Welcome

TO MEET THE STARS

Alternative Energy - Now and the Future

Hosted by

Trudy –Ann King

State Manager - South Australia

green building council australia

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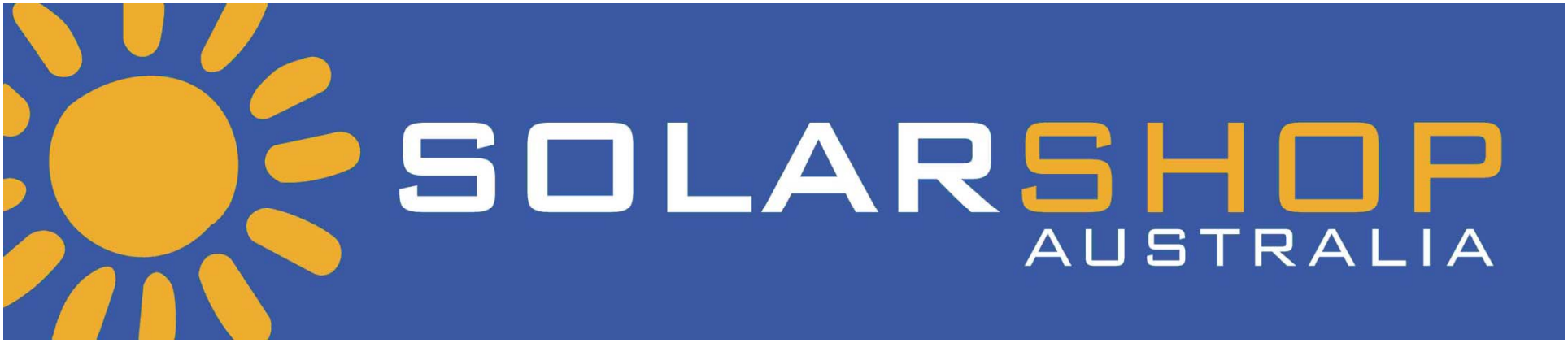
MEET THE STARS – ADELAIDE

14 October 2009



Today's Speakers

James McGregor, Energy Systems Manager
CSIRO

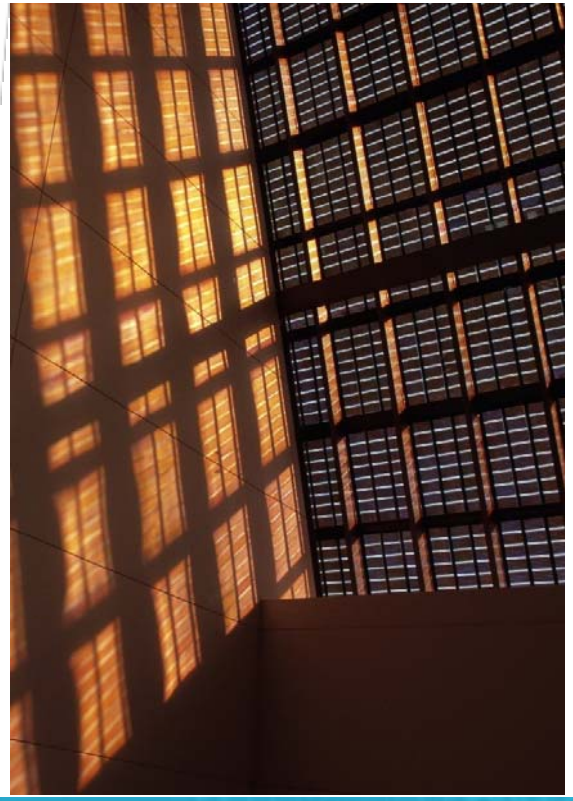
Professor Deo Prasad,
Sustainable Energy at UNSW

Blair Healy, Managing Director
Cogent

Luke Mclean, Project Manager,
Built Environs

David Buetefuer, Project Development Manager
Solar Shop Australia Commercial Division

green building council australia



www.csiro.au

Alternative Energy Now and the Future
CSIRO Energy Technology Research and its application in the Sustainable Built Environment

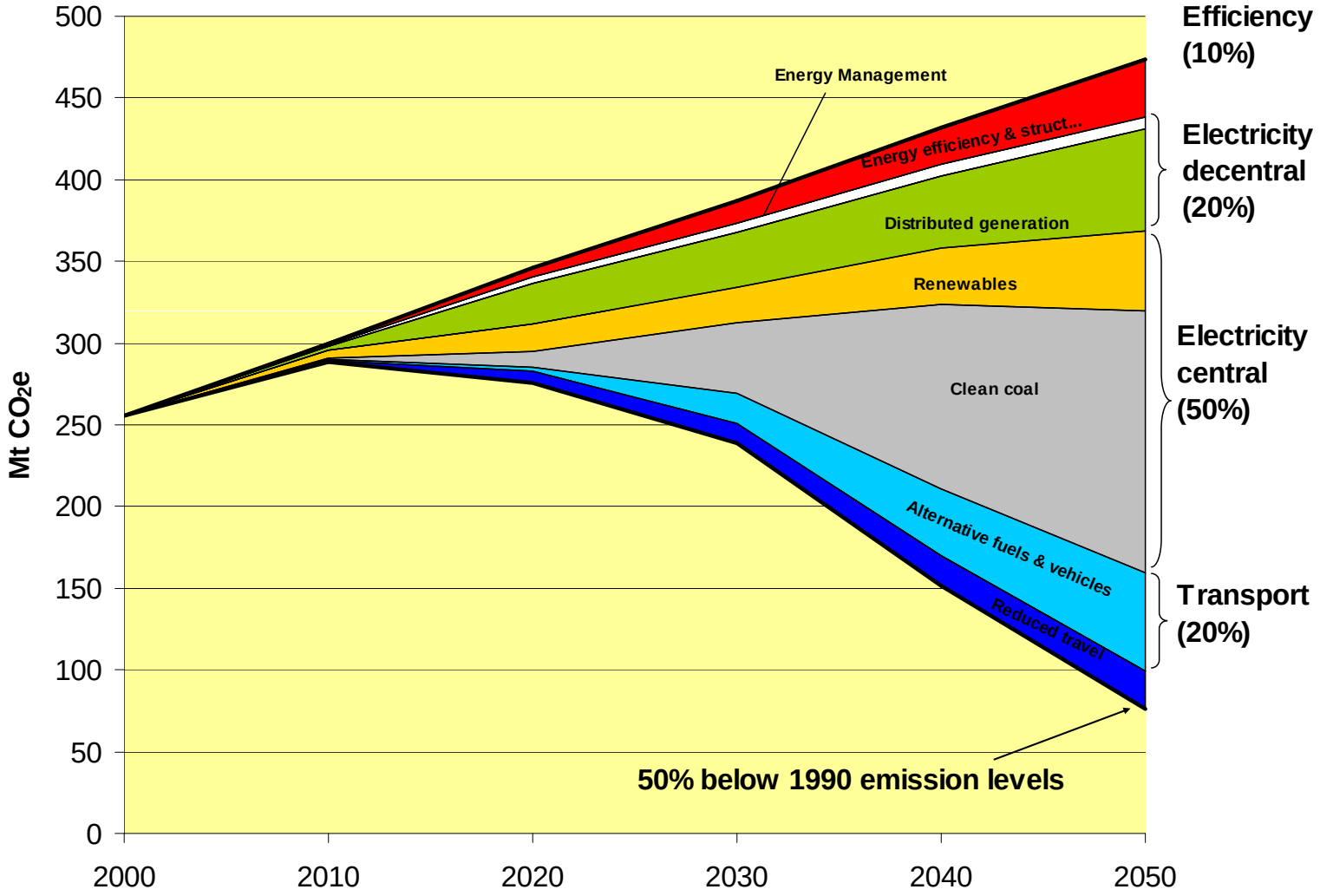
James McGregor
Energy Systems Manager
CSIRO Division of Energy Technology
14th October 2009

CSIRO

Overview

- **Emissions reduction pathway for Australia**
- **CSIRO's Energy Research**
  - **Renewable Energy Systems**
    - Solar Thermal
    - Solar Cooling
    - Vibration Energy Harvesting
    - Organic Photovoltaics
  - **The Intelligent Grid**
    - The Virtual Power Station
    - Self Learning Smart Agent Technologies

Emission reduction pathway for Australia



Source: Energy Futures, Paul Graham, CSIRO

National Solar Energy Centre, Newcastle

Solar Turbine

- **Diesel efficiency improves**
- **Thermal storage readily integrates with other heat sources such as diesel exhaust and solar collectors**
- **Aiming for cost half that of PV's**

Exhaust

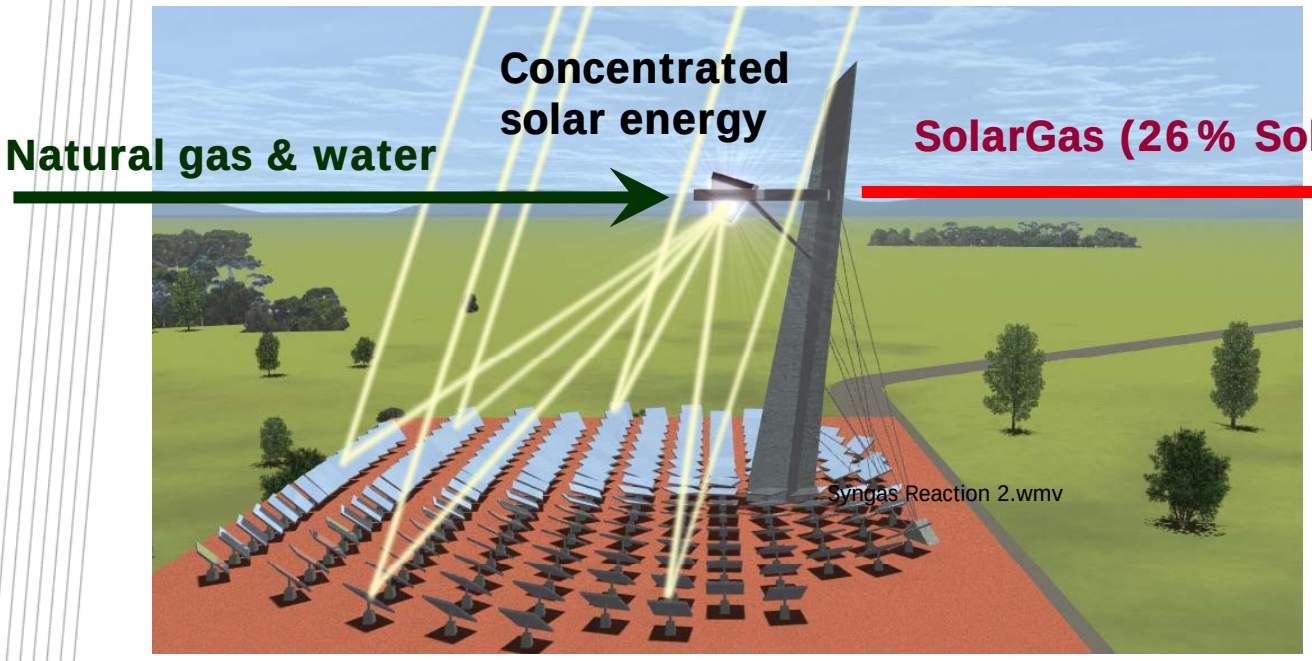
Thermal Storage

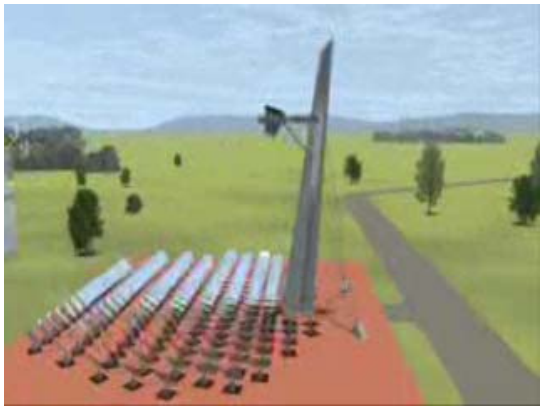
Polygeneration

- **Electricity**
- **Heat**
- **Cooling**
- **Desalination**
- **Water pumping**

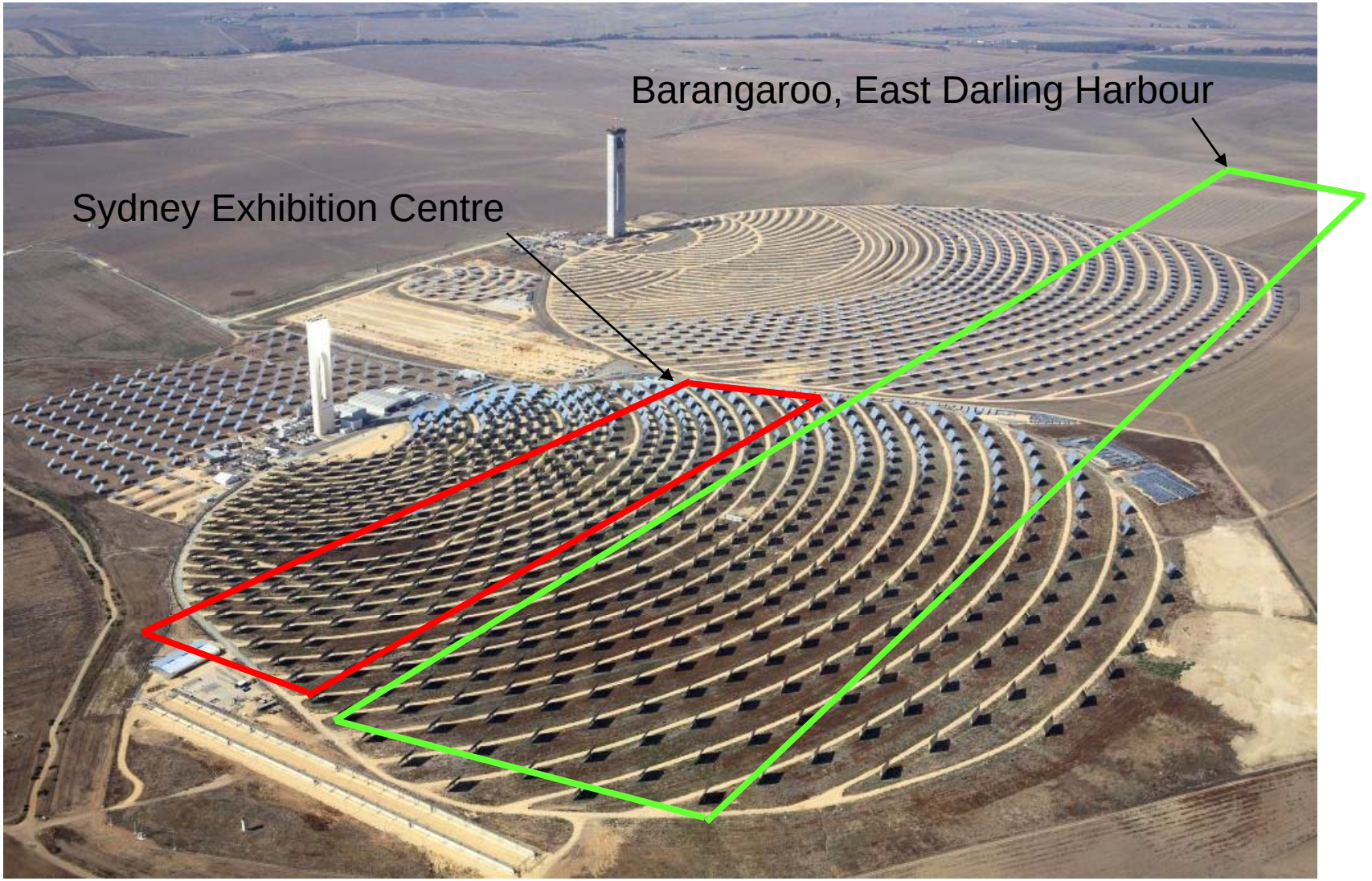
CSIRO's Solar H_2 Technology

"Transitional and modular - bridging the gap to sustainable hydrogen"

