



New directions in renewable energy education

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ABSTRACT

The renewable energy industry is growing rapidly amidst rising concerns about oil depletion and climate change. Renewable energy is seen by many as part of the appropriate response to these concerns and some national Governments have put programs in place to support the wider use of sustainable energy systems. This has led to a rapid increase in demand for renewable energy specialists who are able to design, install and maintain such systems. Most engineers are not trained to use these renewable energy technologies and most are not aware of the principles of sustainability. There is therefore an urgent need to develop and implement new courses that prepare engineers, scientists and energy planners to work with renewables to produce sustainable energy generation systems.

Renewable energy education is a relatively new field and previously it formed a minor part of traditional engineering courses. These days it has an identity of its own, with special techniques, standards and requirements which are not normally encountered in other disciplines. Attempts to add one or two units of study on renewables into traditional science and engineering degrees are unlikely to produce graduates with sufficient knowledge or understanding to use renewables effectively. Modern renewable energy education includes a study of the technology, resources, systems design, economics, industry structure and policies in an integrated package. This prepares the graduates to design sound systems from amongst the range of options available. There are more pitfalls in the use of renewables than there are in using the more mature conventional technologies and systems. Designers, installers and service personnel need to be particularly aware of the industry and the characteristics of the various firms and their technologies.

Over the past decade several new approaches have emerged to renewable energy education that seek to address the needs of the 21st century for sustainable energy supply systems.

This paper will describe the aims, philosophy, structure and outcomes of several of these initiatives. It includes courses in renewable energy science, renewable energy engineering, renewable energy policy and planning and renewable energy technician training. The paper will also describe some aspects of the training of researchers in cooperation with the renewable energy industry.

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1. Introduction

Energy is an essential commodity in modern industrial society. It powers our homes, workplaces, transport and communications systems. It is an issue that affects everyone, yet one which is often poorly understood, until an energy crisis arrives.

We are clearly living in the midst of an energy crisis that seems unlikely to go away. There is unprecedented concern about fuel prices and oil depletion. There is also a high level of concern about global warming and how best to respond to it.

Many people are concerned about these problems and wish to address the symptoms as a matter of urgency, but few understand the basic causes of the problems and consequently fail to realise that fundamental social and technological changes are required to overcome them. Our education system has failed to give us a basic

understanding of energy supply options and their impact on society and the environment.

Many excellent courses have been developed to train engineers and technicians to design, install and maintain conventional energy systems. However, these systems are now the subject of controversy over issues such as global warming, energy security, public health, air pollution, waste disposal and ecological damage.

As a result of these concerns many nations are attempting to replace conventional power stations with renewable energy systems. The international community has taken the first steps towards cutting greenhouse gas emissions and the UN Commission on Environment and Development has urged all nations to adopt processes of ecologically sustainable development [20] (UNCED, 1992).

Some areas of renewable energy are experiencing rapid growth in demand as a result of supportive policies by governments (e.g. Germany, Japan, Netherlands, Denmark, Spain) and this is leading to larger scale production and falling prices for new renewable

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energy systems. Simultaneously the prices of some fossil fuels are rising and this is creating a more attractive market for renewables. In the last five years there has been a worldwide boom in the wind industry and solar PV power is thriving also in Western Europe.

However, this rapid growth has exacerbated the problem of a serious shortage of skilled professionals, with experience in renewables. The type of person in demand includes designers, installers, service and sales representatives, policy analysts, scientists, engineers, teachers and researchers. Without them the quality of systems may be compromised and the demand for renewables may be adversely affected as a result [6].

A recent survey of users of hybrid remote area power supply systems (RAPS) found that only two thirds of them were in working order at the time of the visit. Many users expressed disappointment with the product and many said that better education and training of the users and installers was essential [8]. Poor quality systems and unrealistic expectations of users can give renewable energy systems a bad reputation and lead to market rejection of the product. This is an issue that education and standards can effectively help to address.

