

Sustainable Schools: Making Energy Efficiency a Lifestyle Priority

Ken Purnell[†], Mark Sinclair & Anna Gralton

Central Queensland University

Abstract

Promoting efficient energy use in schools that consequently reduces greenhouse gas emissions is the purpose of a residential Energy Efficiency in Schools (EEIS) program reported on in this paper. Research on this program aligns with one of the “key overarching sustainability issues”, set out in the *Learning for Sustainability: NSW Environmental Education Plan 2002-2005*: “Sustaining energy use, cutting greenhouse gases”. The EEIS program was sponsored by Queensland EPA, Ergon Energy and Education Queensland. Participants learnt about innovation, leadership, coal mining, greenhouse issues, the “greenhouse challenge”, conducting energy audits, alternative energy and promoting energy efficient practices in school and the community.

Three EEIS models in Queensland that supported change in energy usage behaviours of participants (school students, parents and staff) is examined. In each of the models, interviews were conducted and questionnaires were completed with participants. In Model 1 it was found that, overall; the EEIS program did develop positive energy efficient behaviours in those who participated. In relation to whole school effects, mixed results were obtained. In Model 1 a rural school *initially* reduced energy consumption by fifty percent and in Model 2 significant changes in energy efficient behaviours in the school communities occurred. In Model 3 one school followed through an action plan and similar positive effects were observed. The development of an action plan that is implemented in the school, the selection of suitable participants, and post-program visits to schools by relevant staff were among the factors that contributed to the overall success. Each model was found to have achieved their aims to varying degrees but had outcomes that are likely to have both lifetime and possibly intergenerational effects.

Introduction

Education on energy efficiency is a critical component in “education for sustainability” in today’s environment (NSW Council on Environmental Education, 2002, p. vi). “Sustainable energy use, cutting greenhouse gases” has been recognised as an “agreed priority sustainability issue” in NSW’s Environmental Education Plan 2002-2005, *Learning for Sustainability*. It has been nominated as a “specific issue”, needed “to address the systemic nature of sustainability” (NSW Council on Environmental

[†]Address for correspondence: A/Prof Ken Purnell, Associate Dean (Teaching & Learning) and Head of School, Education & Innovation, Faculty of Education & Creative Arts, Central Queensland University, Rockhampton, Qld 4702. Email k.purnell@cqu.edu.au

Education, 2002, pp. 10–11). Research in the environmental education field demonstrates that impacts on behaviour as a result of interventions and the long term effects of these are lacking compared to research on the impacts to attitudes and knowledge (Leemin, Dwyer, Porter & Bobern, 1993; Rickinson, 2001; Purnell, Sinclair & Gralton, 2003). For example, Rickinson (2001) conducted a review of a hundred environmental education studies (involving primary and secondary schools) published between 1993 and 1999 and found that interventions such as residential field trips and school-based programs could, in some cases, develop some positive environmental behaviours. Residential field trips are used in the EEIS program studied here. The literature also commonly refers to actions, such as the turning off of electrical appliances when not in use, recycling, or tree planting, as environmental behaviours. There are also less direct environmental behaviours, such as: social interactions and communication (e.g. discussing issues in an attempt to motivate others); political actions, such as letter writing; and the creation of new projects as a result of programs. In this study desirable environmental behaviours will result in less energy consumption by participating schools. School education programs on energy efficiency have the potential to result in decreased energy consumption thus reducing greenhouse gas emissions and electricity costs. Such programs also have the potential to develop life long energy efficient behaviours and possibly intergenerational effects that are most desirable (for example, at home with their parents and with the participants' own children in the future).

The Queensland EEIS program is supported by the Environment Minister, John Mickel and the launch of the 2004 EEIS program was at Gracemere State School in Central Queensland on 23 June 2004 (see <http://statements.cabinet.qld.gov.au/cgi-bin/display-statement.pl?id=1886&db=media>). The Honourable Mr Mickel noted that:

Since the program began in 1998, more than 30 schools and thousands of primary school students have banded together in central Queensland to become energy efficient ... I also congratulate the Lakes Creek State School on cutting its power bills by 28 per cent as a result of joining the scheme last year. The school has also reduced its greenhouse gas emissions by cutting energy consumption ... It's not only in the schools where we are making inroads. Students are taking the lessons they're learning in the classroom and are convincing family members to reduce their energy consumption by turning off lights when not in use and avoiding the use of appliances such as air conditioners.

