

# Solar Electricity for Industry

Rod Seares

General Manager – Silex Solar



Ai Group Environmental Solutions Forum  
- Energy Reliability and Certainty  
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# Our Group Mission

**To become a world leader in technology innovation for:**

## **1. Alternative Energy Technologies**

- Nuclear Energy
- Solar Energy
- Thermoelectric Energy

## **2. Advanced Semiconductor materials**

- Optical Silicon / Photonics
- Silicon-on-Insulator (SOI) substrates
- 'High-k' dielectric materials

# Silex Group Structure

## Silex Systems – Nuclear Fuel



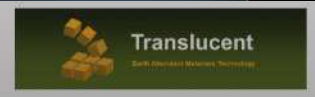
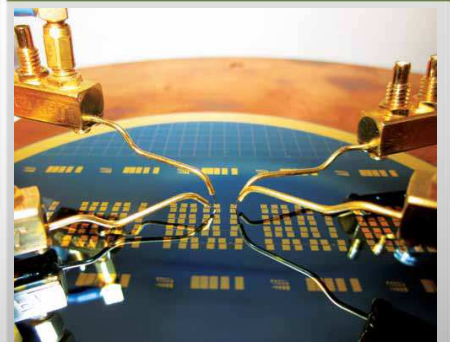
## Silex Solar – PV Panels



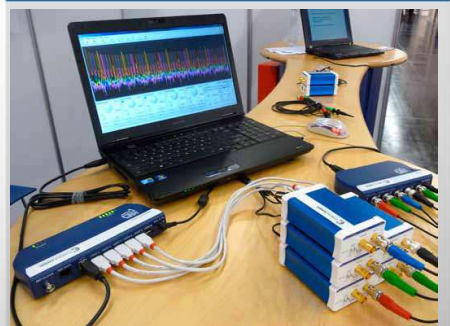
## Solar Systems - CPV



## Translucent - Materials



## Chronologic - Electronics



# Global Solar Market Situation

## Global Solar Growth

**“Solarbuzz Reports World Solar Photovoltaic Market Grew to 18.2 Gigawatts in 2010,**

**This represents growth of 139% over the previous year/.**

The PV industry generated \$82 billion in global revenues in 2010, up 105% Y/Y from \$40 billion in 2009.

Companies throughout the PV chain successfully raised more than \$10 billion in equity and debt over the last 12 months.”

