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Renewable Energy Courses in Australian and New Zealand Universities

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Abstract

Renewable energy is a rapidly developing industry and its growth is dependent to a large extent on the availability of skilled personnel to design, install and maintain systems. Energy policy and planning is also crucial for the development of the industry and analysts are needed with broad interdisciplinary skills in technology, economics and social and environmental sciences. Energy efficiency and energy management are also closely related to renewable energy and both are part of the international effort to limit global warming and conserve fossil fuel resources. The demand for skilled people in all of these areas currently exceeds supply by a considerable margin. This article reviews the state of renewable energy education in Australian and New Zealand Universities and identifies areas where further funding and development are required.

Introduction

Over the past five years the renewable energy industry has made considerable advances in Australia and New Zealand. This is partly due to the mandatory renewable energy target and partly to the development of the technology. Many firms and Government agencies are now seeking qualified energy professionals to assist them with their RE projects. Some State Governments have introduced MRETs that go well beyond the 2% mandated by Commonwealth law. Energy efficiency programs are also being introduced nationally and many firms and consultants are recruiting energy auditors and planners to assist with the development of these programs.

In response to this demand, Australian and New Zealand Universities have expanded their existing courses in energy studies and renewable energy engineering and several new courses have been introduced. Many Universities also offer some coverage of renewable energy and energy efficiency as part of their science and engineering degree courses.

Energy policy is also an area of strong demand in the employment market and several Universities are now offering courses in this area. However there is an acute shortage of energy economists and energy planners at present.

Approach

We have conducted a survey of the RE courses offered in Australian and New Zealand Universities to make the RE community aware of the developments that are occurring in this field. We contacted all Universities that have significant offerings in this field and collected data about the courses offered, the specializations available, the date of establishment of the course, the contact person and the website for further information. We have classified the courses available as undergraduate (Table 1), postgraduate by coursework (Table 2) and postgraduate by research (Table 3).

Table 1: Undergraduate level courses in Renewable Energy in Australia and New Zealand

Institution	Degree/Award Offered	Major or Specialisation	Contact Person	Date of Estab.	URL
Australian National University	Bachelor of Engineering	Sustainable Energy Systems	Andres Cuevas	2000	http://solar.anu.edu.au/level_1/
Murdoch University	Bachelor of Engineering	Renewable Energy Engineering	Gareth Lee	2001	www.eepe.murdoch.edu.au
Murdoch University	Bachelor of Science	Sustainable Energy Management	Philip Jennings	2002	www.eepe.murdoch.edu.au/
Otago University	Bachelor of Science	Energy Studies	Bob Lloyd	2000	www.physics.otago.ac.nz/
Otago University	Bachelor of Applied Science	Energy Management	Bob Lloyd	2000	www.physics.otago.ac.nz/
University of New South Wales	Bachelor of Engineering	Photovoltaics and Solar Energy	Stuart Wenham	2000	www.pv.unsw.edu.au/

Table 2: Postgraduate degrees by coursework in Renewable Energy in Australia and New Zealand

Institution	Degree/Award Offered	Years of Study	Specialisation	Contact Person	Date of Estab	URL
Curtin University of Technology	Master of Engineering Science	1	Renewable Energy Engineering	Chem Nayar	1999	www.ece.curtin.edu.au
Massey University	Master of Technology	1	Renewable Energy	Ralph Sims	2001	http://infoscience.epfl.ch/
Monash University	Postgrad Certificate	0.5	Solar PV Energy Engineering	Ahmad Zahedi	2005	www.ecse.monash.edu.au/
Murdoch University	Postgraduate Certificate	1	Energy Studies	Philip Jennings	1998	www.eepe.murdoch.edu.au
Murdoch University	Postgrad Diploma	1	Energy Studies	Philip Jennings	1992	www.eepe.murdoch.edu.au
Murdoch University	Bachelor of Applied Science	1	Energy Studies	Philip Jennings	1998	www.eepe.murdoch.edu.au
Murdoch University	Master of Science	2	Renewable Energy	Philip Jennings	1998	www.eepe.murdoch.edu.au
Otago University	Master of Applied Science	2	Energy Management	Bob Lloyd	2000	www.physics.otago.ac.nz/
Otago University	Master of Science	2	Energy Studies	Bob Lloyd	2000	www.physics.otago.ac.nz/
Otago University	Graduate Diploma of Science	1	Energy Studies	Bob Lloyd	2000	www.physics.otago.ac.nz/
Massey Universtiy	Postgraduate Diploma in Technology	1	Energy Management	Ralph Sims	2003	http://energy.massey.ac.nz/
Massey University	Master of technology	2	Energy Management	Ralph Sims	2003	http://energy.massey.ac.nz/
Royal Melbourne Institute of Technology	Graduate Certificate	0.5	Sustainable Energy	John Andrews	2006	http://mams.rmit.edu.au/
Royal Melbourne Institute of Technology	Graduate Diploma	1	Sustainable Energy	John Andrews	2006	http://mams.rmit.edu.au/
Royal Melbourne Institute of Technology	Master of Engineering	1.5	Sustainable Energy	John Andrews	2006	http://mams.rmit.edu.au/
University of Melbourne	Graduate Diploma of Engineering Studies	1	Energy Studies	Lu Aye	2003	http://aqua.civenv.unimelb.edu.au/

