



Distributed generation and Storage in Australia

Workshop on Advances on Electricity Storage in Support of Distributed Renewable Energy based Systems

Honolulu, 11th May 2004

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www.bcse.org.au

Agenda



- **What is the Australian Business Council for Sustainable Energy?**
- **Our constituency**
- **Setting the Australian context**
 - **Status**
 - **Issues**
 - **Market development & support programs**
- **Technology developments to date**
- **RAPS – driving innovation**
- **Conclusions**

What is the Australian BCSE?



- **Sustainable energy trade association representing over 250 members**
- **Formed in 2002 from merger of Australian EcoCogeneration Assoc and the Sustainable Energy Industry Association (long history)**
- **Members vary in size from 1-person companies to large publicly-listed companies**
- **Administer the national PV installer accreditation scheme**
- **Part of global network of BCSEs**

What do we do?

- As the foremost Australian advocacy group for RE and SE industry – BCSE lobbies for policy & program support
- Industry development
 - Training and accreditation for PV installers
 - Export development support
 - Assistance to strengthen and deepen the industry
- Membership support services
- Publicity for the industry (EcoGen Magazine, Press Releases etc)

Our coverage

Generation

Wind

Solar

Biomass

Hydro & other

Gas

Cogeneration

Waste-to-energy

Distributed generation

Energy Efficiency

**60 Leicester St Carlton
(Green Building)**

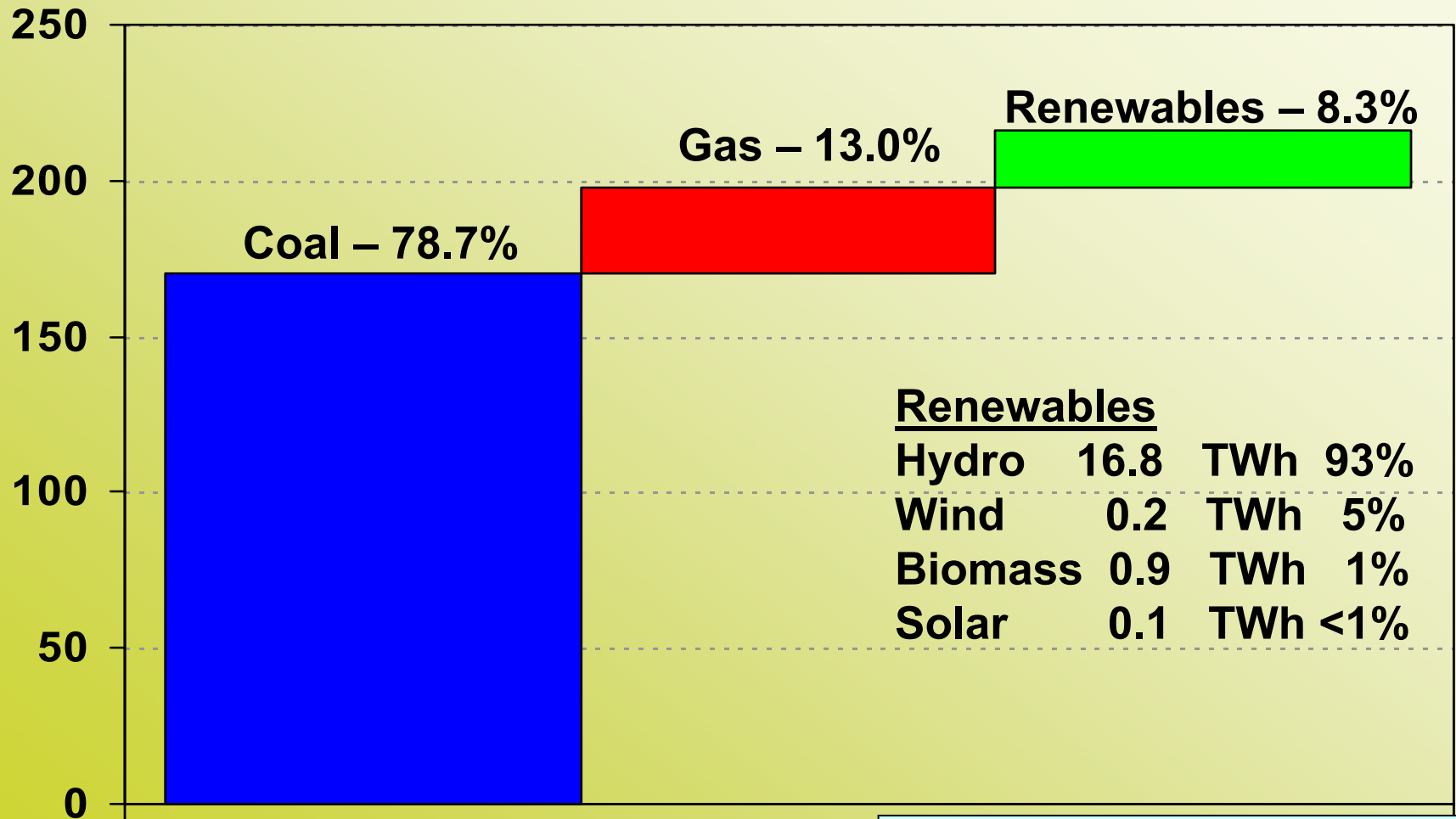
– our home



The Australian RE context



Australia's Power generation by fuel type



Source: ABARE (2000/01 Generation)

Issues for renewable energy technologies



- National electricity market (NEM), administered and managed by NEMCO but regulated on a state basis
- To date, intermittent RE generation in the NEM constitutes very small percentage of the installed generation, but predicted to grow significantly in next 5 years
- Coal fired generation is very cheap compared to RETs
