

# **The Green Fridge Quest - Tertiary Environmental Education for ESD**

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Historically the values of schools and colleges have mirrored those of the larger society. Not only has education uncritically accepted the association of progress and the unfettered growth economy, it has trained engineers and managers, performed the research and developed the technologies which in aggregate have had such a devastating impact on the environment. A fundamental reorientation now needs to occur with the development of new assumptions undergirding education which treat the interaction of ecological processes, market forces, cultural values, equitable decision making, government actions, and environmental impacts of human activities in a holistic, interdependent manner (Berberet in Fien, 1993).

## **Introduction**

The Green Fridge Quest (GFQ) was a collaborative, multidisciplinary research project involving tertiary students and professionals during 1992-93 in the development and promotion of environmentally-friendly methods of domestic refrigeration - ie. methods that are ozone- and greenhouse-safe, energy efficient, recyclable, durable and affordable. The Australian Conservation Foundation (ACF) ran the GFQ jointly with the Centre for Design (CfD) at the Royal Melbourne Institute of Technology (RMIT). This proved to be a natural partnership as the two organisations' share commitment to environmentally-sensitive technology (ie. 'green' technology) and the incorporation of environmental education across the tertiary curriculum. The GFQ received broad support from State and Federal government departments, industry, CSIRO organisations such as the Institution of Engineers Australia (IEAust) and the Australian Consumers' Association (ACA).

The air conditioning and refrigeration industry had become increasingly dependent on ozone-depleting chlorofluorocarbons (CFCs) since their development in the 1930s (and more recently on hydrochlorofluorocarbons, HCFCs and hydrofluorocarbons, HFCs). The environmental dangers of ozone depletion and global warming from these substances is now widely acknowledged. Previously refrigerators relied on other chemicals such as ammonia to reduce temperature.

### **What is Green Technology Anyway?**

Green technology is defined in many ways. A recent discussion paper circulated by the Australian Council for Overseas Aid defines green technology, with particular reference to developing countries. Amongst other criteria, green technology was defined as technology which is people-centred, energy efficient, has minimal acceptable pollution, is conserving of non-renewable resources and encourages women's involvement (Wood, 1993).

The need for green technology is made even more urgent as growing populations in developing countries aspire to the same consumption levels and technological conveniences that industrialised nations have long enjoyed.

### **The Educational Imperatives**

Dallas Kinnear, an environmental educator working with the ACF, was instrumental in maintaining the educational focus of the GFQ.

#### *Environmental Education Across the Tertiary Curriculum*

Environmental education has often been seen as the preserve of biologists, geologists and other 'earth' sciences. There has been confusion as to how environmental principles relate to other disciplines and/or whether environmental education ought to be a discipline in its own right.

There is wide agreement that environmental education has an important role to play in transforming values and empowering people to participate in environmental improvement and protection. Nearly twenty years ago Schumacher (1973) described education as 'the greatest resource' in this endeavour.

Environmental education theory differentiates strongly between education about the environment (eg. teaching environmental facts and concepts), education through the environment (eg. experiential learning through nature) and education for the environment (eg. actively engaging students in the resolution of environmental problems) (Fien, 1993).

It is education for the environment which is seen by many environmental education theorists as the most effective way to make a genuine contribution to environmental well-being since it combines social critique with political and practical action.

#### *Environmental Education in Technical Training*

In contemporary society the importance and influence of the engineering/manufacturing professions is significant. What these workers do - ie. design new products and materials, facilitate the exploration, use and adaptation of natural resources for human needs - has a huge impact on society and the environment. As such the lack of environmental education in technical training is of grave concern. With reference to

engineering education in particular, Dr. Sharon Beder states:

The image of engineering which engineering schools convey is of a field of endeavour that is overwhelmingly concerned with numbers and mathematical analysis. If one studies the course content of most Australian engineering degree courses, one finds an obsession with the technical, the mathematical and the scientific and an almost complete neglect of the social, political and environmental issues (not to mention the managerial and industrial relation aspects) that shape engineering practice in the real world. Where such issues creep into the courses they are usually treated as secondary and even unimportant considerations (Beder, 1989).

A recent (22 Nov. 1993) symposium held at the University of NSW ('Environmental Issues in Engineering Education - Greening Engineering Graduates') acknowledged that today's engineering graduates needed skills which are not being provided by traditional engineering courses. The symposium leaflet declares that:

Prominent among these skills is an ability to practice engineering in a manner that is sensitive to the environment and aware of the tools being developed by many discipline areas - economics, law, management etc. - for environmental management. Equally important is an appreciation of the socio-political environment within which engineering is undertaken.

