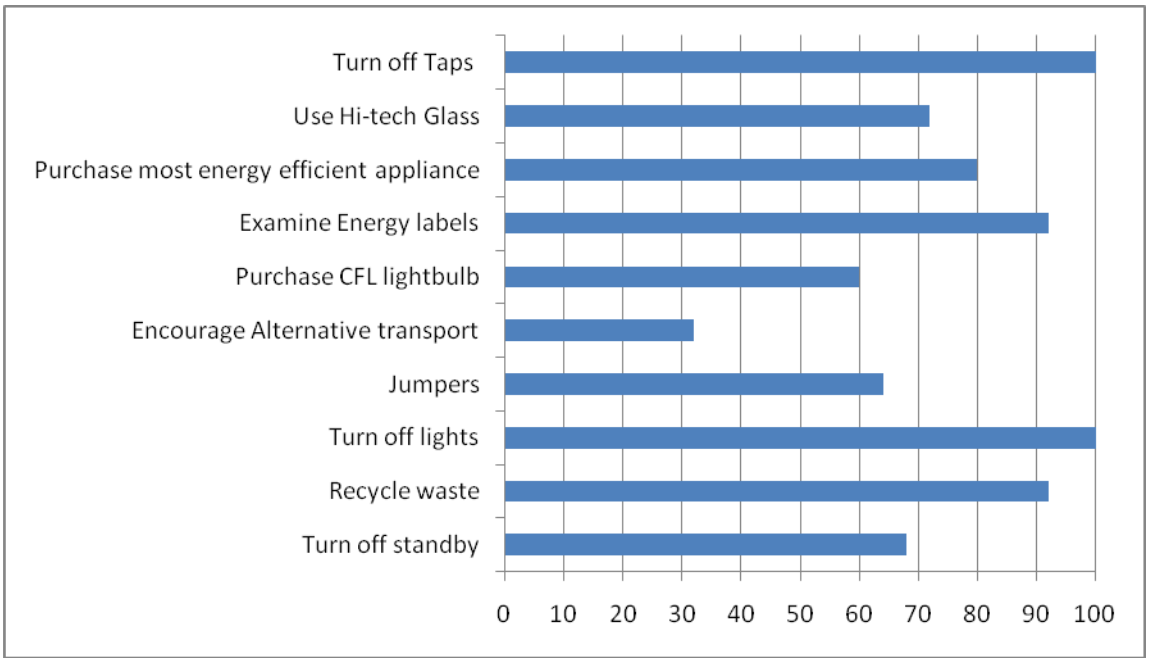
"I've seen students turning off lights, automatically, as class leaves the room. We've got new insulation and new windows, so the students are asking to turn off heat and they were involved in deciding the introduction of new hand dryers with no heat element"

Another teacher suggested that while willing to help in energy saving activity, students do also need to be regularly prompted:

"I guess they're more willing to switch off lights and close doors or windows to prevent heat loss. But they still require reminders and regular follow ups... but at the same time, I've seen them remind teachers to turn things off in the labs"

Figure 21 (overleaf) depicts the motivations teachers have to teach energy in the classroom. Teachers were asked to respond to 14 statements on a five point scale from strongly agree to strongly disagree. For clarity this has amalgamated into strongly agree and agree, neutral, disagree and strongly disagree and no response.

Fig 20: Reported energy behaviours (as % of total respondents 35)



All respondents indicated that it is important to bring environmental issues into the classroom, with the same number suggesting strongly that engaging pupils early is a way to halt future climate change. Similarly, no respondents responded positively to the statement 'I don't think it is important to teach energy and climate change in school'. 92% of post-primary teachers report that energy education is something they are personally interested in, with the same number linking energy education to respect and values for the school. 96% suggest that teaching energy education in school develops students' interests in environmental issues, with 88% of respondents suggesting that students enjoy this work.

Despite their interest, 40% of teachers said that they have to teach energy education because it is part of the curriculum, 52% because it is school policy and 32% because the principal wants to incorporate energy education in the school. 56% stated that receiving external support makes energy education easier to teach.

These findings would suggest that teachers' primary motivation to teach these subjects stems from interest. The results from interviews would broadly support these findings. Results from an interview with a post-primary teacher indicated her wish to involve students in energy

saving measures, the Green Schools programme and Gaisce awards in Transition year as a way to enhance the personal development of the students. As she suggests, “they have never been involved in anything like this before, it’s good for them to see what’s out there”. Taken in this way SEAI projects, and programmes, within the broader context of the GSP, are thought of as broadening the learning experience of students, and enhancing their personal development. Literature outlined in Chapter 2 also suggests that these wider social values are a very real form of learning in environmental education.

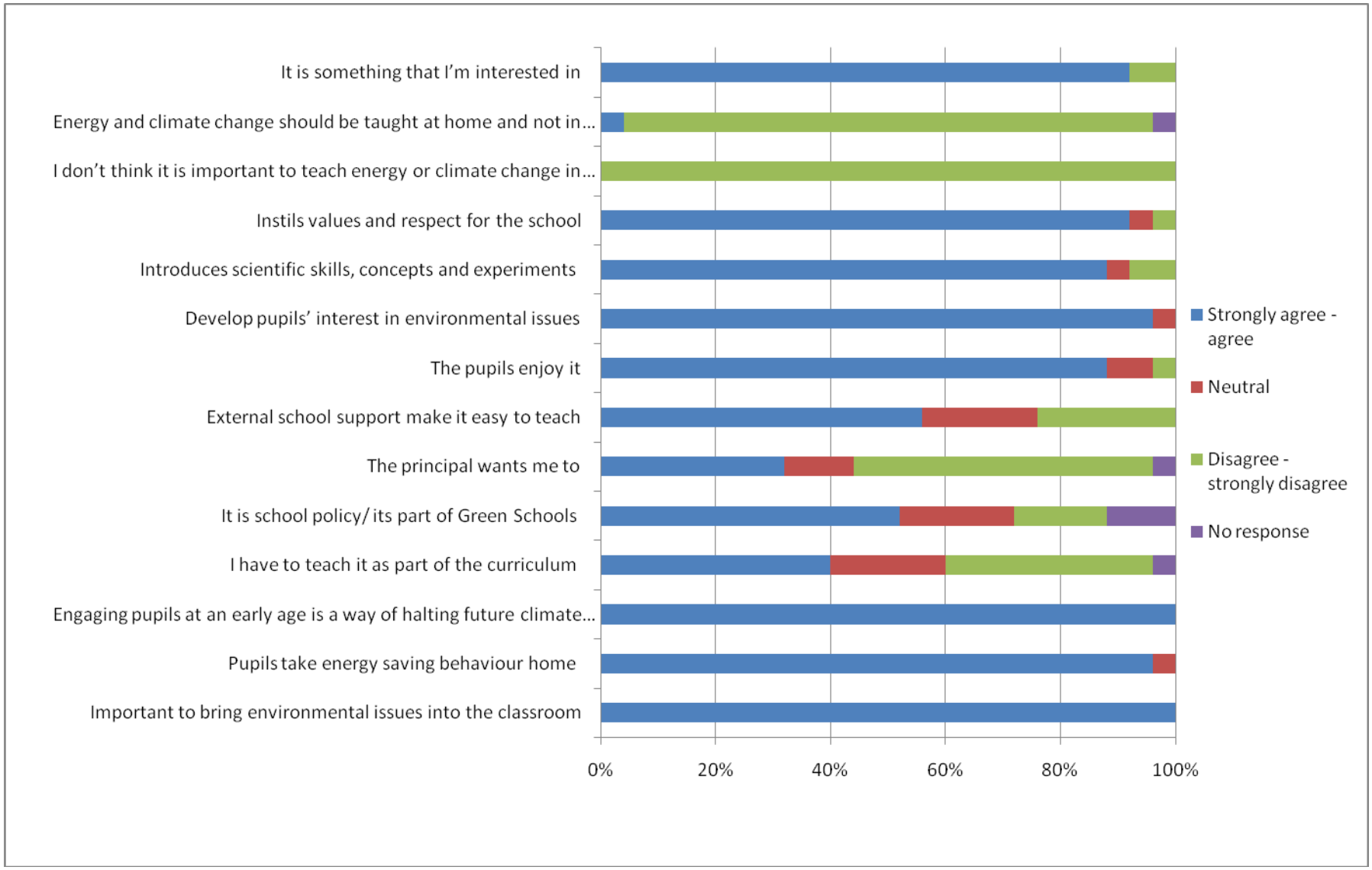
However, as with primary schools, leadership from the principal is an important factor in galvanising all staff around energy saving behaviours, and providing the teaching priorities or ethos which underpin the school learning environment. Similarly having a school policy, being a member of GSP or having a school energy plan in place would support greater integration of energy education within the school ethos.

Questionnaires and teacher interviewees strongly stated that integration of energy education with the post-primary curriculum is essential given tight timetables, and the continuing focus on exams and assessment, as the following extract highlights:

“In modern education with the pressure of exams it is very difficult to fit anything that is not on the curriculum into the school timetable. Time is a major, major issue. It’s next to impossible to cover the syllabus in the time given, so any resource material would need to cover the syllabus material and remain within its confines”

They went on to suggest that with moves toward a more action and project oriented curricula (e.g. TY and CSPE) energy education is increasingly important in second level education as a way of developing pupils interest in environmental issues and introducing them to issues of responsibility, citizenship, justice and scientific skills, as has previously been highlighted by interviewees in the previous section.

Fig 21: Reported motivation for teaching energy education (as % of total respondents 35)



A greater percentage of post-primary respondents than primary reported that pupils take energy education home, at 90% and 60% respectively. Motivation to teach energy education in order to instil values and respect for the school also scored quite highly with post-primary teachers, at 94%. Only 4% of respondents answered positively to statement that energy and climate change should be taught at home and not in school. Overall these results are relatively similar to those of primary school teachers.

Teaching practice and energy education in post-primary schools

In this section a number of factors pertinent to energy education are addressed; this includes the current practice of energy education in schools, perceptions of curriculum integration, teaching context, current sources of energy education material and requirements for additional resources, and lastly, teachers' confidence levels in teaching energy education.

Energy education teaching in schools

Respondents were asked to report on the type of energy education the school undertakes. For the purposes of the evaluation energy education was divided into three subjects, climate change, energy science and energy saving. Table 4.7 presents the results to this question.

Table 4. 7: Schools undertaking energy education (as % of total respondents 35)

Climate change	**52%**
Energy science	**32%**
Energy saving	**44%**

Table 4.7 (above) indicates that schools most frequently teach climate change (52%), followed by energy saving (44%) and lastly energy science (32%). There are a number of possible explanations for this result. First, post-primary educators tend to be subject specific, with the questionnaire being completed by geography, science, CSPE, modern

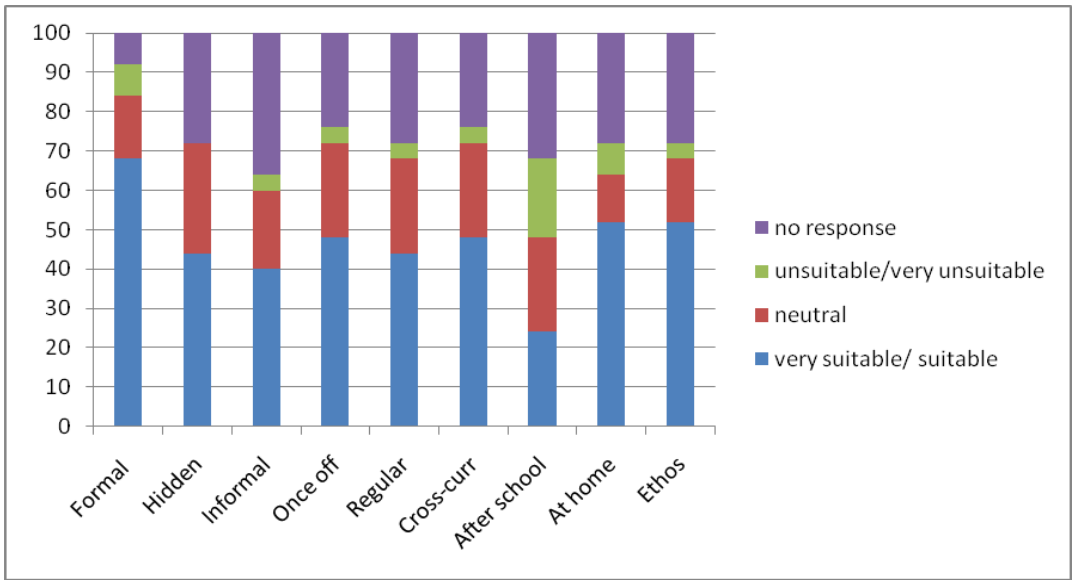
language and TY coordinators. The high number of respondents teaching TY and geography may help to explain the relatively higher proportion within the climate change category. The low response for energy science may reflect the relatively lower number of science teacher respondents, or suggest that this facet of energy education does not feature strongly within the science curriculum at post-primary level. However, cursory analysis of SEAI post-primary workshop evaluation with junior cycle science students indicates that such learning is highly valued by science teachers. There is potential for increased energy education in science teaching in the future.

These findings starkly contrast with those of primary school, with respondents at the primary level appearing to engage far more readily with energy education (91% , 82%, 95% respectively). This finding is interesting as there is ample scope for energy education in the post-primary curriculum, as SEAI highlight through the provision of resource material across 7 post-primary subjects.

Teaching context

Questions concerning teaching context were devised to investigate how teachers perceive the teaching of energy education, for example, if it should be conducted on an ongoing or one off basis. The results across the three energy education areas were remarkably similar.

Fig 26: Teaching context climate change (as % of total respondents 35)



A number of points can be made from the analysis of teaching context. First are the positive responses to integration of climate change and energy science with the formal curriculum. This would also suggest that these topics are viewed as exam orientated, particularly when compared with the statistics for energy saving. A second key trend in this data is the relatively high proportion of teachers who feel that energy education should be supported in the home environment, particularly for energy saving. This may suggest that teachers believe that energy saving behaviour taught in the school needs on- going commitment and reinforcement in the home environment. As literature and examples of good practice (e.g. Energy matters UK) illustrate, linking schools with community and the home environment can support on-going environmental actions. Additionally it can help broaden the education context through recognition and examination of social, political, economic and cultural contexts (Uzzell, 1999; 2000).

