

Renewable Energy Education

An Essential Foundation for Market Development

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Abstract

Renewable energy technology is developing rapidly but there are still substantial social, economic and political barriers which are impeding its wider use. One of these is the perception that it is too expensive, and another is that it is unreliable. Other obstacles include vested interests and traditional practices which favour the use of fossil fuels.

Education is a powerful agent of social change and it can contribute substantially to the development of the renewable energy industry. However this will require a substantial investment by companies and Governments in education programs aimed at producing the expertise to deliver and maintain high quality renewable energy systems. Flexible, multilevel educational courseware is urgently needed to train energy professionals and to raise consumer awareness.

The Australian Cooperative Research Centre for Renewable Energy (ACRE) was established to help develop an internationally competitive Australian renewable energy industry. Part of its task involves the development of educational programs for training engineers, scientists and policy makers in renewable energy technology. It also aims to develop the market through the provision of information to schools and the general community. This paper describes the approach, objectives and anticipated outcomes of ACRE's Education Program.

1 INTRODUCTION

The use of renewable energy is growing rapidly as the technology matures. This trend is expected to escalate as a result of technological developments and international efforts to reduce greenhouse gas emissions. The growth of the renewable energy industry is dependent on high quality products and the availability of educational services specifically directed towards renewables. We urgently need more scientists and engineers to develop renewable energy systems and to take advantage of new developments in this technology. Many technicians will be required to install, maintain and repair renewable energy systems. Teachers need in-service training to acquaint them with renewable energy and courseware is required for them to use in schools. The public also needs up-to-date, independent advice about renewable energy systems. This is essential for building confidence in the ability of renewable energy to meet our needs.

The sudden surge of growth which has occurred in the industry over the past five years has emphasized the need for more educational programs. Utilities and industry are finding it difficult to recruit staff who are qualified to design and maintain renewable energy systems. Developing countries are turning to renewable energy as a clean, reliable option for their rural electrification programs but they are limited by a shortage of appropriately trained engineers, technicians and policy analysts.

Industry and government need staff with experience in energy management and they are looking for short training courses where their technical staff can acquire these skills. These courses need to meet defined international standards to ensure that renewable energy systems are of acceptable quality and are sustainable in the field.

The public demand for information about renewables is enormous but little is being done to service it. This is a short-sighted policy because public confidence is essential for the continued growth of the industry. There is currently a high level of public support for renewables but there is a lack of detailed knowledge about the options available and their relative costs.

As concern about global warming and climate change intensifies, society is demanding greater efficiency in energy production and use. Demand management is a very effective way of reducing electricity costs and greenhouse gas emissions. Renewable energy technology also offers the opportunity to displace fossil fuels and it is likely to have a major role in our future energy supply (ESD Working Group, 1992).

The Australian Cooperative Research Centre for Renewable Energy (ACRE) is part of the Australian Government's Greenhouse Response Strategy (Australian Government, 1995). It was announced in March 1995 as part of a package of measures called Greenhouse 21C which were designed to supplement the 'no regrets' measures in the original Greenhouse Response Strategy (National Greenhouse Steering Committee, 1992). The Australian Government was one of the first nations to sign the United Nations' Framework Convention on Climate Change which was adopted at the Earth Summit in Rio de Janeiro in June 1992. This treaty commits signatories to progressively reducing greenhouse gas emissions below current levels in order to prevent rapid climate change.

ACRE was established in July 1996 following competitive bids by four consortia. The Centre is hosted by Murdoch University and involves 21 participating organisations from three States and two Territories and New Zealand. Industry and the utilities have a major role in ACRE in addition to University staff and students.

ACRE is managed by a private company, called ACRE Ltd, of which the participants are the shareholders. The interaction of University, utility and industry staff under the umbrella of ACRE produces synergies which assist the commercialisation of new technology.

ACRE is also committed to addressing the social and environmental issues raised by global warming by developing and commercialising high quality renewable energy systems and promoting energy efficiency. A crucial part of this mission is to provide educational services to support this new technology and to build public confidence in renewable energy systems.

2 THE ROLE OF EDUCATION

Education is a powerful agent of social change. It raises awareness of new developments and provides training for the practitioners who are responsible for the implementation of new technology. Community education can create confidence in a new product and train the public to use it effectively. Educational programs have been a vital part of the development of the computer industry and the automobile industry for example.

Education also has a vital role in the development of the renewable energy industry, although so far very little recognition has been given to it by the industry or Government. In some circles it is considered to be an expensive luxury and less important than technological development. This is a fundamental misconception which is impeding the growth of the industry. Education, information and training are an integral part of the industry and must be given a high priority in the business plan of all firms involved in the renewable energy industry.

Education can assist the development of the industry in the following ways.