Activities such as this symposium give hope that engineering training can move towards full integration of environmental and social principles - that is, education for the environment.

#### *Encouraging the Study of Science and Technology*

There is no doubt that one reason that the young - and particularly women - are 'turned off' science and engineering as fields of study is that they perceive these endeavours to be responsible for many of the social and environment ills the planet currently suffers. The lack of women in engineering has been identified as an area of concern by the IEAust.

The incorporation of environmental principles in technical subjects could fuel an upsurge in interest in the study of science and technology amongst today's environmentally-aware youth. And the environment movement can benefit as some commentators believe that it has been the application of science to environmental causes which has brought the movement 'acceptability, even respectability' (Eckersley, 1992) by the wider public.

## **Environmental Imperatives**

The environmental problems inherent to domestic refrigerators addressed by the GFQ were ozone depletion, global warming/energy efficiency and waste minimisation.

### *Ozone*

The hazards of ozone depletion are well known - ultraviolet (UV) radiation causes skin cancer, cataracts and immune deficiency diseases, as well as negatively affecting the growth of plants and the marine food chain. The ozone layer is protected under the international agreement, the Montreal Protocol on Substances that Deplete the Ozone Layer.

Refrigeration and air conditioning technology are now the major use of CFCs, HCFCs and HFCs which are commonly used in the insulating foam and refrigeration cycle.

### *Global Warming*

Predicted consequences of Global Warming include sea-level rise, increased occurrence of bush fires and tropical storms and the shifting of climate zones. These would cause massive disruptions to wilderness and human settlements.

Carbon dioxide (CO<sup>2</sup>), methane, nitrous oxide and CFCs, HCFCs and HFCs are the most common greenhouse gases. CO<sup>2</sup>, the major greenhouse gas, is released when fossil fuels are burnt - primarily coal, oil and gas. Electricity production is the biggest source of CO<sup>2</sup> from human activities. Energy efficiency is central to halting global warming. In many homes in Australia, refrigeration is the second biggest use of electricity after hot water heaters (Greene, 1989).

Though present in much smaller quantities than other greenhouse gases, CFCs/HCFCs and HFCs are significant direct contributors to global warming, trapping between 10,000 - 27,000 times more heat, on a per molecule basis, than CO<sup>2</sup>.

### *Waste minimisation*

Minimising waste in both materials and energy used during the full life cycle of a product - from manufacture to disposal - is central to green technology. Current whitegoods - eg. large domestic appliances such as fridges - are difficult or impossible to disassemble for recycling due to the resins, glues and coatings used.

Some manufacturers have begun recovering and recycling their old appliances. This trend, known as Extended Producer Responsibility (EPR) requires products be 'designed for disassembly' and recycling.

### **Industry Imperative**

The National Commission of the Environment, a private sector initiative convened by the World Wide Fund for Nature in the USA, declared that 'the most important and immediate target of ... environment policy is to encourage the development and adoption of technologies compatible with sustainable development. The Commission also declared that 'highest priority should go to energy efficiency' of equipment and in the production of electricity.

A society pursuing sustainability should reflect this concept centrally in its industrial activity as much as in its education system. This will require change to human values and desires as much as technical innovation.

### *Ecologically Sustainable Development (ESD)*

While there is no universally accepted definition of ESD, it is most often understood to mean development which aims to meet the needs of people today, while conserving ecosystems and resources for the benefit of future generations (National Strategy for Ecologically Sustainable Development, 1992).

In 1992 the National Commission of the Environment put forward ESD policy recommendations for the national government. A key recommendation is that all sectors of the community - schools, families, religious organisations, the media, business, and government - cooperate to develop an 'environmentally literate citizenry'. State and local governments should continue to develop and institute 'interdisciplinary environmental curricula' in education at all levels and fund environmental education initiatives.

Unfortunately, this has rarely been the case, particularly at the tertiary level, where the restrictions of academic disciplines make it especially difficult to develop an interdisciplinary approach to learning.

The GFQ, by assisting and motivating industry to develop environmentally-safe refrigeration technology, is one step towards attaining ESD. It also suggests a new understanding of environmental education as essentially 'education for ESD'.