The EEIS program seeks outcomes of energy efficiency and more sustainable energy use. It is sponsored by the Queensland EPA, Ergon Energy and Education Queensland. It involves three different models of delivering an EEIS program. In the first Model (Model 1), two schools that had participated in the program, and two that had not, were examined in this study. These schools were selected based on their similarities in geographical location and size, enabling a comparison of the schools' energy use and expenditure patterns. The study also examined the five schools that participated in Model 2's program and three of the five that participated in Model 3. Model 2 and 3 were included in the study to provide further information on the impacts resulting from the EEIS programs.

The EEIS Program and the Three Models

The Energy Efficiency in Schools initiative is a residential program (duration of up to 7 days) that introduces participants to the concept of energy efficiency and immerses them in settings connected to the world away from the classroom to enhance

understandings of concepts and issues to create a greater “real world” awareness of the greenhouse gas issues (Appenzeller & Dimick, 2004). Participants in the program include primary-school aged children, parents and teachers. The program aims to establish a network of student leaders in the community who focus on energy efficiency and incorporates school community members in decision-making.

The program culminates in an Action Plan to reduce energy consumption and/or greenhouse gases once back at school (see Appendix A as an example of such a plan). Having an Action Plan has been found to be one of the key factors in contributing to the program’s success. The Action Plan is collaboratively developed by the student, the adult helper, and the Environmental Education Centre’s (EEC’s) principal. Adult participants also take the knowledge and skills learnt during the program back to the school and community. After the program, students and their adult participants are encouraged to speak at school staff meetings, school assemblies and Parents and Citizens Associations (P&C) about energy efficiency and the reduction of greenhouse gas emissions; that is, community education about the knowledge and skills learnt during the program.

There are three models of delivering the EEIS program that have been developed by the EEC’s involved. Geographically these EEC’s are in Central Queensland, Cairns and southeast Queensland. Model 1 was the first of its kind in Queensland, with the other Models based upon that. The primary goal of the three models is to reduce energy consumption in schools; however, variations in the program were due to the differences in geographical location and available resources to support the program (see Table 1). An example overview of one model is found in Appendix B.

Model 1

Three Environmental Education Centre’s (EEC) conducted Model 1’s program over seven days. Criteria used to select participants were based on the potential maximum benefits to the individual and the school and included primary school aged students and parents. It was anticipated that students would take their enhanced knowledge and skills to reduce electricity consumption into their homes as well and impact positively upon energy efficiency there. Also, by involving parents in the program, it is envisaged that the knowledge and skills learnt will be further enhanced in the home and transferred to the wider community.

Prior to participating in the program, students conducted energy audits of their school’s electricity consumption and at the residential program, energy efficiency Action Plans are drawn up, which guided behaviours once back at school. The pre-program energy audits enabled post-program comparisons of school energy consumption.

Model 1’s EEIS program included visits to and first-hand experience of coal mining sites, heavy industry (cement, aluminium), a coal-fired power station, and renewable energy production. Through various activities, the participants also learnt about cooperation, initiative, leadership, team building, global warming and greenhouse gas issues, the commitment of several heavy industries to the greenhouse challenge, and how to conduct energy audits. The program supports the curriculum in key learning areas such as *Studies of Society and Environment, Mathematics, Science and Health and Physical Development* (Hossack, 2002).

Model 2

One Environmental Education Centre ran the program over four days (Barford, 2002). Only local schools were selected to participate in this program, with the intention of facilitating post-program visits. The EEC’s principal spoke to schools prior to the program to develop awareness and interest amongst future participants. Five schools

TABLE 1: The Three Models of the Energy Efficiency in Schools (EEIS)