- Electricity prices some of lowest lowest in the world:
av -residential AU\$0.1254 Wh, business AU\$0.919 Wh
- RETs largely dependant on national and state support prorgams

Australian government policy measures



- Mandated Renewable Energy Target (MRET) - 9,500 GWh by 2010. Tradable Renewable Energy Certificates
- PV Rebate Program (PVRP): AU\$4Wp, capped at AU\$4000 per system; grid and non-grid tied
 - Residential use ; community use
- Remote Renewable Rebate Program (RRPGP): 6 states, variable \$ amounts depending on diesel usage, total amount about AU\$200m to 2005
 - 50% capital costs incl RE generating equipment, enabling equipment & installation and design

State Government measures



- Rebate schemes for SWH in most states
- NSW - Retailer greenhouse benchmarks
- Victoria - Five Star scheme for new homes
- NSW - Building Sustainability Index (BASIX)

Technology developments to date



- Wind power
- Bagasse
- Hydro
- Waste to energy
 - Landfill gas
 - Sewerage wastes
- Hot dry rocks
- Solar water heating
- Solar PV
 - Grid-tied
 - SPVs off-grid
 - BOS components
 - Developments in storage for SPVs

Wind - development



- Australia has world class wind energy resource (long coastline)
- Renewables obligation (MRET) has triggered significant project development (over 3000 MW under development)
- Pacific Hydro, Stanwell and Hydro Tasmania are leading development efforts



Wind manufacturing



- World leading manufacturers of small-scale wind turbines
- Vestas has invested in local turbine assembly and manufacture
- Keppel Prince exporting tower sections to NZ



Cogeneration - bagasse



- Australia has 30 sugar mills, many at worlds best practice (CSR, Bundaberg, McKay Sugar)
- Boiler manufacturers Alstom and BRW exporting to Asian sugar industry
- CSR \$100m expansion at Pioneer mill under way (63 MW)



Hydro power expertise

- Most of Australia's RE capacity to date comes from large-scale hydro (93% of 8%)
- Pumped storage on the Snowy Mountains scheme
- No new large hydro schemes likely due to environmental considerations and taken-up resources