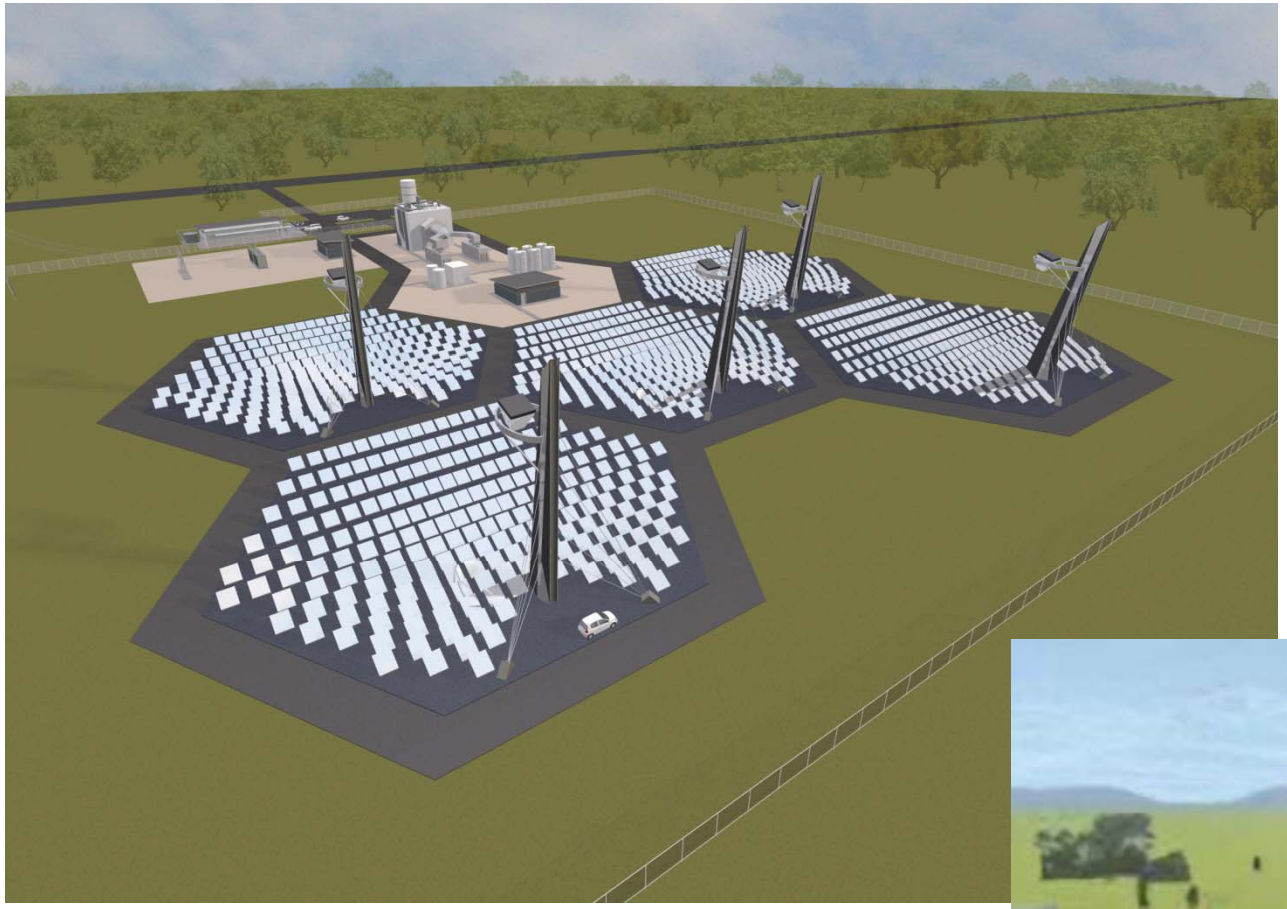




CSIRO

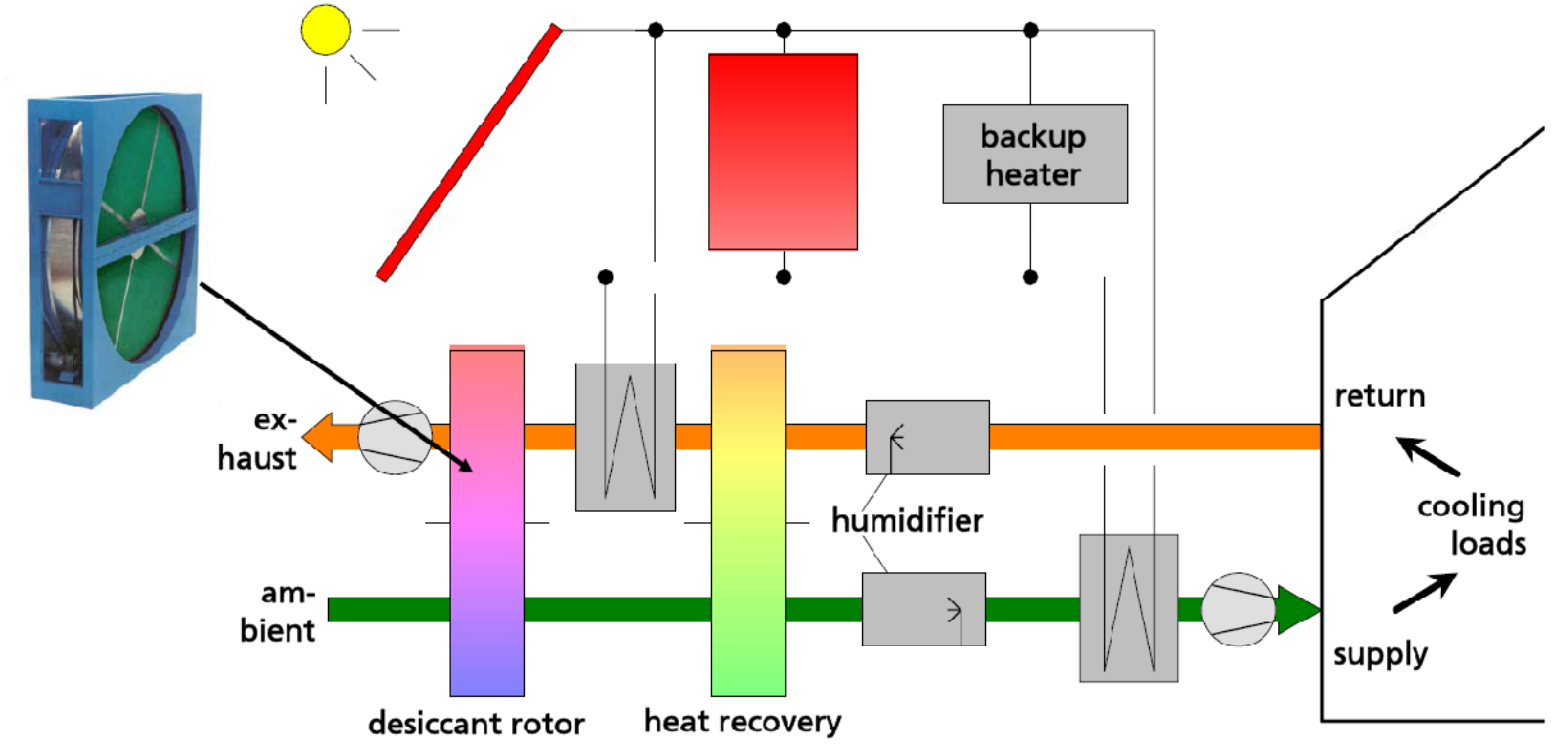

Barangaroo, East Darling Harbour
Sydney Exhibition Centre

Multi-tower Solar Array

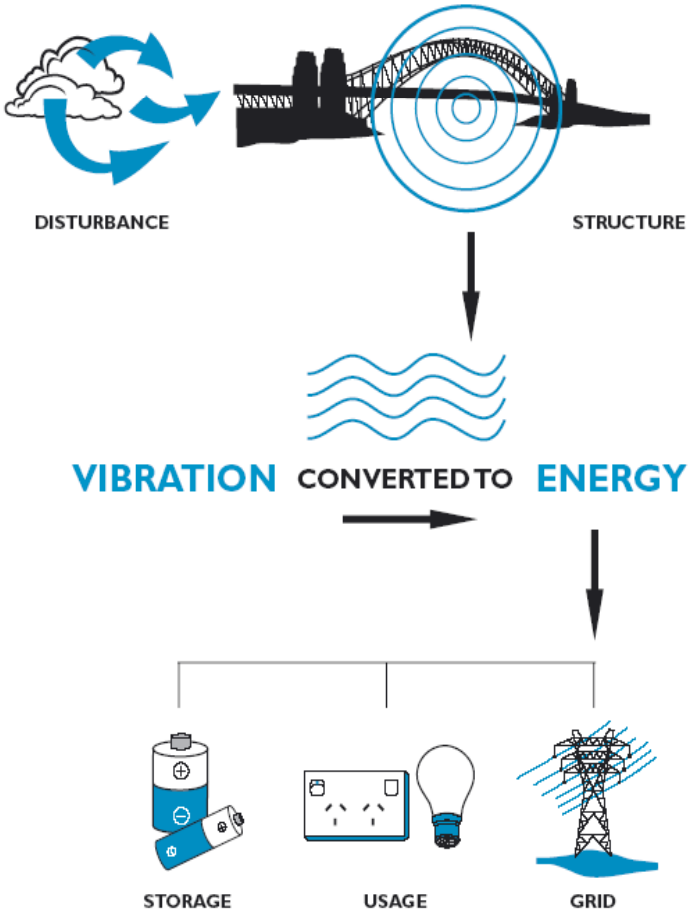


Solar Cooling

Desiccant system schematic



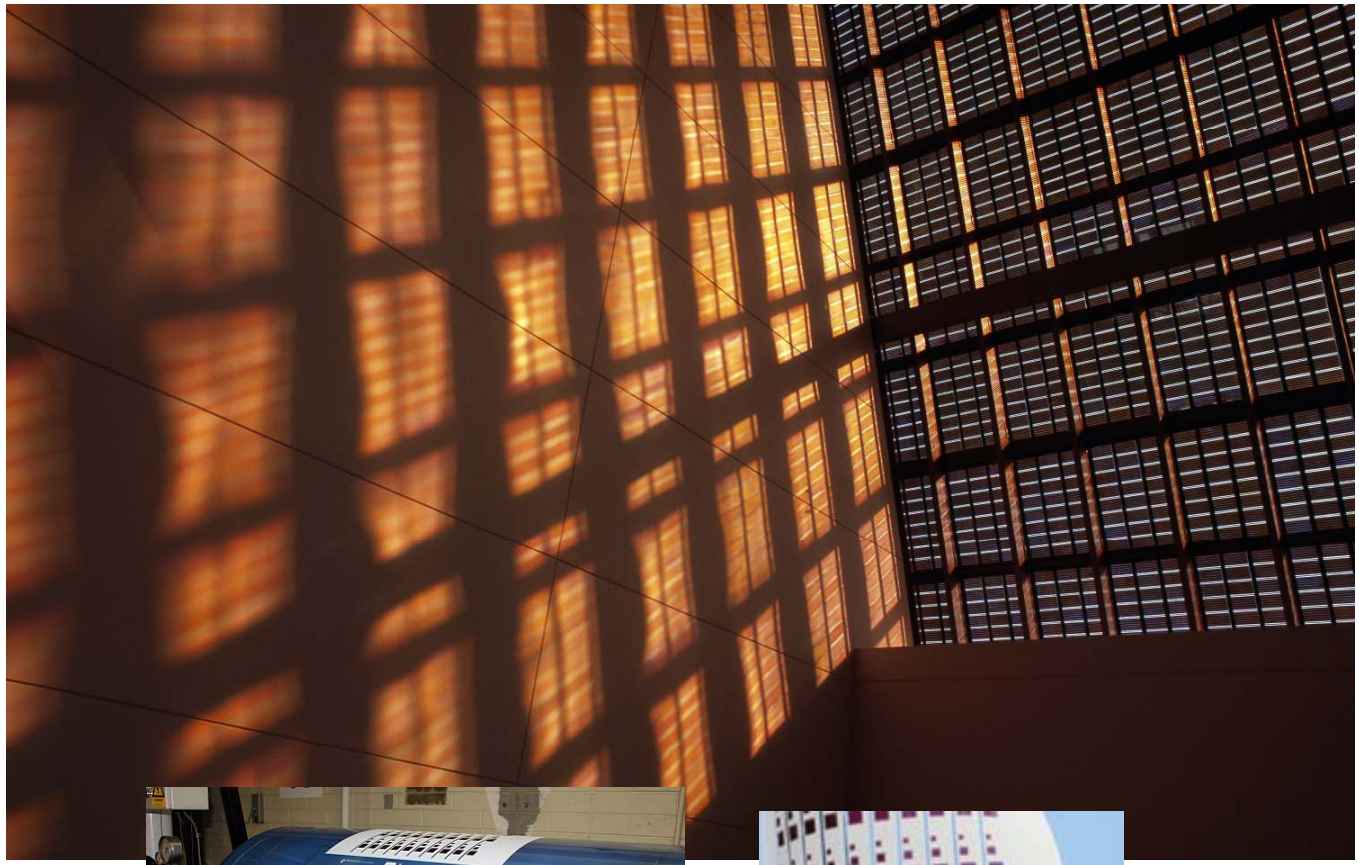
Vibration Energy Harvesting

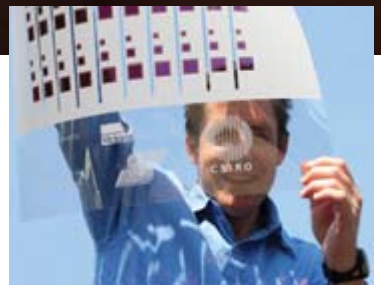


- Sydney Harbour Bridge vibration = 6.6MW
- Capturing say 10% = 660kW
- Enough power for 220 homes
- Vibration is clean renewable energy source

Vibration Harvesting

Organic Photovoltaics

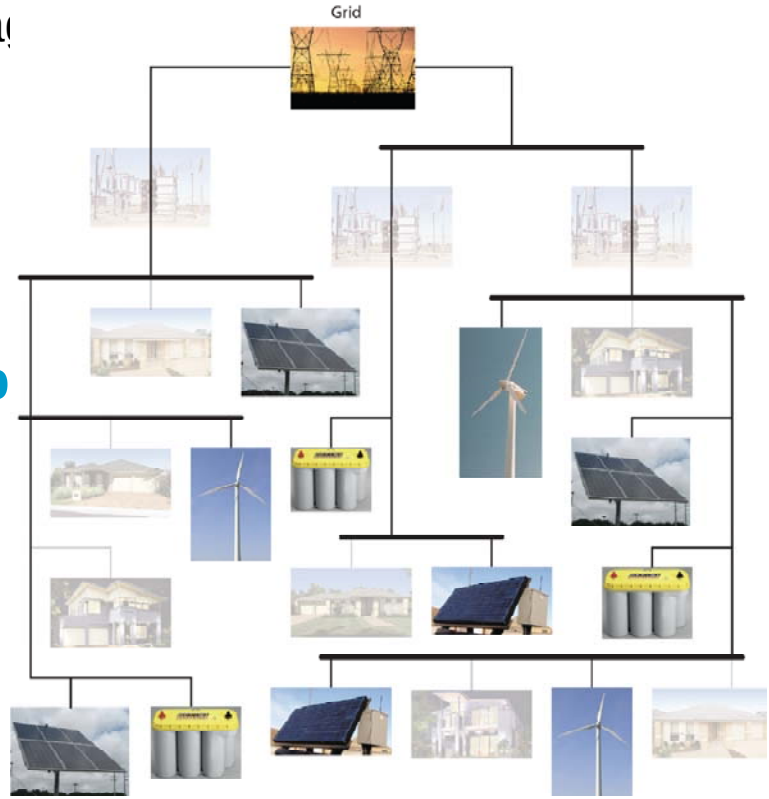




CSIRO

The Virtual Power Station

- **Although individually small and unreliable, together DG can:**
  - Aggregate to a marketable packa
  - Provide firm generation capacity
  - Use spatial awareness to improve forecasts – hence lower storage requirements
- **Foster a community ownership of energy & improve reliability**
- **Get more value from your existing renewables**
- **Overcome intermittency and become a valued part of the electricity generation mix**