	Model 1	Model 2	Model 3
Duration	Seven days	Four days	Three days
Conducted by	Three EEC's	One EEC	One EEC with support from another
Participants	One student/school One "adult helper" per school (usually parent)	Four students per school (2x Year 6, 2x Year 7) Five Schools One teacher per school for Action Plan day	Four students/school (except for one where were two) One adult/school (teachers/teachers aide) Five schools
Activities	Coal mining sites, Heavy Industry; Coal fired power station; Creation of Action Plan; Energy Audits; Greenhouse Gas CD Alternative Energy Co-operation, Initiative, leadership, team building	Hydropower station; Creation of Action Plan; Energy Audits; Greenhouse Gas CD; Speakers on wind and solar energy, and air conditioning; Computer animated presentation; Communication and team-building skills	Coal-fired power station; Energy Audits; Drafting of Action Plans; Greenhouse Gas CD; Getting to know you games; Rainforest tour; Planting of trees as part of a carbon sink project

were involved in the program. Participants included four students (two from Year 6 and two from Year 7) and one teacher, who was involved for one day to assist in the drawing up of the Action Plan. Activities and experiences included: a tour of a hydropower facility; spokespeople talking on renewable energy; the examination of lighting and the auditing of electrical appliances; and, the use of a CD greenhouse gas calculator. Participants also learnt about communication, teamwork and leadership skills. The program ended with a parents' night, where participants delivered a power point presentation on the program's activities and the school's Action Plan that was developed. The Principal conducted post-program visits two months and six months after the program. This post-program follow up in the schools supported their school-based actions to reduce electricity usage.

Model 3

One EEC conducted model 3's program with the assistance of another (Brown, 2002a; Brown, 2002b). This program ran over three days and five schools participated. Four students and one adult (teachers and teachers aide/parent) represented each school. Throughout the program, participants visited a power station, collected data on

how energy is created and how different appliances use energy, and the quantity of electricity that each appliance uses. They drafted an energy efficiency Action Plan, participated in getting to know you games, undertook a rainforest tour, and planted trees as part of a carbon sink project. The EEC's principal conducted a post-program visit, to each school, two months following the program.

Outcomes of the EEIS Programs

Model 1

In studying Model 1, two treatment and two control schools were selected to be able to make comparisons between schools that participated in the EEIS and similar schools (size, location, socioeconomic characteristics, etc.), that did not participate. These schools were within 50 kilometres of the university and this permitted ease of access. The most dramatic reductions and change in behaviours were found in the rural treatment school, which had reduced electricity consumption by fifty percent following participation in the program. Eventually these levels returned back to those corresponding with the pre-program levels, due to the introduction of the Internet and air conditioning. In relation to these increases, the then Principal suggested that if the school had not participated in the program, energy consumption would have proceeded exponentially.

A number of factors were found to have contributed to the positive impact of the program on individuals and the school. These included:

- a small student population;
- the Principal was very involved in the implementation of the Action Plan;
- the adult (a parent) became an "energy policewoman";
- the school had a very strong community spirit and parent involvement; and
- many of the students' homes possess solar and mains power.

As for the longitudinal impacts of the program, these were not easily identified. That is, students are still energy conscious and demonstrate energy efficient behaviours, but whether this is due to the effects of the program or their energy conscious backgrounds is not identifiable. The program has had lasting effects upon the school and its community (e.g. only turning on lighting and fans in the school when necessary). Staff changes have meant that electricity conservation has not been pursued as rigorously post-program. However, in comparing the rural control school with the rural treatment school, some differences between reported and self-reported energy efficiency behaviours were found (i.e. less reported and self-reported behaviours in the control school).

In the case of the urban treatment school in Model 1, some impacts on energy efficient behaviours and consumption were found; however, a whole school effect as in the smaller rural school did not occur. The program did lead to an increase in awareness on energy efficiency in the school and the curriculum was enriched and extended as a result. However, there was no significant evidence of changes in environmental behaviours of school students, staff and community post-program. The urban control school did not demonstrate comparable energy efficiency behaviours.

In the urban treatment school, electricity accounts were not so useful to give an indication of energy use behaviour changes as new buildings had been developed in the time of the study and these added to electricity costs. This school had other mitigating factors with a relatively large student population (approx. 600 students) and only one student and one adult (a parent) participated in the program. A greater number of participants in a large sized school should have a positive impact on future outcomes. The number of schools that participated in this Model (about 20 in Model 1 and five

in Model 2 and 3) could be reduced and the number of participants from each school could be increased. An increase in pre and on-going post visits by the organisers of the program could further enhance positive outcomes. Evidence suggests that this Model successfully met the aims and high standards of the program.