Mini hydro expertise

- **Development of containerized mini-hydro**
 - Capacity typically up to 400kW
 - Application in remote area power supply
- **Existing system refurbishments**
- **Rubicon Turbines – GE Australia**
 - Designed, built and installed in Australia
 - 5% more efficient than Pelton Turbines
- **Wivenhoe Mini Hydro, 4.5 MW system**

Hydro – overseas expertise



- SMEC -engineering and development consultancy (750 MW, West Seti project in Nepal)
- Pacific Hydro – projects in Philippines and Chile
- Hydro Tasmania, engineering and consultancy services

Waste to energy projects

- 59 waste to energy projects operating in Australia at the end of 2003, with a total capacity of 510 MW.
- *Of these –*
 - 100 MW land fill gas
 - 1 MW MSW
 - 26 MW sewerage gas
 - 4 MW wood waste
 - 102 MW coal waste methane
 - 204 MW waste gas

Landfill gas



- 35 plants in Australia, being 100 MW of capacity
- 28 plants installed overseas in Europe, Asia and the USA

Sewerage waste



**26 MW
sewerage
gas plant
installed in
Australia**

Farm-based anaerobic digester technologies



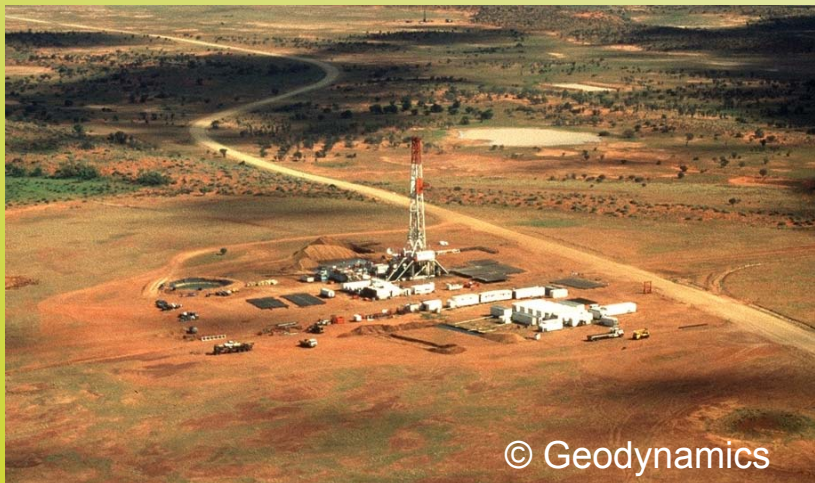
Slurry from dairies, pigs, feedlots, chicken raising, etc are odorous and pose increasing environmental problems.

Other 'wet' biomass sources being developed are vineyards, olive farms, cheese factories, orchards ...