Third, teachers' perceptions to once off, regular and cross-curricular possibilities for energy education are relatively uniform across the three areas. This may indicate that teachers feel energy education is suitable for integration with different teaching contexts, with each providing a different purpose or type of delivery to students; for example workshop are useful in motivating and engaging students, whereas regular

cross-cross curricular activities embed and provide a context for these once-off engagements.

Lastly, when compared to the results of primary school respondents there is very little difference in the overall trends in the data. Primary teachers also consider curriculum integration as key, and follow similar patterns in teaching contexts thereafter.

Fig 27: Teaching context energy science (as % of total respondents 35)

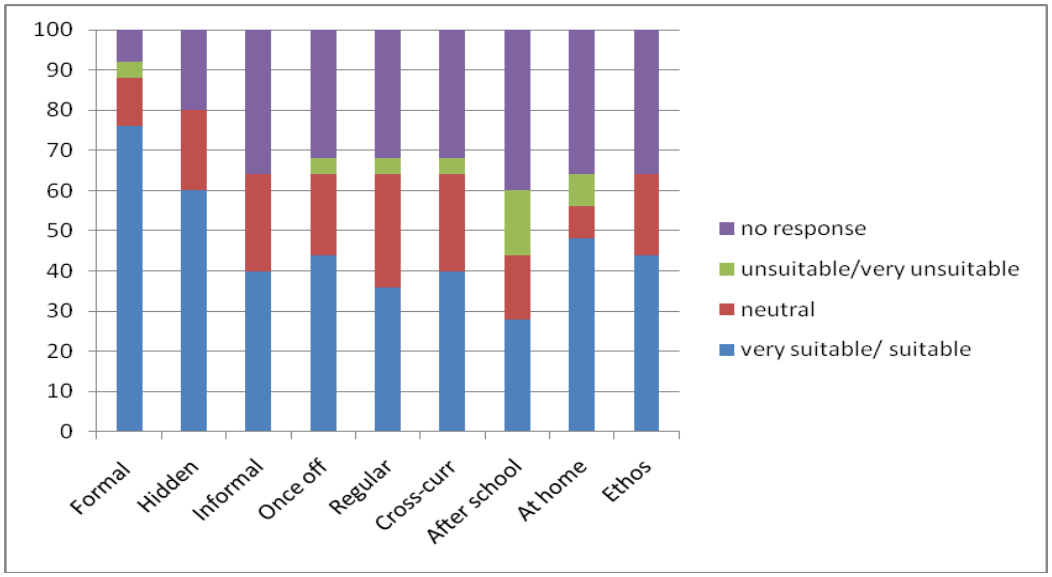
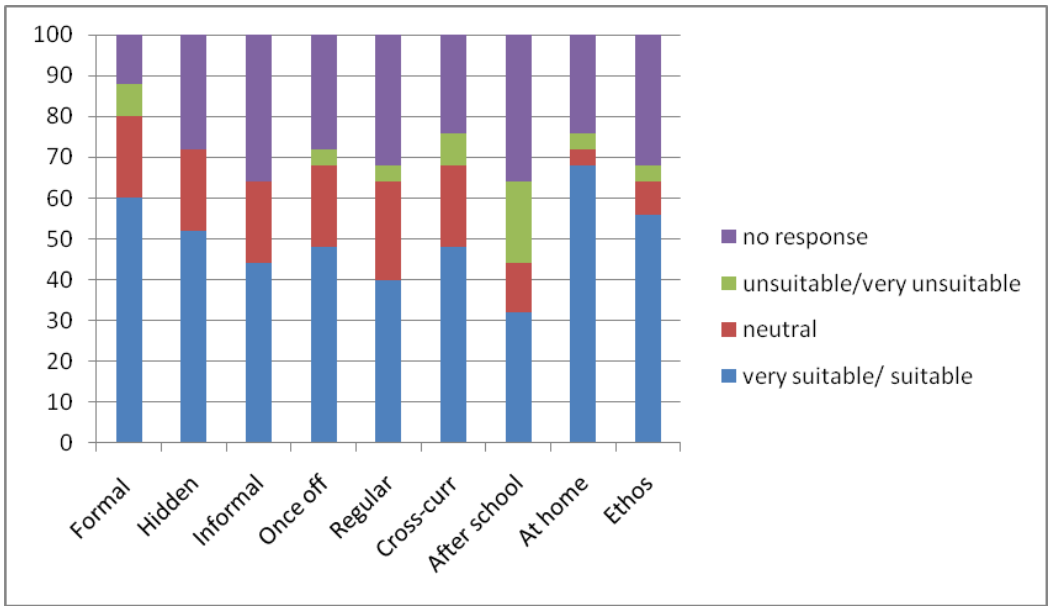


Fig 28: Teaching context energy saving (as % of total respondents 35)



Current sources of energy education teaching material

Respondents were asked about current sources of teaching material for energy education, including written resources, external speakers to schools and programmes that they engage in. Teachers were asked to identify resources used under each category. Teachers had the opportunity to indicate more than one resource under each category.

Table 4.8: Sources of written material (as % of total respondents 35)

Sources of written resources	Climate change	Energy science	Energy saving
Curriculum exemplars	44	32	36
Internet	**88**	40	**68**
NGO _ Dev	40	12	12
NGO_Env	36	24	20
Green schools	44	16	36
SEAI	**44**	**40**	**40**
Discover Science	20	20	12

Table 4.8 indicates that the most popular source of written material for teachers is from the internet, particularly in the case of climate change and energy saving. These results mirror the findings as primary level. Curriculum exemplars however, are less utilised by post-primary teachers, when compared with primary. Conversely, NGO_ENV and SEAI appear to occupy a greater share in written resource material provision with post-primary teachers, particularly in terms of climate change and energy science. On the basis of these findings it would appear that Green Schools has less of a role in terms of written resource provision at post-primary level. However, this findings must also be positioned in terms of teachers interviews, which suggest that post-primary teachers are highly reliant on text books.

Table 4.9: Sources of external speakers (as % of total respondents 35)

Sources of external speakers	Climate change	Energy science	Energy saving
County Council	**32**	12	24
Science Bus	8	0	0
SEAI	**24**	**12**	**20**
Green Schools	24	8	20
NGO _ Dev	24	8	8
NGO_Env	16	8	12

With regard to external speakers visiting schools, at primary level Green Schools was clearly a forerunner in this regard. However, the landscape changes substantially at post-primary level where both SEAI and the County Council are the most consistent sources of external speakers, particularly with respect to energy science.

Table 4.10: Sources of programmes (as % of total respondents 35)

Sources of programmes	Climate change	Energy science	Energy saving
Teacher Education CPD	12	12	4
Green Schools	24	12	16
Discover science	8	12	8
Science Week	**40**	**40**	**32**
Young Scientist	24	20	16
Change.ie	4	4	8

In terms of the programmes teachers access in order to teach energy education Science Week is a clearly most popular at post-primary level, with GSP being most popular or well known at primary respondents. Significantly, the percentages for CPD at both primary and post-primary are remarkably similar. In addition to the responses outlined in the table above 12 % of schools also suggested the SEAI One Good Idea programme. In terms of the programmes teachers access in order to teach energy education the science week, the GSP and BT Young Scientists proves most popular across climate change, energy science and energy saving. In contrast teacher education CPD

programmes have proved less influential in terms of providing support to teachers, particularly in energy saving.

Additional teaching resources

Respondents were asked to indicate additional resources and supports required to enable them better teach, or begin to teach energy education. The results of this question follow in a similar vein to results discussed thus far in this section, with common patterns emerging across climate change, energy science and energy saving. Figures 29, 30 and 31 indicate that the support of other teachers and the principal are important. Significantly, given the relatively low uptake of CPD revealed in the previous question, respondents strongly or very strongly agreed (80% - 83%) that additional professional development for teachers is required to assist them in teaching energy education. A comparison with primary respondents is also noteworthy with respect to text books; they occupy a much higher proportion of positive responses at post-primary level. This finding is not unexpected given recent reviews of Junior Cycle curriculum for example, which suggests that despite efforts, inquiry lead learning has been difficult to implement at post primary level. Over 70% of respondents suggest that school books are required for climate change and energy saving teaching. This drops to 58% in the case of energy science. Interviews conducted as part of this evaluation, and the results of interviews with post-primary teachers indicate that teachers remain heavily reliant on text books to teach the post-primary curriculum.

Fig 29: Additional teaching resources required climate change (as % of total respondents 35)

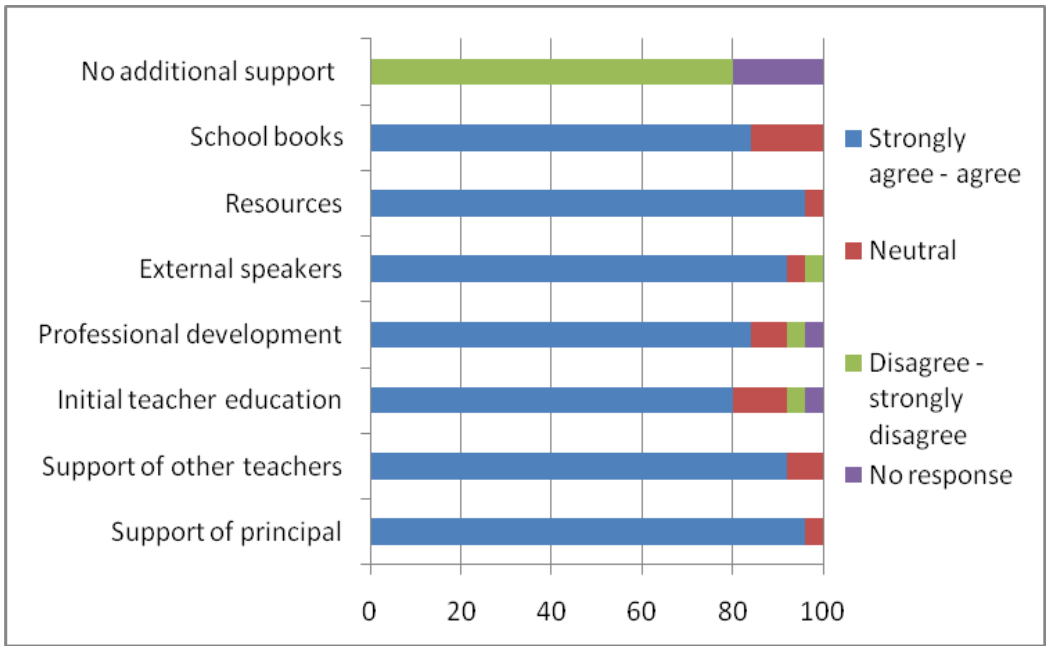


Fig 30: Additional teaching resources required energy science (as % of total respondents 35)

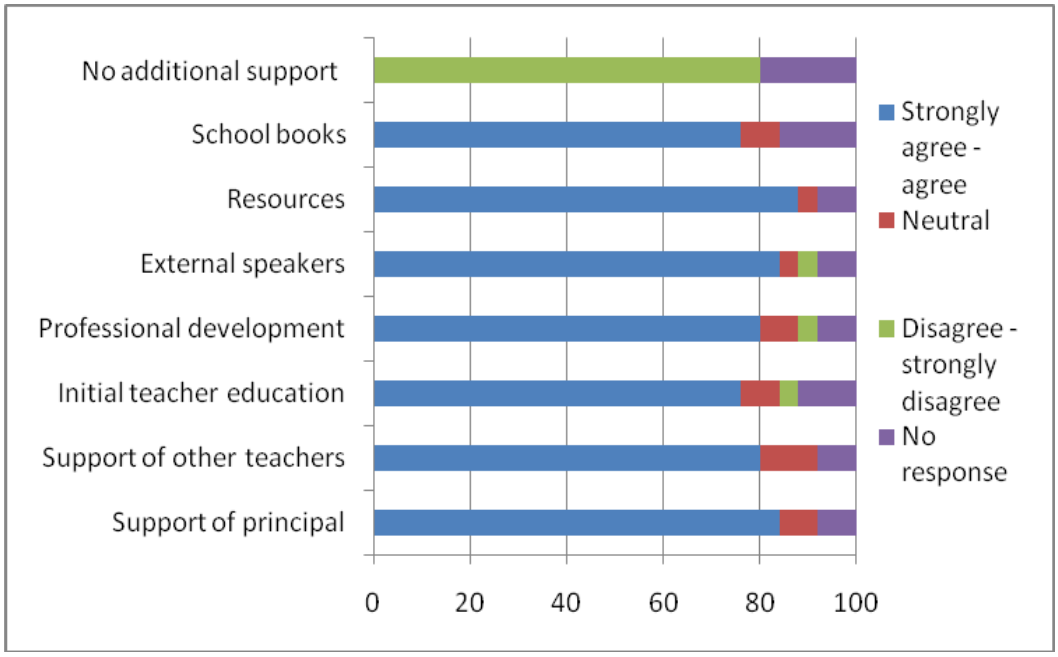
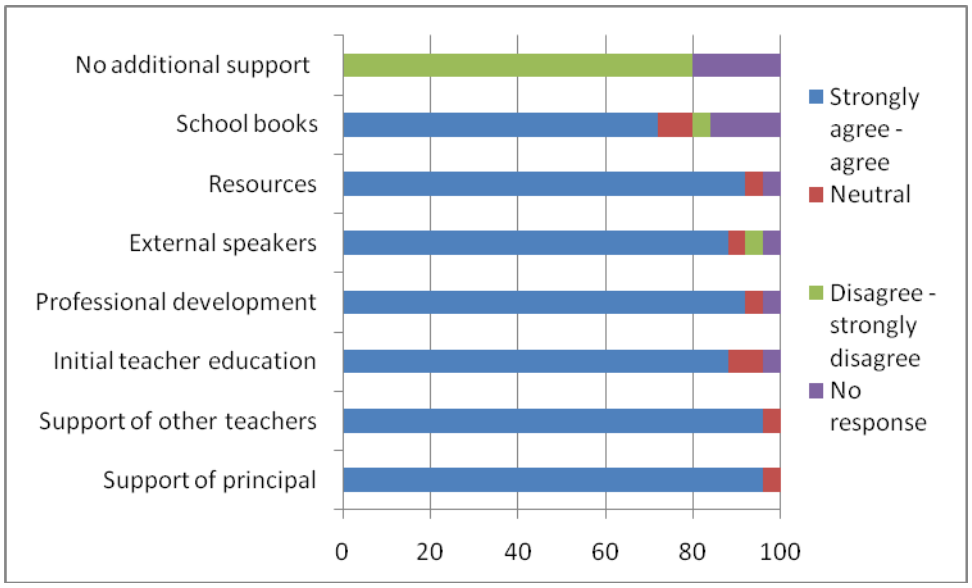


Fig 31: Additional teaching resources required energy saving (as % of total respondents 35)



Ranking highly across the three elements of energy education are the external supports to teachers, such as written resources and external speakers. Teacher requirements for professional development and teacher education were slightly increased in energy science when compared with climate change and energy saving.