Virtual Power Station

RENEWABLE AGGREGATED POWER

Home View Interact Details Products

Interact with the Virtual Power Station

Virtual Power Station

RENEWABLE AGGREGATED POWER

Home | Details | View | About | Login

VPS Total Output

Change Date

?	October, 2008						
«	‹	Today				›	»
wk	Sun	Mon	Tue	Wed	Thu	Fri	Sat
39				1	2	3	4
40	5	6	7	8	9	10	11
41	12	13	14	15	16	17	18
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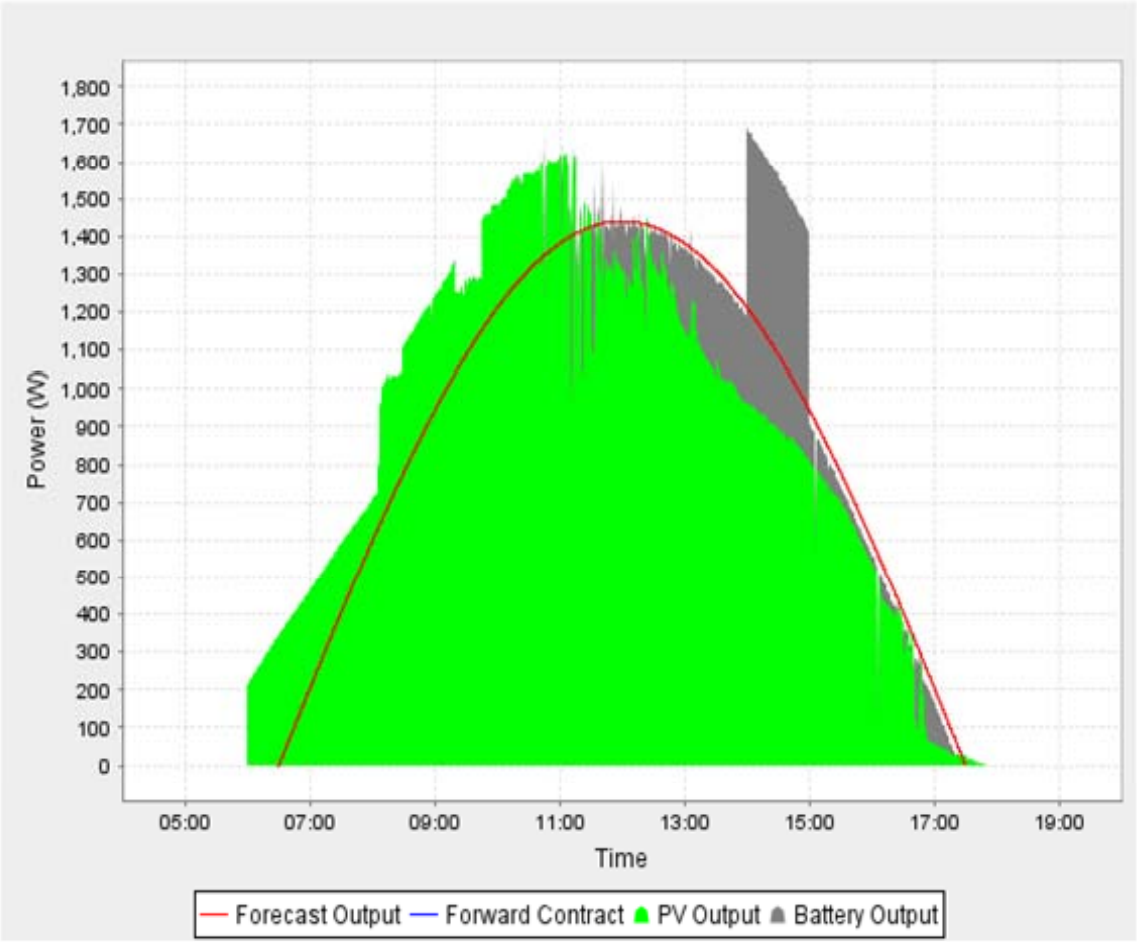
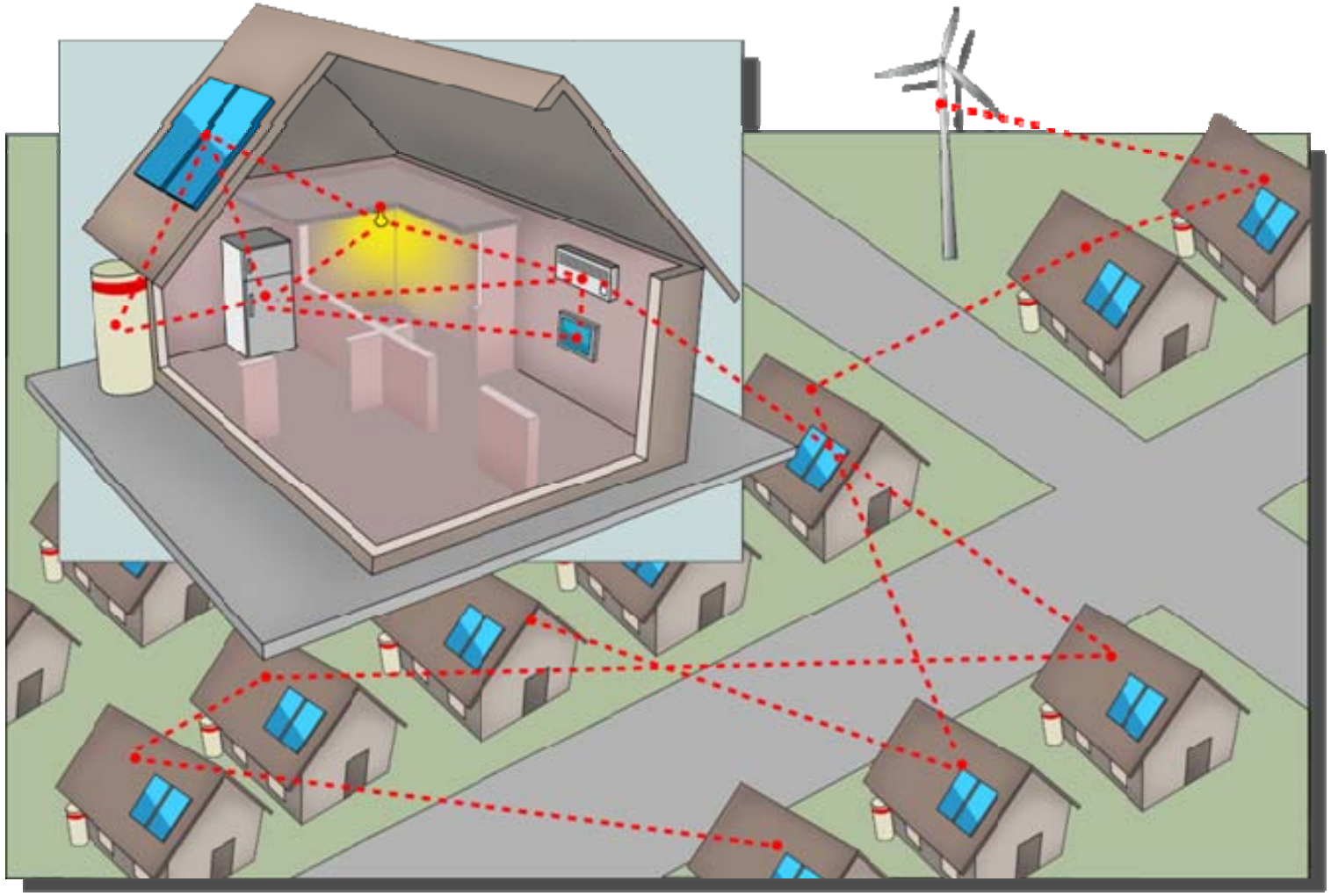
Select date



Sustainable Building Energy End Use Intelligent Energy Management Technology



Multi-agent Networks and Intelligent Grids

CSIRO Energy Technology
James McGregor
Energy Systems Manager

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Thank you

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Building Integrated Photovoltaics -innovative concepts, policies & tools

Presenter:

Professor Deo Prasad
UNSW

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Contents

- **BiPV concepts and Multifunctional façades**
- **Policy Issues**
  - Solar Cities Program
  - Tariff debate
  - Other Rebate/Subsidies
- **Tools**
  - Australia
  - Canada
- **Economic Challenges**

UNSW Quadrangle

- 42kWp System
- two arrays comprise 252 - BP5170S modules.
- 9 modules are connected in series, called a 'string'.
- Each two strings are fed into one of 14 - BP Solar Gci2500 Inverters.

- LIVE DATA www.energy.unsw.edu.au

Alice Springs Hotel

- 305-kilowatt solar power system atop the roof of the Crowne Plaza Hotel in Alice Springs, Northern Territory
- expected to provide between 40 and 80 percent of the hotel's power requirements, depending on the time of year

Building adapted PV (mainstream)

43.9kWp Bisol p-Si modules, Slovenia, Congress Centre

PV as part of Building function

221kWp of blessed Vatican PV

Building integrated concepts for roof systems

Building integrated concepts for façades

13 kWp PV at Vocational School Tyrol, Austria

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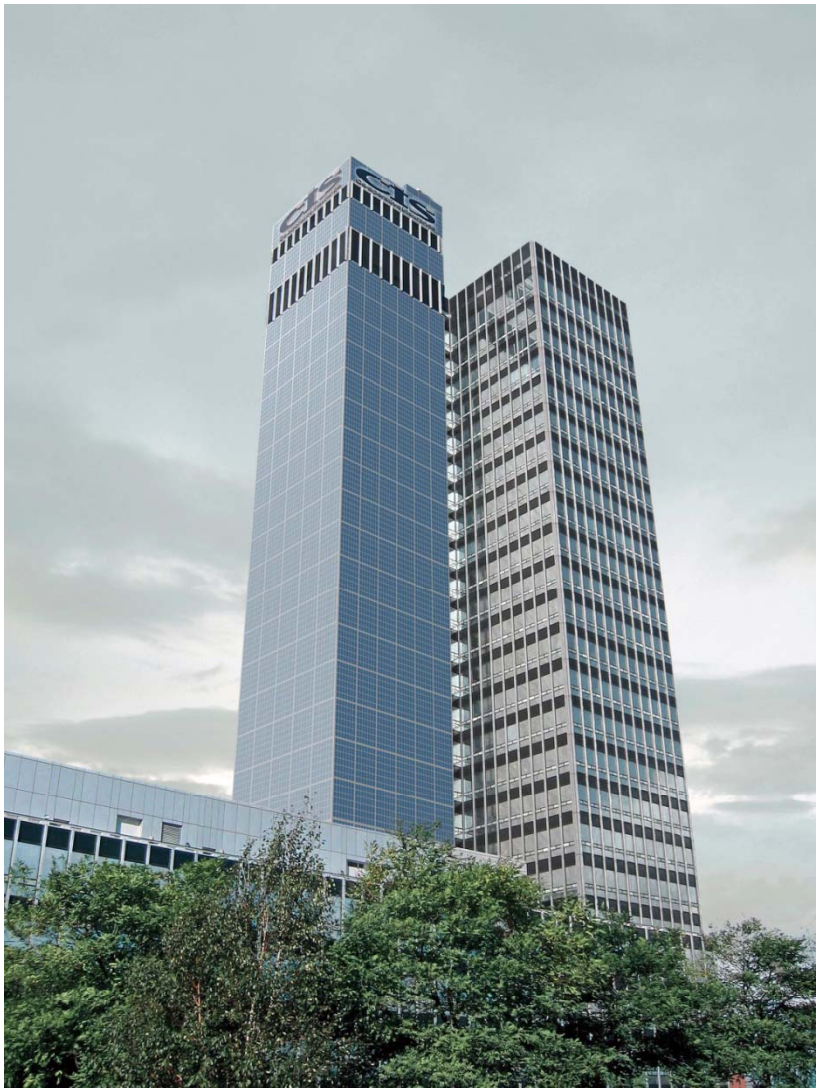
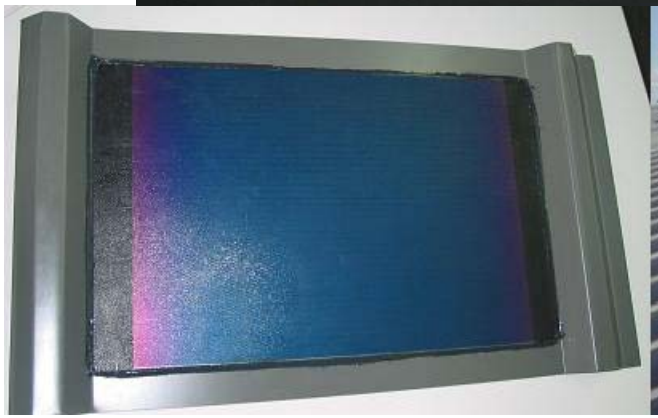
Building integrated concepts for façades



Solar Kogarah (AJC)

Kogarah SYDNEY 160 kWp



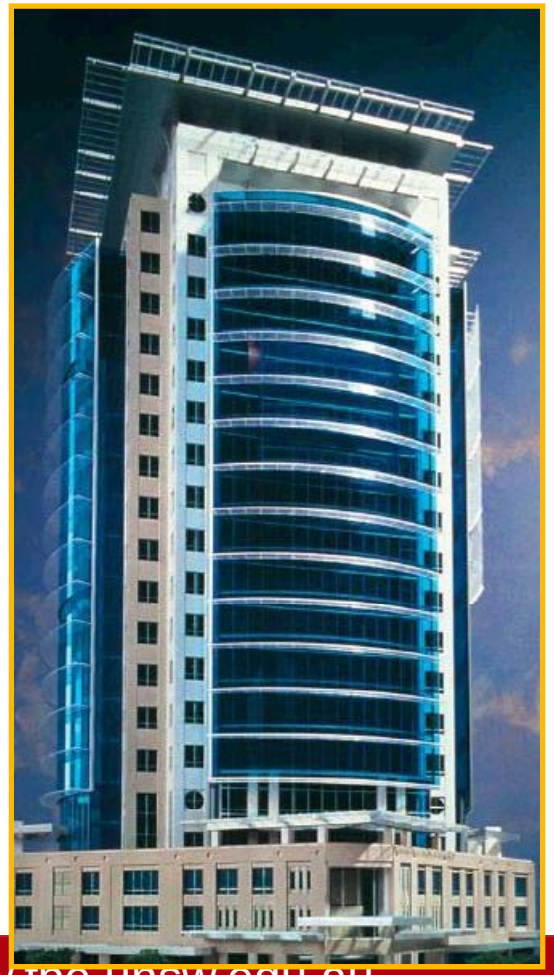
Australian showcase projects in major cities

Kogarah
SYDNEY
160 kWp

QV Markets
MELBOURNE
190 kWp

Melbourne
University
43 kWp

High Rise
BRISBANE
60 kWp



Original 629kWp

Olympic Village
SYDNEY

Additional 72kWp

Shade systems and balustrades

System (UPS)
Solar Electricity goes to the DC bus of the UPS

Power generated:
140,000 kWh = 6% of total building's demand
or
Enough to power 30 to 40 houses

Benefits of Integrated Solar Energy and Low Energy Systems

- 20% + return on $1M invested
- Building 20% more energy efficient
- Reduction of CO2 per annum = 1600 tonnes
- Operational cost saving of $214,000 / year
- Building qualifies for 5 star SEDA greenhouse rating