University of Melbourne	Postgrad Diploma in Engineering	1	Energy Studies	Lu Aye	2003	http://aqua.civenv.unimelb.edu.au/
University of Melbourne	Master of Science	1	Energy Studies	Lu Aye	2003	www.eng.unimelb.edu.au/
University of Melbourne	Master of Applied Science	1.5	Renewable Energy	Lu Aye	2003	www.eng.unimelb.edu.au/
University of Melbourne	Master of Engineering Science	1.5	Renewable Energy	Lu Aye	2000	www.eng.unimelb.edu.au/
University of New South Wales	Graduate Certificate in Electrical Engineering	1	Photovoltaics	Stuart Wenham	2000	www.handbook.unsw.edu.au/
University of New South Wales	Graduate Diploma in Electrical Engineering	1.5	Photovoltaics	Stuart Wenham	2001	www.handbook.unsw.edu.au/
University of New South Wales	Master of Engineering Science	1	Photovoltaics and Solar Energy	Stuart Wenham	2002	www.handbook.unsw.edu.au/

Table 3: Research Degrees in Renewable Energy in Australia and New Zealand

University	Award Offered	Major Areas Available	URL
Australian National University	MPhil, PhD	Photovoltaics, Solar Thermal	http://solar.anu.edu.au/
Curtin University of Technology	MPhil, PhD	Power conditioning, hybrid systems	http://handbook.curtin.edu.au/
Murdoch University	MPhil, PhD	Hybrid systems, photovoltaics, energy storage Energy policy	/www.eepe.murdoch.edu.au/
Massey University	PhD	Energy Management, Biofuels	http://cms.massey.ac.nz/
Otago University	PhD	Energy Management/Energy Studies	www.physics.otago.ac.nz/
Royal Melbourne Institute of Technology	M Eng, PhD	Solar Thermal, Cogeneration	http://mams.rmit.edu.au/
University of Newcastle	MPhil, PhD	Wind and hybrid systems	www.wind.newcastle.edu.au/
University of NSW	MEng	Photovoltaics, hybrid systems, grid-connected systems, solar thermal, energy storage.	www.pv.unsw.edu.au/

University of NSW	MPhil, PhD	Photovoltaics, hybrid systems, grid-connected systems, solar thermal, energy storage.	www.pv.unsw.edu.au/
University of Sydney	MPhil, PhD	Solar thermal power systems	www.chem.eng.usyd.edu.au/
University of Tasmania	MPhil, PhD	Solar cooking, wood heaters	http://fcms.its.utas.edu.au/

Observations

- Three Australian Universities offer full undergraduate degree programs in renewable energy engineering or energy studies. In New Zealand only Otago University offers undergraduate studies in energy studies and energy management.

- Most Universities offer one or two courses on renewable energy as part of their science or engineering degree programs. Some Universities embed this material in other courses relating to electrical and power engineering.

- All of the undergraduate programs have been developed since 2000 in response to market demand for skilled professionals specialising in renewable energy and/or energy efficiency.

- Six Australian Universities and two New Zealand Universities offer full coursework degree programs at the postgraduate level in renewable energy and energy management. These offerings are designed for experienced professional scientists and engineers who may wish to change career direction and move into areas such as renewable energy systems, energy policy and planning, energy efficiency or energy management.

- A variety of postgraduate courses is available (23 in all) including postgraduate certificates (1 semester), postgraduate diplomas (2 semesters) and Masters by coursework (2-4 semesters).

- Postgraduate research programs in renewable energy and energy management are offered by eight Australian Universities and two New Zealand Universities. The Australian Universities have particular strengths in photovoltaics, and solar thermal systems, while New Zealand is strong in biofuels and energy management. Very few Universities offer research opportunities in energy policy or energy economics although this is an area of great interest to government and industry.

- It is clear that the major focus of RE education at present is on postgraduate coursework and research degrees. These cater for experienced professionals who want to switch their career direction from conventional to renewable energy. The range of undergraduate offerings is still quite limited and all of the courses have appeared since 2000. There is a growing interest amongst school leavers in renewable energy and this is expected to increase as the fight against global warming intensifies.

- In New Zealand, Otago University started undergraduate courses in energy studies and energy management in 2000 to assist the NZ energy sector which had been suffering from a severe shortage of trained graduates in this field.

- Two Universities, Murdoch and Massey, offer on-line studies in renewable energy to external students in Australia and New Zealand and overseas. These Universities have a cooperative agreement to share courses and teaching resources.

- Australia has research strengths in photovoltaics and solar thermal technology and this is reflected in the courses and specializations offered. New Zealand has strengths in energy management and biofuels and these complement the Australian offerings.

- Despite these recent developments in RE education there is still a severe skills shortage in the RE sector. This is expected to worsen as demand increases in response to programs to address global warming. The shortage of funds for RE research and development has impacted on the research effort of Universities in Australia and postgraduate enrolments are a very low levels. The availability of good employment opportunities for graduates contrasts starkly with the shortage of research funds and has resulted in many graduates choosing employment in industry in preference to research careers. This is turn limits the ability of Universities to teach and innovate in these areas.

Conclusions

Australia is experiencing considerable growth in its renewable energy industries as a result of efforts to combat global warming. NZ has one of the highest proportions of renewable energy in place of any country in the world and has recently put policies in place to ensure that the electricity sector sources 90% of its energy from renewable resources by 2025. There is a strong growth in demand for continuing professional education in renewable energy and energy efficiency.

Although the universities and technical colleges are responding to this challenge, there are still many issues and problems that need to be addressed. The curriculum will have to evolve to keep pace with the technical developments in the field. Greater use of the Internet as a teaching vehicle will have to be adopted by all universities, if they are to remain at the front of this field and reach out to professionals in their homes and workplaces. Greater financial support for RE research and development both the government and the industry is required to ensure that the exodus of technologies and human resources, from both Australia and NZ, are curtailed. Further there is a need for accreditation and quality assurance for RE courses that can be addressed by Governments and professional organisations. All of these matters should form part of a comprehensive national sustainable energy policy.

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