Teacher confidence in energy education

As the following graphs indicate, teachers' levels of confidence are generally high with respect to energy education, and follow a similar pattern to primary respondents. As with teachers at primary level, post-primary respondents appear to be least confident about teaching energy science (20%), when compared with climate change (0%) and energy saving (4%).

Fig 32: Level of Confidence – Climate change (as % of total respondents 35)

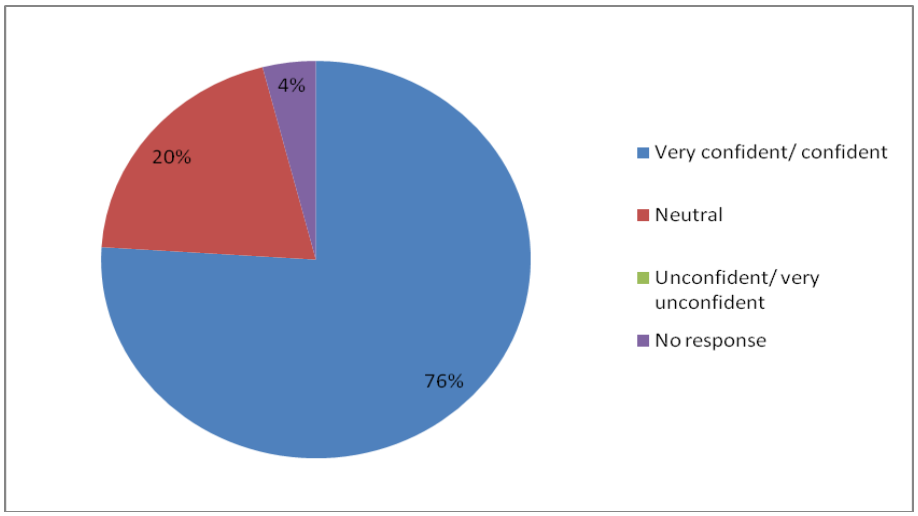


Fig 33: Level of Confidence – Energy saving (as % of total respondents 35)

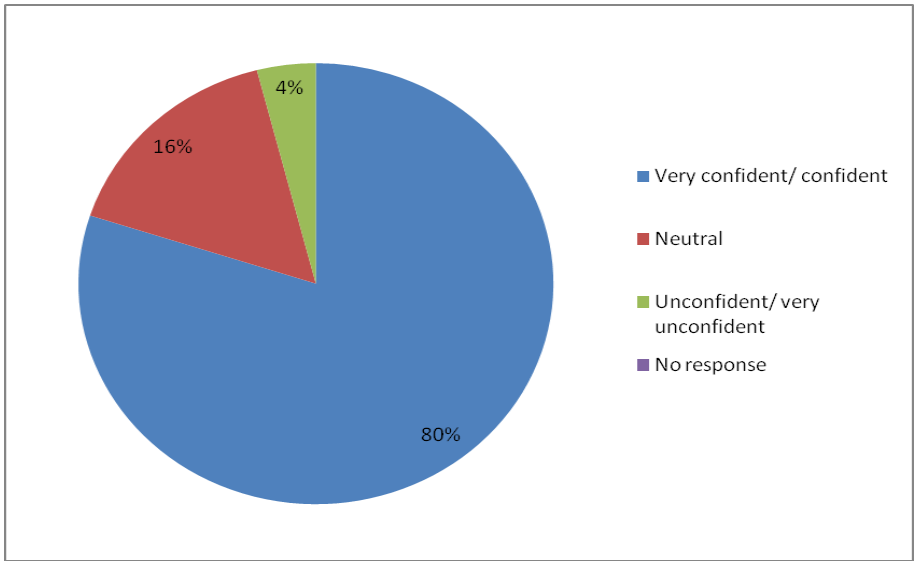
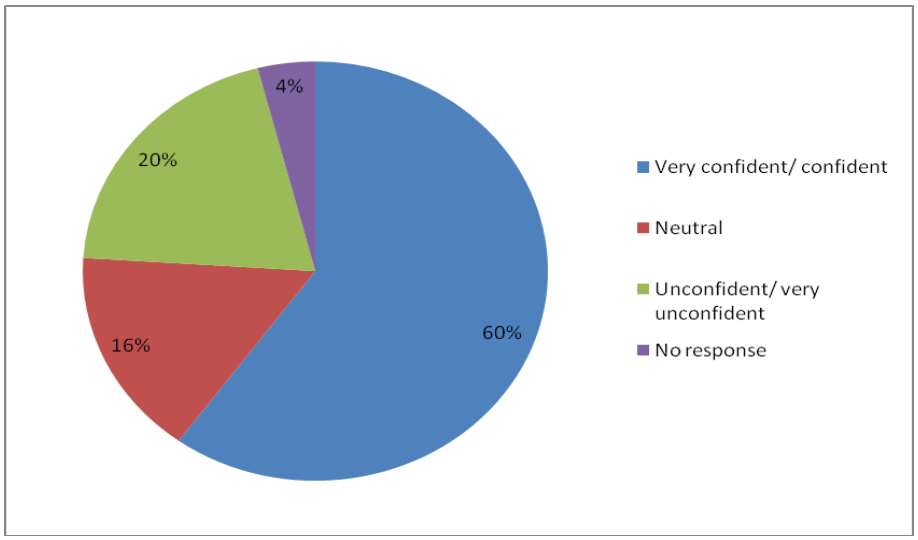


Fig 34: Level of Confidence – Energy science (as % of total respondents 35)



This finding reiterates the literature discussed in Chapter 2 pertaining to confidence in science teaching internationally and the requirements for ongoing and increased support for science teaching at both primary, and evidently, post-primary level. This situation is particularly acute in the light of new endeavours regarding the integration of IBSE at post-primary level. It also raises issues of SEAI engagement with teacher education both through CPD and initial teacher education.

Perceptions of curriculum integration

With regard to the integration of energy education into the curriculum, teacher's perceptions at post-primary followed a similar pattern to primary analysis with a strong leaning towards science and geography curricula. Additionally, responses across the three subject areas, climate change, energy science and energy saving behaviour are quite similar, as figures 23, 24 and 25 indicate. Some differences do arise however, with a small percentage of post-primary respondents suggesting energy education links with 'other' curriculum areas – these included religion, technology, home economics and modern languages.

Fig 23: Curriculum integration with energy science (as % of total respondents 35)

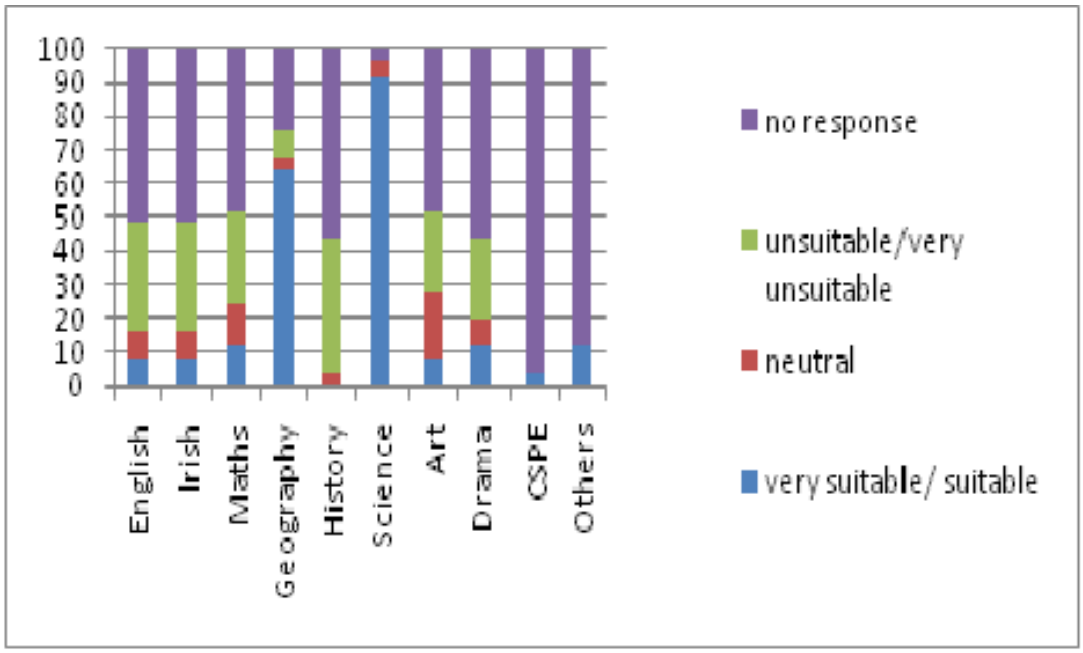


Fig 24: Curriculum integration with climate change (as % of total respondents 35)

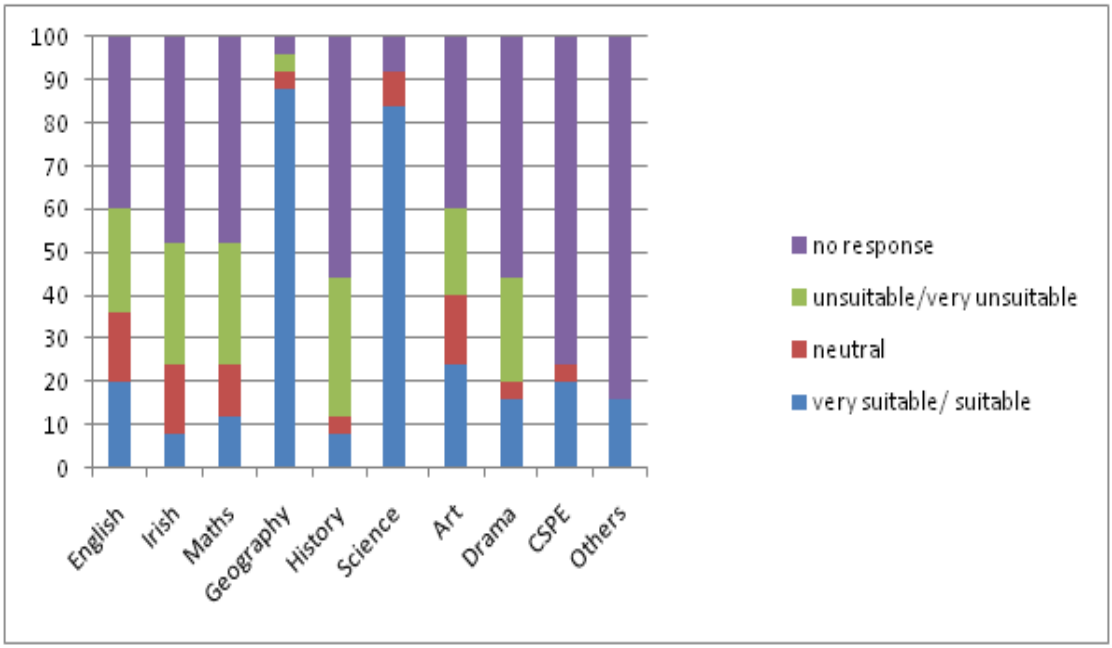
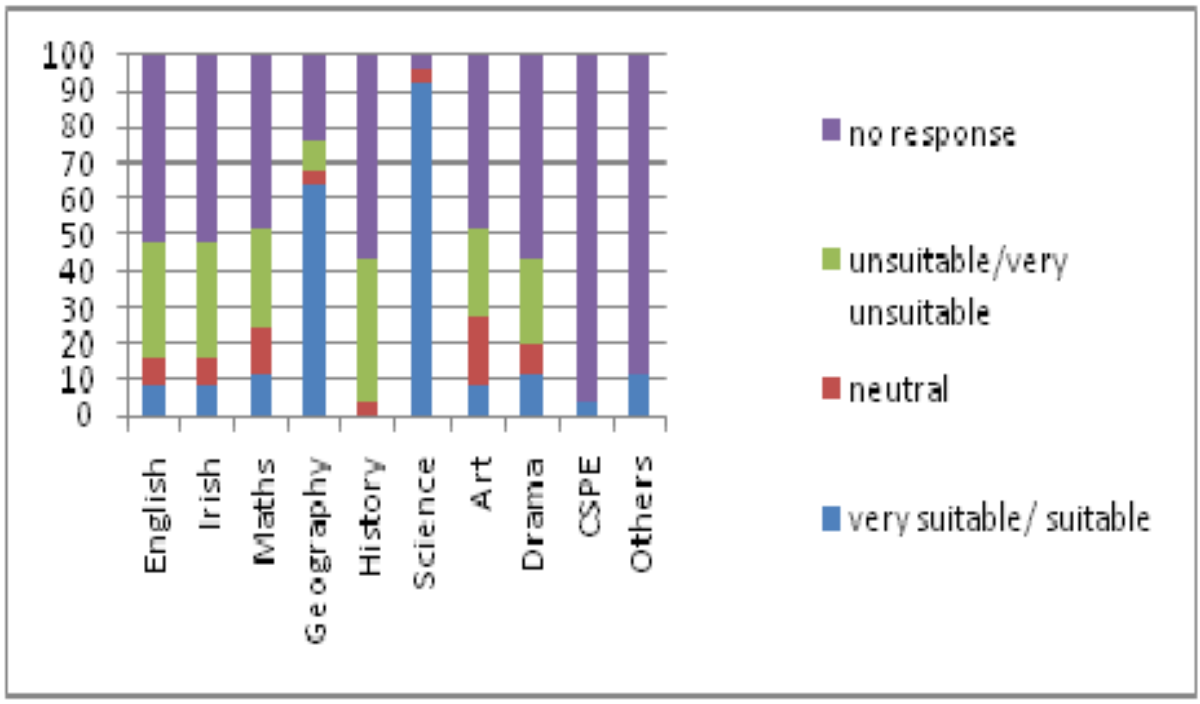


Fig 25: Curriculum integration with energy saving (as % of total respondents 35)



Figures 23, 24 & 25 indicate that teachers see energy education most closely aligned with science and geography curricula. Somewhat surprising are the low numbers of CSPE, particularly with regard to energy saving (19%). The results also indicate that that history, Irish, English and Maths were perceived as the most unsuitable subjects for teaching energy education. Both teacher interviews and qualitative comments in questionnaires highlighted the importance of TY as a mechanism for project work around climate change and energy saving in particular, with the interviewees mentioned energy science in the context of the BT Young Scientists. However, while space was provided for teachers to include their own suggestions of curriculum areas in the questionnaire, TY was not mentioned in this context.