Hot dry rocks



Demonstration
projects in South
Australia and
Queensland



PV Industry in Australia

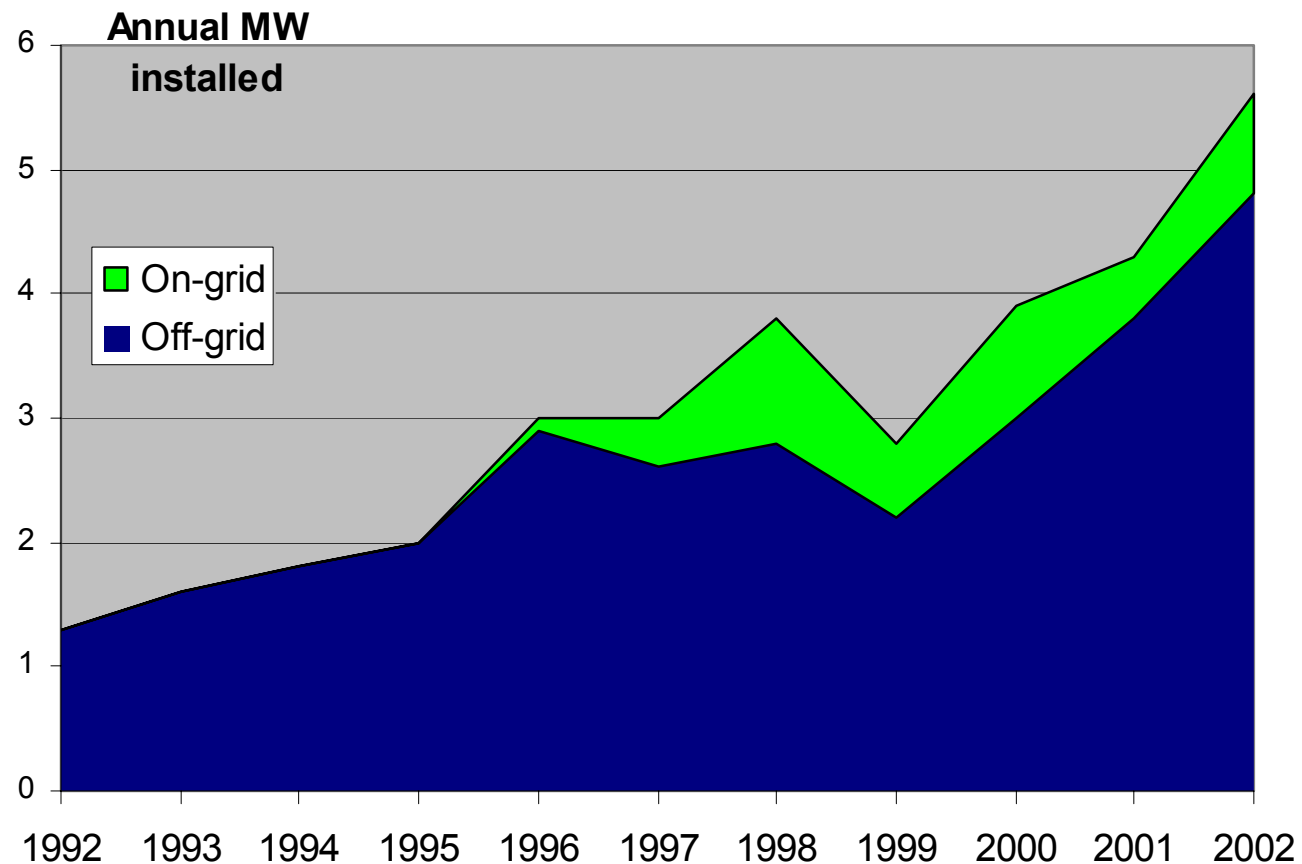


Australia has been at forefront of industry development

Sales increasing at over 25 % per annum (from very small base)