However, the surge of demand for renewable energy systems over the past five years has caught us unprepared. Few expected such a rapid increase in demand and few had been planning to develop the capacity to train the professional people needed to launch the industry into this new phase. As a result many firms are unable to recruit people with the full range of skills required to design and implement sustainable RE-based power generation systems.

Now that it is clear that a fundamental shift in energy markets is under way, a major effort is developing to train the new professionals needed to introduce the new technologies. These people are not the electrical engineers of yesterday, with a slightly different training. They are a new breed who understand the new technologies and the appropriate roles for them in the society of the future. They require a broader training in social, economic and environmental issues than the current professionals who design and operate today's conventional power supply systems [4].

2. The role of education in the renewable energy industry

Education has a vital role to play in the development of a sustainable society. It is a powerful agent of social change, it raises awareness of new developments, it provides training for the professionals and it trains researchers who will develop the next generation of systems and devices.

In addition community education creates confidence in the new products and trains the public to use them effectively. The need for education of the community and the vital role it plays in market development and in building confidence in renewable energy has often been neglected by the renewable energy industry. Education, however, plays a central role in the development of new high technology industries as the examples of the computer industry and the aircraft industry clearly illustrate.

Education also has a crucial role in the development of the renewable energy industry [4]. It is not the only ingredient needed for success, but it performs several vital functions including:

- promotion of greater public awareness of the technology;
- development of consumer confidence in the technology;
- training of technical support staff, who are essential for designing, installing and maintaining high quality renewable energy systems;
- initial training of engineers, scientists and researchers who will develop new systems, devices and technologies for the industry;
- training of policy analysts who are knowledgeable about the industry and are able to produce effective policies for industry development; and

- training of people who will provide advice and assistance to future customers of the industry.

Experience shows that those firms that have given adequate attention to these issues have thrived in the highly competitive, high technology market place, while many of those that have ignored the need to invest in information and education have failed in spite of having good products for sale.

3. The educational needs of the RE industry and society

As a result of our surveys and enquiries, we have identified the following needs for renewable energy education [7]:

- retraining of professionals who wish to move into the renewable energy industry;
- retraining of technicians and tradespeople who wish to work in this field;
- initial training of scientists and engineers to design and develop new RE systems;
- training in renewable energy technology and policy for financiers, investors and policy analysts;
- short, in-service, professional development courses on aspects of renewable energy technology and policy;
- lessons and resources for schools on energy issues; and
- contemporary information about renewable energy technology for the general public.

Such information and training should not be confined to technology or policy issues. Because of the context in which renewable energy is developing, it is essential that training should address economic, social and environmental issues arising from the technology as well. Renewable energy systems are expected to provide sustainable solutions to energy supply requirements. Therefore it is essential that designers of such systems are fully aware of the philosophy and practice of ecologically sustainable development [6,2,16].

4. New approaches to renewable energy education

Over the past decade there have been several innovative developments in renewable energy education that attempt to address the needs of industry and the public aspirations for sustainability and greenhouse gas abatement. There have been a number of important renewable energy education initiatives in Australia in recent years some of which are internationally significant. I will not attempt to review this entire field but I will focus on several key examples of new approaches to renewable energy education.

4.1. Technical education

The Brisbane and North Point Institute of technical and further education (TAFE) has offered a Certificate IV in Renewable Energy Since 1988. Trevor Berrill and colleagues at BNPIT have produced learning packages to support this course. The Business Council for Sustainable Energy (BCSE) supports this course as the preferred pathway to accredit industry system designers and installers. These materials are used in a number of TAFE colleges across Australia. They have also converted their learning package to a flexible learning format to accommodate short courses and distance education. The BNPIT package has been adopted nationally by the National Training Authority and this has greatly assisted the renewable energy industry by providing a thorough, high-quality and nationally-accredited package for training the additional technicians and tradespeople needed to support the growth of the industry.

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