Respondents awareness of SEAI and use of SEAI materials

92% of respondents indicated that they were aware of SEAI, or had heard of the organisation in some respect before the questionnaire. The following table shows how respondents come to hear about the organisation. It should be noted that respondents

frequently mentioned two sources in conjunction, for example, a letter from SEAI and TV/Media.

Table 4.11: Respondents awareness of SEAI – sources of information (as % of total respondents 35)

Green Schools	12%	**TV/media - home research**	28%
Internet search	32%	**Colleague**	8%
Letter from SEAI	36%	**School newsletter**	8%
Teacher education	8%	**DEC information**	0%
Environmental Awareness officer			8%

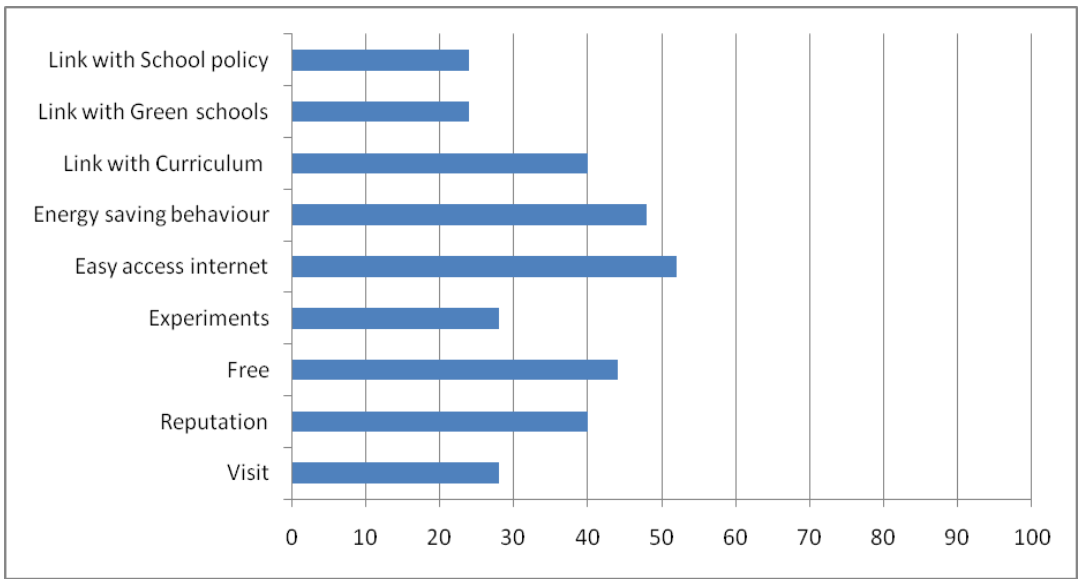
The most popular source of awareness of SEAI comes from direct contact with the organisation via a letter (36%). This contrasts with the findings of primary respondents in this regard who indicated the GSP as a point of contact. The second mechanism is through an internet search (32%) often in conjunction with TV/media and research of home energy improvement grants (28%). This suggests increasing SEAI visibility at post-primary and primary levels may require significantly different mechanisms, e.g. maximising integration of the schools programme though awareness of SEAI home energy grants scheme in conjunction with direct contact at post-primary level. It also indicates that they may be significant scope to raise the profile of SEAI at post-primary level via these mechanisms in the future, which would also encourage a whole school approach to energy education (via DEC for example) or though school-home-community education linkages. However, it should be noted that these mechanisms could equally be applied to primary teachers, in conjunction with the ongoing and continued strength of the GSP at this level.

Table 4.12: Respondents awareness of SEAI – use of SEAI services

	Number of schools	As % of respondents (35)
Workshops	4	12%
Resources	20	56%
Website	21	60%

Given the small number of respondants to questions relating to respondents reasons for using SEAI materials, it is difficult to draw any firm conclusions. Suffice to say, the majority who used SEAI resources did so via the internet as a results of access to resources via this medium (52% of respondents). Other motivations given by the questionaire for accessing the SEAI wesbite included information on energy saving behaviour (48%), curriculum links and free availaibility of resources (40%). These findings are similar to primary responses, with the exception of the GSP. 70% of primary responents accessed resources as a result of Green Schools, this falls to 22% at post-primary level. Similarly, the motivation to seek information for a school policy or plan is not stongly apparent at post-primary level, when compared to primary. This too may offer oppertunities for SEAI in promoting a whole school approach to energy education at post-primary level.

Fig 35: Reasons provided for use of SEAI materials (as % of total respondents - 35)



As the following two graphs indicate, users of SEAI resources show a high degree of satisfaction with these resources, for example, the website or worksheets. This finding, although somewhat limited in its stength due to low numbers, may suggest that the profile of SEAI at post-primary level needs to be increased to allow greater uptate of SEAI education resources at this level.

Fig 36a: Satisfaction with resources (as % of total respondents - 35)

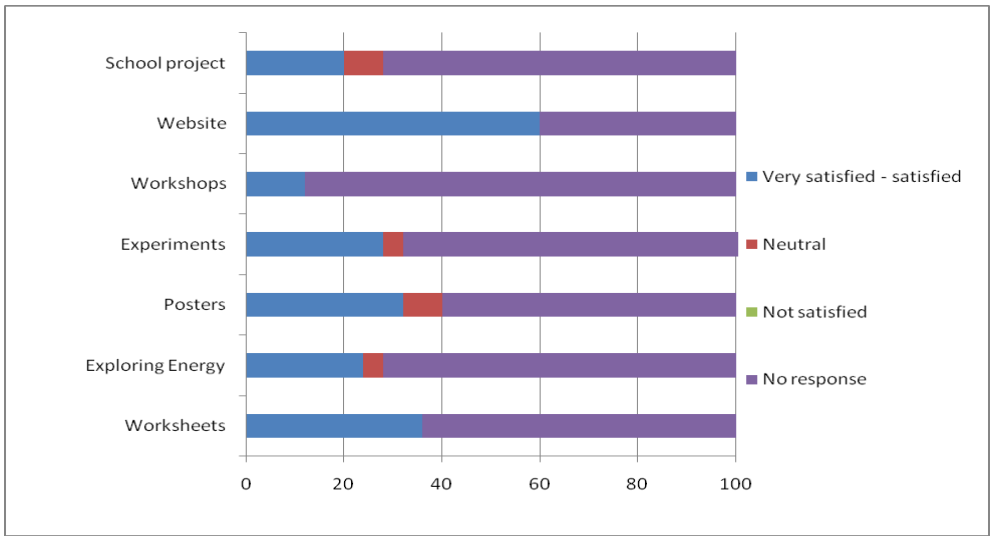
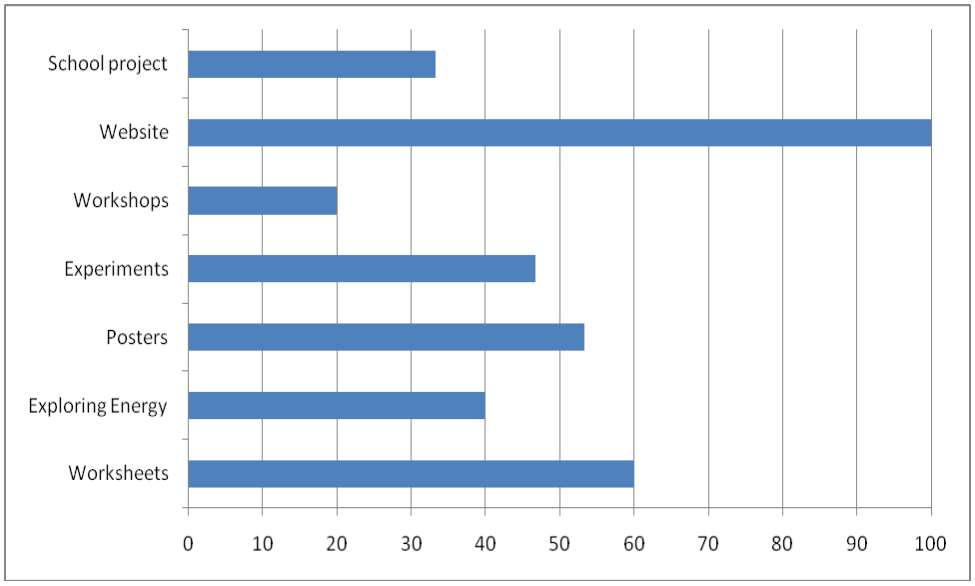


Fig 36b: Satisfaction with resources (as % of total respondents indicating use of SEAI resources - 21)



Finally respondents were asked if they felt that SEAI resources had an impact on pupils knowledge, awareness and behaviour. As the following figures indicate, teachers were favourable towards the impact SEAI energy education has on young people. Less clear however, is the relative impact of different resources, programmes and social contexts which are also involved in the teaching of energy education.

Fig 37: Knowledge of climate change

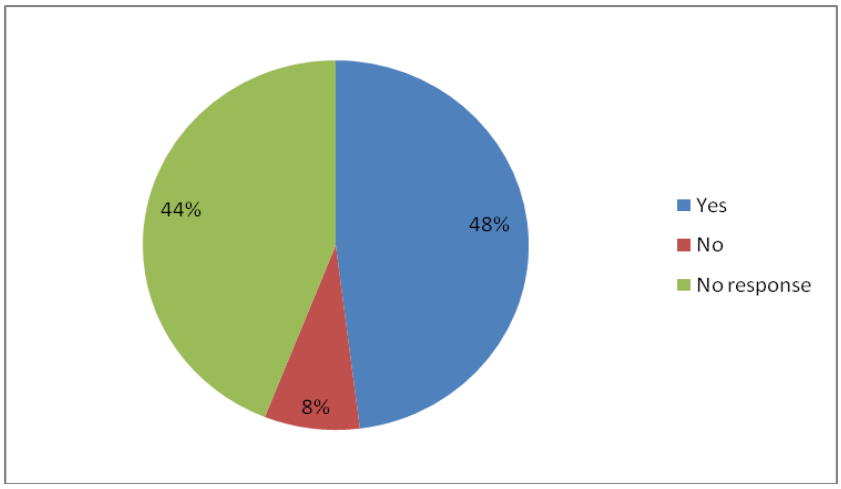


Fig 38: Knowledge of energy science

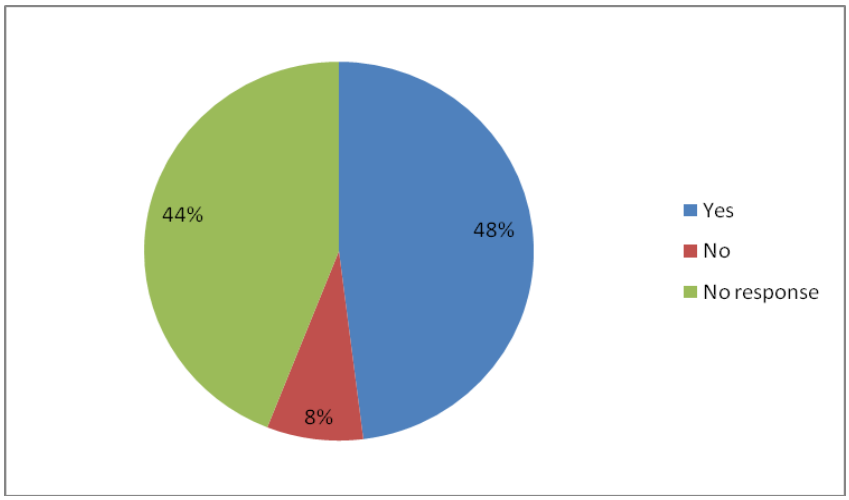


Fig 39: Awareness of energy saving

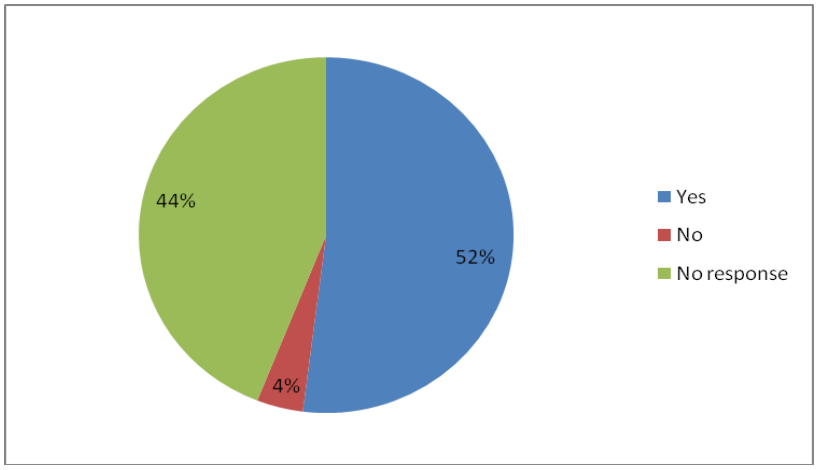
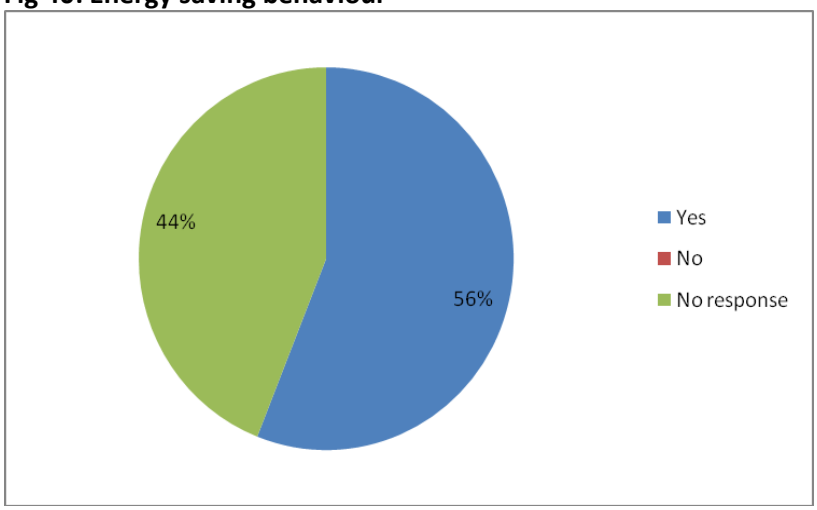


Fig 40: Energy saving behaviour



As was the case with primary school respondents, post primary respondents indicated that SEAI education resources have had an impact in increasing knowledge and behaviours with students. Discussion with two post-primary teachers involved in the One Good Idea project indicated that this form of project work increases motivation and personal interest in energy education. As literature review findings indicate, such on-going project work which has a social dimension, is goal directed and student led can enhance student learning.