1. It promotes greater public awareness of the technology and confidence in using it.
2. The availability of technical advice and support services is essential for industry.
3. Education should be combined with a demonstration program to build confidence and awareness of the technology.
4. Education can provide a pool of trained researchers to continue the development of the technology
5. Trained technical support staff are essential for installing, repairing and maintaining renewable energy systems.
6. People need to be aware of the technology and have the confidence to use it where appropriate.

Some effort has been made in recent years by a number of organisations to address these educational needs. Several State Government agencies, such as Energy Victoria and the Renewable Energy Advisory Council of WA, have published fact sheets and teachers kits on a variety of topics. The Solar Energy Industries Association of Australia has developed training packages for installers of systems. Several TAFE Colleges have developed training courses based on the SEIAA curriculum plus additional topics. Several Universities have developed units in renewable energy topics but little progress has been made in defining an appropriate curriculum or in coordinating these offerings.

The World Solar Summit, sponsored by UNESCO, has recently attempted to develop a tertiary level curriculum with appropriate textbooks and supporting materials. This project is still in progress and the results so far are impressive. The International Solar Energy Society has given some attention to the development of standards for training courses and moves are underway to establish international accreditation schemes for such courses. ISES is also working with UNESCO to establish the International Renewable Energy Information and Communication System (IREICS) on the internet.

In Australia, ANZSES has held several workshops on education and has attempted to promote cooperation and dialogue between renewable energy educators

ACRE plans to build on this foundation and work towards a comprehensive, integrated approach to renewable energy education. In doing this it will utilise existing materials wherever possible and cooperate with other agencies to avoid duplication of effort.

3 OBJECTIVES

The ACRE Education Program aims to address the need for renewable energy education at all levels from primary school to continuing professional development. Outside the formal education system it also provides information for the community and helps to develop confidence in renewable energy products. It attempts to reach the widest possible audience using the most cost-effective means. This implies the use of modern educational technology and cooperation with international educational networks and training agencies.

The Program draws heavily on the research programs of ACRE. It cooperates with other agencies, particularly the utilities, in providing information about renewables, energy management and greenhouse issues. It has a role in publicising the demonstration projects and products of ACRE and it assists with the recruitment and training of research students for the technical programs.

Good communications within ACRE are essential for its success and the Education Program has a major role in producing newsletters and information for participants, most of which are transmitted by the internet (see. <http://wwwphys.murdoch.edu.au/acre/>).

Consistent with the commercial focus of ACRE, the Education Program aims to generate significant income from course fees, grants and the sale of educational materials. This is an ambitious goal because Australians are unaccustomed to paying the full cost of education and training. However ACRE is partially subsidised by the in-kind contributions of the participants and this helps to make this objective achievable.

The goal of the program is to provide a commercially viable service in education, information and training which is sensitive to market needs and national objectives. In doing this it draws on the expertise of the participants in the CRC and the wider community.

ACRE's Education Program aims to achieve this goal by :

1. promoting the development of the market for renewable energy through the provision of information about ACRE products and renewables in general
2. developing appropriate education and training courses to address the needs of ACRE and the community
3. making these courses available to the widest possible audience via the internet and agreements with education and training agencies
4. promoting the exchange of relevant information within ACRE and to its customers and supporters
5. cooperating with other organisations with compatible objectives in promoting the development of the renewable energy industry.

4 APPROACH

Our research has identified a number of specific market demands and community needs which we wish to address. The Australian Government has also set certain educational goals for us which we have agreed to address (DIST, 1995). They are :

1. postgraduate research training with industry placements
2. university courses in renewable energy technology, energy policy and greenhouse issues. This includes coursework in several disciplines at the undergraduate and postgraduate levels.
3. short courses and workshops for in-service training of personnel from industry and government.

4. courseware and hardware for use in energy education in schools and universities. This covers both technical training and general awareness raising aspects.
5. promotion of the applications of renewable energy technology via demonstrations and information about issues and products.
6. facilitation of the flow of information into, within and out of ACRE.

This approach will not meet all market demands for educational services. It is designed to assist ACRE to fulfil its mission by training people to develop and use renewable energy systems. It is also directed towards those areas which are likely to be financially viable beyond the seven-year life of the Government funding. Activities such as information and demonstration are only undertaken if sufficient funding is available from external sources such as industry and utilities. The use of the internet facilitates the provision of information to a national and international audience.

The development of information and courseware for schools is an important part of the development of markets for renewable energy systems. However this is a very expensive task and ACRE is focusing its efforts on developing courseware which supports market development for its products. Professional development workshops for teachers are used in preference to direct teaching of classes in schools.

5 CONTENT

The Education Program contains five projects, each of which has a project team containing several participants. Most of the projects operate on a national basis drawing together participants with interests and expertise in that area. Industry and the utilities have a major role in the delivery of the program as well as academics. New participants are welcome if they can add additional relevant expertise and/or bring additional funds to ACRE.