### **The Imperative of Consumer Acceptance**

Many of the obstacles to a green fridge becoming commercially available are non-technical and may have more to do with industry concerns about consumer acceptance than a lack of 'know-how'. A purely technical solution fails to recognise that changing behaviour can be more effective in protecting the environment. For example, the behaviours of recycling and car pooling, if widespread, have the potential to bring about great environmental benefits without major technical innovation.

The concept of the 'e-con' being developed by the EcoDesign Foundation is defined as anything which functions as shorthand for the importance of green technology in everyday life. The fridge has become a symbol of affluence in many developing countries and a popular icon in Western homes, adorned with inspirational messages, grocery lists, children's artwork - all held on by the latest gimmick in fridge magnets. Fridges are the modern day hearth - associated with food, sustenance, comfort and security. By redefining objects such as the common home fridge along environmental lines a powerful environmental symbol, or 'e-con', is created.

### **Aims of the GFQ**

- 1) Encouraging the incorporation of environmental education principles across disciplines at the tertiary level, particularly in engineering and technical training;
- 2) Encouraging young people to apply their tertiary training in science, technology and the social sciences to solving environmental problems;
- 3) Fostering collaboration between industry, tertiary institutions, government and community in the development of green technology;
- 4) Demonstrating Australia's national commitment to Ecologically Sustainable Development;
- 5) Inspiring industry to develop and market environmentally safe products; and
- 6) Promoting consumer demand for green technology.

### **Major Events of the Quest**

The following is a brief description of the major events of the GFQ in (roughly) chronological order.

GFQ Launch at Students, Science & Sustainability Conference - 24 -26 April 1991 - Australian National University - This conference brought together tertiary students who shared a common concern about the role of science - and students - in achieving ESD.

Green Fridge Quest Newsletters (No. 1-5), Feb. 1992. The first of 5 newsletters was published in February 1992. Newsletter No. 1 included technical specifications.

Ozone Protection for the 90s - A South Pacific - South East Asian Workshop, March 1992 - A talk about the Green Fridge Quest was presented to this Workshop which included delegates from developing countries in the South Pacific and South East Asia. Information materials were available at the ACF booth. ACF, in conjunction with the GFQ, assisted non-government delegates, from Australia and overseas, to attend the workshop which otherwise would have been totally and industry/government affair.

Tertiary Educator's and Industry Seminar - Friday, 17 July 1992, Centre for Design at RMIT- A one day workshop attended by tertiary lecturers and industry representatives at which links were forged between industry and academia. A variety of papers were given including 'Assessment of Tertiary Projects' and 'Designing for a "Green" Market'. Feedback was sought on how to best achieve the educational aims of the GFQ.

**Media Coverage** - Throughout the GFQ media attention was sought and achieved. This included TV, radio and press coverage.

**Master Class Workshop of the Green Fridge Quest** - 22 November 1993, National Science & Technology Centre - The final event of the GFQ at which selected participants presented their work to an expert panel and audience made up of industry, tertiary and non-government representatives. The event was opened by the Hon. Ros Kelly, former Minister for the Environment and closed by Hon. Ross Free, Minister for Schools, Vocational and Technical Training [representing the Hon. Kim Beazley, (former) Minister for Employment, Education and Training]

**Commercial follow-up** - At this writing the ACF is investigating the viability of product endorsement and/or licensing of one successful design presented at the Master Class Workshop.

## **Evaluation**

The research needed for social practice can best be characterised as... a type of action research, a comparative research on the conditions and effects of various forms of social action, and research leading to social action. Research that produces nothing but books will not suffice (Lewin, K. in Zuber-Skerritt, 1991).

