

Photovoltaics Education in Australia

Richard Corkish¹

¹Head, School of Photovoltaic and Renewable Energy Engineering, University of New South Wales, Sydney 2052, Australia. r.corkish@unsw.edu.au

ABSTRACT: The paper summarises the current photovoltaics education offerings available in Australia. Most prominently, a specialist photovoltaics engineering bachelor degree is available, as are majors within general engineering degrees. Technical training programs are offered at various locations around the country, some focussed on designer and installer accreditation requirements. Syllabus material is in preparation for introduction into the senior secondary school Engineering Studies subject in the state of New South Wales in 2008.

Keywords: education, photovoltaics

1. INTRODUCTION

Despite its relatively small population, Australia has had a photovoltaics research and development activity that is very strong, for more than three decades. This stemmed from two main factors. Firstly, the young academic, Dr. Martin Green, who started photovoltaics research at the School of Electrical Engineering, University of New South Wales (UNSW) in the 1970s and gradually built up a strong group that was able to attract new researchers and, by Australian non-medical research funding norms, good funding, primarily from the Australian Research Council. Secondly, the very strong market that existed for remote-area installations of stand-alone photovoltaics systems in Australia in the 1980s stimulated considerable interest in further development, including from the main consumer, Telecom Australia, who used photovoltaics to power a very large expansion of communications capacity, with microwave repeater stations. UNSW has remained strong in silicon photovoltaics and

has been joined by another strong research group at the Australian National University (ANU). Many photovoltaic business and research leaders around the world studied for the PhD degree at UNSW.

In the late 1990s the research group at UNSW became strongly conscious of the growing global demand and the coming need for large numbers of engineers to support future research, development, manufacturing, system and product design and installation, and policy advice and formulation. The group formed a new, separate budget unit, eventually to become the School of Photovoltaic and Renewable Energy Engineering in 2006, within the Faculty of Engineering in 1999, and pioneered specialist photovoltaics engineering education the next year. There are currently two other Australian universities with important photovoltaics teaching activities: Murdoch University, in and near Perth, and the Australian National University, in Canberra.

In addition to engineering education, there are several technical colleges that offer

training for technical students [1], many using programs and course materials developed by the Brisbane North Institute of Technical and Further Education. Such programs are a mandated path to accreditation for system designers and installers [2]. Preparations are also underway to introduce photovoltaics as an option for secondary schools.

2. ENGINEERING EDUCATION

2.1 University Education

Specialist bachelor degree engineering in photovoltaics was pioneered by UNSW in 2000, with a view to the coming boom in demand for well educated engineers in this growing field. As of first semester 2008, 158 students were enrolled in Photovoltaics and Solar Energy Engineering [3] (Fig. 1) and an additional 85 are enrolled in its sister program, Renewable Energy Engineering [3] (Fig. 2). Students frequently change between these programs and there is significant overlap.

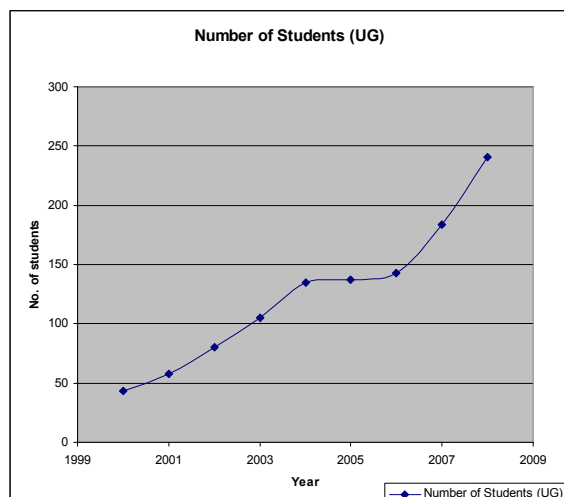


Figure 1: Undergraduate enrolled student numbers at UNSW in Photovoltaics and Solar Energy Engineering, versus year. Data is for Semester 2 each year, except for 2008, for which Semester 1 data is used.