Off grid systems have dominated installations

Exports account for 80 percent of module manufacturing capacity



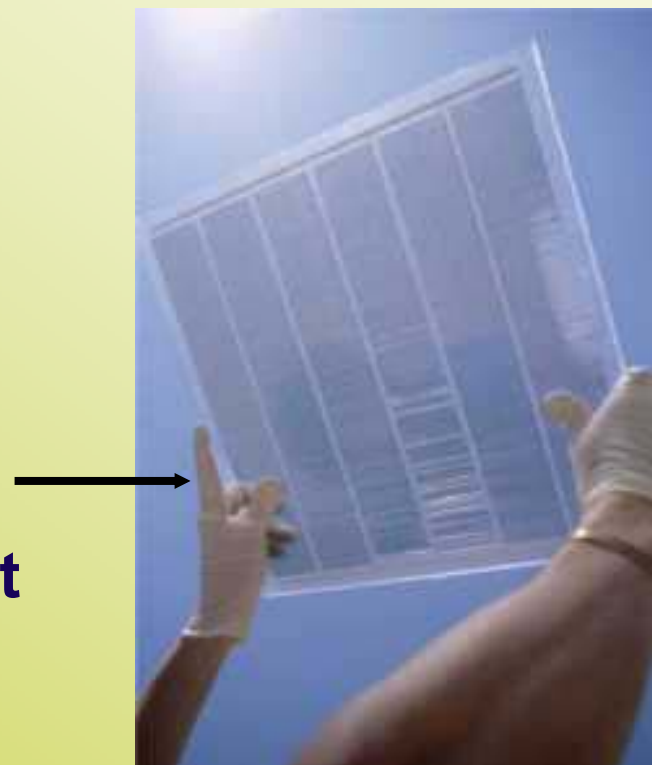
PV module manufacturing



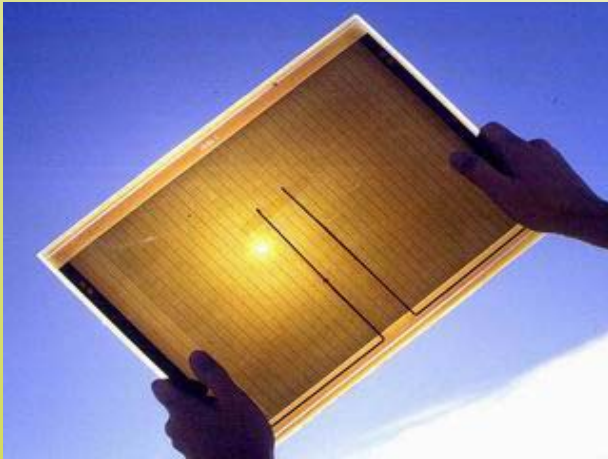
Modules first manufactured in 1975

BP Solar's Homebush factory,
NSW (35 MW/yr)

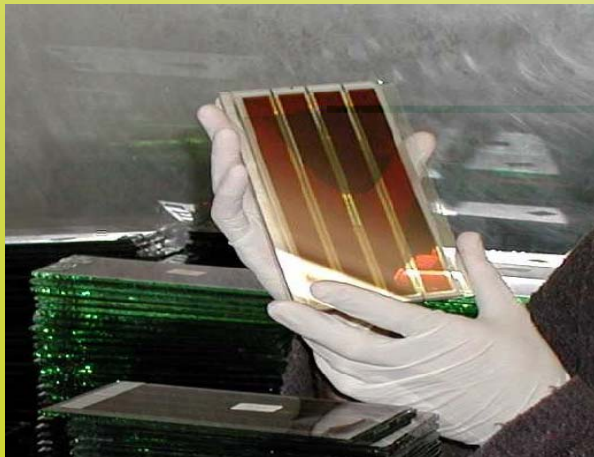
ANU / Origin Energy's new
efficient sliver cell (5 MW plant
under construction, South
Australia)



PV Pilot plants



- Pacific Solar (and UNSW) - Crystalline Silicon on Glass (CSG)