Façade innovation

A-Si solar fascia
Lambeth, UK

43kWp Melbourne University PV glazing façade, Australia

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Innovative design

La-Vaguada entrance PV canopy 5.2kWp Madrid

Synergies with building materials

1MWp Mont-Cenis-Academy building, Herne Germany

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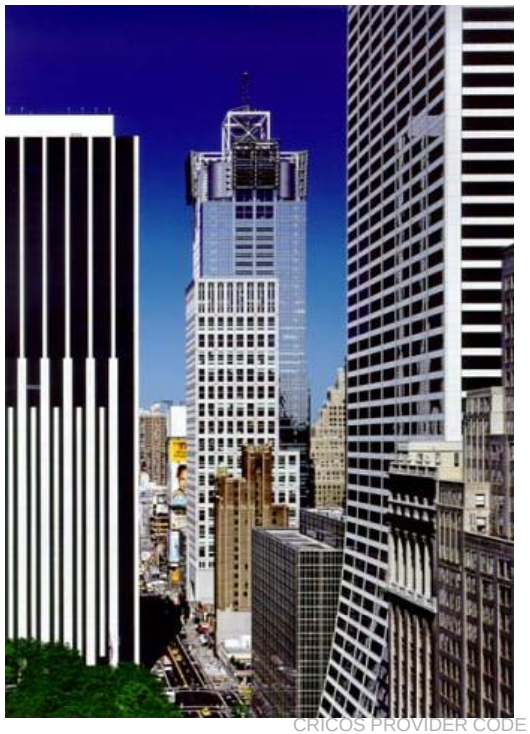
Four Times Square, NY

- 48-storey skyscraper – 1st major office building built in NY in 1990s
- BIPV curtain wall from 37th to 43rd floor on south and east facades replacing spandrel glass.
- BIPV attached to building in same way as standard glass



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Global examples – pergola

BIPV application : Pergola

Building name	*:*	*The Solar Pergola*
Location	*:*	*Spain, Barcelona*
Building type	*:*	*Pergola*
Completion	*:*	*2004*
PV application	*:*	*Roof integrated PV*
Type of PV :	*Monocrystalline silicone*	
Quantity	*:*	*449 kWp*
Yield	*:*	*1250 kWh/kWp*

General Description

The 50m height PV area is close to the size of a football pitch (112x50m2)

Source : http://www.isofoton.com/espaniol/forum.pdf

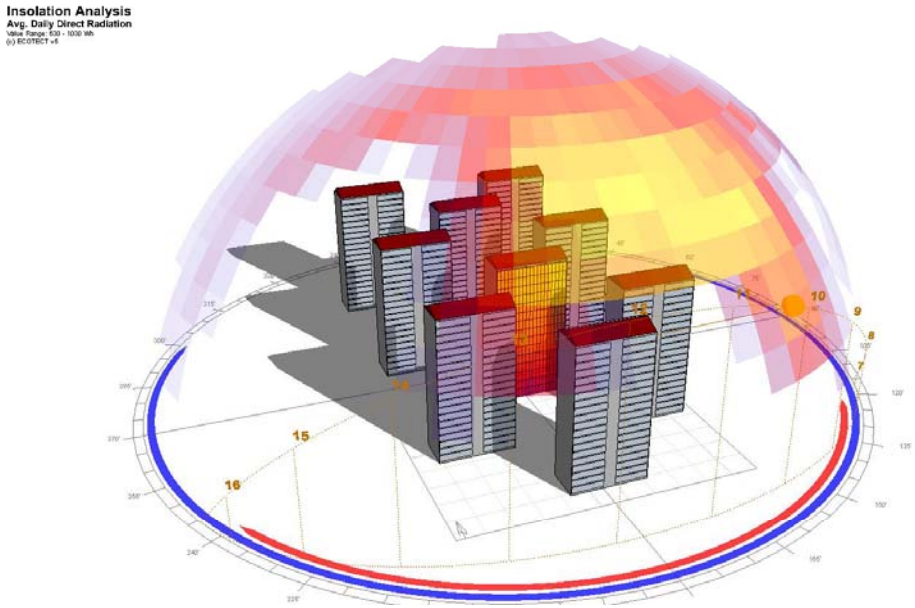
http://www.earthscan.co.uk/news/article/mps/UAN/226/v/3/sp/332244698595342568278

CODE 00098G

Global examples – High rise

Korea

250kWp PV systems on roof mounted apartment blocks



Day lighting and power generation design control

BIPV Buildings in Beijing

Tianpu,Beijing Grid-connected system(50kWp)

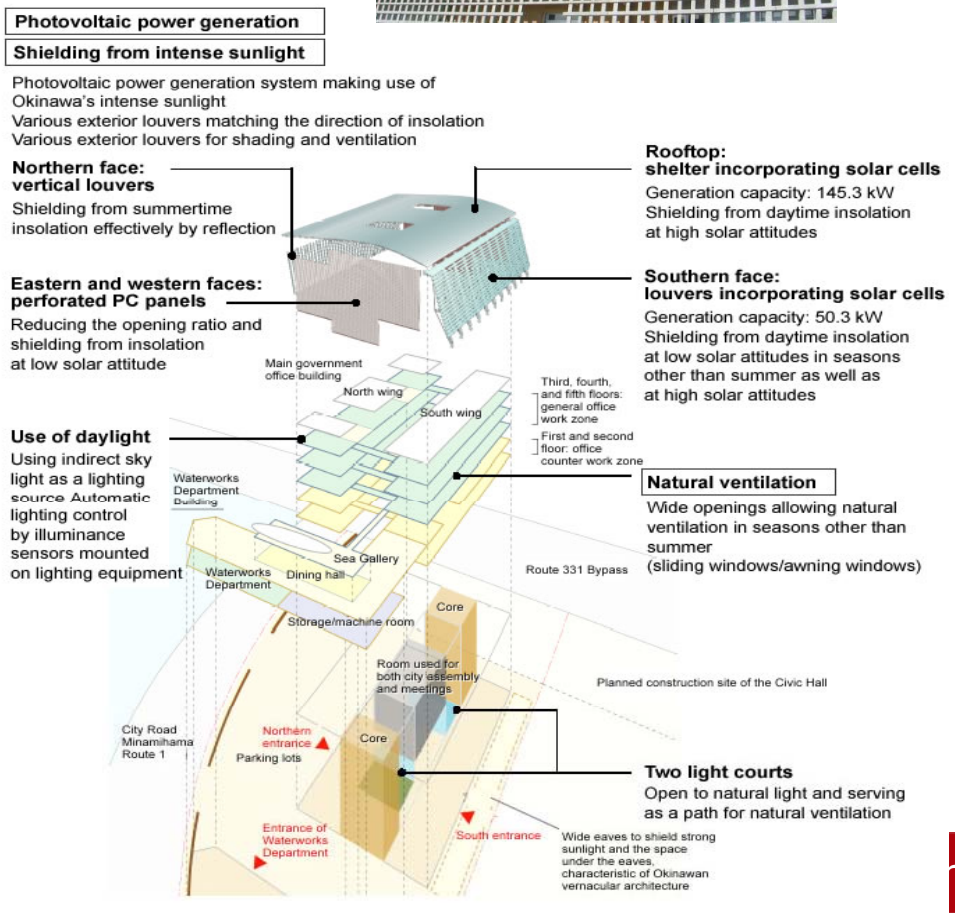
•National Gymnasium Grid-connected system
•(100kWp) (In progress)

Volkswagen Beijing Service Center(43.2kWp)

•The new solar-powered Bus Stop Indicator in Beijing

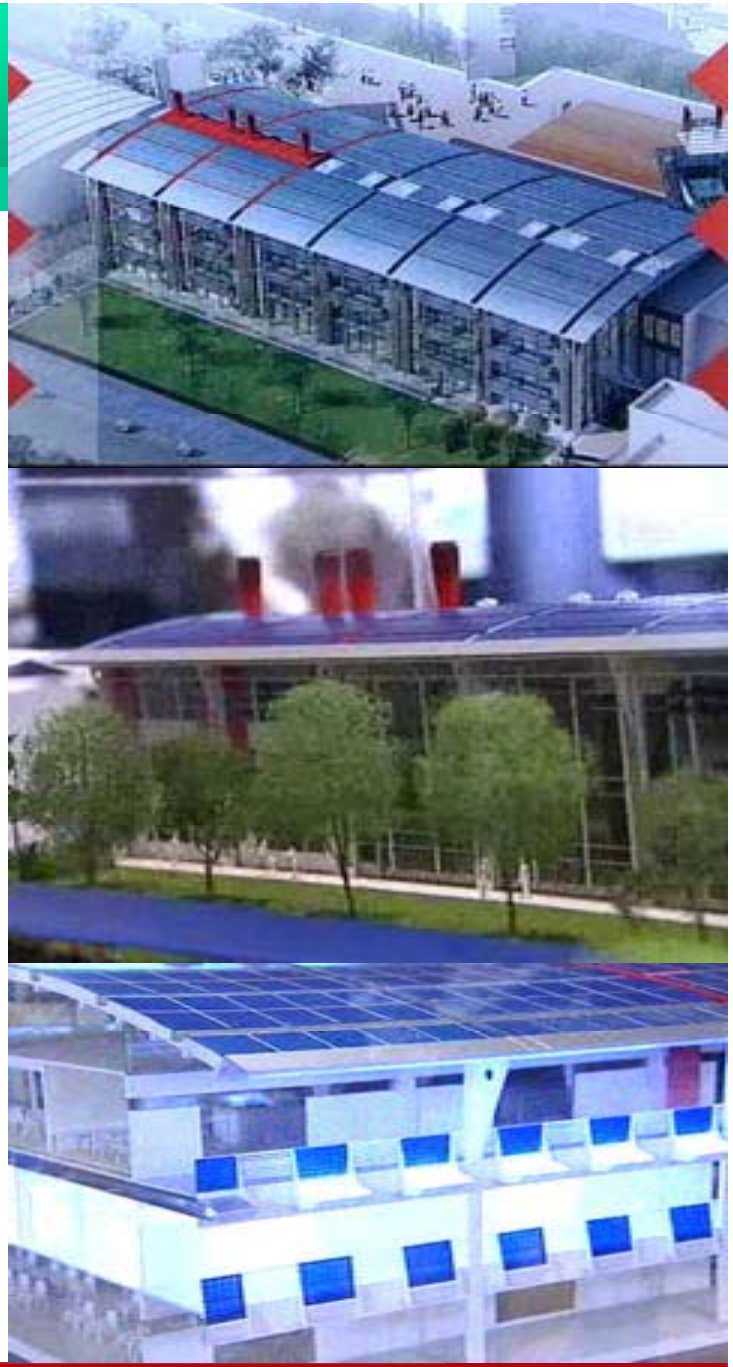
Whole building solution - IEQ performance

Itoman City Government building, Itoman, Okinawa, Japan

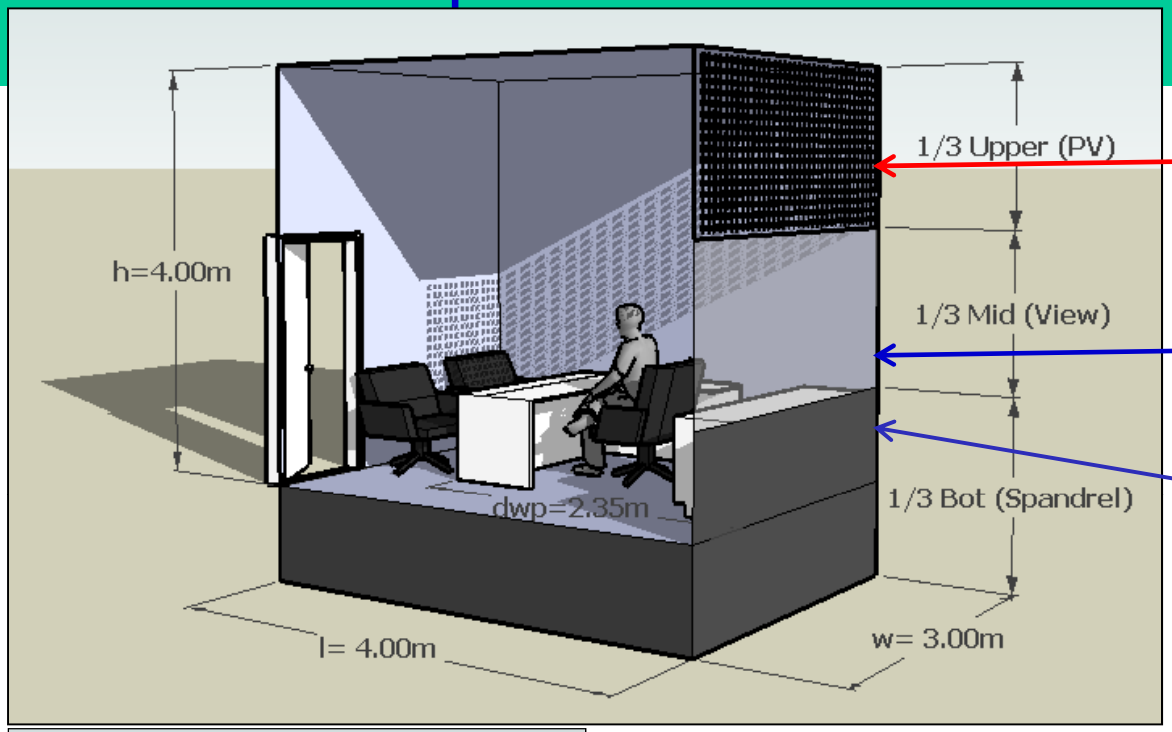


Singapore ZEB

- S$10 million spent to retrofit of an existing facility to incorporate some of the latest energy-efficient inventions
- The building is able to generate as much electricity as it consumes through renewable energy. This works out to a net energy consumption of zero over a typical year
- The solar panels which constitute about 15% of the building cost
- 60 percent of utility bills usually goes into air-conditioning. Sensors will detect the presence of users and will direct fresh air to their breathing zones. Recycled air will be used for ambient cooling

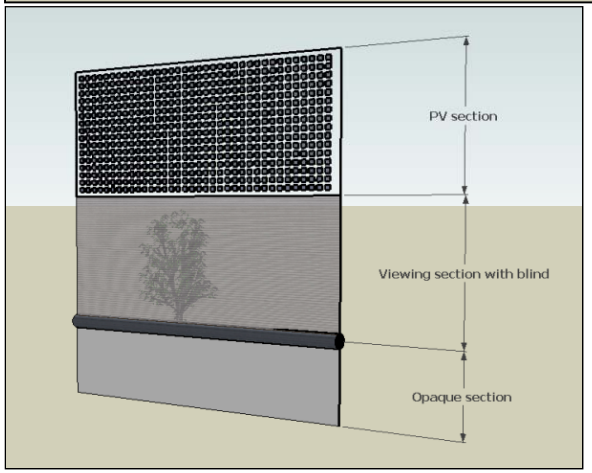


•Semitransparent PV windows



3 section façade:

- 1/3 Upper section with semitransparent PV
- 1/3 Middle viewing section with blind
- 1/3 Bottom opaque section below workplane



- ***Base case –***
  Single office located in Montreal

- Develop concepts and design methodology for façade with PV

Australian Solar Feed in Tariff

- SA - 44 c/kWh, net export up to 10 kWp, for up to 10MW or until 2028
- Qld – 44 c/kWh net export, for up to 8 MW or until 2028
- ACT – 3.88x tariff (50.05c) gross 20 years for 10 kWp systems, 80% (40.04c) for systems between 10-30 kWp
- Vic - 60 c/kWh net export up to 3.2 kWp, for 15 years, ends 2024
- Energy Australia - 28 c/kWh net export, between 2-8pm
- Alice Springs Solar City – 45 c/kWh gross export 10 years, limit of $5 per day
- NSW – 60c/kWh net for 20 years up to 10kWp
- WA and TAS still to decide