Model 2

All five of the schools that participated in Model 2 were examined. No comparison schools were selected, as there were issues of access. The program had only taken place six months prior to this study, with an end of year deadline for the full implementation of the Action Plan, and so evidence in the form of electricity bills was not yet available. Despite this, there was significant evidence of the development of energy efficiency behaviours in students, staff and community members post-program. Participants and the EEC's Principal were still highly motivated six months following participation in the program and all were looking forward to the following year's program. Impacts flowed on to non-participant students, school staff, parents and other community members. Energy efficiency behaviours developed post-program included:

- turning off lights and other electrical appliances when not in use;
- gradually switching to energy efficient lighting;
- placing energy efficient posters near light switches in classrooms;
- presentation of the Action Plan and progress to students, school staff, and P&C members;
- the placement of energy monitors in classrooms; and
- conducting energy efficiency competitions.

Communication about the program, via repeated presentations to the school, promoted an increase in awareness and knowledge of energy efficiency right throughout the school community. This Model was unique in that the adult participant, a teacher, was only present at the program for the one day when the Action Plan was drawn up. This demonstrates that not being involved in the entire program has not affected outcomes. In fact, the selection of a set of motivated teachers to assist in drawing up the Action Plan has contributed to its success. Another major factor that assisted this Model was the selection of only local schools and post-program visits undertaken by the Principal of the EEC.

Model 3

Three of the five schools that participated in Model 3's program were included in the study. The other two had not followed up on the program. Schools that did not participate in the EEIS program were not included in the study for comparison purposes.

One of the three schools involved was in the process of following up on an Action Plan; however, whole of school effects and motivation levels were not as strong as in the other Models. This school was involved in energy efficient behaviours pre-program and for this reason it was difficult to ascertain the impacts. In the other two schools involved in the study, the teachers were unable to assist (for various reasons) in following through on the Action Plan. In this model evidence suggested that the participants, as a result of the program, were more aware and knowledgeable about energy efficiency and did develop some positive energy efficiency behaviours. Effects on the whole of school were not demonstrated and it was reported that a number of participants required additional skills to implement the Action Plan (e.g. use of equipment). During interviews, the short duration of the program and the need for pre and post-program visits were identified as areas for future consideration.

Overall, the three models provided a range of opportunities for participants to learn about energy efficiency and to enact this through Action Plans in their schools. Knowledge that is acted on through experiential learning was found to be a powerful way to achieve the goals of the EEIS program. Each of the three EEIS models and each participating school is set within a unique context that provides particular opportunities within that context. One key generalisation that can clearly be made is that in most cases it was apparent that the EEIS program did develop positive energy efficient behaviours in those that participated (i.e. students, teachers and parents) and the school communities from which they came. These three models demonstrate the worth of the learning experiences to change energy consumption behaviours in school communities to become more energy efficient. In some cases there were radical changes such as a 50% reduction in one participating school to others where the direct effects are negligible. However, in all instances it was clear that schools that pursued energy efficient practices as a result of participation in an EEIS program benefited themselves in terms of reduced electricity consumption compared to what their electricity consumption would have otherwise have been. This is in the context where some schools found that their electricity consumption (and costs) increased after participation in an EEIS program due to new initiatives in their school such as the "Cool schools project" where a school may have new large air conditioning units installed or a new computer laboratory.

Limitations of Study

This study examined EEIS models in Queensland only. The opportunities for the researchers to collect data from the three EEIS models was influenced by the availability of staff in EEC's and students and staff in participating schools as well as access to schools. In Model 1 we were able to compare participating schools with non-participating but this design could not be duplicated for the other two models due to time and funding constraints. Our focus was on changed behaviours to reduce electricity consumption rather than a wider look at the impacts in general upon student learning as a result of participating in the EEIS program. Closer monitoring of outcomes would be desirable and this is reliant on accurate data before and after the program from the participating schools. There is also the need to evaluate not only the immediate effects of participating in an EEIS program but also the longer term – what impact has the school's participation in the EEIS program had in five years time in the school and in the community? The three models developed independently but were influenced by the first EEIS program in 1998 in Central Queensland and subsequent modifications to that model. What developed were three quite different models of delivery that took up local opportunities of resource bases to meet local needs. That is, there was not a standardised delivery where all models sought to achieve common outcomes. Therefore it is not possible to compare directly the achievements of the models. All three models have been modified over time to continuously improve their capacity to meet local needs. An important context is that the core business of the EEC's is about delivering curriculum for learners that focus on environmental and related outcomes. So while EEIS is an important part of their delivery, it represents only a small part of the working year for the participating EEC's. What has been observed is that the EEIS program in its different forms has informed other curriculum offered at the EEC's.