4.6 Post-Primary Summary and Conclusions

The results of the post-primary level evaluation present a number of important themes which will be addressed and developed in the recommendations:

- In a similar manner to primary analysis the research indicates that post-primary respondents are personally interested and well motivated towards teaching energy education, with motivations derived from personal interest and linked to creating an ethos of respect for the school and school property.
- Findings also reveal that teachers require that energy education should be strongly linked to the curriculum, but that opportunities exist of energy

education in a range of teaching contexts, such as a whole school approach, school ethos and creating links between the home and the school.

- While the One Good Idea programme was viewed favourably, it becomes apparent from interviews that at post-primary level there is significant competition between Transition year programme providers, with a variety organisations encouraging energy education. These organisations, such as BT Young Scientists, Young Social Innovators and Eco-Unesco are all open to further co-operation with SEAI.
- It also became apparent that each TY programme provider has different goals or underpinning ethos.
- Additionally there were calls to integrate TY programmes within a spirit of co-operation rather than competition; it was suggested that SEAI could take a leading role in this.
- Significantly there was less awareness of and therefore discussion of SEAI post-primary resources; however, organisations such as DoEHLG did point public queries in the direction of SEAI and operate as a dissemination point.
- Significantly there is considerable potential for SEAI to work with NCCA at Junior Cert and Leaving Certificate level (particularly in science) in the light of progression towards the integration of IBSE approaches at post-primary level.
- As with primary research, findings from the post-primary evaluation are in line with international research which suggests that teachers have little confidence in teaching science and in this instance, energy science.
- Responses from teachers via questionnaire indicate that teachers are aware of the potential curriculum links beyond science and geography (although these are most frequently mentioned). Respondents with specific experience in CSPE, religion, technology, home economics and modern languages mentioned that they considered these subjects applicable for energy education.
- Teaching context questions illustrate that energy education fits into a range of teaching contexts. Research suggests that whole school action orientated

education which links the school the wider community teaches energy education from a broader perspective. Findings from the evaluation suggest that there are ample opportunities for SEAI to further integrate energy education into schools by encouraging a whole school perspective, but also, make and substantiate links between home and school energy education.

- Given the above discussion, teacher education through CPD and initial teacher education is vital to increase confidence in energy education teaching and promote the resources of SEAI. However, the findings indicate that teachers do not appear to currently access CPD as a way of up-skilling around energy education. Further research may be required to pin-point the reason for this, but it does suggest that there may be a gap between information about SEAI teacher education and provision of these courses to interested teachers.

Chapter 5 Recommendations

1. Development of SEAI energy science leadership

Findings: This evaluation mirrors national and international research which reflects deep concerns regarding the teaching (and learning) of primary and post-primary science. Key factors underpinning these concerns are teachers' confidence and competence in employing inquiry -based approaches to science, pupils apparent lack of interest in science in school and poor uptake of science at upper post - primary and tertiary levels. This evaluation indicates that teachers and experts alike see energy science as a key competency within SEAI resources. For example, teachers' recognised new scientific knowledge gained through SEAI workshops, and experts expressed admiration for SEAI engagement with complex physical science concepts (e.g. forces and thermodynamics).

Recommendations:

We recommend that SEAI become expert/leader on energy, energy science in the primary and post-primary education sectors.

Action:

- Develop an IBSE/whole school/ action competence approach
- Engage in ITE and CPD
- Develop strategic partnerships
- Develop advisory panel (critical friends)

2. Adaptation of SEAI resources

Findings: Both quantitative and qualitative findings with primary and post-primary school teachers indicated the high esteem in which SEAI resources (e.g. website, activity books, story books, posters, lesson plans and workshops) are held.

Interviews with experts and agencies familiar with SEAI resources suggest that the materials and workshops offered good direction to further children and young people's knowledge and understanding of energy education, but that they did not enable children to engage in their own inquiry – related to science, environmental action/competence, or citizenship.

Findings at both primary and post-primary also demonstrate teachers' reliance on text book teaching, and their perception of energy education as a science and geography subject, neglecting opportunities for cross-curricular teaching.

To address these, the main findings, we recommend that SEAI resources (materials, website and workshops) be reviewed with the intention of:

a. **adapting them to guide teachers in setting up inquiry based lessons which incorporate higher order thinking and action competence with children and young people.** [8]
b. **highlighting cross-cutting themes and curricular integration.**

[8] Specifically: SEAI can provide students/teachers with a science related / energy saving related / problem to be solved. Pupils then discuss this problem and then devise way of testing / finding out solution to this problem. In groups they discuss what they are going to do (investigation) and how they are going to conduct the investigation. They discuss their predications and how they are going to record / measure data. They then have to decide how they are going record findings (graphs, data loggers, photos, video etc) and interpret results. Students then decide how they will communicate findings. Cross curricular themes of societal responsibility and stewardship for environment should also be raised; e.g. advocating for better buildings, better public transport, examination of energy use and energy alternatives.

Action for resources (general):

- Position resources to show where and how they engage with higher order thinking and learning[9]
- Focus on how IBSE approaches help develop students' literacy and numeracy skills. Highlight the interaction of functional literacy and numeracy skills with energy education, which provides a valuable learning context e.g. examining bills, making calculations based on energy savings.
- Position resources within a whole school / action competence approach (e.g. DEC, Green schools, school energy policy)
- Position current resources and/or create new resource for use beyond the school grounds, incorporating home and community and link schools with the wider community.

Action for website:

- Creation of additional pages on the website to illustrate how SEAI resources fit into an inquiry based model of education
- Creation of additional pages on the website to illustrate how SEAI resources address curriculum integration
- As part of IBSE SEAI can provide a platform to showcase students advertising campaigns, awareness booklets etc via the SEAI website
- SEAI can also lend support through student association with SEAI brand/organisational identity

[9] e.g. through problem based learning, critical thinking, collaborative work, discussion, observing, questioning, devising investigations, analysing and measuring, reporting and communicating results.

Action for workshops:

- Offer more frequent once-off workshops e.g. once a term.
- Update SEAI workshops and facilitator capacity to better incorporate inquiry based approach
- Update SEAI workshops and facilitator capacity to demonstrate curriculum integration
- Establish a protocol for offering school workshops which would include expectations of prior teacher's involvement, teacher engagement in the process and openness to engage further with SEAI in energy education e.g. professional development for all/selected staff. [10]
- Establish with the school participating in a workshop a commitment to a whole school policy or practice with regard to energy (e.g. integration with DEC, GSP or creation of an energy plan)
- At workshops, provide information for teachers to show how SEAI resources can be used across curricula.

Findings: Both quantitative and qualitative findings with post-primary interviewees and school teachers indicated the opportunities for enhancing visibility and use of SEAI post-primary resources.

We recommend that SEAI increase the visibility of post-primary education resources in particular

[10] Ensure that teachers understand the purpose of the workshop in SEAI's terms, and see the workshop as part of their own delivery of energy education. Ensure that teachers will teach prior energy education lessons, undertake to attend the workshop, assist and work with facilitators in setting up the inquiry; actively engage in the process and engage the children further in activities using recommended methodologies and materials after the workshop in the context of a whole school/action oriented/ IBSE approach.

Action:

- Work closely with post-primary level NCCA policy officer to develop new IBSE opportunities for senior cycle science.
- Strengthen the use of JC and LC materials on the website through increased promotion within existing strategic partnerships
- With policy makers of JC and LC curricula SEAI could explore possibilities for compulsory material on energy to be included and examined. This is one way to ensure that energy education is not treated as a once off in post-primary schools.
- Work with (dependant on SEAI priorities and resources) TY programmes (e.g. BT Young Scientists, ECO-UNESCO, YSI) to assist in energy education integration to increase profile of energy education. Use this to promote JC and LC materials with teachers.

3. Initial teacher education (ITE)[11] & Professional development (CPD)

Findings: The literature review highlights the importance of initial teacher education (ITE) and continuing professional development (CPD) for teachers to provide pedagogical knowledge in teaching about energy. However, quantitative results from this survey show that while teachers view ITE and CPD as important in up-skilling in energy education, few avail of, or are aware of opportunities in this regard.

Recommendations:

We recommend that SEAI enable the development of long term ITE and CPD programmes, in conjunction with ITE and CPD providers, that would focus on developing primary and post-primary teachers' pedagogical knowledge of inquiry and

[11] ITE in this context is taken to mean undergraduate courses, or first teaching qualifications for primary teachers and the HDip for post-primary.

action competence based education. Such programmes would help be particularly useful in science to develop confidence and competence in employing IBSE methodologies, but also with regard to geography and citizenship. ITE and CPD programmes could also provide the opportunity to highlight how SEAI resources address curricula integration and time management issues.

Action:

- With regard to primary and post-primary ITE: instigate greater links with colleges of education and experts in science education, geography, history and citizenship education
- With regard to primary and post-primary CPD:
    - SEAI could provide workshops or brief information sessions to teachers and post-holders, in conjunction with current pupil workshops; and longer workshops as part of summer CPD courses; in particular the following areas should be addressed:
        - Science / IBSE approaches
        - Citizenship / Whole school approaches
        - School-home education linkages
        - Curriculum integration

Added value: This recommendation would also address one of the issues raised by the respondents in terms of the importance of involving all teachers in a school, and principals, to ensure wide dissemination of resources and energy saving behaviours. Also, by engaging the principal with SEAI CPD they may be more inclined to support energy education. Through these means SEAI would be assured that if their direct programme provision was to end that energy education would continue to be a central dimension of both primary and post primary education.

Providing CPD in IBSE through energy education content also adds value. This would raise awareness of energy education and using innovative IBSE methodologies, build

confidence and competence in teachers, who would be more inclined to use these methodologies in their classroom. As a result, it would be expected to increase children's awareness and interest in science and energy related issues.

4. Strategic partnerships

Findings: The literature review indicates that integration of policy and service provision provides increased education opportunities. The findings of the research highlight the potential for increased integration of SEAI education activities within the wider SEAI organisation. This would strengthen SEAI education initiatives, providing real world energy education through the DEC or Home Energy Grants schemes.

Recommendation: Increase internal strategic partnership arrangements and linkages within SEAI. A number of possibilities exist to strengthen education integration with current SEAI policies and services.

Action:

- Use DEC as a mechanism or goal for energy teaching (all other lessons/ workshops throughout the school using SEAI education materials building up to this applied energy workshop)
- Use the energy grants schemes and helpline as a mechanism for reaching children outside the classroom. E.g Offer a small leaflet with information, activities, games to applicants with children looking for home energy grants.
- Integrate the SEAI education programme in schools with the Home energy grants to provide real world illustrations for children and young people in energy conservation and conversion to renewables (where applicable).
- Provide workshops for parents, similar to the teachers' workshops, which look at energy education (practical steps) but also, focuses on working/educating children in the home

Findings: Research indicates that SEAI is well positioned and respected in the energy education sector, having good connections with a range of public, private and civil society organisations, but that there is a considerable overlap, replication and redundancy in energy education resource provision.

Recommendations:

Increase external strategic partnership arrangements and linkages. SEAI work with other government agencies and civil society organisations, or advocate with these organisations, that energy education interventions become integrated. Through this, energy education can be mapped and made explicit to the education sector and wider public.

Action:

- Identify possible replication and opportunities for cooperation between other energy and climate change education providers (e.g. EPA, DoEHLG, ECO etc)
- Work with energy education providers on climate change and energy awareness programmes as a way of presenting an integrated picture on the subject e.g. linking climate change with renewable energy, economics and the green society.
- Produce an overview document which outlines for policy makers, teachers and schools to identify the names and roles of the various state departments and agencies, their projects and commitments and where they fit into energy education. These could be presented in the context of overall national targets and commitments in relation to energy conservation and climate change.
- Create opportunities such as national conference on energy/environmental education, round tables or expert practice workshops.
- Increase visibility of SEAI education (body) and resources through existing education networks e.g. Discover science and engineering; continue to work with DSE in their centres as a base for workshops; integrate programmes (e.g Guzzler and Molly Cool)

Findings: The findings indicate that curriculum development at both primary and post-primary is moving towards action competency approaches and skill development. However, findings also indicate that teachers, particularly at post-primary level, are highly reliant on text books for teaching. International and national research also suggests that teachers have difficulty in engaging in action based learning in the classroom.

We recommend that SEAI liaise with curriculum bodies, teacher educators and education specialists and text book publishers in the exercise of adapting to an action competence/ inquiry based approach and curriculum integration. Through this SEAI provide opportunities for themselves to engage with stakeholders in science education including subject associations, teacher unions, IASEE etc.

Action:

- Work with teacher education experts to help develop the methodologies towards genuine integration of energy education with the maths, science, English, history, geography curriculua.
- Work with NCCA (primary) on strategies to address concerns of curriculum overload and higher order thinking
- Work closely particularly at post-primary level with NCCA policy officer to develop new resources for senior cycle science.
- Consolidate current and form new contacts with text book publishers to integrate SEAI education material in these contexts.

Added value: This would assist SEAI in further building relationships and enhancing its profile and investment returns.

Findings: The findings indicate the valuable support provided by SEAI to schools through the One Good Idea programme, but also the overlap between this project and that of civil society organisations at post-primary transition year level. Findings also clearly

indicate that the Green Schools Programme (GSP) has been hugely successful in primary school and is as such the most effective vehicle for engaging schools in energy education. It is apparent to the evaluators that SEAI is making a significant contribution to the GSP essentially through its provision of materials on energy education and provision of workshops to participating schools. This is enabling the school to engage and integrate energy education into their curriculum work. As the government agency with responsibility for energy education it is important that school communities would recognise the role, function and contribution of SEAI. Insuring that SEAI's contribution to Green Schools is adequately acknowledged and publicised would add greatly to the profile of the SEAI with a signification sector of the population.