EU NEWS……..May 2009

- ‘European Parliament voted for ‘zero energy buildings…. Zero Energy Buildings is a key element in the renewed EU legislation on buildings. During the last plenary session the Parliament adopted new legal requirements for Europe’s buildings and their energy performance
- From 2019 all new buildings in the EU will have to produce more renewable energy onsite for example by solar panels than they consume, the Parliament decided by recasting the Energy Performance Buildings Directive of 2002.
- These zero energy buildings will include energy efficient buildings whose overall annual primary energy consumption is equal to or less than the energy production from renewable sources on site. By 2015 national targets will be set to fix minimum percentages of existing buildings to be zero energy’ --*EU Media*

•Net-Zero Energy Commercial Building Initiative :

•U.S. Department of Energy

•Energy Efficiency and Renewable Energy

•Building Technologies Program

•http://www1.eere.energy.gov/buildings/commercial_initiative/zero_energy_projects.html

•The Net-Zero Energy Commercial Building Initiative aims to achieve marketable net-zero energy commercial buildings by 2025. Net-zero energy buildings generate as much energy as they consume through efficient technologies and on-site power

•**Zero Energy Building**

•**Energy and Atmosphere,**

• Net Zero Site Energy, Building produces at least as much energy as it uses in a year, when accounted for at the site

• Net Zero Source Energy, Building produces at least as much energy as it uses in a year, when accounted for at the source

• Net Zero Energy Emissions, Building produces at least as much emissions-free renewable energy as it uses from emission-producing energy sources annually

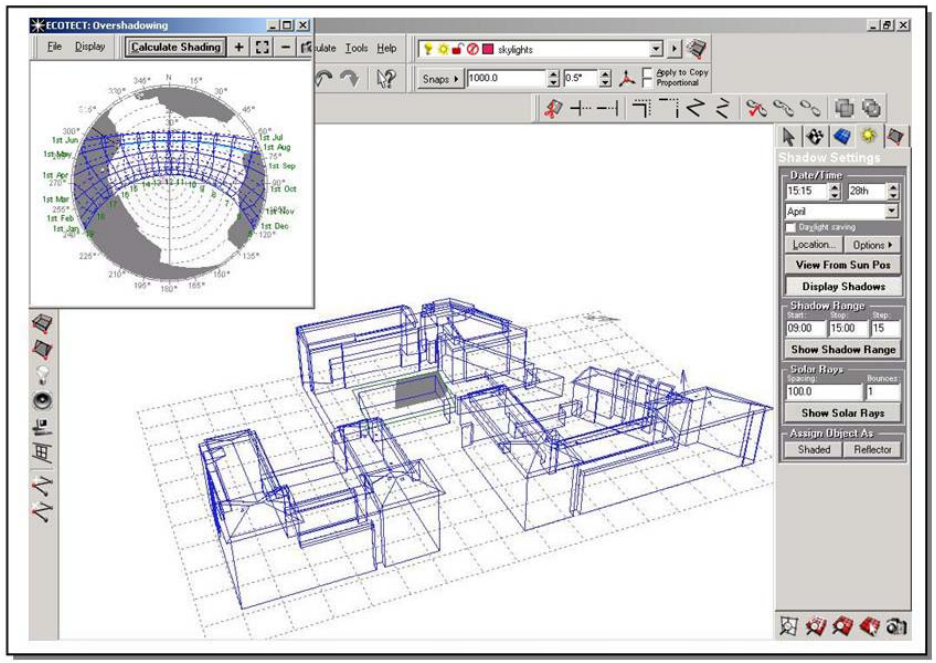
Challenges for Net-zero and Low-energy homes/buildings

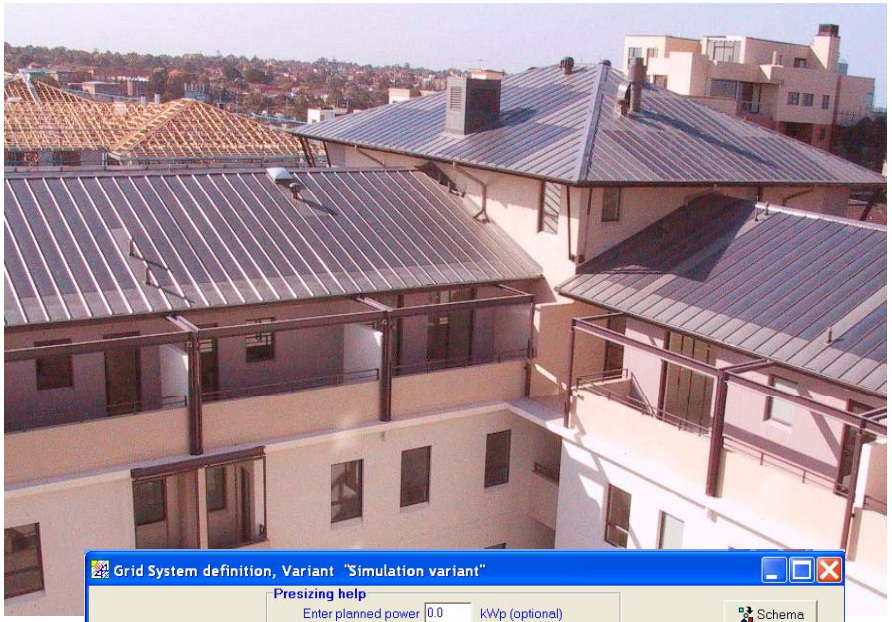
- Integration of solar technologies with the architecture and with the envelope.
- Integration and optimization of solar with energy efficiency technologies – must not be separate.
- Thermal storage and passive solar design – what are the obstacles; need to integrate in standards – design tool being developed by SBRN.
- Integrated control of energy and solar systems: reduction of peak loads will reduce need for new power plants.

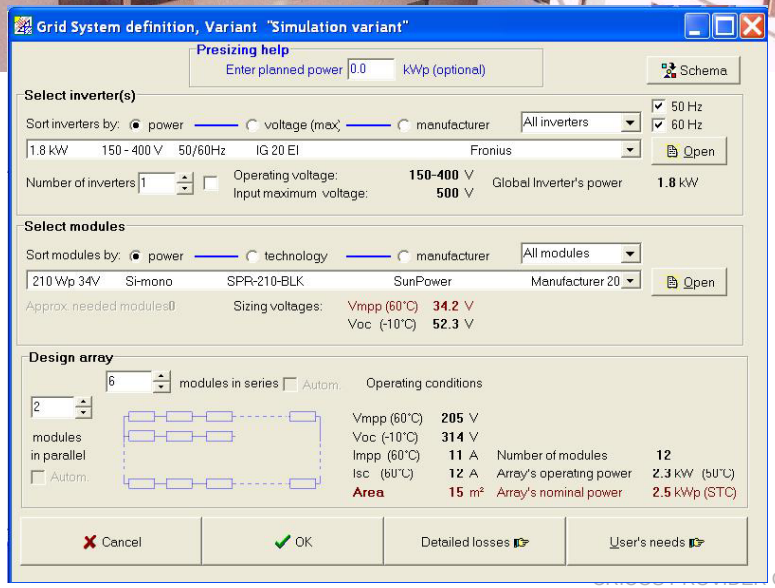
ESP-r and its BiPV and PVT Modelling Ability

- ESP-r is open-source software used by researchers worldwide.
- While requiring some knowledge of energy modelling and thermodynamics, ESP-r is very capable of modeling nearly any advanced feature.
- Uses **finite difference method**, making it more accurate than many other programs for modelling thermal mass &passive solar performance.
- An application-specific/or user-friendly user interface can be created to build and simulate ESP-r models.
  - For example, HOT3000, a popular program for assessing the energy use of houses uses ESP-r as a simulation engine.

PVSYST and ECOTECT simulation







Ecotect was used for generating hemispherical sky obscuration model to feed into PVSYST which is part limited by a basic CAD interface

Economic Challenge

- Link to property value
  - Why do we cost PV on buildings as a utility? It is a building material.
  - Value added benefits!
  - 5%-15% property value impact????
- Innovative financing.
- Who has lost money in developing, selling, owning a green building? Check Olympic site.
- Productivity gains and social environment

Cogent Energy

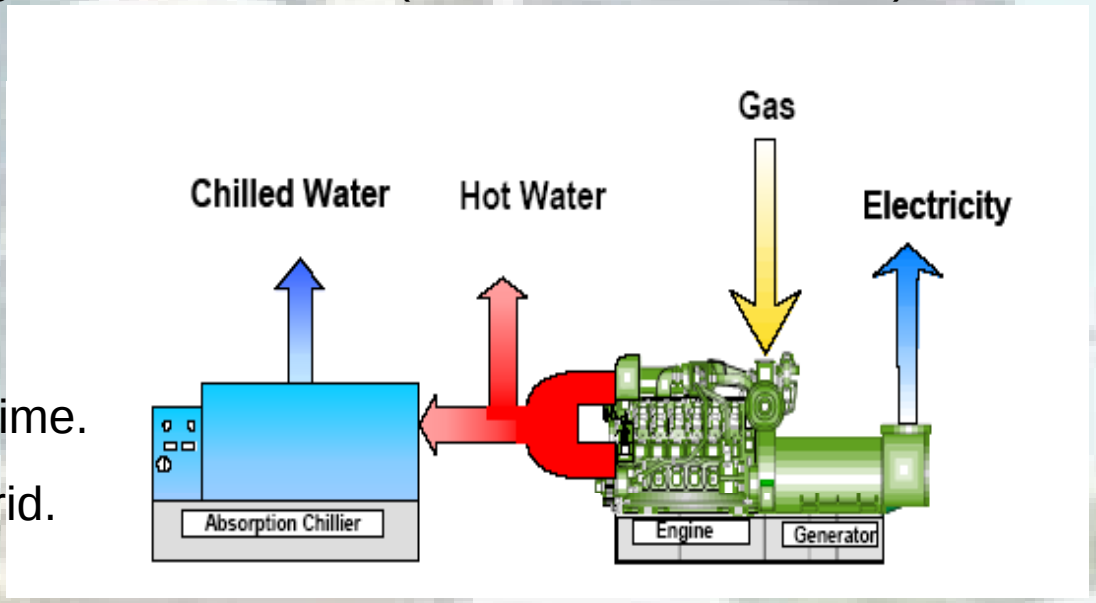
GBCA Presentation

Sydney, 29th September 09

What is Cogeneration & Advantages?

What is Cogeneration?

- Simultaneous production & use of electricity & heat.
- Sometimes referred to as Tri-generation or CHP (Combined Heat Power).



Advantages

- Proven, low risk & short lead time.
- 50% less CO2 emissions to grid.
- Up to 80% energy efficient.
- Can uplift Green Star & NABERS ratings by 1-2 stars.
- Usually cost-effective.

Building Case Study – 101 Miller St, N Sydney

- Building Owners – Mirvac & Eureka
- Installed during building refurbishment in late 2008
- 40k sqm commercial, 10k sqm retail
- Plant services base building and tenants
- Tenants – Federal ATG Dept, NSW RTA, AGL
- Base building & tenant energy rates competitive to grid
- Plant Size
  - 2.4 MW electrical
  - 1.5 MW absorption chilling
  - 70% efficiency
- 5 Star Green Star, 5 Star NABERS energy

Getting it Done!

Do it yourself

- Out sourced design & installation
- Cost of about $2.0-$2.5m per 1 MW installation (including absorption chillers)
- Ongoing operations & maintenance at about $120k pa per 1MW
- Accept risk with future gas prices
- ROI normally determines ***go*** or ***no-go***

Outsource to distributed energy company (like Cogent Energy)

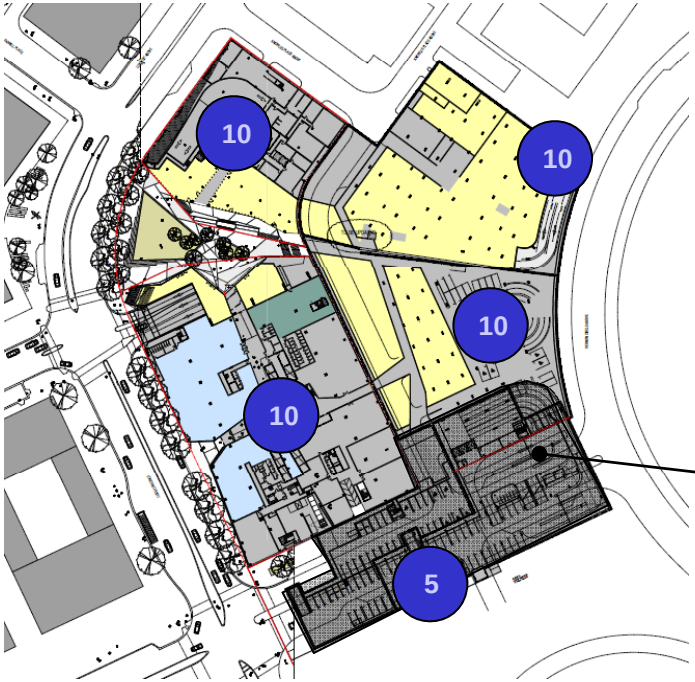
- Cogent Energy designs, installs, finances, operates and maintains plant
- 12 year ESA (Energy Supply Agreement)
- Electricity, hot water and chilled water priced competitively to black grid energy
- No gas price risk
- Capital contribution usually required (~ $250k)

Sharing spaces (3 spaces); potential Green Star Innovation credits;

#

electric car charging station (futureproofing only); provided by Better Place; potential Green Star Innovation credits;

bicycle parking and facilities (>350 spaces); Green Star Tra-3 points;



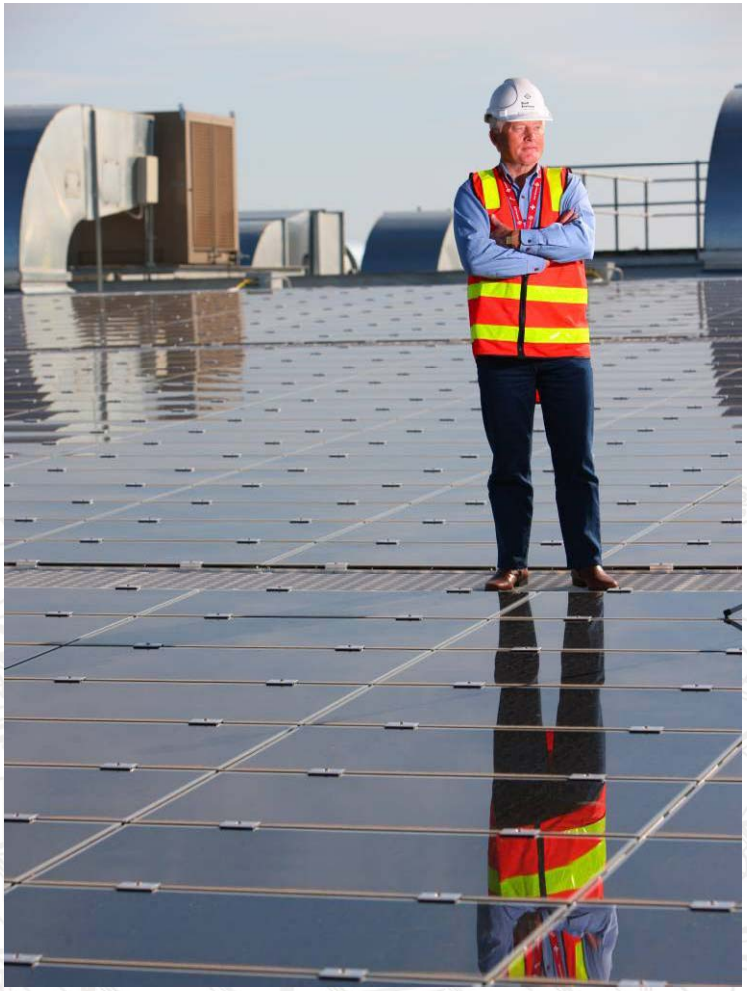
directed parking system for public car park; reduces greenhouse gas emissions from car exhaust; 1-3% reduction in operating costs;