Source: [Marketbuzz®](#) 2011, issued March 15<sup>th</sup> by Solarbuzz

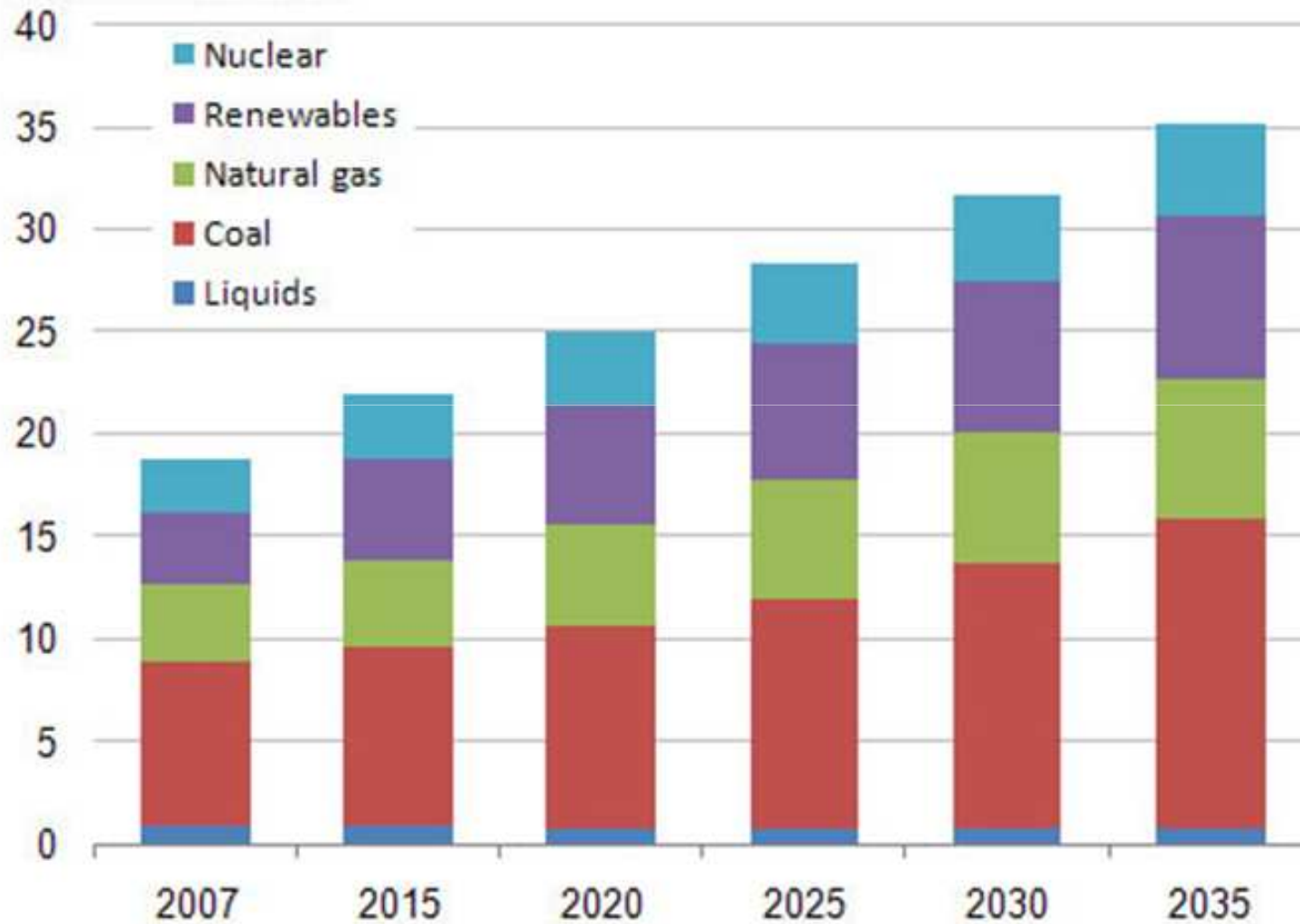
# Global Clean Energy investment for 2010

**FIGURE 5: TOTAL WORLDWIDE INSTALLED CLEAN ENERGY CAPACITY BY TECHNOLOGY (AS OF 2010)**

Wind	193 GW
Small-Hydro	80 GW
Biomass and Waste-to-Energy	65 GW
Solar	43 GW
Geothermal	7 GW
Marine	0.27 GW
<b>Total</b>	<b>388 GW</b>

Source: Who's winning The Clean Energy Race ?  
2010 Edition (March 2011)