- Sustainable Technologies International's titania dye-sensitised solar cell

Balance of System components

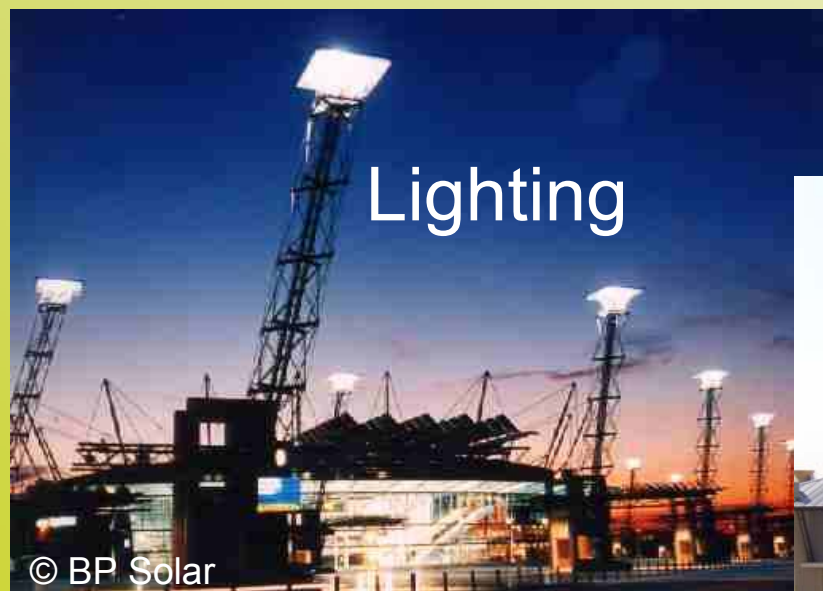


- Australia has leading manufacturers of power conditioning and control equipment
- Produce robust and reliable components (off-grid use)

Battery manufacturers

- Two types of Solar Batteries made locally:
 - Flooded (requires routine maintenance)
 - Valve Regulated Lead Acid batteries
- Battery Energy, Sydney, manufacture flooded and GEL batteries
- Century Yuasa, Adelaide, manufactures lead acid GEL for homestead and farm applications. Have a new battery coming out purely for the telecoms market
- Exide (prev GNB) now only assembles in Australia

Grid-tied applications



Solar PV Systems (SPVs) – off-grid applications



- **Australian PV systems are manufactured to withstand the harshest conditions and ambient temperatures of 40 – 50°C**
- **Australia ‘cut its PV teeth’ in remote area power, and still is a leader in systems, installer training and applications**

Large-scale off-grid SPVs for mines, remote communities and stations



Hamersley Mine PV Systems, WA



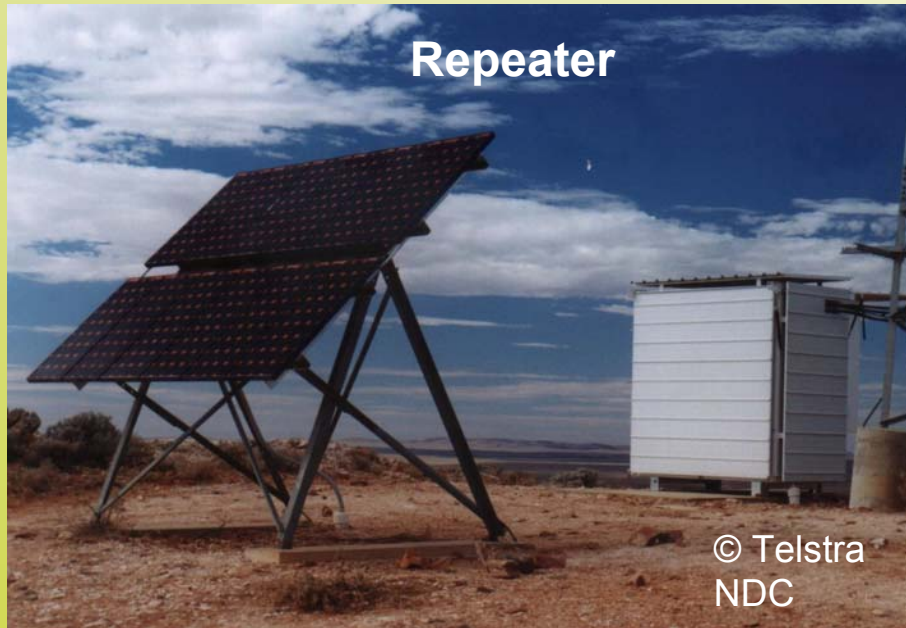
Residential / station SPVs



Supported by
the RRPGP and
some state
programs



Bringing telephony to isolated communities

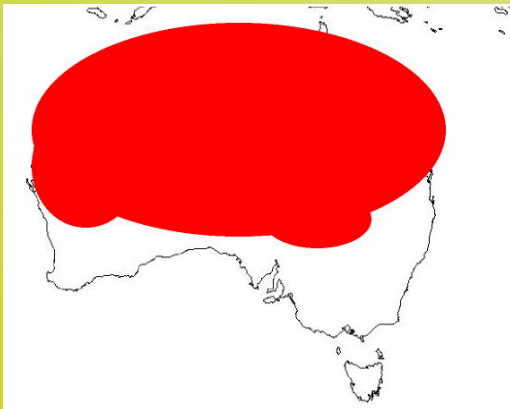


Telstra NDC

1000 repeaters

10,000 customers

PV-powered for 20 years



Water pumping

Tracking PV systems efficiently power different types of pumps in harsh conditions, due to encased moving joints, and temperature sensitive controls