ARUP

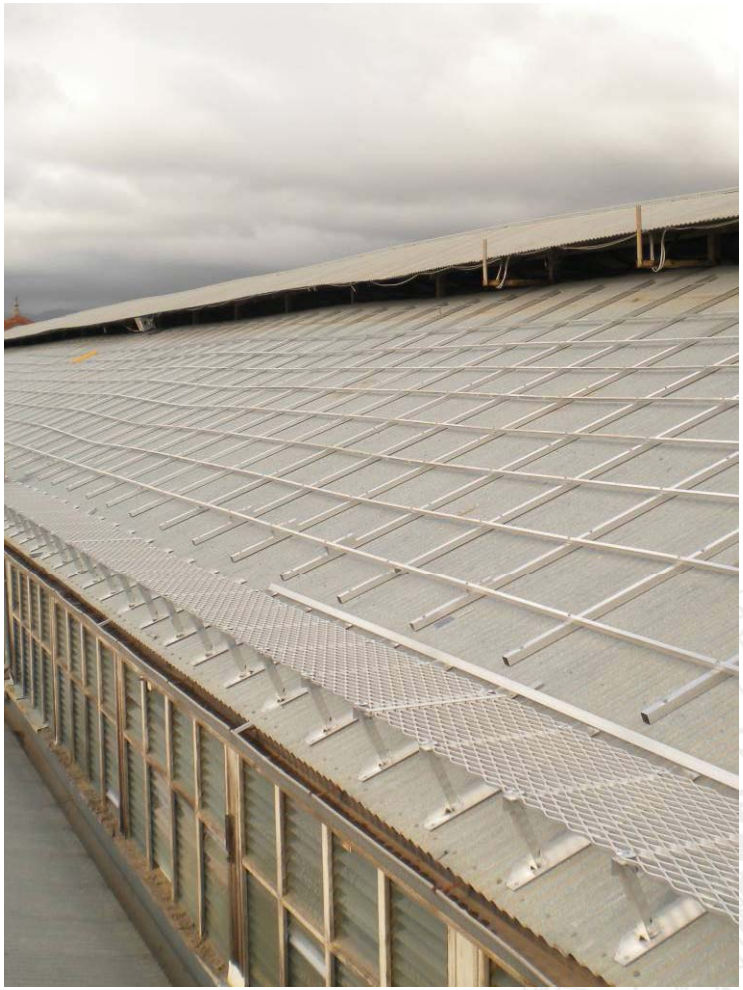
Adelaide Showground Solar Project

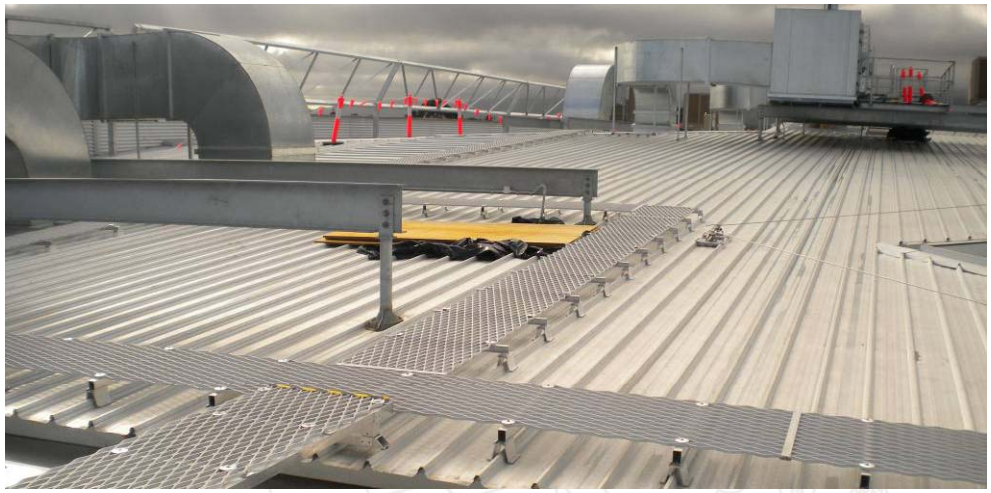
Built Environs

Adelaide Showground Solar Project

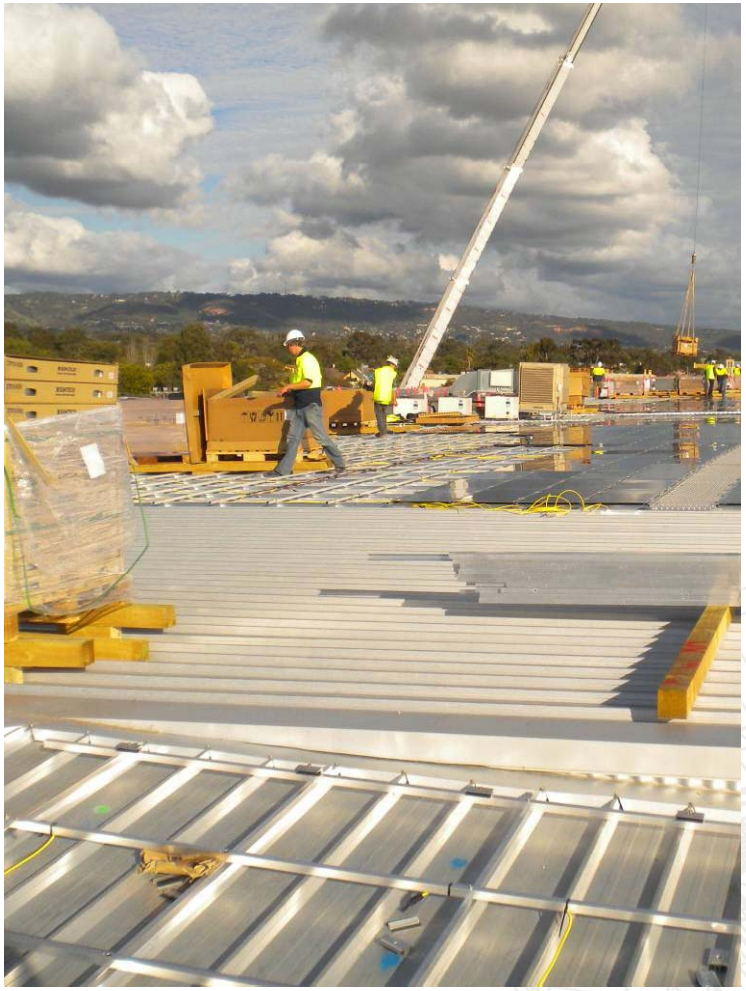


Adelaide Showground Solar Project

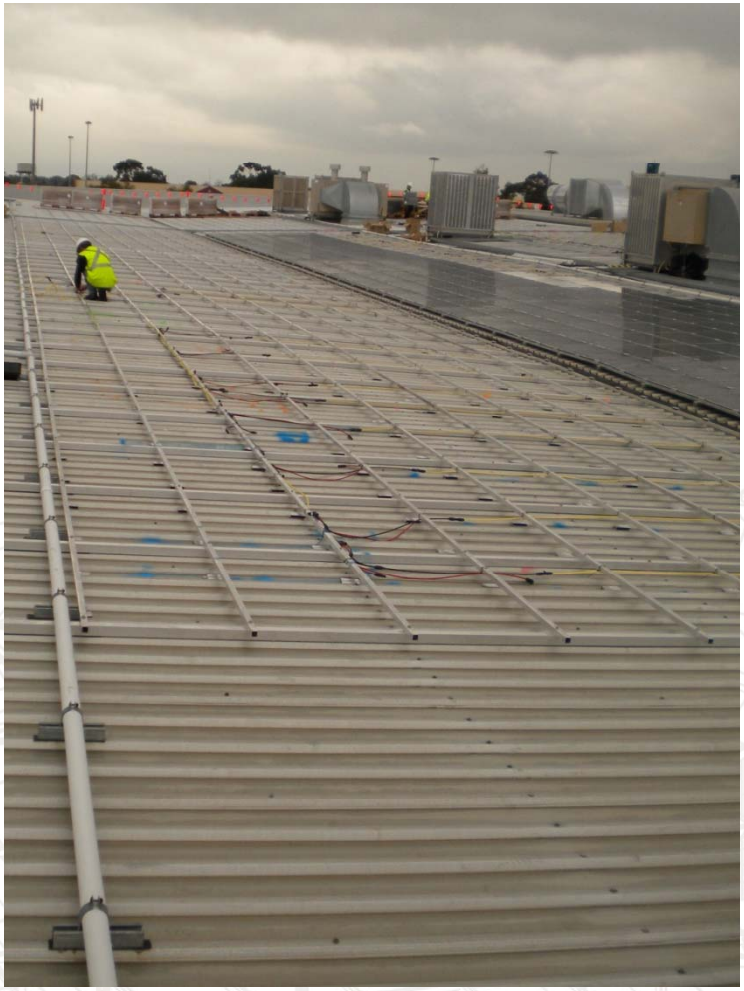




Adelaide Showground Solar Project



Adelaide Showground Solar Project



Adelaide Showground Solar Project

Adelaide Showground Solar Project

Adelaide Showground Solar Project

Adelaide Showground 1.0MW Solar Project

•Australia's largest commissioned solar power system to date (including non-PV technologies), rated at 1.0MW, or one million Watts.

•Next largest PV array is 400kW sunfarm in Singleton, NSW, commissioned 11 years ago by Country Energy.

Some Project Facts

- Built in alliance partnership with Built Environs
- The total array spans 6 building rooftops
- The project took 14 months from inception, to calls for expression of interest, request for tenders, post tender negotiations, contract execution to practical completion.
- Construction took approx 2 months for 20 installers through Winter and a lot of rain.

Some Project Facts

- The total array spans 6 building rooftops and includes 12,720 solar modules, some fascade-mounted (vertical)
- 12,612 x Fist Solar FS277 (77.5W) Thin Film frameless modules
- 108 x SunTech STP200-18/Ub (200W) Polycrystalline modules
- 95 x SMA transformerless inverters including SMC-11000TL and SB5000TL units

Some Project Facts

Building/Structure	Number of Solar Generators (each terminated to a distinct Distribution Board)	Rated power (Watts Peak)	No. of Modules	No. of Grid Inverters (89xSMC11000TL + 6xSB5000TL)	Ave size of each Solar Generator (Watts Peak)	Comments
Dairy	1	32,085	414	3	32,085	
Ridley	3	139,965	1806	13	46,655	
Jubilee	12	421,755	5442	39	35,146	
Goyder	5	219,945	2838	20	43,989	
Wayville	2	85,560	1104	8	42,780	
Alpaca	1	78,120	1008	8 (2x SB5000TL)	78,120	
Goyder Façade	1	5670	27	1 (SB5000TL)	5670	Connected to Goyder
Jubilee Facade	1	5670	27	1(SB5000TL)	5670	Connected to Jubilee
Screen	1	11,340	54	2 (SB5000TL)	11,340	Connected to Goyder
Total	27	1,000,110	12720	95	38,466	

On the job

On the job

The finished product

QUESTIONS

Thank You

TO OUR SPEAKERS….

James McGregor, Energy Systems Manager
CSIRO

Professor Deo Prasad,
Sustainable Energy at UNSW

Blair Healy, Managing Director,
Cogent

Luke Mclean, Project Manager
Built Environs

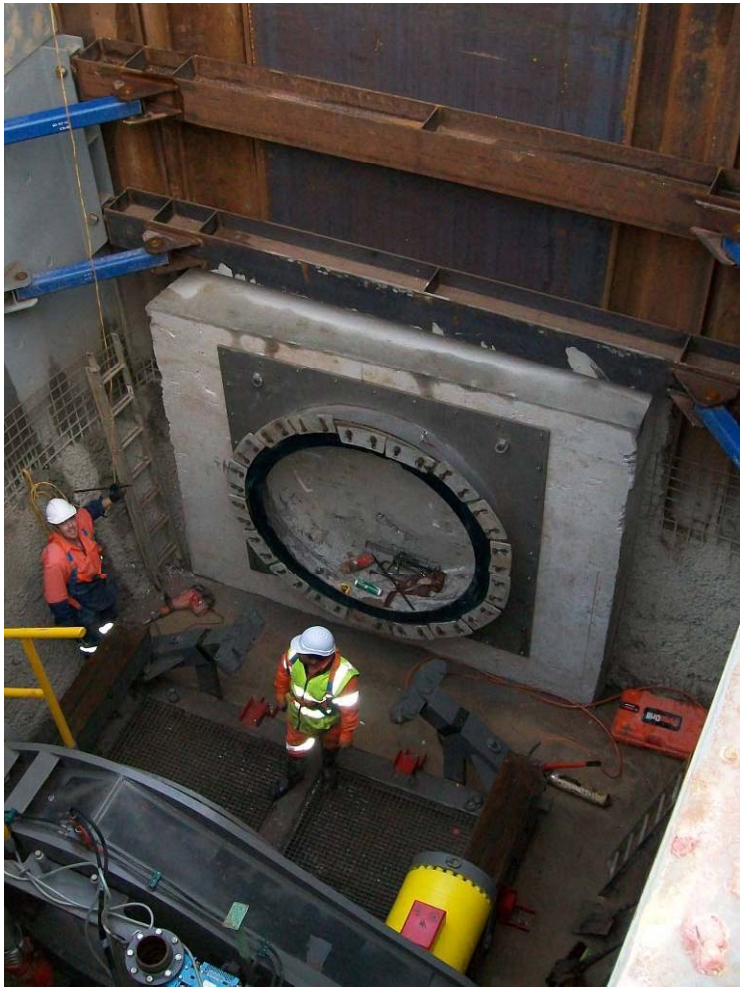
David Buetefuer,
Project Development Manager, Solar Shop
Australia Commercial Division

Save water, Save lives.