We recommend that SEAI maintain ongoing links with civil society energy education providers and create formal arrangement with Green schools

Action:

- Maintain ongoing links with YSI, Eco-Unesco and BT Young Scientists as resources allow
- Arrange a high level meeting between SEAI and Green Schools to develop and formalise the relationships
- Highlight existing contribution of SEAI to GSP

Appendix 1: Introduction to SEAI preliminary desk study analysis

Internet use

Over a six month interval between October 2009 – March 2010 the results of SEAI education section internet access and usage was examined. The data over the six months are relatively consistent. For the purposes of analysis here, an average is taken over the six month period.

7116 visits to the (www.seai.ie/) site were made and 24,533 pages viewed, on average, per month. An average of 3.44 pages were viewed per visit, with 74% of visits each month from new visitors. The site experienced a 57% bounce rate over the 6 month period, which indicates that a relatively high percentage of visitors leave the site very shortly after visiting it. Interestingly, just under half, 48%, of visits to the website over this period are of Irish origin. The remainder originate from a range of countries such as the UK, US, Canada and New Zealand. Of the visits to the site, the majority, 58% came via a Google search, with (16%) coming to the site directly. The remainder predominantly come through the site via Google images search, Bing and Yahoo. The most commonly applied search terms include SEI, SEI.IE and sustainable energy Ireland. A smaller number of searches (average 2%) reference fossil fuels and the green house effect.

12% of SEAI site visits are to the schools pages (www.seai.ie/schools). Approximately 4% of page views (average 24,533 per month) were specifically directed towards the primary and secondary school pages (www.seai.ie/schools/primary_schools/ and www.seai.ie/schools/primary_schools/resources_available and http://www.seai.ie/Schools/Secondary_Schools/). A smaller proportion visited the energy game, One Good Idea, energy worksheets and lesson plans websites (average 1%).

Workshops conducted

A brief overview of the number of workshops conducted in primary schools was derived from SEAI databases. Due to different ways of compiling results it is difficult to conclusively derive patterns from the data, as the table below illustrates.

Table Appendix 1

	2006	2007	2008	2009*	2010**
Junior workshop	282	129	258	127	141
Senior workshop	267	444	360	365	147
Additional	N/A	92	80	N/A	N/A
Notes	*2009 – saw an increase in SEAI and divergence across different sectors including the addition of post-primary workshops which account for 25 days 2009 senior workshop – 216 workshops **2010 figures and number of workshops accounted for differently to previous years accounting for decline				

Appendix 2 Questionnaire

Teaching energy saving and energy science in schools

A survey for primary and post-primary schools in Ireland

by

The Sustainable Energy Authority of Ireland and

St. Patrick's College Drumcondra.

This survey is being conducted with primary and post-primary schools across the country to evaluate the way in which energy and energy saving is currently addressed in schools, and assess the needs of schools in this area.

The survey should be completed by the principal of the school or an appropriate teacher, such as, a Green Schools co-ordinator. It will take between 15 – 20 minutes. Section 1-4 should be completed by all respondents. Section 5 should be completed only by respondents who have participated in SEAI activities. Section 6 provides space for those who wish to include additional comments.

Please use the pre-paid envelope provided and return the survey to: Rachel Kavanagh, Centre for Human Rights and Citizenship Education, St. Patrick's College, Drumcondra by 1st of November.

All information is confidential and will in no circumstances be made available to any third party. The team at St. Patrick's and Sustainable Energy Authority of Ireland greatly appreciate your role in completing the survey.

SECTION 1: SCHOOL DETAILS

Contact name: _____

Role: Principal ☐ Green Schools co-ordinator ☐

Other (please indicate) _____

Class _____

Principle Subject Area(s) (Secondary teachers only):

SECTION 2: SCHOOL ENERGY PLANNING AND POLICY

Please indicate PLANS, POLICIES AND PROGRAMMES you engage in around energy at school. Please circle the appropriate answer (yes or no):

1. Does your school have a school plan? Yes / No

1.a Does this plan have an energy statement? Yes / No

2.a Are you member of the Green Schools programme? Yes / No

2.b If you answered **yes** to the question above, please indicate the flags you have completed. **Please circle all that apply.**

Waste & Litter Energy Water Travel Climate Change

2.c Which Green Schools flag you are currently working on?

Please circle all that apply.

Waste & Litter Energy Water Travel Climate Change

Are you aware of any **other** programmes or policies your school is engaged in with regarding energy? Please briefly outline

_____

_____

_____

SECTION 3: SCHOOL ENERGY SAVING ACTIVITIES

3. What energy saving activities do you regularly conduct at school:

There are spaces left below for you to include additional activities.

For each statement please indicate (√) if **in your school you…**

	Yes	**No**
turn off standby on electrical appliances		
recycle waste (e.g. cans, bottles and plastics)		
turn off lights when not necessary		
put on jumpers instead of turning up the heat		
walk, cycle bus instead of using car to school		
use energy saving CFL light bulbs in the school		
buying a new appliance, we look for the energy label		
buying a new appliance we purchase the most energy efficient		
have double glazed windows with argon fill or low emissivity glass		
make sure taps are tuned off when not in use		

SECTION 4: CLIMATE CHANGE, ENERGY SCIENCE AND ENERGY SAVING IN THE CLASSROOM

Research has indicated that there are three broad categories of energy education: **climate change, energy science and energy saving.**

The purpose of this section is to find out how teachers view each of these topics. First, with regard to their appropriate position within the curriculum and second, within the formal, informal and non-formal learning environment.

For your information each type of energy education is described briefly below.

Climate change –includes teaching about changing global climate as a result of the **production of CO2** (Carbon dioxide) from human activity through the use, for example of **fossil fuels**. It might also include teaching about the disproportionate use of **resources** between developed and developing countries.

Energy science –includes the science of **energy in physical, chemical and biological** terms. In physics, this might include teaching about different types of energy, e.g. potential and kinetic energy and in chemistry how CO2 and O2 are created. In biology it would include respiration and photosynetheis and how these two processes create O2 and CO2 and also the differences between renewable and non-renewable forms of energy.

Energy saving –includes teaching about the practicalities of **energy consumption** and how to save energy in the school and home, e.g turning off lights, avoiding using the car, putting on an extra jumper, using energy efficient appliances. It would also include aspects of energy efficiency such as solar panels, insulation, lagging jackets, buying highly efficient electrical appliances.

4.1a Do you teach any of the following in the classroom?

Please circle your answer(s):		
Climate change	YES	NO
Energy science	YES	NO
Energy saving	YES	NO

4.1b Please indicate (√) the resources you have used or are currently using to teach energy in the classroom:

	Climate change	**Energy science**	**Energy saving**
Written resources/packs			
Curriculum exemplars			
Information from the internet			
Teacher Education courses			
Trocaire **Check Oxfam**			
Stop Climate Chaos – check schools program			
Green Schools			
Sustainable Energy Authority of Ireland (SEAI)			
Discover Science and Engineering			
Other:			
External speakers or workshops			
County Council			
Science Bus			
Sustainable Energy Authority of Ireland			
Green Schools			
Trocaire or other development NGO e.g. Oxfam			
Other:			

Programmes			
Green Schools			
Discover Science and Engineering Ireland			
Science Week			
Young Scientist			
Other:			

4.2 Where does energy fit within classroom teaching time?

Please indicate to which subjects you feel climate change, energy science and energy saving are best suited.

Please rank your thoughts from:

Very well suited 1 2 3 4 5 Very unsuitable

Subject	Climate change	Energy science	Energy saving
English			
Irish			
Maths			
Geography			
History			
Science			
SESE			
SPHE			
Art			
Drama			

ESS			
Other:			

4.3 Teaching happens in many contexts. Please indicate how appropriate you feel each of the following learning contexts are to the subjects of climate change, energy science and energy saving.

Please rank your thoughts from:

Very well suited 1 2 3 4 5 Very unsuitable

Subject	Climate change	Energy science	Energy saving
Formal curriculum			
Hidden curriculum*			
Informal curriculum			
Once-off programmes/ Workshops			
Regular, on-going teaching			
Cross-curriculum			
After school			
At home			
Overall ethos of the school			

*Hidden curriculum = The norms, values and social expectations indirectly conveyed to students by the styles of teaching, unarticulated assumptions in teaching materials and the organizational characteristics of educational institutions

4.4 Please (√) your current level of confidence about teaching energy:

Subject	Climate change	Energy Science	Energy saving
Very confident			
Confident			
Neutral			
Unconfident			
Very unconfident			

4.5 Why teach energy in the classroom?

For each statement insert the number that corresponds with how you feel.

Strongly agree 1 2 3 4 5 6 7 Strongly disagree

If there are alternative reasons why you teach energy in the classroom that are not listed here, please include on the blank lines below and rank appropriately.

Reasons to teach	
It is important to bring environmental issues into the classroom	
By demonstrating energy saving behaviour in the classroom, pupils take energy saving behaviour home	
Engaging pupils at an early age is a way of halting future climate change	
I have to teach it as part of the curriculum	
It is school policy/ its part of Green Schools	
The principal wants me to	
There's a lot of external school support, such as workshops and teaching resources which make it an easy environmental issue to teach	
The pupils enjoy it	
It will develop pupils' interest in environmental issues	

It provides a way of introducing scientific skills, concepts and experiments	
It instils values and respect for the school	
I don't think it is important to teach energy or climate change in school	
Energy and climate change should be taught at home and not in school	
It is something that I'm interested in	
It teaches the scientific principles underpinning climate change	

4.6 What additional supports do you feel are required for better energy teaching?

Please tick (√) as appropriate.

Space has been left for your own views. Please feel free to include and rate.

Climate change:

Subject	Very important	Important	Neutral	Unimportant	Very unimportant
Support of principal					
Support of other teachers					
Additional initial teacher education					
Additional professional development					
Additional external speakers					
Additional resources					
School books					
No additional support required					

Energy science:

Subject	Very important	Important	Neutral	Unimportant	Very unimportant
Support of principal					
Support of other teachers					
Additional initial teacher education					
Additional professional development					
Additional external speakers					
Additional resources					
School books					
No additional support required					

Energy saving:

Subject	Very important	Important	Neutral	Unimportant	Very unimportant
Support of principal					
Support of other teachers					
Additional initial teacher education					
Additional professional development					
Additional external speakers					
Additional resources					
School books					
No additional support required					

SECTION 5: AWARENESS OF SEAI and LEVEL OF ENGAGEMENT

5.1 Have you heard of Sustainable Energy Authority of Ireland (SEAI)?

(formally known as Sustainable Energy Ireland – SEI)

Please circle one: Yes No

If you answered **No** to the above question, please go to **Section 6**

If you answered **Yes**, please continue to question **5.2**

5.2 How did you hear about SEAI?

Please circle

1. School newsletter 2. Letter from SEAI 3.Website (while looking for resources)

4. Colleague 5. Environmental awareness officer 6. Green Schools

Other (please indicate)_____

5.3 Has your school previously used SEAI services? If so, which ones?

Please circle

1. Workshops Yes No

2. Resources (e.g. workbooks, posters etc) Yes No

3. Website Yes No

If you answered **No to all three**, please go to **Section 6**

If you answered **Yes to any above**, please continue to question **5.4**

5.4 Why did you use SEAI resources?

For each statement, please rank your thoughts from:

Very important 1 2 3 4 5 6 7 Very unimportant

Space has been left for your own views. Please feel free to include and rate.

Provide a visit to school		Reinforces energy saving behaviour	
Good reputation		Links in with the curriculum	
Free		Fitted in with Green Schools	
Good experiments		Fitted in with school policy	
Easy to access resources over the internet		**Other:**	

5.5 For each of the SEAI services and materials you have utilised, please indicate how satisfied you were. That is, the degree to which the resources met with your expectations and proved useful in the classroom. **If these services or materials were not used, please leave blank.**

	1	2	3	4	5
SEAI downloadable worksheets					
SEAI Energy File					
SEAI Guzzler Investigates Energy					
SEAI Exploring Energy					
SEAI posters					
SEAI experiments					
SEAI workshops					
SEAI stories (e.g Guzzler)					
SEAI website					
SEAI secondary school projects					
SEAI floor game					
SEAI designing and making activities					
Other (Please indicate)					

1 = very satisfied

2 = satisfied

3 = neutral

4 = unsatisfied

5 = very unsatisfied

5.6a If you received an SEAI workshop:

Prior to receiving an SEAI workshop, how frequently you used each of the following resources to teach about energy. **Please indicate (√)**

	1	2	3	4	5
SEAI downloadable worksheets					
SEAI books of experiments					
SEAI posters					
Standard text books					
Green Schools material					
Other material (Please indicate)					
Other (Please indicate)					

1 – Very frequently

2 – Frequently

3 – Sometimes

4 – Seldom

5 – Rarely

5.6b If you received an SEAI workshop:

After receiving an SEAI workshop, how frequently you used each of the following resources to teach about energy. **Please indicate (√)**

	1	2	3	4	5
SEAI downloadable worksheets					
SEAI books of experiments					
SEAI posters					
Standard text books					
Green Schools material					
Other material (Please indicate)					
Other (Please indicate)					

1 – Very frequently

2 – Frequently

3 – Sometimes

4 – Seldom

5 – Rarely

5.7 Did you invite SEAI for a return (2nd or 3rd) visit?

Please circle: Yes No

6.a Did you feel the resources had an impact on pupil's knowledge and behaviour:

Please circle your answer(s):		
knowledge of climate change	YES	NO
knowledge of energy science	YES	NO
awareness of energy saving	YES	NO
energy saving behaviour	YES	NO

6.b Where you answered Yes to the above questions please briefly outline the knowledge and behaviours observed:

6.c Where you answered No to the above questions please briefly outline why you feel the materials failed to deliver changes in knowledge and behaviours:

SECTION 6: ADDITIONAL NOTES

Do you have any comments you would like to add

Appendix 3 – Models of Environmental Behaviour

Some of the earliest models (developed in the US) were based on a linear progression of environmental knowledge leading to environmental awareness and concern (environmental attitudes), which in turn was thought to lead to pro-environmental behaviour. These rationalist models assumed that educating people about environmental issues would automatically result in more pro-environmental behaviour (Kollmuss & Agyeman, 2002). These models from the early 1970s were soon proven to be flawed, research showed that in most cases, increases in knowledge and awareness did not lead to pro-environmental behaviour.