The Photovoltaics and Solar Energy Engineering program is fully accredited by

Engineers Australia and intends to educate students in almost all aspects of photovoltaics, from device technology and manufacturing, through photovoltaic systems design, installation, maintenance, reliability and life cycle analysis, to aspects of policy and marketing. Promising students are encouraged to work in research-related activities with leading researchers and to move on to PhD study after graduation. Combined (“double”) degrees are possible in combination with Bachelor of Commerce or Bachelor of Science or Bachelor of Arts or Bachelor of Laws.

Co-operative scholarship places, in which students work with collaborating companies during their studies, are currently provided by BP Solar, CSG Solar, Suntech Power and Renewable Energy Corporation.

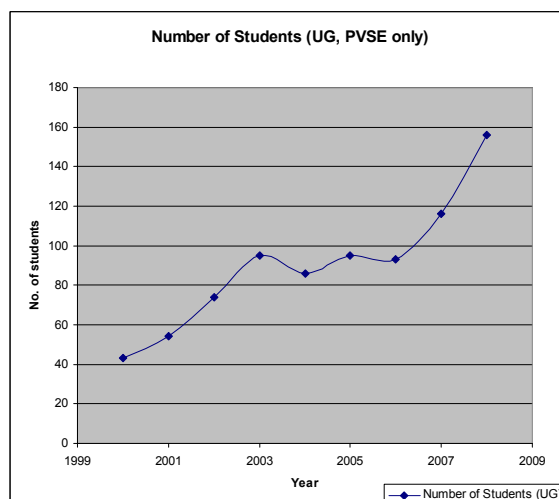


Figure 2: Undergraduate enrolled student numbers at UNSW in either Photovoltaics and Solar Energy Engineering or Renewable Energy Engineering, versus year. Data is for Semester 2 each year, except for 2008, for which Semester 1 data is used.

Bachelor degree graduates have mainly found employment within Australia, including in photovoltaics technology companies with local activities (BP Solar, CSG Solar), photovoltaics systems providers, electricity retailers, sustainability design companies, architecture and design organisations, general consulting

engineering companies, government departments, etc.

The Master of Engineering Science program [3] at UNSW is intended to allow engineers from related disciplines to gain specialist education in photovoltaics and renewable energy fields. The program takes three semesters full time and there are exit points available for the awards of Graduate Certificate of Engineering Science and Graduate Diploma of Engineering Science. Student numbers have been historically been very small (Fig. 3) but are experiencing very strong growth at present.

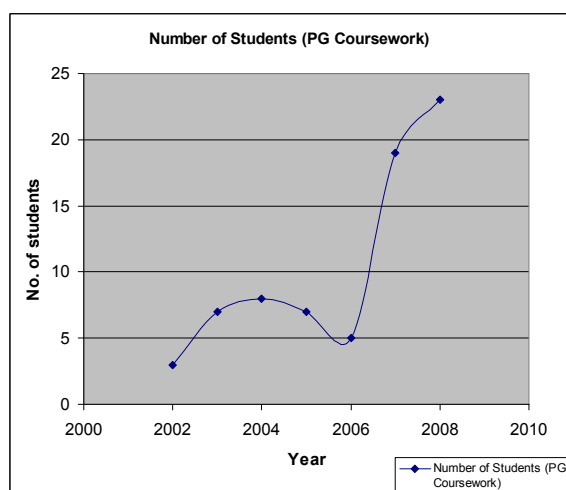


Figure 3: Postgraduate enrolled student numbers at UNSW in Photovoltaics and Solar Energy Engineering, versus year. Data is for Semester 2 each year, except for 2008, for which Semester 1 data is used. Early indications are that the Semester 2 data will show a significant increase.

