

2. Power Engineering and Renewable Energy Technologies

Energy systems UNSW

Energy systems research will have a profound impact on the evolution of our existing energy delivery systems. A prime example is the significant change occurring in the generation and supply of electrical energy. We are moving away from a centralised model of generation to one where generation is becoming dispersed and distributed around the electrical network. Network operators now have generation sources on their networks that are non-dispatchable and uncontrolled. This makes network planning, operation, control and protection much more of a challenge. On the flip-side, distributed generation can also provide users with a lower-carbon source of energy which is more efficient and potentially more flexible. Clearly there is a need to investigate the technologies and techniques required to harness these advantages whilst minimising the impact on the network operators.

The Energy Systems research group is one of Australia's leading research teams investigating these areas. Our staff are experts in a number of key areas including:

- Renewable generation and integration;
- Power system operations;
- Protection systems;
- Energy storage systems;
- Power electronics;
- High-voltage systems;
- Electric drive systems;
- Power economics;
- Market operation and restructuring;
- Condition monitoring, diagnostics and prognostics;
- Energy economics.

Much of our research focusses on power systems applications which includes the electricity grid, automotive and aerospace applications, and marine systems. Our research is performed in collaboration with industry in Australia and beyond, and our innovations have been commercialised by industry. Examples of current research interests is available here.

Staff in the energy research team also contribute to the Centre for Energy and Environmental Markets (CEEM) and the Australian Energy Research Institute (AERI).

For more details, please visit our website:

<http://www.engineering.unsw.edu.au/electrical-engineering/energy-systems>)

Australian Energy Research Institute (AERI), UNSW

The Institute is a sustainable energy think tank that focuses on transforming energy research into practical applications. The Institute builds upon 30 years of energy research leadership at the University of New South Wales (UNSW) and has launched coordinated strategies to address every level of the energy challenge.

The vision of this energy research institute is to become an internationally recognized model of collaborative interaction between academia, industry, business and community to transform thinking and provide long-term solutions for the move towards a truly sustainable energy infrastructure.

The strength of AERI comes from the opportunity it provides in developing comprehensive research across all disciplines. The Institute, located within the Tyree Energy Technologies Building, is a critical link in the chain that drives innovation into industry and out into the wider community.

Our focus will be directed towards key areas such as renewable and sustainable energy systems, the creation of smart electricity grids, and the development of alternative fuels. We know that unsustainable sources of energy must be replaced sooner or later.

Our research focus on the creation of sustainable energy infrastructure will last hundreds of years into the future. Innovations come through dialogue and debate as well as through an expansion of energy research into economics, policy analysis and regulation, engineering, sciences, social sciences, economics, markets, business and technology. Working across these disciplines means that we can create a system that is larger than each of its parts and an understanding of energy related complexities that was not possible before.

For more details, please visit our website:

<http://www.aeri.unsw.edu.au/information-about/aeri/about-institute>

Australian Centre for Advanced Photovoltaics (ACAP)

The Australian Centre for Advanced Photovoltaics (ACAP) comprises the Australian partners of the Australia-US Institute for Advanced Photovoltaics (AUSIAPV), is developing the next generations of photovoltaic technology, providing a pipeline of opportunities for performance increase and cost reduction. Headquartered at UNSW's School of Photovoltaic and Renewable Energy Engineering, the Centre includes research groups at CSIRO, Australian National University, University of Melbourne, University of Queensland and Monash University. AUSIAPV links ACAP with NSF/DOE Energy Research Center for Quantum Energy and Sustainable Technologies (QESST), based at Arizona State University, the National Renewable Energy Laboratory, Sandia National Laboratories, The Molecular Foundry at Lawrence Berkeley National Laboratories, Stanford University, Georgia Institute of Technology and University of California – Santa Barbara.

These national and international research collaborations provide a pathway for highly visible, structured photovoltaic research collaboration between Australian and American researchers, research institutes and agencies, with significant joint programs based on the clear synergies between participating bodies.

The Centre is significantly accelerating photovoltaic development beyond that achievable by the institutions acting individually, leveraging past and current funding.

This Program is supported by the Australian Government through the Australian Renewable Energy Agency (ARENA). The Australian Government, through ARENA, is supporting Australian research and development in solar photovoltaic and solar thermal technologies to help solar power become cost competitive with other energy sources. The views expressed herein are not necessarily the views of the Australian Government, and the Australian Government does not accept responsibility for any information or advice contained herein.

ACAP encourages collaboration with new and existing partners. If interested, please contact one of the node directors in your technical area.

ACAP is a member of the Australian Photovoltaics Institute (APVI).

For more details, please visit our website:

<http://www.acap.net.au/>

School of Photovoltaic and Renewable Energy Engineering (SPREE)

The UNSW School of Photovoltaic and Renewable Energy Engineering is one of 10 Schools in Australia's largest Faculty of Engineering.

For over two decades The University of New South Wales has been a world leader in research and commercialisation of high performance silicon solar cells. The UNSW School of Photovoltaic and Renewable Energy Engineering was established in order to enable a greater number of students to specialise in Photovoltaics (the science and the engineering practice of turning sunshine directly into electricity by using solar cells). With energy becoming an increasingly important world-wide issue, the breadth of our teaching in Photovoltaic Engineering was increased to include Renewable Energy Engineering.

Undergraduate degrees include the Bachelor of Engineering in Photovoltaic and Solar Energy Engineering; and, the Bachelor of Engineering in Renewable Energy Engineering. It is also possible to study in a combined degree program.

On the postgraduate level, we currently have many PhD and Masters Degree candidates and many of these will go on to work world-wide in the explosively growing Photovoltaics or Renewable Energy industries. At the last count, 35 of our higher degree graduates had CEO, CTO or other senior management positions in some of the world's largest photovoltaics companies.

It is an exciting time for engineers who choose to look at a world needing increasing amounts of energy and seeing the solution being in utilising the renewable resources available to everyone; sunshine, wind, rain, tides and biomass, to name a few.

World-wide there is a real need for the specialties that we teach. If you are interested in these specialties we invite you to consider studying with us.

For more details, please visit our website:

<http://www.engineering.unsw.edu.au/energy-engineering/>