### *Action Research*

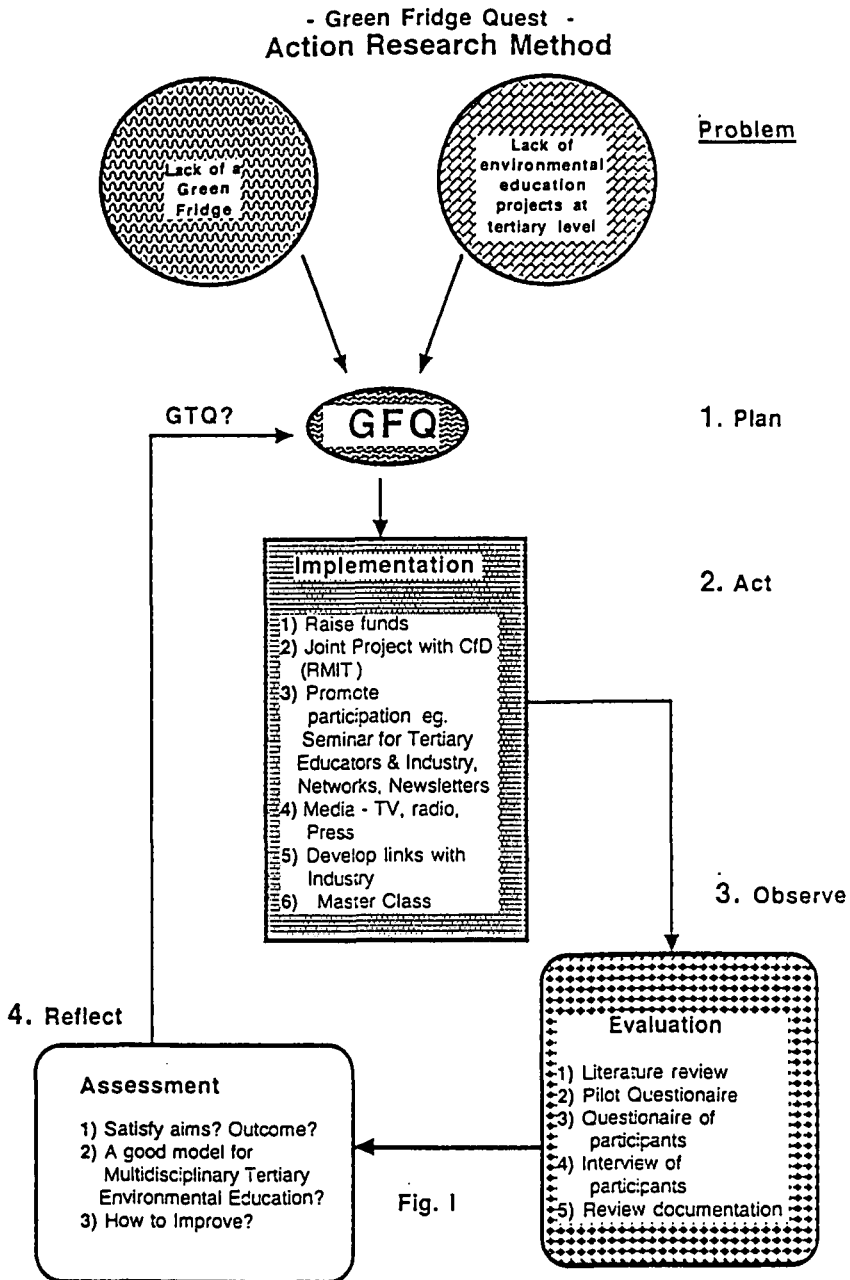
Action research attempts to combine practical concerns with the goals of social science by linking knowledge, action and outcomes in a way that allows extrapolation beyond the immediate situation (Morgan, 1983).

The methods used in the development and evaluation of the GFQ have been those of action research (See Fig. 1):

- 1) a real-life problem was identified, eg. lack of a 'green' domestic refrigerator on the market and lack of education for the environment at the tertiary level;
- 2) a plan was developed which addressed both problems, eg. the Green Fridge Quest with both professional and student categories;
- 3) action was taken to implement the plan, eg. fund raising, newsletters, etc.
- 4) an evaluation of the GFQ was performed; which led to
- 5) improving the approach for future 'Green Technology Quests'. (GTQs)  
(based on Zuber-Skerritt, 1991).



**Fig. 1**



The GFG aimed to be a collaborative process, another characteristic of action research. The organisers of the GFG did not claim to have the 'right' answer to the problem(s) and the students' and professionals' contributions



were central to the outcomes, both in terms of developing a new way of doing environmental education at the tertiary level and in developing a new environmentally-friendly refrigerator. Participants were given the opportunity to present their work at a final Workshop where they were the 'stars', not the passive recipients of information. By their involvement, the participants contributed to the wider action research experiment of the GFQ itself.

#### *Case Study Method of Evaluation*

The case study method was used as the basis for evaluating the GFQ. Case study method is essentially a qualitative approach which uses a variety of sources of information to arrive at an in-depth picture of a program or activity.

O'Hearn (1982) points out that when smaller numbers of subjects are involved, case studies are particularly appropriate. (In this instance 25 questionnaire responses were analysed and seven interviews performed.) In such settings it is often more informative to document the event in terms of what actually happened, rather than embarking upon a statistically driven experimental design more appropriate to a large population.

