The University of Queensland
AUSTRALIA

UQ SOLAR
THE EXPERIMENTS

The challenge with solar power – like many other alternative energy sources – is inconsistency: when it is cloudy, less power is produced. The UQ solar array panels have been set up to allow researchers to experiment with different ways of storing and collecting energy consistently, and how best to feed energy from stand-alone generating plants into the electricity grid. Several experiments are currently under way:

Research project 1: Next-generation battery storage

*(Industry partners: **RedFlow** and **Energex**)*

By its very nature, generating power from the sun is not consistent: when solar panels are blocked by shade, or clouds pass by, or the sky is overcast, less power is generated. The key to harnessing this intermittent power is to store it until it can be released back to the electricity grid, either as an ongoing source or to supplement peak demand.

By incorporating a large-scale zinc-bromine battery storage system into the UQ Solar St Lucia array, researchers will be able to trial new methods of storing this captured power and then assess how best it can be released back to the grid when most needed, i.e. during peak times (UQ's peak demand is around midday).

Energy distributor Energex has contributed $90,000 to fund state-of-the-art metering and monitoring equipment in order to provide high-quality data for analysis.

The prototype RedFlow 200 system, rated at 200kW, will be linked to a 339kW section of the UQ Solar array, and an identical 339kW adjacent group of panels will feed their power directly into the grid as the power is generated. Researchers can then compare the output of both to see which performs best in different situations, and investigate which methods are the most cost-effective.

This project will also help advance understanding of how one-megawatt-plus size alternative energy sources will interact with the current power grid, which was originally set up to take massive, high-voltage electricity inputs from a small number of large coal or gas power stations.

Results may even lay the groundwork for a totally redesigned national grid, one that can cope with many types of small and medium-sized renewable energy sources, such as geothermal, biomass, wind or solar, feeding in power from numerous and varied locations.

The project will also allow better understanding of the capabilities of zinc-bromine batteries, which have the big environmental benefit of being filled with water, rather than acid (as are traditional lead batteries). Zinc-bromine batteries are making solar energy much more useable, useful and effective.

UQ is pleased to be partnering with local Brisbane firm RedFlow, whose world-leading technology is a big advantage for this globally significant research project.

The University of Queensland

W: www.uq.edu.au/solarenergy **T:** 07 3365 3555 **E:** solar@uq.edu.au **A:** The University of Queensland, St Lucia, Q 4072 Australia

Media: *For more information, please contact Craig Froome, UQ Global Change Institute, 07 3365 3689*

Research project 2: Concentrating Photovoltaic Array

*(Industry partners: **SolFocus** and **Ingenero**)*

The six- by seven-metre, ground-mounted solar-tracking Concentrating Photovoltaic (CPV) Array on Sir Fred Schonell Drive is one of just 31 of its kind in Australia (all the rest are at Alice Springs Airport). Using a different system to the rest of the UQ Solar array which comprises photovoltaic (PV) panels, it will be used to directly compare the two types of technology in a subtropical setting.

In general, the CPV array is more efficient than traditional PV panels when the sun is shining because it produces full output throughout the whole day, rather than in just the few hours before and after midday (as does the PV system). This results in more energy generation per kW of solar panels installed. Using a motor-driven, dual axis to allow optimum solar harvesting, the CPV faces lower on the horizon in winter and higher overhead in summer, automatically following the sun across the sky each day to track the sun's exact angle on all days of the year.

However, it is less efficient than traditional flat panels when the sky is overcast.

The 8.4 kilowatt CPV array was manufactured by California-based SolFocus. Valued at about $90,000, it was donated and installed by Ingenero, which also installed the photovoltaic solar array across four rooftops at UQ St Lucia.

The CPV tracking panel comprises 28 parabolic focusing, photovoltaic modules, each with 20 individual reflectors and a high-efficiency triple-junction semiconductor solar cell.

Live data from the CPV array can be viewed at: **www.uq.edu.au/solarenergy**

Research project 3: Shading analysis/smart modules research

*(Industry partners: **Trina Solar** and **National Semiconductors**)*

Shading of solar panels can affect the amount of power generated from the sun. This research will investigate the output of deliberately shaded panels compared with regular solar panels and panels that have a prototype device installed to increase their efficiency – the SN2100 blocking diode, developed by NYSE-listed National Semiconductors.

The devices will be attached to the back of approximately 10 per cent of the UQ Solar array at St Lucia and researchers will analyse the impact that both shading and the blocking diode device have on electricity generation. Results will be compared to determine how effective the technology is before the devices are released commercially.

Design and installation research

Designing and installing Australia's biggest rooftop PV solar power system drew on the combined resources and significant expertise of UQ academics and engineers, working with industry leaders.

UQ's Property & Facilities division and UQ's School of Mathematics and Physics worked closely with engineering consultants Aurecon and lead contractor Ingenero, a Brisbane-based company with specialist skills in solar installations for large-scale commercial/industrial clients.

The 1.22 megawatt array is almost 25 per cent larger than any other rooftop system in Australia, with the added complexity of being split between four buildings (the second largest is at the Adelaide Showgrounds with a one megawatt installation).

During the design stage, engineers conducted a full shading analysis of the campus and ranked each building individually. They then studied those higher ranked buildings to determine what level of roof strengthening would be required to hold the weight of the panels and space for associated equipment such as inverters.