The initial projects in the Education Program are :

5.1 Postgraduate Training

This includes research training with placements in industry with students working on projects within ACRE's technical programs. This is a key feature of the collaborative relationship between the public and private sectors which characterises Cooperative Research Centres. Generally research students work in industrial laboratories for part of their studies and they have both academic and industrial supervisors. This should benefit both industry and the students by ensuring that their work is relevant to the needs of the industry.

A Postgraduate Diploma, two Postgraduate Certificates and a coursework Masters' degree are also offered through Murdoch University focusing on renewable energy technology, energy efficiency and energy policy and planning. This coursework degree is available for internal and external study using on-line presentation and the major market is fee-paying energy professionals who require training in renewables. The MSc includes a dissertation which may involve on the job training or an industrial placement.

5.2 Undergraduate Studies

This project involves the development and use of courseware for undergraduate education in science, engineering and social studies. The courseware will be developed by several of the participating Universities and will be tested by them before it is offered to other ACRE participants. Eventually it will be sold to other universities in Australia and overseas. This project will address the market need for trained professionals to design, build and operate renewable energy systems. Some of the undergraduate units are intended for inclusion in University courses to ensure the graduates are familiar with renewables and energy efficiency.

5.3 Short Courses

Industry and government have expressed a need for short courses and workshops on technical and policy issues. Postgraduate students in ACRE will also receive instruction on thesis writing, technical reports, project planning and conference presentations. This project will offer a variety of courses to cater for this diverse clientele which includes practising scientists, engineers, energy managers and technicians. It will also cater for the needs of the Australian renewable energy industry for in-service training, particularly of technicians to support the growth of the market. These courses are currently offered at Curtin University in Perth and at the University of NSW however developing countries are also experiencing a shortage of trained personnel to service their rapidly growing renewable energy industries and these courses may be offered at overseas venues also.

Currently short courses are planned or have been offered on topics such as remote area power supply systems, energy management in commercial buildings, passive solar design, grid-connected renewable energy systems, battery maintenance, installation and maintenance of renewable energy systems and wind site selection.

5.4 Community Education

There is a substantial demand from the community for reliable information about greenhouse issues and renewable energy. This includes all aspects of energy generation, storage and power conditioning plus energy management and energy efficient appliances. Some of the ACRE participants are already active in this area and ACRE will co-ordinate and extend these efforts. ACRE caters to a wide section of this market by providing information on the internet and by distributing information about its demonstration projects. Other activities will depend on locating appropriate sponsors.

5.5 School Education

This is another major area of demand which is being under-served at present. ACRE's efforts are focused on collecting and reviewing existing resources. Those judged to be suitable will be tested in schools and distributed throughout Australia. These materials include experiments, demonstrations and lesson plans which have been developed for educational use in Australia and overseas. The project will focus on developing a small portfolio of high quality courseware suitable for Australian schools and train teachers to use it. This project is currently operating in NSW, WA and the ACT. The availability of external funding will determine the scope of this project and the areas which benefit from it.

Other educational projects have been discussed by the participants and they will be offered if additional funds become available to support them. They include conferences and workshops and the extension of the educational program to other States and Territories.

6 PROPOSED OUTCOMES

These projects aim to address specific national objectives and market needs. They will also contribute to the quality of the research work in ACRE by disseminating information and training postgraduate students to maximise their performance.

It is anticipated that the Education Program will contribute to the success of the industry and ACRE in the following ways :

1. training researchers who will work with industry to develop new systems and applications
2. training professional people who are familiar with renewable energy systems and their applications;
3. training users and installers of renewable energy systems
4. promoting the development of the renewable energy industry through the provision of information about renewable energy technology
5. building public confidence in renewable energy systems through demonstrations and information.

7 CONCLUSIONS

The Australian Cooperative Research Centre for Renewable Energy draws together staff and resources from across Australia to provide high quality renewable energy systems. The Education Program of ACRE assists this effort by training professional researchers and keeping industry and Government abreast of new developments. It will also help to develop market demand by providing accurate, independent information about renewable energy systems and greenhouse issues. The Education Program aims to generate a substantial proportion of its funding from fees, external grants and sponsorship. An active education and information program is considered to be a vital component of the strategy for developing the renewable energy industry in Australia.

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9 REFERENCES

Australian Government (1995), Greenhouse 21C Package, *Media Statement by the Minister for the Environment*, 29 March 1995.

Department of Industry, Science and Technology (1995), *Cooperative Research Centres Program : 1995 Special Selection Round*, Canberra.

Ecologically Sustainable Development Working Group (1992), *Greenhouse Report*, Australian Government Publishing Service, Canberra.

Inter-Governmental Committee on Ecologically Sustainable Development (1995), *Progress in Implementing the National Greenhouse Response Strategy and Issues to be Considered in the 1996 Major Review of the NGRS*, Department of the Environment, Sport and Territories, Canberra.

National Greenhouse Steering Committee (1992), *Draft National Greenhouse Response Strategy*, Australian Government Publishing Service, Canberra.