

# AUSTRALIA

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Fig. 1 – PV Water Pumping (photo S. Troman).

## GENERAL FRAMEWORK

Photovoltaics is an important renewable energy technology for Australia, with well established research groups and off-grid markets providing a good base for expanding grid and export markets. Public interest in climate change is now high and the new Government elected in late 2007 has ratified the Kyoto Protocol. Although PV remains a relatively high cost option, because of Australia's low electricity prices, its implementation is more straightforward than many other energy options, with few aesthetic, noise, water or emission issues arising. Hence, with Australia's excellent solar resources and continued rebates, the PV market is expected to grow more rapidly over the coming years.

The largest installed capacity of PV in Australia is for off-grid industrial and agricultural applications. These include power systems for telecommunications, signalling, cathodic protection, water pumping and lighting. Significant markets also exist for off grid residential and commercial power supplies and increasingly for fuel saving and peak load reduction on community diesel grid systems. The number of PV installations connected to central grids has increased steadily. The main grid applications are rooftop systems for private residences, schools and community buildings, with commercial interest now emerging, as a result of green building codes. There is also a growing market for recreational PV applications, for caravans, boats and off-road vehicles.

## NATIONAL PROGRAMMES

In 2006 a total of 23,7 MAUD was spent on PV market support programmes, the largest portion of which was spent on off-grid PV applications to displace diesel fuel use.

The *Renewable Remote Power Generation Programme* (RRPGP) is an Australian Government programme, administered by State and Territory Governments which aims to increase the use of renewable energy for power generation in off-grid and fringe of grid areas, to reduce diesel use, to assist the Australian renewable energy industry and the infrastructure needs of indigenous communities, and to reduce long-term greenhouse gas emissions. The target groups are indigenous and other small communities, commercial operations, including pastoral properties, tourist facilities and mining operations, water pumping and isolated households that operate within diesel grids, use direct diesel generation or are at the end of long grid lines. Grants of up to 50 % of the capital cost of renewable generation and essential enabling equipment are available, with additional funding provided by some States.

The *Photovoltaic Rebate Programme* (PVRP) is funded by the Australian Government and provides PV rebates to householders and owners of community buildings, such as schools, to install photovoltaic systems in order to reduce greenhouse emissions, assist in the development of the Australian PV industry and increase public awareness of renewable energy. The householder rebates were doubled in 2007, to AUD8/Wp for the first kWp, with a corresponding increase in demand. School and community installations are eligible for a 50 % rebate, capped at 2 kWp. 1 230 systems were installed in 2006, amounting to 1,85 MWp, of which 75 % were on grid connected buildings. Since the start of the programme in 2000, more than 8 000 systems, using 10 MWp of PV, have been installed and rebates of over 40 MAUD have been provided. From 2007 an additional 150 MAUD over 5 years was allocated to the programme.





Fig. 3 - Bushlight community RE System installed at Wanmarra outstation in Central Australia.

## INDUSTRY STATUS

*BP Solar* is the largest commercial PV manufacturer in Australia with an installed cell capacity of 50 MW. In 2006 it produced 36 MW of cells and 7,6 MW of modules. The company is also active in the development of safe and efficient installation systems and procedures including new frame types, mounting systems, smart communications and modular pre-designed packaged systems. BP Solar and Dux have developed a combined PV / solar water heater kit, sold as the BP Solar Energizer Plus. It is available in several sizes and aims to streamline household solar conversion.

*Bushlight* was established under the RPPGP to provide sustainable energy services to remote aboriginal communities. It has developed a modular, scalable renewable energy power supply system which can supply loads between 2 and 32 kWh per day, with provision for a diesel generator to cater for higher loads if required. The systems are designed in conjunction with the community, which is also provided with appropriate educational material. For community systems, energy management units are installed at each house to ensure community supply is maintained.

*CSG Solar* commenced commercial module production in Germany during 2006 but continues its research in Australia on Crystalline Silicon on Glass, a thin film PV technology based on initial research at the University of NSW.

*Dyesol* is the industrial research hub for the world's network of researchers into Dye Solar Cell (DSC) technology. Dyesol researches, develops and manufactures DSC materials and components, including nanoparticulate pastes and dyes, as well as equipment specifically designed to research and manufacture DSC.

*Origin Energy* is commercialising the "Sliver cell" PV technology developed by the Australian National University. The technology promises crystalline Si cell performance with significantly lower wafer requirements. Trial 10 W and 70 W modules have been produced from a 5 MW Pilot Plant.

*PV Solar Energy Pty Ltd* has developed a PV roof tile which uses a low cost pluggable PV junction box and monocrystalline solar cell laminates. Installation options include active air flow in the roof space below the modules to keep them cool and to allow warm air circulation into the building during winter months.

*Solar Systems Ltd.* has developed and commercialised a PV tracking concentrator dish system for off-grid community power supplies and end of grid applications. Current systems achieve 500 times

concentration and use air or water cooling. The systems were initially based on silicon cells, but upgrading to higher efficiency non-silicon devices is now underway. The company has been granted 75 MAUD from the Australian Government and 50 MAUD from the Victorian Government towards a 154 MW heliostat PV concentrator power plant to be built in northern Victoria. Installation will commence in 2008.

## MARKET DEVELOPMENT

PV installations in Australia in 2006 totalled 9,72 MWp, a 16 % growth since 2005. Of this, central grid installations accounted for 2,1 MW, off-grid residential 3,37 MW, off-grid industrial and agricultural 3,58 MWp and diesel grids 0,625 MWp. Grid installations grew at a rate of 31 % and now account for nearly 13 % of installed capacity. The recent doubling of PVRP rebates is likely to see a large increase in the grid market for PV over coming years, while continued increases in diesel fuel prices will also keep the off-grid market growing.

PV module and system prices increased by 4-10 % in 2006, with the flow through of earlier international silicon prices, as well as more stringent training and OH&S procedures. Module prices averaged AUD 8,50 and rooftop systems 12,50 AUD per Wp. Price competition for both modules and systems is likely to see prices stabilise and begin to drop in 2008.

## FUTURE OUTLOOK

The Australian PV market has been growing steadily over the past decade, assisted by government grant programs, but began to increase markedly towards the end of 2006 when public awareness and discussion of climate change increased. From 2007 the PV market is expected to grow at a faster rate since Federal Government grant programs have been extended or increased and several State Governments have announced local renewable energy targets. BP Solar is the only flat plate PV manufacturer in Australia at present, with a production capacity far in excess of current local use. There is interest in establishing other PV plants, so an increase in the local market may stimulate some proposals. It may also encourage local commercialisation of new PV technology, most of which currently goes overseas.

Solar Systems continues its development and installation of concentrator PV systems, with the market increasing both in Australia and internationally, particularly for use in diesel grids. Australia has more than 400 MW of diesel generation which will be impacted by both diesel price increases and any introduction of a carbon price, so that this market is also likely to grow strongly over the next five years.

State and Federal Governments are currently developing plans for a national Emissions Trading scheme, which will reduce the margin between renewable and fossil fuel based electricity supplies and provide another boost for the PV market.