House (1980) sees the aim of the case study approach as improving understanding of the program and in improving the program itself, rather than explanation or propositional knowledge. Such an approach is rooted in the practical arts where the aim 'is to get things done' and clearly complements the goals of action research. Case studies also tend to focus on the program process itself and how people view the program. This is consistent with the aims of the GFQ evaluation, which is evaluating program success, not individual participants' attainment.

As pointed out by Thomas (1989a), programs in environmental education are generally complex. Thomas sites some of the strengths of the case study method. Case studies:

- 1) are 'strong in reality' whereas other research data are usually easily organised but often unrealistic;
- 2) allow useful generalisation to similar situations;
- 3) establish an archive of descriptive material;
- 4) are accessible to the public;
- 5) begin in and contribute to a world of action and
- 6) allow multiple source of data.

The data collection techniques used were:

- 1) general questionnaire;
- 2) in-depth interviews of representative participants and contributors and
- 3) review of records.

### **Summary of Outcomes**

The GFQ achieved environmental protection through three main avenues: environmental education, promotion of technical solutions, industry and consumer awareness.

These achievements are outlined below.

#### *Environmental Education*

The GFQ involved over 100 tertiary students in 1992-93 in a rewarding and innovative experience of multidisciplinary education for the environment. These students were drawn from a range of disciplines - engineering, public relations, marketing, industrial design and psychology. In the process collaboration was fostered between industry, tertiary institutions, government and the community in the development of 'green technology'. Some examples of student projects follow:

- 1) **Community Attitudes to purchasing a 'Green Fridge'**. Third year social psychology students interviewed over 400 people and conducted focus groups to determine attitude and behaviour to purchasing a 'Green Fridge' in relation to gender, occupation, education and income.
- 2) **Propane in domestic refrigeration** - Theoretical and experimental investigation of propane as a refrigerant in domestic refrigeration/freezers using computer modelling.
- 3) **Marketing** - Marketing students designed and staffed a GFQ display booth at the Great Australian Science Show and designed original GFQ publicity leaflet.

Specific recommendations for improvement of the process resulted from the formal evaluation of the GFQ. These included the need to: increase and make more timely the information provided to academics (eg. through provision of information kits); work more closely with organisations such as IEAust and ACA; run annual Green Technology Quests (GTQ) modelled after the GFQ; increase focus on the social considerations and impact of technology innovation; enhance the multidisciplinary and intersectoral approach in future GTQs; provide more feedback to participants.

Extensive networks, awareness and support have been established amongst tertiary lecturers, further encouraging the incorporation of 'education for the environment' across disciplines. Both students and lecturers would like to see the continuation of GTQ projects.

#### *Promotion of Technical Solutions*

The GFQ provided a platform from which to publicise technical solutions, both current and potential. Examples include: a thermoelectric refrigeration system from Hydrocool Pty Ltd and the 'Greenfreeze' propane refrigerator promoted by Greenpeace. The Hydrocool system will

be featured in an upcoming episode of 'Quantum', the ABC TV science and technology program.

The ACF continues to promote commercialisation of technologies uncovered by the GFQ.

### *Industry and Consumer Awareness*

Major whitegoods manufacturers such as Email and Fisher Paykel have confirmed that the GFQ, along with other influences, served to promote their recent development and commercialisation of more environmentally friendly domestic refrigerators.

The GFQ has helped to establish the home fridge as an 'e-con' - a popular symbol of green technology. Submissions to the GFQ such as the Green Fridge Quest poster designed by RedPlanet Printers and the behavioural research carried out by Victoria University of Technology psychology students have assisted this.

Media coverage of the GFQ has informed consumers about the environmental concerns around domestic fridges and contributed to increasing consumer demand for green technology.

### **Conclusion**

The GFQ has been an innovative and empowering way to involve tertiary students in education for the environment - and in education for ESD, increased community awareness of the environmental shortcomings of current fridges and motivated industry to provide 'green' products. As a model for future GTQs it has provided a solid basis for continuation and improvement of this type of tertiary-level environmental education project.

NOTE: The Final Report of the Green Fridge Quest is available for \$10 from either the Australian Conservation Foundation (GPO Box 2699 Canberra 2601) or the Centre for Design at RMIT (GPO Box 2476V Melbourne 3001)

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