One of the earliest models, The Theory of Reasoned Action and Theory of Planned Behaviour (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980) was built on empirical research difficulties related to measuring attitudes and values. Fishbein and Ajzen maintain that people are essentially rational, in that they "make systematic use of information available to them", and are not controlled by unconscious motives or overpowering desires", neither is their behaviour "thoughtless" (Fishbein & Ajzen, 1975:15). Therefore attitudes do not determine behaviour directly; rather they influence behavioural intentions that in turn shape our actions. Intentions are not only influenced by attitudes but also by social ('normative') pressures. Thus "the ultimate determinants of any behaviour are the behavioural beliefs concerning its consequences and normative beliefs concerning the prescriptions of others" (Ajzen & Fishbein, 1980: 239).

In 1986, Hines, Hungerford and Tomera published their Model of Responsible Environmental Behaviour which was based on Ajzen and Fishbein's theory of planned behaviour (Hines et al., 1987). Following a similar line of reasoning their review of factors that contribute to responsible environmental behaviour Hungerford and Volk (1990) outline a series of variables. 'Entry-level variables' are those that predispose people to take an interest in the environment. 'Ownership variables', include a personal investment in certain environmental issues and making oneself knowledgeable about them. Lastly, Hungerford & Volk describe 'empowerment variables' including skills about using environmental action strategies and the belief that one can be

successful. This includes the 'Locus of control' which represents an individual's perception of whether he or she has the ability to bring about change through his or her own behaviour, locus of control is related to the notion of empowerment, and participation.

People with a strong internal locus of control believe that their actions can bring about change. People with an external locus of control, on the other hand, feel that their actions are insignificant, and feel that change can only be brought about by powerful others. This is associated with verbal commitment, which is the communicated willingness to take action, or intention to action, which is was considered to give some indication about the person's willingness to engage in pro-environmental behaviour. While a conclusive and useful model, the relationship between knowledge and attitudes, attitudes and intentions, and intentions and actual responsible behaviour, are weak. More recent models have paid greater attention to situational variables, which include economic constraints, social pressures, and opportunities to choose different actions.

The field of environmental psychology has contributed to the debate by introducing models with address personal traits of altruism and empathy. As Kollmuss & Agyeman (2002) highlight persons with a strong selfish and competitive orientation are less likely to act ecologically; and people who have satisfied their personal needs are more likely to act ecologically because they have more resources (time, money, energy) to care about bigger, less personal, social, and pro-environmental issues. The second assumption underlies many other studies and models (e.g. Maslow's hierarchy of human needs). However, this latter point in particular is complicated, with substantial evidence suggesting that the most affluent nations causing most environmental damage.

A parallel can be drawn between models that incorporate altruism and the more recent value–belief–norm theory based in social psychology summarized by Stern (2000). According to this theory, environmental behaviour is predicated upon an individuals' value of the protection of the environment for its own sake, or because the individual understand its benefits for human society. Stern (2000) goes onto suggest that individuals also need to know enough about

environmental issues to understand consequences for themselves and the people and places that matter to them. Finally, individuals need to believe that they can have an effect on these issues and that the social norms of their culture prescribe that they should act them.

Appendix 4 - Explaining precursors to environmental behaviour

Much research has examined environmental values and attitudes towards environmental issues and the relationship between these factors, additional situational and psychology contexts, and environmental behaviour. Until recently, equivocal evidence surrounded the role of environmental values in shaping environmental action. A considerable amount of confusion was generated by the apparently interchangeable use of terms that appeared to measure the same construct. Environmental 'concern', 'attitudes' and 'values' have all been operationalised to measure what could arguably be termed environmental values, since these are the basic "criteria people use to select and justify actions and to evaluate people (including the self) and events" (Schwartz 1992:1).

Values are discussed and described in the literature pertaining to environmental issues in a number of ways. Kellert (1995) for example, reflecting his social-psychology background, regards them as a combination of affective (emotional) and cognitive (intellectual) perceptions and understandings. Values are viewed as an emergent phenomenon involving the convergence of emotion and intellect, which are inherently linked. Values consist of both cognitive and emotional elements that allow personal evaluation of an object represented in the individual's mind. The cognitive component, beliefs, can be regarded as the knowledge an individual has of a particular issue; as such it can be subjective. The emotional component is often described as the evaluation of the object; the feelings and/or importance one attaches to an object. Kellert (1995) summarises this to describe values as broadly integrated beliefs and feelings possessed by individuals. Foster (1997) reflects this complexity, writing that, "value… is a word with all the complexity of life itself. What we value, and how we value it, depends on both our values and on the value of things in themselves" (Foster, 1997:2). Building on this

definition, Burgess (2003) puts the definition of value in very simple terms, thinking of values as reasons given for actions.

Values are generally considered durable "holding a high place in a persons internal evaluative hierarchy" (Hitlin & Piliavin, 2004: 361). However, it is also broadly recognised that some values are considered long term and universal, such as security, achievement, self direction and important life goals or standards which serve as guiding principles in a person's life or life attributes such as obedience and honesty (Rokeach, 1973). The idea of value durability is contested, particularly in relation to environmental values. The kinds of values possessed and expressed regarding environmental matters are much more diverse according to Rolston (1994). Environmental values, in other words, do not stand alone; they find different means of expression passing through meanings and practices already in place such as social, political and/or economic lenses (Rolston, 1994). As such environmental values are malleable, and must be "lived through, experienced" (Rolston 1988: 29). This suggests that environmental values can depend on context; for example, gender, life stage, economic situation, level of education attainment, and environmental issue under consideration. This flexibility in environmental values, the relationship between knowledge, values and behaviour has lead to some important debates on the factors that influence environmental behaviour.

Precursors to environmental behaviour/values: life experience

Palmer & Suggate (1996) examined the significant life experiences of active, informed, conservationists in the UK. The purpose of this study was to highlight the kinds of experiences that produce adults who are informed about and actively promote environmentally positive behaviour. In a later study, these authors reveal that 55% of respondents report the importance of childhood experiences of nature, followed by higher education courses and personal relationships were also cited as common influences (Palmer & Suggate, 2004). It is interesting to note that adult memories of childhood often emphasise the emotional significance of experiential relations to nearby nature that seemingly become a legacy carried into adulthood

(Schultz, 2000). As Iozzi (1989:5) suggests: “significant evidence [exists] that the affective domain is the key entry point to learning and teaching”.

In the U.S. Chawla (1998; 2006: 367) reviewed literature in environmental education to assess formative influences on environmental behaviour, these include “positive experiences in natural areas, usually over a sustained period of time; family members who set examples of attention and respect for the natural world; teachers; books and other media; environmental organisations; and experiences of habitat destruction”. Most research on the formative experiences of environmental activists and educators are simple descriptive studies, based on interviews or surveys which have asked people the sources of their environmental interest, concern or action (see review by Chawla, 1998; see also Palmer & Suggate, 2004).

The responses of these retrospective qualitative studies do coincide with the findings of large quantitative studies which examine childhood experiences distinguishing environmentally active respondents from those who show less commitment (Wells & Lekies, 2006). In these studies, from half to more than 80% of the respondents identify childhood experiences of nature as a significant experience, such as free play, hiking, camping, fishing and berry picking. They mention influential family members or other role models, equally, or often as second in importance. As one would expect, environmental educators often attribute their vocation to influential teachers and education. Other common answers involve experiences in organizations like the scouts or environmental groups, witnessing the destruction or pollution of a valued place, and reading books about nature and the environment. Also Chawala (2006) points to previous research which has looked at the importance of memory over the course of life, suggesting that childhood memories of nature can be used at different during different periods of life to inform decision making.

These findings suggest that nature activities in childhood and youth, as well as the example of parents, teachers and other role models who show an interest in nature or environmental issues, are key ‘entry-level variables’ (Hungerford & Volk, 1990) that predispose people to take an interest in nature themselves and later work for its protection. These antecedents of action

are exactly what developmental theory in the field of environmental psychology would predict. The evidence available (e.g. Kellert, 2002) suggests that contact with the natural world, especially during middle childhood occupies a surprisingly important place in a child's emotional responsiveness and receptivity. Kellert (2002) also suggests that a child's willingness to engage and interact with the natural world greatly depends on emotions it generates. In many, if not most learning situations, emotional precedes cognitive processes as a basis for maturation and development. In addition to these internal processes, family members (parents and siblings) can also be highly influential.

Role models enable young people to observe the success of others, see the processes other people use to achieve their goals, and then assess their own competence in comparison. Parents and other family members are critical role models of interest in public issues as well as pro-social values. In a comparison of adolescents in seven nations, young people were most likely to say that helping their country and doing something to improve their society were important life goals if they also reported that their families emphasized an ethic of social justice (Flanagan et al., 1998). Children are more likely to participate in community activities if their parents are also active in this way, or give them approval and encouragement to take part (Pancer & Pratt, 1999). Also these studies suggest that young peoples' most frequent form of civic engagement was working to protect the environment. These findings indicate that it is important for educators to reach out to parents, communicating the importance of democratic parenting, highlighting student contributions, and enlisting parents' support and involvement when classes do community projects.

This body of research has been criticized, primarily because it looks backwards to distant childhood experiences rather than focusing on contemporary conditions for young people. However, no conflicting evidence has been presented, and the fact that similar formative experiences are identified by descriptive qualitative studies and large quantitative correlation surveys, across a variety of cultures and age groups (from secondary school students to older populations) gives these findings weight. That such research on significant life experiences has elicited similar results, despite variously worded questions, suggests that it is tapping a valid

and widely shared self-awareness regarding formative environmental experiences. Despite different sample groups and differently worded questions[12], most studies have yielded similar answers regarding formative influences: positive experiences in natural areas, usually over a sustained period of time; family members who set examples of attention and respect for the natural world; teachers; books and other media; environmental organizations; and experiences of habitat destruction (Chawla, 1998).

Precursors to environmental behaviour: situational factors

A second group of variables that have been linked to environmental behaviour can be characterized as situational factors. These factors pertain to an individual's access to given services, their socio-demographic make-up and their knowledge and experience of the relevant behaviours. Institutional factors include the provision of necessary infrastructure. The effect of a given service evidently differs according to the behaviour in question, but in general, research has shown that those who have greater access to services, such as recycling schemes or local bus services (Guagnano et al. 1995). Gardner & Stern (2002) contend that whether or not people take action on environmental issues in-line with their values and concerns depends, to a large degree, on the scale of the barriers that they face in terms of the time and resources that action will cost. Many barriers are structural, or built into the fabric of everyday life through government regulations, business practices, or the physical form of human settlements. Therefore these barriers should also be addressed and recognised in the path towards more sustainable lifestyles. However, Kollmuss & Argeyman (2002) suggest that institutional barriers can be overcome through people's actions as citizens. Kollmuss & Agyeman (2002) argue that economic factors have a strong influence on people's decisions and behaviour; for example, until recently, very low prices for heating oil in the US prevented people from taking energy

[12] There is a large body of research on the construction of survey instruments which shows that even slight variations in the wording of questions may have significant effects on the type of responses received (Schwarz & Sudman, 1993).

conservation measures. Economic factors are also intertwined with social, infrastructural, and psychological factors, exemplified by the plastic bag charge in Ireland, and ensuing cultural conversion to reusable bags and more awareness of suitable packaging.

A second set of variables relates to socio-demographics. A wide range of social variables have been linked to environmental action, such as age, gender, education, income and family type. Research has provided evidence for higher levels of pro-environmental behaviour amongst younger, female, well-educated, wealthy individuals in nuclear families (Hines et al. 1987). However, these findings have been contested.

A third set of situational factors pertains to building understanding of environmental issues. Hungerford and Volk (1990) for example, noted several knowledges which are important to this process; in-depth knowledge about an issue and knowledge or skill in using environmental action strategies. Hungerford & Volk observed, however, that many environmental education programs are constructed on the false premise that knowledge about issues is sufficient, and that knowledge by itself will lead to action. As Kollmuss & Agyeman (2002) suggest, a complex mix of factors can influence the building of understanding. These can include, but are not exclusive to institutional, economic, social and cultural environments, in addition to personal factors such as prior knowledge, awareness, values, attitudes, emotion, locus of control, motivation, responsibilities and priorities. As Finger-Stitch (2003) suggests, people generally care about what is of interest to them and become committed when they feel that they can achieve something. Stern (2000) has argued that the source of knowledge, quite apart from its content, may be of great significance, relating to its frame of reference and how such knowledge is conveyed (see also MacNaghten & Urry 1998; Wynne, 1996). Without doubt, knowledge plays a key role in activating environmental action, but this may pertain as much to how such information is perceived, as well as its content.

Research conducted by Barr & Glig (2005) shows that although knowledge can be instrumental in influencing behaviour, but also, there are numerous motivating or disabling factors that impact on peoples' attitudes and actions. This study of waste management behaviours found

that with regard to recycling behaviour, those most likely to recycle had a good appreciation of specific bodies of knowledge, such as what could be recycled and when. These authors conclude that this knowledge not only enhanced their behaviour, but also their willingness and ability to take part in the activity, and the participants confidence to act. This research demonstrates the link between knowledge, self-efficacy and empowerment at the personal level leading to environmental behaviour. The work of Barr & Gilg (2005) is useful in this regard, as their research shows that although knowledge can be instrumental in influencing behaviour, there are numerous motivating or disabling factors that impact on peoples' actions. Environmental education studies have found that while knowledge of environmental issues may increase through formal education system, other factors such as the life experiences and local environment play a role in the cultivation of understanding and interest (Chawla, 2006; 1998; Palmer, 1998).

Precursors to environmental behaviour: psychological factors

Van Liere and Dunlap (1978) have argued that environmental action can be conceptualized partly as altruistic behaviour. Individuals who feel morally obliged to act without any incentive or penalty were far more likely to engage in environmental behaviours regularly than those who assigned the problem to other individuals. Acting for the benefit of others with no definitive personal benefit appears to be significant in influencing environmental action. In addition, those individuals who gain satisfaction from environmental action, such as being frugal or recycling bottles, were more likely to maintain their behaviour after an initial start. This satisfaction can include a sense of well-being and self-worth.

The influence of others' behaviour and, in particular social pressure, has been shown to affect a number of environmental behaviours. Most notably, kerbside recycling, as a readily visible behaviour, has been shown to exert significant social pressure on non-participants to 'put their bin out' (Oskamp et al . 1991). However, these normative processes are contingent upon an awareness of a social pressure to change behaviour, which may not be the case in regard to more habitual action (e.g. switching off lights in unused rooms).

The threat posed by environmental problems, such as air pollution or global warming, can have a significant impact on the degree to which individuals are motivated to change behavioural practices in an attempt to alleviate the problem. As such, this relates to the degree to which individuals perceive that a given behavioural response will have the desired effect. Higher levels of such response efficacy are likely to yield higher levels of action on behalf of citizens. This has been shown by Hinchliffe (1996) who demonstrated that a lack of response efficacy can be extremely detrimental. A large number of environmental behaviours are also affected by self-efficacy and the extent to which individuals perceive that they have the time and resources to act.