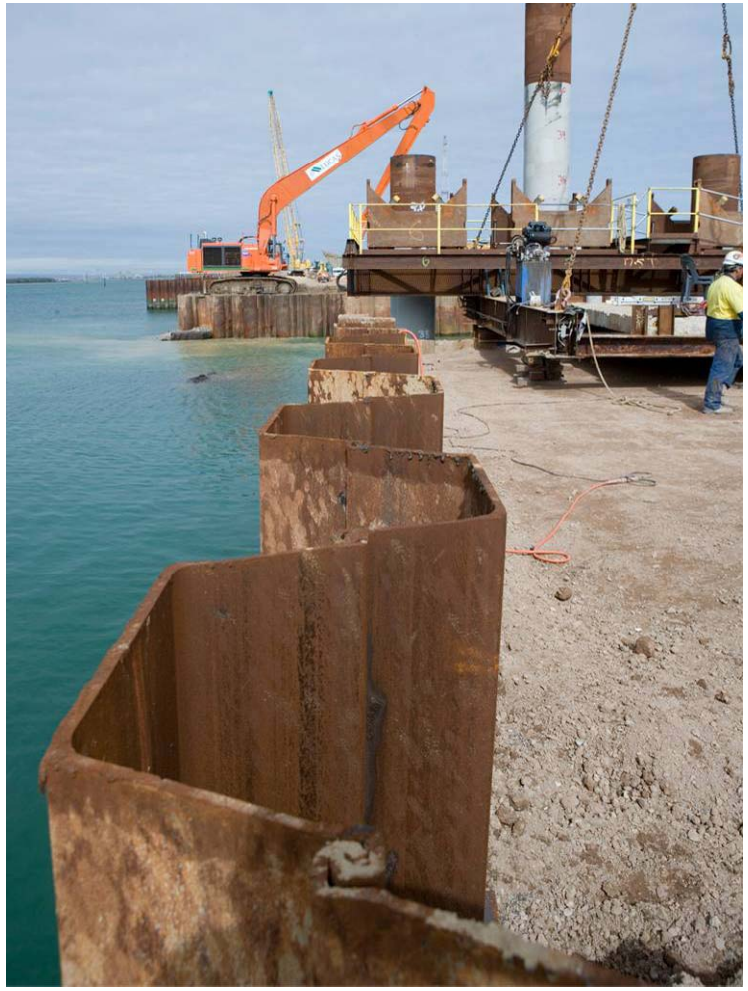
Recent major projects

Built Environs

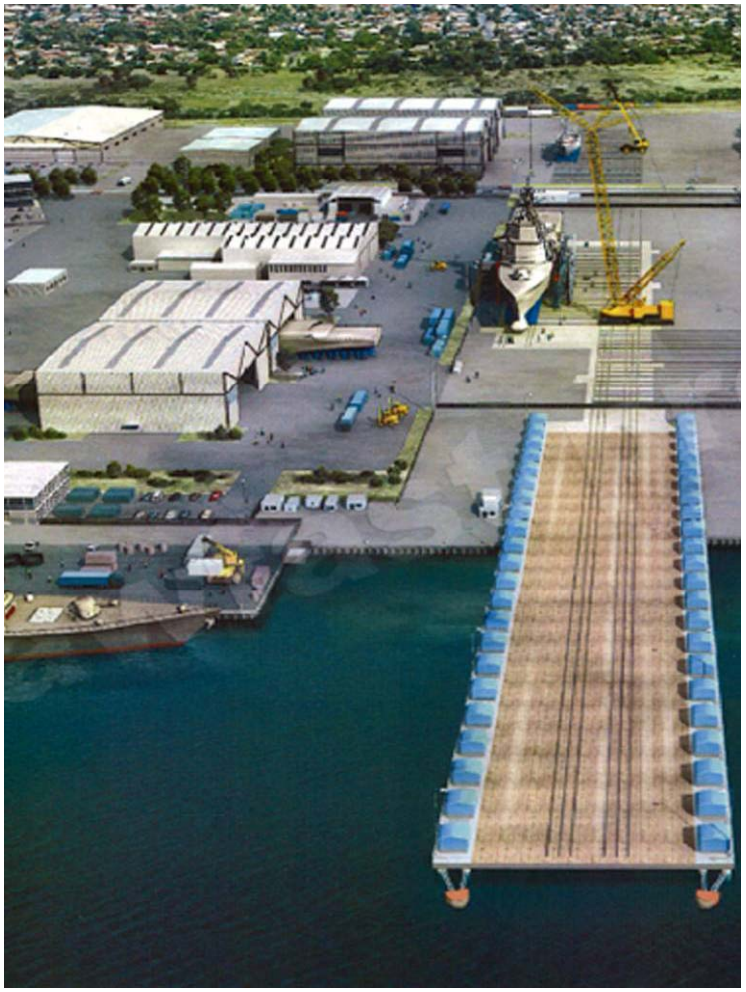
Adelaide Desalination Transfer Pipeline (in joint venture)



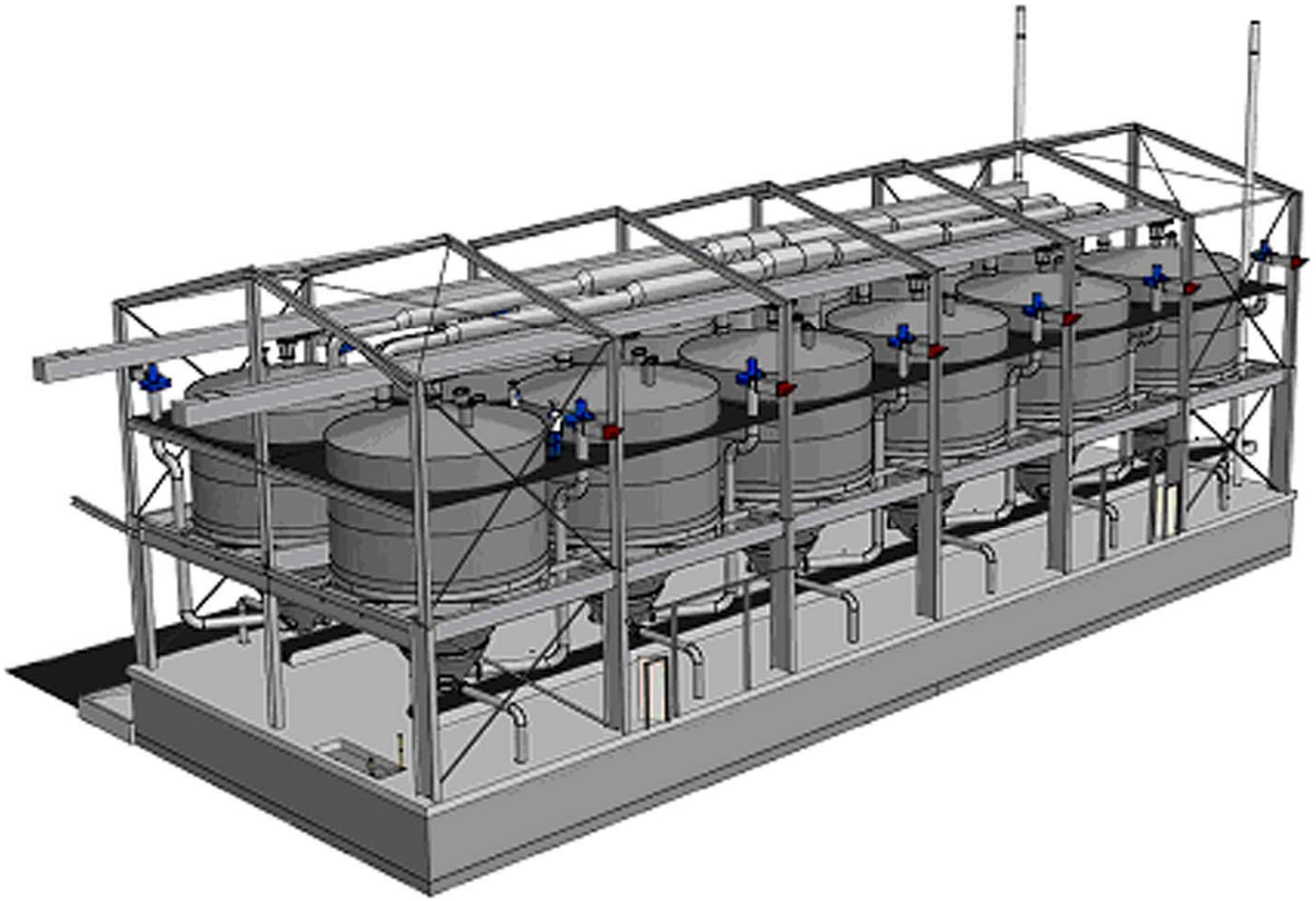
Common User Facility (CUF) (in joint venture)



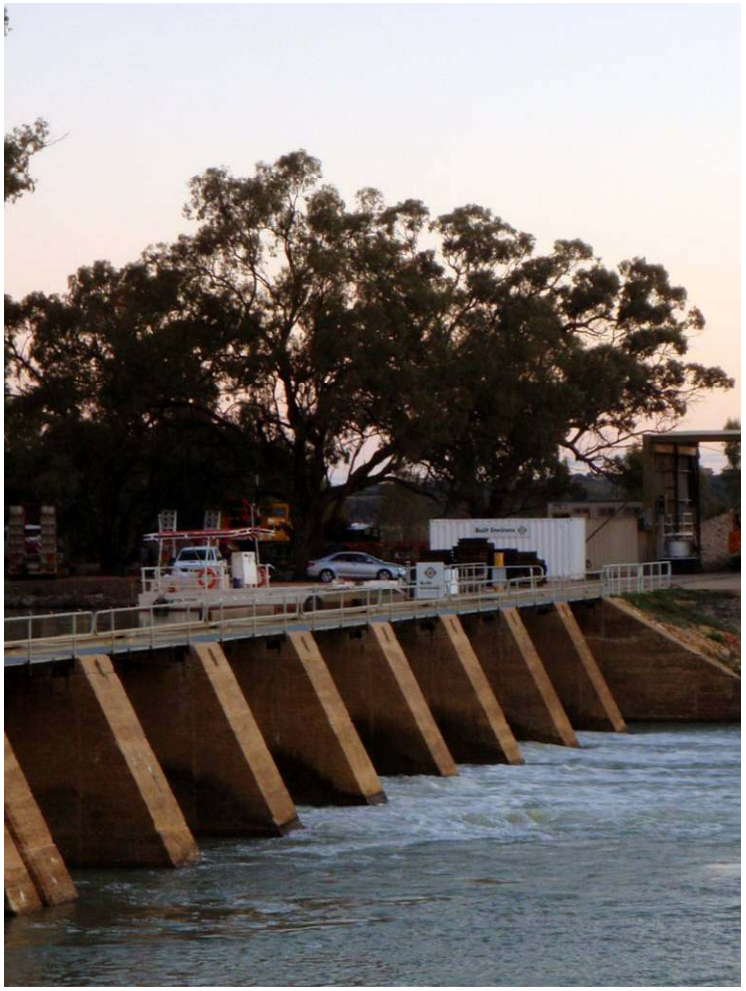
Common User Facility (CUF) (in joint venture)