Conclusions

Clearly each of the three models has taken advantage of its local contexts and the personnel available to support its running (school and other experts). The residential nature of the programs has had an attitudinal effect upon participants that has most

significant benefits in terms of learning outcomes – as one participant commented “our experiences of the seven day program will remain with us for life”. On the inputs side, each program has drawn upon the best available human and physical resources. Whole school effects were varied and were more evident in those programs where participants demonstrated keen involvement and where post-program follow up visits by key stakeholders occurred. Model 1’s rural school demonstrated an initial fifty percent reduction in electricity consumption, whilst Model 2 led to strong effects in energy behaviours in the whole of school. For Model 3, in the one school that did follow through post-program, similar positive effects were obtained.

It was demonstrated that the implementation of the Action Plan was still very much a “work in progress” in a number of schools and that this was a significant factor contributing to the program’s success. More participants in the larger schools might lead to a “strength in numbers” effect and help sustain motivation, while suitable participant selection is recognised as a significant factor in promoting energy efficient behaviours throughout the entire school community. Finally, it was found that post-program visits by the EEC’s Principals contributed to participant motivation and improved outcomes. These outcomes have clear implications for continuous quality improvements in the future and for other EEIS type programs. In particular, the consideration of a residential component, whole classes of students with their teachers (say second last year of primary school to follow up in the last year and mentor other students), pre and post residential program school visits by EEC staff to support learning and school curriculum, and most importantly Action Plans that achieve outcomes and are carefully implemented and monitored.

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Appendix A: Example of an Action Plan for reduction in energy usage

Action plan for my school

Critical components:

- **Focus on outcomes** eg. 20% reduction in electricity consumption over next 12 months
- **Whole school community involvement**
- **Turning off lights and equipment when not in use**
- **Keep up the momentum** through ongoing **education** and **curriculum** experiences including information in the school newsletter (e.g. report ongoing performance in relation to targets, talks at school assembly, staff and P&C meetings)
- **School Principal** supporting cleaners, staff and students in energy efficiency practices including purchasing policies
- **Leader roles for students** including energy monitors

We need to actively work towards better outcomes for our environment. While this needs to be pursued vigorously globally and across large regions (for example, the Kyoto agreement of 1993 signed by many nations including Australia to limit greenhouse production and the work of non-government organisations [NGOs]), local action is also a critical part of any strategy to reduce our contributions to greenhouse gasses.

In our energy efficiency in schools program we are focussing on the reduction of electricity consumption. The framework discussed on the program had three areas:

1. Maintenance
2. Technology/retrofitting
3. Education

It involved looking at three key questions:

1. What needs to be done?
2. How will it be done?
3. By whom will it be done?

Strategies to consider as a departure point for ideas included:

Minimising usage of electricity by more environmentally friendly practices of turn off, when not in use, lights [only on when people are in room and agree that artificial lighting is needed] and other equipment (eg. computers, TV's [do not have on "standby"], fridges [over longer holidays], fans, hot water urns [replace with a jug if you can], photocopier). Buying energy efficient equipment to replace old equipment when they come up for renewal is an important contribution to becoming a more energy efficient school. Monitoring progress (through energy audits of consumption of electricity by the school), and policing practices to ensure that energy efficiency is promoted and sustained are important components of a school wide strategy. Having a whole school approach that is agreed on, worked towards and actively promoted by, for example, students and staff is essential to create energy efficiency in schools. A continuing education program that is infused in the curriculum (eg. use the video and booklet distributed to all Queensland schools in 2000: *Power for a sustainable future*), and which orientates new students and staff to the school's energy efficient philosophies and practices will help your school be a leader in reducing electricity consumption and benefiting the environment with less greenhouse gas emissions. Demonstrating to the local community your school's commitment through retrofitting – consider solar panels (financial support maybe available through AGO or utilities – see relevant websites such as www.greenhouse.gov.au). Beyond energy efficiency there are many other

programs that schools may be involved in to, for example, reduce waste, be involved in tree planting programs and learnscape the school to promote positive outcomes for our environment. Remember: if we all do a little bit individually, then collectively we do a lot.

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Appendix B: Overview of one of the EEIS models in the project

Information provided by Greg Hossack, Principal of North Keppel Island Environmental Education Centre