But also, researchers distinguish between primary motives, such as striving to live an environmental lifestyle and selective motives, those which influence a specific action, such as driving to work because it's raining. Internal barriers to pro-environmental behaviour can occur when the primary motives (environmental values) are overridden by the selective motives (personal comfort). As this example indicates, Kollmus & Argyeman (2002) argue that primary motives, such as altruistic and social values, are often covered up by the more immediate, selective motives, which evolve around one's own needs (e.g. being comfortable, saving money or time) or are based on habit. This finding raises questions regarding the prioritization of environmental issues amongst individuals and their willingness to place environmental issues above other concerns.

Selman (1998) has argued that environmental citizenship influences environmental behaviour. Environmental citizenship is grounded in the notion of the local community, where decisions on the environment are taken locally and by democratic means. However, Harrison et al. (1996) has noted the lack of 'collectivism' perceived by British individuals and the implications of this for environmental decision-making and action. This lack of collectivism has been related to response efficacy, whereby individuals appear willing to accept responsibility only for issues over which they have direct influence (MacNaghten & Urry, 1998).

Appendix 5 – Comparison of Primary and Post-primary findings

Question	Primary	Post-primary
Most reported energy saving behaviours	Recycling waste – 100% Turning off taps – 98% Turning off lights – 96%	Turning off taps – 100% Turning off lights – 100% Recycling waste – 92%
Least reported energy saving behaviours	Alternative transport – 44% Purchasing energy efficient light bulbs – 46% Putting on a jumper – 47%	Alternative transport – 32% Putting on a jumper – 63% Purchasing energy efficient light bulbs – 32%
Motivations for teaching energy saving: Similarities	Personal interest, values for the school, scientific skills and concepts, interest and engagement of pupils in environmental issues, pupils taking behaviour home	Personal interest, values for the school, scientific skills and concepts, interest and engagement of pupils in environmental issues, pupils taking behaviour home
Motivations for teaching energy saving: Difference	Its school policy/green school 91% strongly agree	Its school policy/green school 70% strongly agree
Schools undertaking Climate change education	91% strongly agree	52% strongly agree
Schools undertaking Energy science	82% strongly agree	32% strongly agree
Schools undertaking Energy saving	95% strongly agree	44% strongly agree
Teaching context energy education – similarities	Both primary and post-primary teachers felt formal curriculum was best, and after school the least, appropriate for teaching energy education. Similar scores for home and ethos of school	
Teaching context energy education – differences	Primary teachers more favourable to teaching energy education within hidden, informal, once-off, cross-curricular teaching contexts.	
Sources of energy education teaching material: written	Internet, green schools, curriculum exemplars	Internet, SEAI, curriculum exemplars
Sources of energy education teaching material: external speakers	Green schools	SEAI, county council, green schools
Sources of energy education teaching material:	Green schools; Science week	Science Week; Young Scientists

programmes		
Additional teaching materials required to teach energy education	School books (least favoured) All other resources similarly favoured to post-primary	Schools books (more highly favoured than primary) All other resources similarly favoured to primary
Teachers confidence in teaching climate change	86% strongly confident	76% strongly confident
Teachers confidence in teaching energy science	60% strongly confident	60% strongly confident
Teachers confidence in teaching energy saving	89% strongly confident	80% strongly confident
Opportunities for curriculum integration	Geography and science	Geography and science
Awareness of SEAI through	Green schools; internet search	Letter from SEAI; internet search; TV/media home research
Used SEAI education resources previously	68%	60%
Reasons provided for use of SEAI resources	Free, link with the curriculum, energy saving behaviour tips, green schools programme	Easy access through internet, energy saving behaviour tips, free, link with curriculum
Satisfaction with resources	High	High
Reported affect of resources on pupils knowledge of energy science	60% noted change in knowledge	48% noted change in knowledge
Reported affect of resources on pupils knowledge of climate change	56% noted change in knowledge	48% noted change in knowledge
Reported affect of resources on pupils awareness of energy saving	65% noted change in awareness	52% noted change in awareness
Reported affect of resources on pupils energy saving behaviour	65% noted change in behaviour	56% noted change in behaviour

Appendix 6 – Adapted SEAI lesson Plans

OVERVIEW

In the recommendations it was suggested that the existing SEAI 'lesson plans' might be adapted to adopt a more inquiry-based approach to teaching and learning science. To this extent the original SEAI lesson plans on electricity, magnetism and sound have been modified. The revised inquiry-based activities are more child-led rather than teacher directed in approach, an approach to science which is likely to be new for many Irish primary school teachers. To facilitate successful implementation of the revised activities we recommend that accompanying teachers' guidelines would accompany the pupils' activities.

In the first section below (Part 1) an exemplar of how the original SEAI 'experiments' on the topics of sound, magnetism and electricity could be taught using an inquiry-based approach is included. Some of the original activities have been omitted, others have been adapted and some new investigations have been added. Suggestions for the possible inclusion of historical vignettes, fact files and a 'to think about' section have also been highlighted. The second section (Part 2) provides a provisional framework of what the accompanying teacher guidelines might comprise.

Part 1: Pupils' Activities

SOUND

How do we hear?

Drawing: Depiction of child listening to radio. Radio is on table and music 'notes' are coming out of radio. Child is listening.

How do you think the child can hear the music? Draw arrows on the picture to show your ideas.

Fact file: "How we hear!"

When something makes a sound, it vibrates (shakes). These vibrations travel through the air and enter your ear. When they get to your ear, the vibrations travel along a tube inside your ear until they reach your eardrum. Your eardrum then vibrates which causes three little bones inside your ear to vibrate too. These bones are called the hammer, anvil and the stirrup. These 3 bones then send vibrations to another part of your ear called the cochlea (shaped like a snail). The cochlea changes the vibrations into messages that are sent to your brain. The brain then interprets the messages and tells you what sound you are hearing.

Insert Diagram of the ear

Picture of Buster or similar SEAI Character

Speech bubble with text:

"Sound is a type of energy. It makes things move / happen. Try some of these activities to investigate sound energy".

Feeling sound

Activity: Feeling sound

1. Put your hand on your throat. Can you feel anything move?
2. Now say your name a few times. Can you feel anything move now? What do you think this is?
3. Whisper your name a few times. What do you notice?
4. Shout your name a few times. What do you notice?
5. Was there any difference in what you felt when you shouted and whispered your name? Discuss what you found out with your partner.
6. What does this tell you about sound energy?

For you to think about:

Have you ever 'felt' sound before? Discuss your ideas with your partner or teacher.

Seeing Sound

Activity: Rice on drum

1. Put some rice on a drum. Hit the drum.
2. Draw a diagram of this and describe what happens to the rice. Why do you think this happens?

Activity: Tuning fork in a bowl

1. Take a tuning fork and hit it off your table or chair. Put the tuning fork to your ear. What did you hear / see / feel? Record your observations on Table A.
2. Hit the tuning fork off your table again. This time look at the tuning fork. What do you see / feel? Record your observations on Table A.
3. Now fill a beaker with water. Tap the tuning fork on the table.
4. Put the end of the tuning fork into the water.
5. Observe what happens. Why do you think this happened? Record your observations and explanations on Table A.

Table A: Write about what you found out each time
(Leave sufficient space for students to record their answers) When I hit the tuning fork off the table . . . I think this happened because . . .
When I put the tuning fork to my ear … I think this happened because …
When I put the tuning fork in the beaker of water … I think this happened because …

For you to investigate further...

- Does it matter which end of the tuning fork you put into the water? Investigate.
- Can you make a bigger / smaller spray of water? Investigate.
- What do you think would happen if you used a different sized tuning fork? Investigate.

Did you know?

Light travels a million times faster than sound which is why we hear thunder well after you see a flash of lightning, even though they both happen at the same time.

Magnificent Magnets

Talk about where you have seen magnets in everyday life with your class and teacher. In groups make a list of everything you know about magnets and discuss what you know with the rest of your class.

Investigating Magnets

Suggestion to include:

Picture of Guzzler or similar SEAI Character. Speech bubble with text

"Using your magnets see if you can find out the answers to some of the following questions I have on Magnets".

Question 1: What kind of materials are attracted to magnets? Investigate.

Write about some of the things you found out during your investigations
• • • •

Question 2: Are all metals attracted to magnets? Investigate.

Write about some of the things you found out during your investigations
• • •

Question 3: How can you make two magnets stick (attract) to each other? Investigate

Write about some of the things you found out during your investigations
• • • •

Question 4: How can you make one magnet push or move another magnet without touching it? Investigate.

Write about some of the things you found out during your investigations
• • •

Question 5: Do magnets attract through different materials like wood / cardboard / water? Investigate?

Write about some of the things you found out during your investigations
• • • •

Investigating the strength of magnets

Drawing: Four children talking. Each child has a different sized and shaped magnet in their hands E.g. bar magnet, horse shoe magnet, wand magnet etc . Speech bubbles coming out of their mouths

Child 1: I think my magnet is the strongest because it is the biggest

Child 2: I think my magnet is the strongest because it can attract at both ends

Child 3: I think my magnet is the strongest because it is the heaviest

Child 4: I don't think we know which one is the strongest by looking, I think we'd have to test them to see which is the strongest

Which child do you agree with? Why?

Which child do you disagree with why?

In your groups plan an investigation you could do to test which magnet is the strongest.

Our Investigation Planning sheet *(This could be included as an appendix)*

Problem we are investigating: ***Which is the strongest magnet***

What we are going to do:

How we are going to make a fair test:

What we are going to measure:

What we predict:

Our Results

What we found out:

A picture of your results:

Did you know

In some countries there are trains that work by using magnets. In Japan for example the Maglev train can travel 581km/hr and it doesn't even touch the rails. It stays above the rails by the magnetic force of repelling (North and north poles or south and south poles)

ELECTRICITY

It is thought that a scientist called Alessandro Volta invented the first battery in 1799. Volta's battery was very different to the batteries we use today. His battery was very big and heavy and contained liquid and metals. It took scientists over a 100 years to develop Volta's battery into one that was small enough to carry around easily. When you are investigating electricity in these activities take a close look at the battery. You will see 1.5V or 1.5 Volt on the battery. Why do you think it's called a Volt? In the mid 1800s a scientist called Thomas Edison invented the first light-bulb. Now try some of these activities and see if you can make a light bulb light!

Investigating Electricity

Directions could be in form of Guzzler and Speech Bubble:

1. Try to make a bulb light using 2 wires and a battery. Draw a picture of your circuit.

    - Is there more than one way to do this? Investigate and draw a picture.

Write about 2 things you have learnt from doing this

-
-

2. Now put your bulb in a bulb-holder and see if you get it to light using 2 wires and a battery. Draw a picture of your circuit.

Write about 2 things you have learnt from making this circuit

-
-

3. Try to make a buzzer sound. Draw a picture of your circuit.

    - How can you make your buzzer sound louder? Investigate!

Write about 2 things you have learnt from making this circuit

-
-

4. Try to make a motor move. Draw a picture of your circuit.

    - Can you make your motor change direction? Investigate!
    - Can you make your motor go faster? Investigate?

Write about 2 things you have learnt from making this circuit

-
-

Did you Know?

When lightning hit power cables in New York in 1977 nine million people were plunged into darkness with many people trapped in lifts. Thieves looted shops and supermarkets. 426 police officers were injured trying to keep law and order, there was chaos without electricity.

Part 2: Suggested Framework 'Teachers' Guidelines'

NB: This is a broad overview

SECTION A: OVERVIEW

This section would provide teachers with a brief background on the inquiry- based approaches / methodologies to teaching and learning science that are used in this series of SEAI lessons. For example, this section might include information on:

- Setting a context, making the science relevant to children's ideas
- Finding out what children know about the different topics, establishing whether or not children hold ' misconceptions' about the scientific concepts
- Investigations: Providing children with opportunities to investigate the different areas / investigate some 'misconceptions' they may hold on the different topics
- IBSE approaches
- Relevant to children's lives
- Problem solving
- Application and development of science skills
- Developing pupils' scientific knowledge
- Child led rather than teacher directed investigations
- Open-ended investigations rather than the more traditional prescribed (recipe book type) science experiments
- Creativity and imagination in science
- Enjoyment
- Greater impact on children's knowledge on topics addressed
- Increasing children's interest in science topics

SECTIONS B/C/D/E

Overview

Include a different section for each of the topics you wish to cover. For Example:

- Sections B: Energy
- Section C: Food for thought
- Section D: Acid
- Section E: Acid Rain

Each of these sections could include the following four sub-sections that would provide teachers with information about :

1. The Key Message
2. The relevant scientific content knowledge that the teacher might require in order to facilitate the children's learning in each of the investigations
3. Suggestions for introducing the different topics/ themes. Suggestions for setting the context and for findings out the children's knowledge / ideas.
4. Materials required & teaching guidelines for facilitating the children in conducting their independent investigations

Exemplar

SECTION B: ENERGY

1. Key message

E.G: Sound, magnetic, chemical and electrical energy can make things happen because they are all different forms of energy. Try to draw all this together by the general idea that sound, magnetic, chemical and electrical energy can make things happen because they are all different forms of energy.

2. Science Background Information for TEACHER

This section would include 3 / 4 paragraphs containing relevant scientific concepts on Sound, Magnets, Electricity. A sentence or two about possible 'misconceptions' the children may hold regarding the different topics could also be included here.

Sound

When a sound is made it makes the air vibrate and these vibrations carry the sound to your ears…

Magnetism

Magnetism is an invisible force between certain materials and can attract or repel…

Electricity

Electrical energy is the energy that makes many things work, i.e. electricity which powers lights, computers, toasters and televisions….

3. Introducing Topic / Setting Context / Finding out children's Ideas

Example

- Question and answer session (would include exemplar questions for teachers)
- Think and draw: E.G. Teacher hits a drum to make a sound and asks the children to draw how they think they hear the sound.
- Constructing concept maps
- Using concept cartoons

4. Materials required and Teaching Guides to specific activities

In this section the materials required for each of the investigations would be listed. Detailed teacher guidelines (tips) that would help teachers in facilitating their pupils in conducting the various investigations and activities would also be provided.

SECTION C: FOOD FOR THOUGHT

SECTION D: ACID ATTACK

SECTION E: ACID RAIN

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