Apart from the generally enhanced community interest in global warming and sustainable energy, the recent growth in undergraduate and postgraduate student numbers has been aided by sponsorship support for tuition fees from the Australian Government through the Asia Pacific Partnership on Clean Development and Climate (APP) [4]. Of particular interest for the current audience could be the opportunities to study for a Masters of Engineering Science in Photovoltaics and

Solar Energy Engineering at UNSW with 50% of the tuition fees paid by by the Australian Government through APP [5]. Additional places will be available in 2009 for students who are citizens of Republic of Korea, China and India.

Additional information and discussion about photovoltaics and solar energy engineering and renewable energy engineering education at UNSW may be found in Chapter 5 of the most recent report of the School's ARC Photovoltaic Centre of Excellence [6].

The Bachelor of Engineering in Renewable Energy Engineering program at the Rockingham Campus of Murdoch University [7] was developed in partnership with that at UNSW and its introduction in 2002 preceded the UNSW program's by one year. It included photovoltaics and related topics. Combined ("double") degrees are possible in combination with Bachelor of Commerce or Bachelor of Science. Research at Murdoch University has been strong historically in remote area energy systems incorporating renewable energy inputs and that experience feeds into the undergraduate education offerings. Related offerings at Murdoch University include Bachelor of Science in Sustainable Energy Management and a range of relevant postgraduate programs [8]. Murdoch University also offers postgraduate programs in renewable energy engineering [7].

The Australian National University is home to the second-ranked silicon photovoltaics laboratory in the country and also offers relevant courses as a Sustainable Energy Systems Major within its Engineering education framework [9], including some photovoltaics content.

Other Australian universities offer some photovoltaics content within engineering and science programs but there are currently no other coherent or complete programs with a photovoltaics focus.

2.2 Technical Training

Technical training for photovoltaics in Australia is focussed not on cell production but on application of solar modules in stand-alone or grid-connected systems. One motivator for the existence of such training programs has been the drive by the industry umbrella organisation, the Australian Business Council for Solar Energy (now incorporated in the Clean Energy Council [10], to encourage system designers and installers to gain accreditation [2]. Such accreditation is not a regulatory requirement in Australia but State and Federal government subsidy schemes [11] generally support only systems that rely on accredited designers and installers.

The Clean Energy Council maintains a list of training organisations registered for delivery of technical training [12], several of which are colleges of Technical and Further education (TAFE) [1]. Many TAFE colleges use teaching materials originally developed by the Brisbane North Institute of TAFE and which are available commercially [13].

At least one of the registered training organisations, Global Sustainable Energy Systems, develops its own training materials [14] and also offers training internationally.

2.2 School Education

There is currently very little education about photovoltaics offered in primary or secondary schools in Australia, to this author's knowledge, although several previous "solar schools" subsidy programs have required that installed systems be incorporated into education programs. (The new National Solar Schools Program [15] will not have such a requirement, apart from a need for retrospective reporting on "an outline of the energy, water efficiency, educational and awareness raising activities undertaken by the school" [16] but promises to encourage the installation of significant quantities of photovoltaic modules on schools around the country).

With support from the New South Wales State Government and in collaboration with

a secondary school teacher at Kirrawee High School, UNSW is currently working to finalise the development of syllabus support materials for use by teachers and students of Engineering Studies [17]. This syllabus includes the possibility of "focus units" to be produced and taught by individual schools, based on their own expertise and experience. UNSW student and staff will complete the preparation of a Photovoltaics focus unit in October 2008. The unit has and will be trialled in Kirrawee High School and then released for free distribution to all teachers of Engineering Studies.

3. CONCLUSION

Photovoltaics education is in a healthy state in Australia, especially at the university level. Opportunities for university study are available for international students and fees for postgraduate coursework study by Korean, Chinese and Indian students may be partly supported by the Australian Government in 2009. Technical training has been uncertain and incoherent but the basis has been developed the number and completeness of offerings is likely to improve dramatically as student numbers grow. Preparations are well to increase the penetration into the secondary syllabus of the most populous state, New South Wales.

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