Pinkenba Malting Plant, Queensland



Lock 3, Overland Corner

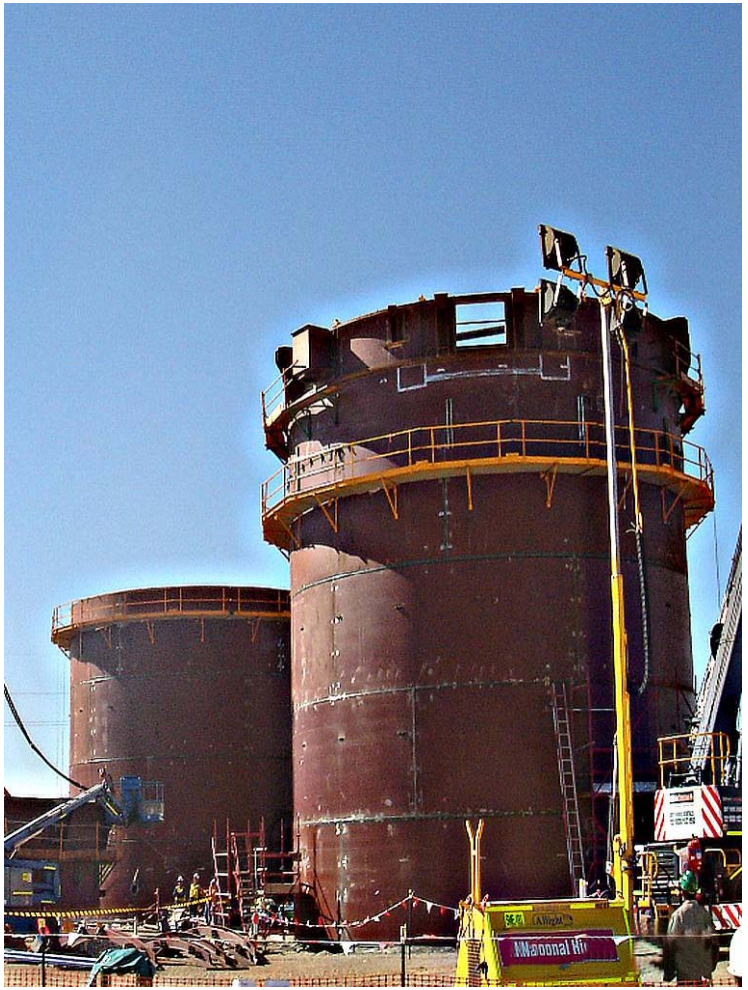


Capital Wind Farm, New South Wales

Hallett Hill Wind Farm

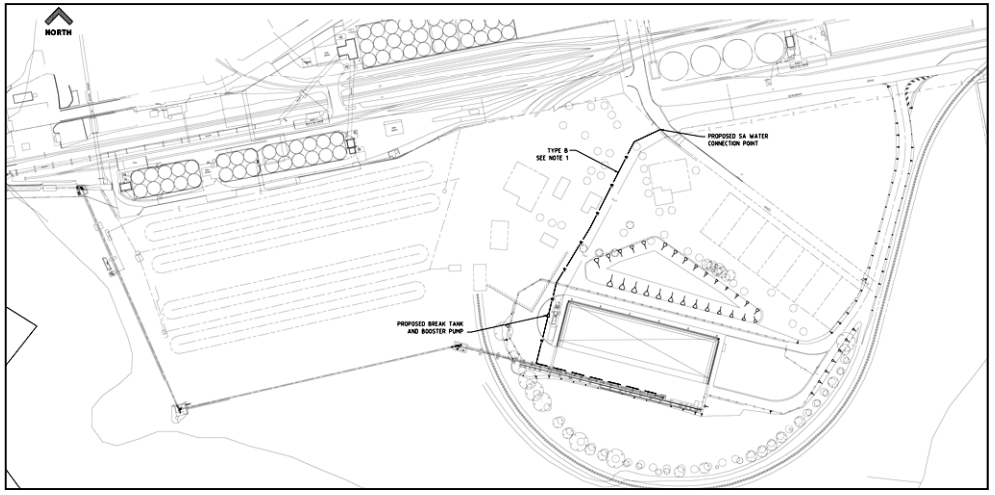
Clements Gap Wind Farm

Tails Leach Circuit Upgrade, Olympic Dam

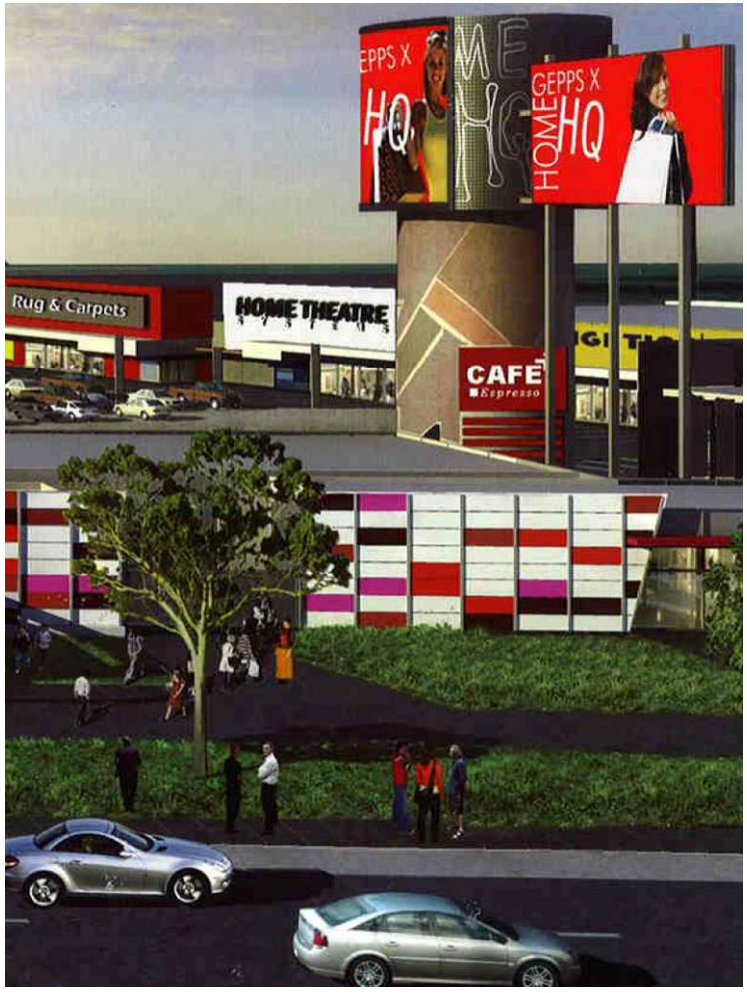


Structural Mechanical Piping – Package 2

Port Thevenard Mineral Sands Transfer Facility



Gepps Cross Home HQ

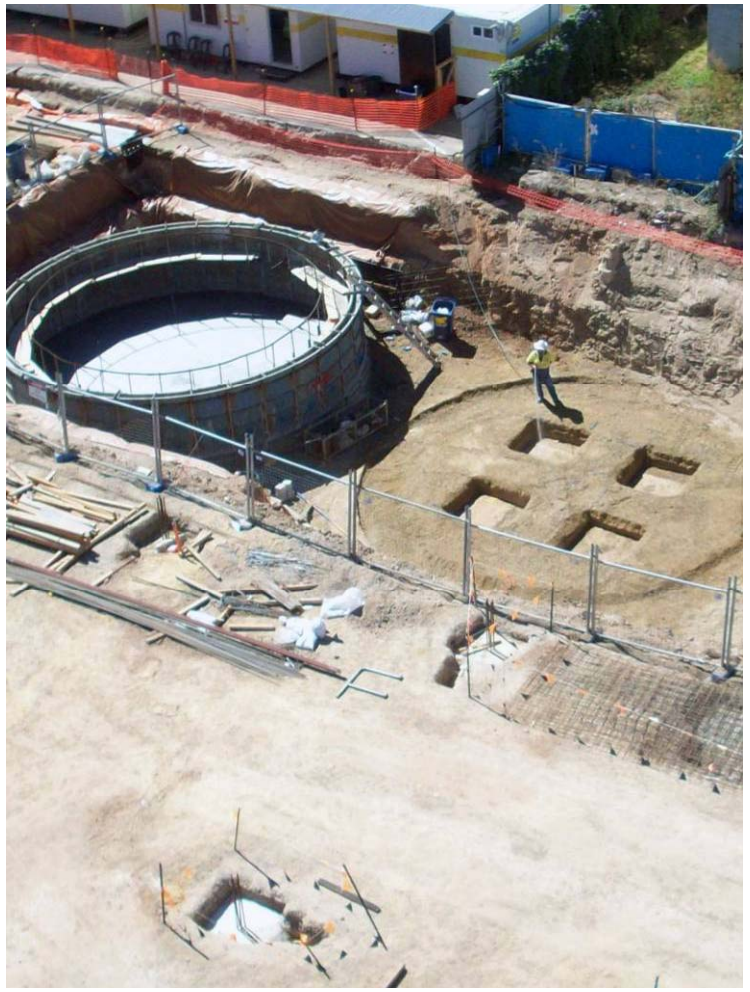


University of Adelaide Plant Accelerator

Adelaide Showground Solar Project

SOLARSHOP AUSTRALIA

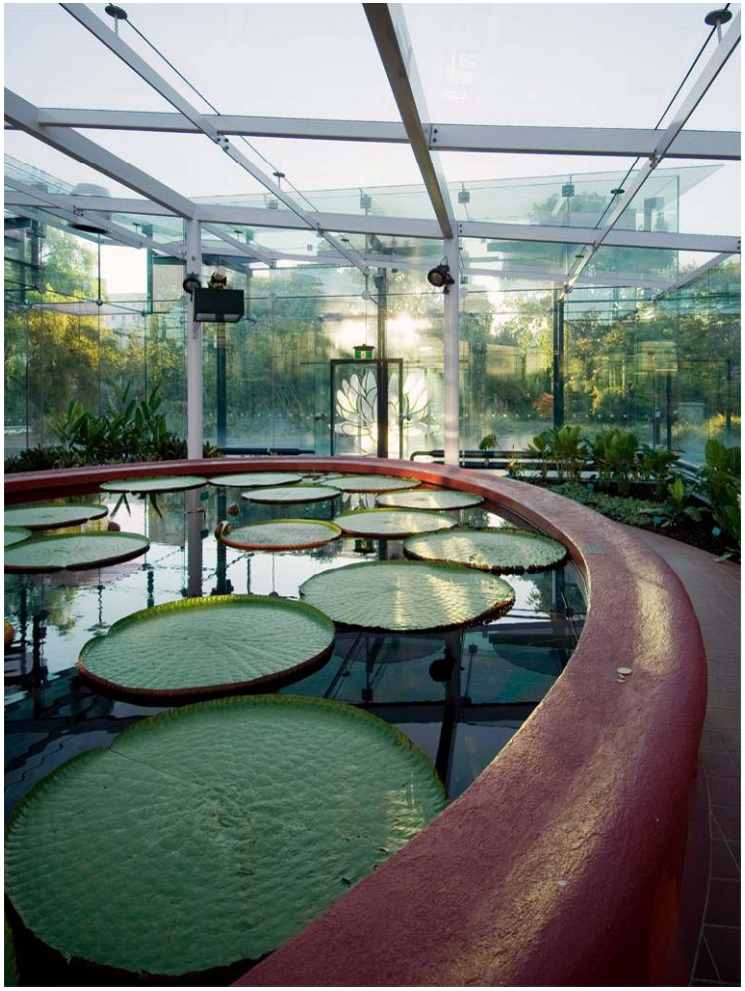
CMI Toyota Showroom, West Terrace



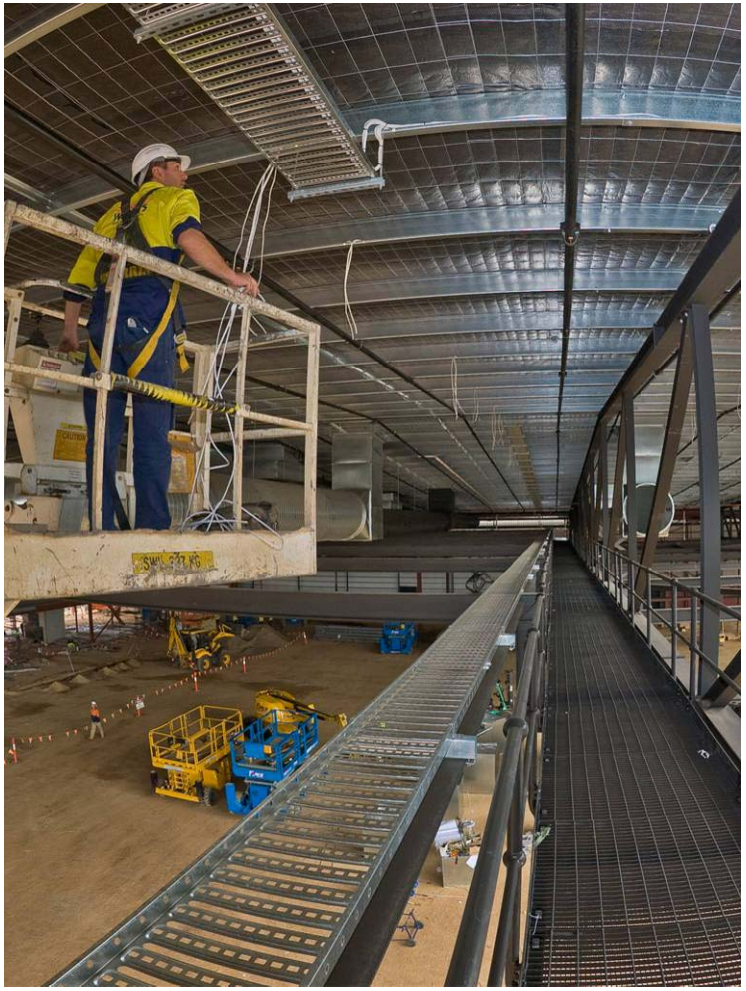
Adelaide Oval Western Grandstand

Adelaide Oval Western Grandstand

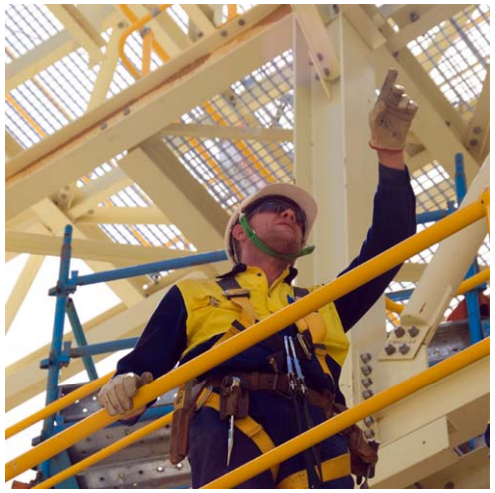
Amazon Waterlily Pavilion



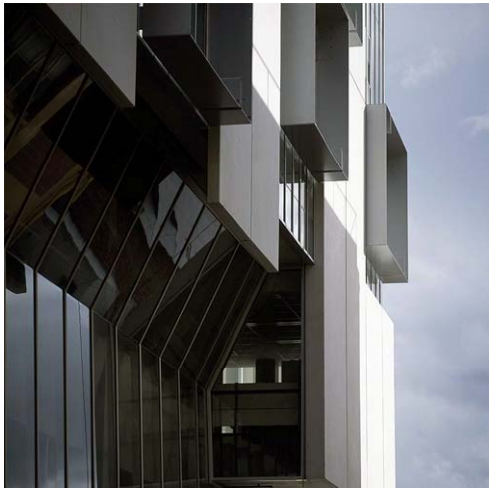
Adelaide Showground – Goyder Pavilion



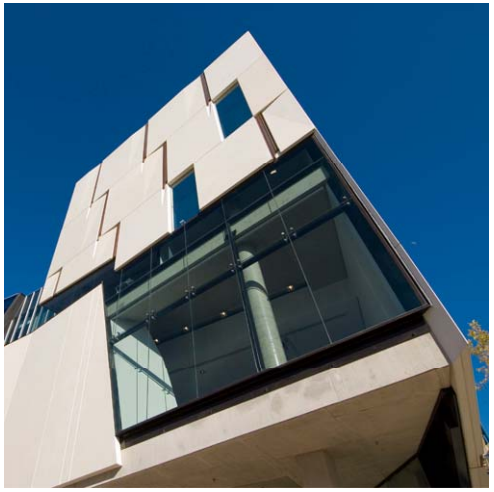
Ravensthorpe Projects, Western Australia

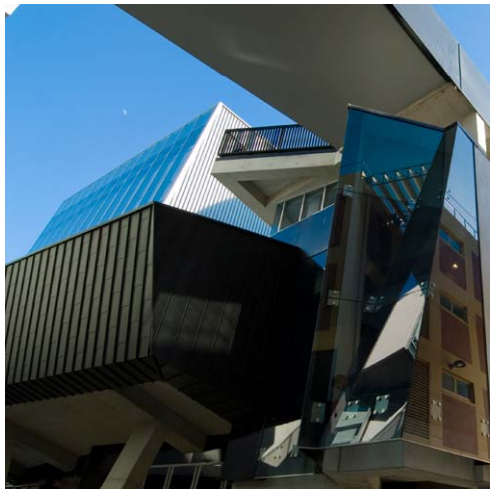


UniSA City West Campus

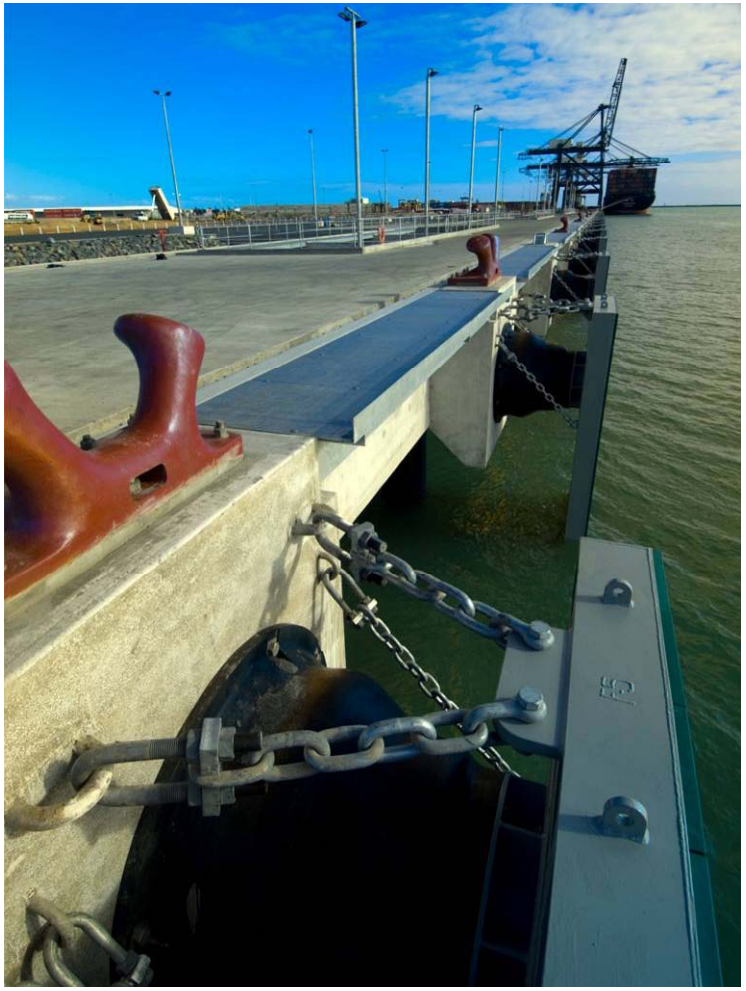


UniSA Hawke Building

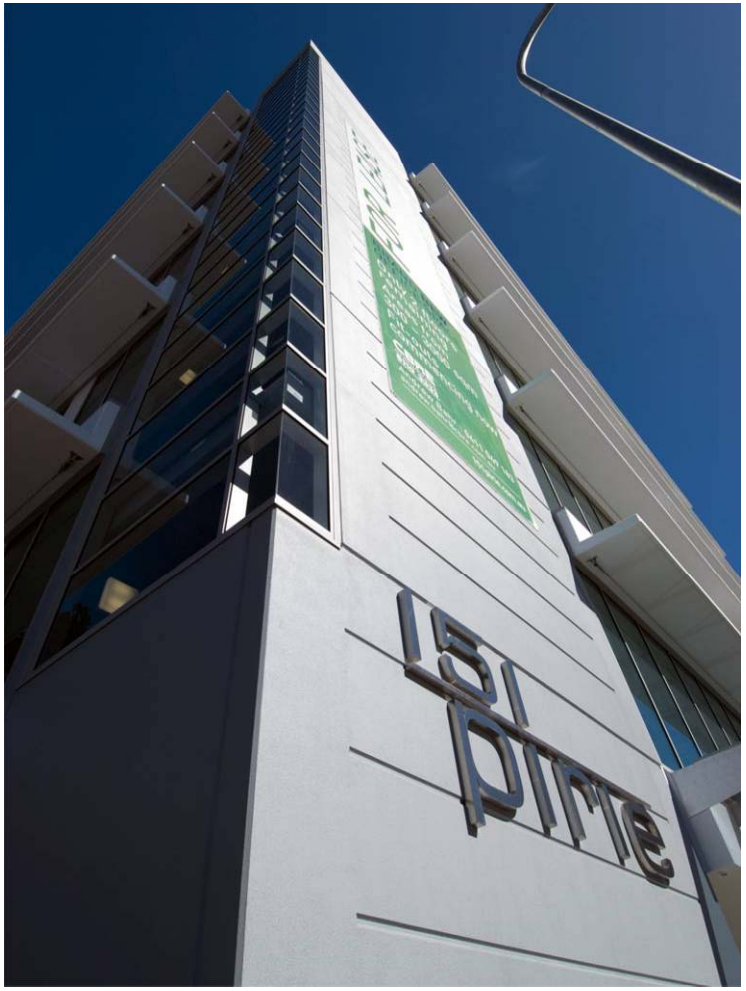




Outer Harbour Wharf



151 Pirie



UniLodge Metro Adelaide

WorldPark Adelaide

GREEN STAR COURSES

Class: Green Star Accredited Professional

Date: 24 November 2009

Level:

State: South Australia

green building council australia

THE EVENT

Greens on The Green

Date: 27 November 2009

State: South Australia

green building council australia

Thank You

Further information on GBCA

www.gbca.org.au