Training and accreditation



- **BCSE runs national PV installers accreditation scheme (on and off grid)**
- **Accreditation required by most state authorities before PV rebates payable**
- **Increasingly aligned to national electrotechnical training packages**
- **2-tier system: Provisional and Full**
- **Complaint and inspection procedures**

Systems Testing



**Research Institute
for Sustainable
Energy (RISE)
maintains world-
class test facilities
in Perth**



Exportable!



Australia's expertise in SPVs and other remote renewable power applications lends itself well to assisting other countries to develop their renewables capabilities and installed capacity



Remote power systems - driving innovation



- **Solar System's concentrator (Pitjantjatjara, SA)**



- **Mawson, wind project, Antarctica (Powercorp, Western Power)**

D&WS – Diesel and Wind Systems



- **Developed by Western Power, Perth, for remote grids in harsh terrains**
- **Based on high penetration wind energy inputs (20 – 600 kW)**
- **Customise and retrofits for diesel power stations 30 kW – 30 MW installed capacity, or design & build new power station**
- **Power station automation, SCADA and feeder control using IPS and Microlink control technology**
- **Low Load Diesel™ technology for increased wind penetration**
- **Energy flow levelling and deferrable load control using Western Power's patented Dynamic Grid Interface™ technology**
- **Energy storage using slow speed flywheel technology**

Solar Concentrators

- Solar Systems CS500 dishes
- 500 x concentration onto PV
- 13 international patents
- Large scale SPVs, mini-grids and fringe of grid
- 2 power station complete, 2 under construction
- Working with Spectrolab and NREL



Mini grid technology developments



- Diesel (or 'soft') grids require special inverter technology and ancillary equipment to work with large RE inputs b/c cause of variability of their generation
- Solar Systems/PSA new mini-grid systems will have a small battery – for load levelling, not storage



New developments in storage



- **Zinc Bromine Batteries (ZBB)**
 - R&D at Murdoch University, WA
 - Target markets include renewable energy storage (RAPS applications) and utility load management
 - Flowing electrolyte and non-flow electrolyte batteries
 - High energy efficiency and deep discharge capability – high performance and cost effective
 - Successful demonstration projects in Australia and USA. \$3.5 million project won for PG&E California

Continued

- **King Island Power Station**
 - Commissioned 1986, now has 4 diesel gensets, using approx 3 mill litres diesel/yr with diesel generation costs over AU\$.30/kWh
 - Also has 3 x 250 kW wind turbines, installed 1998
 - Problems with system stability

- **VRB was the first installed by Pinnacle VRB (UNSW original patent)**
 - *Using battery storage to smooth out short term wind variability and support the system*
 - 200 kW for 4 hours – energy storage
 - 300 kW for 5 minutes – allow time to start diesel genset
 - 400 kW for 10 seconds – support power system

RAPs & SPVs – some observations



- Strong off-grid base has driven success to date
- Stimulated innovation in technology and systems development
- Significant improvements in systems, standards, accreditation and training
- Developed system packaging for remote communities
- Great springboard for exports to developing countries



Bushlight Project (for remote aboriginal communities)

Conclusions

- **Australia has diverse and robust experiences with distributed power systems and energy storage technologies in both on and off grid situations**
- **Has range of R&D, demonstration and commercial technologies and applications**
- **Very keen to participate in collaborative renewable energy projects**