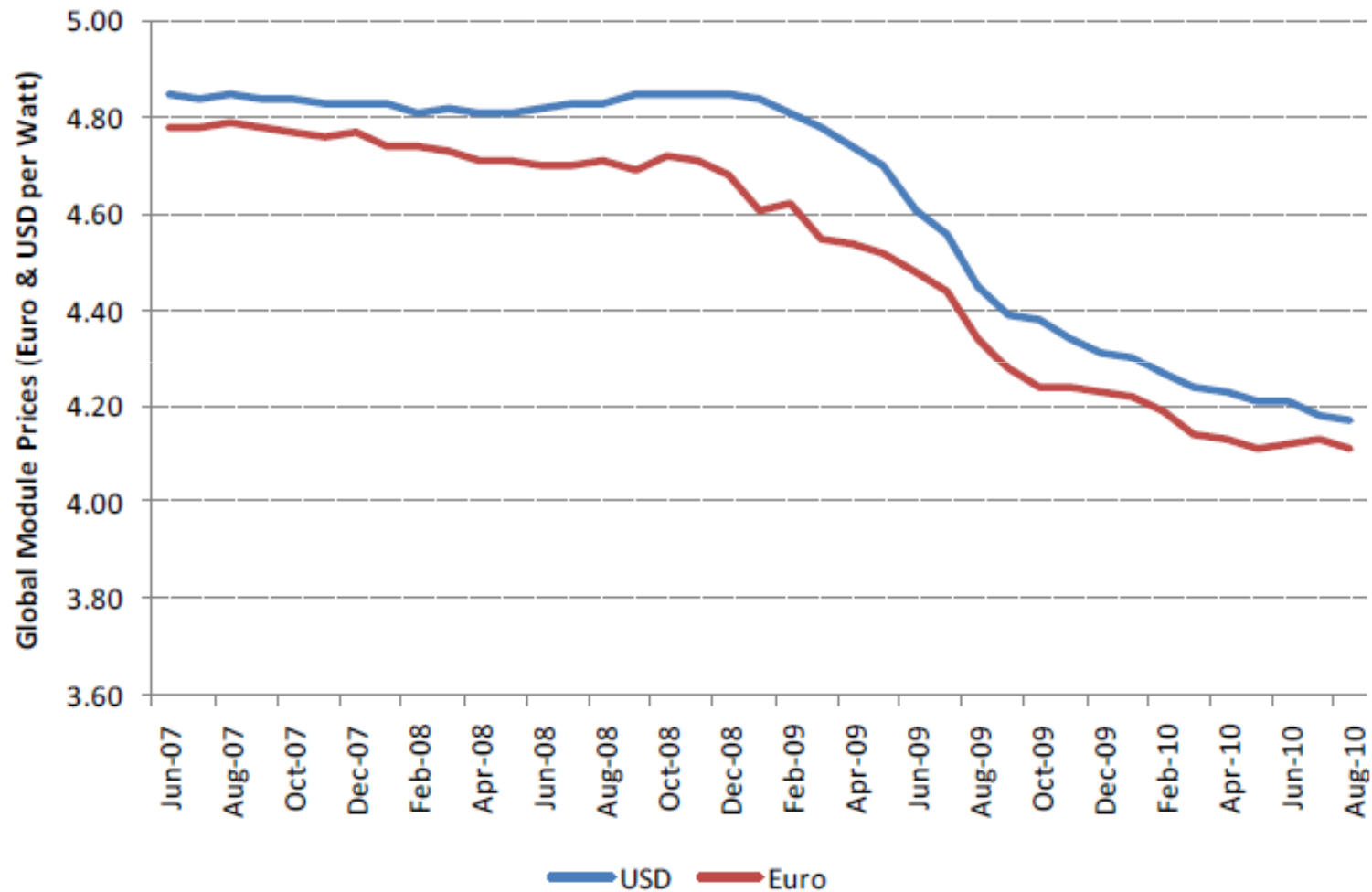
## World Net Electricity Generation by Fuel (trillion kilowatt-hours)



Source: US Energy Information Administration, International Energy Outlook 2010

# Solar more affordable

## – Prices dropping



Source Solarbuzz module retail prices to August 2010 ([www.solarbuzz.com/Moduleprices.htm](http://www.solarbuzz.com/Moduleprices.htm))



## Solar Systems Utility Scale PV

Dense Array CPV Solar

## Solar Systems Overview

- Solar Systems has been developing world-leading Concentrating Photovoltaic (CPV) technology for 20 years in Melbourne, Australia – for utility scale solar power stations.
- Solar Systems CPV technology based on the unique '**Dense Array Converter**' concept using the most efficient solar cells in the world (currently ~40%)
- Assets acquired by Silex Systems in early 2010, including:
  - Extensive Patent portfolio being extended to protect core technology
  - 500MW Manufacturing plant (Melbourne) and Bridgewater demonstration facility
- Dense Array CPV technology being prepared for large scale commercial deployment
- Solar Systems CPV technology aims to be one of the lowest cost solar power producer in the world



## Solar Systems CPV Solar Plant Operating Experience 10+ Years Operations with 5 CPV Installations

### CPV Dish Solar Power Facilities:

- 5 power plants installed in central Australia
- Triple Junction Cell introduced 2005 (~ 2x efficiency of silicon cells, ~ 4x Thin Film)
- 1.2MW reliable, integrated, manageable power stations commissioned
- Over 100 dish years of experience
- Module operating data every minute of operation
- Plans to build more remote CPV facilities

### Mildura Power Station Project:

- 100MW PV power station - one of the world's largest
- \$125 million Government funding for project (\$75m Federal and \$50m Victorian support).
- 2MW Pilot Plant to commence in mid- 2011



## Aerial view of the Bridgewater Demonstration Facility



## Solar PV Power Station – Hermannsburg, N.T.





# Silex Solar

## Sydney Olympic Park

Mono-Silicon Flat Panel Business  
(100% subsidiary of Silex Systems)

# Sydney Olympic Park Plant

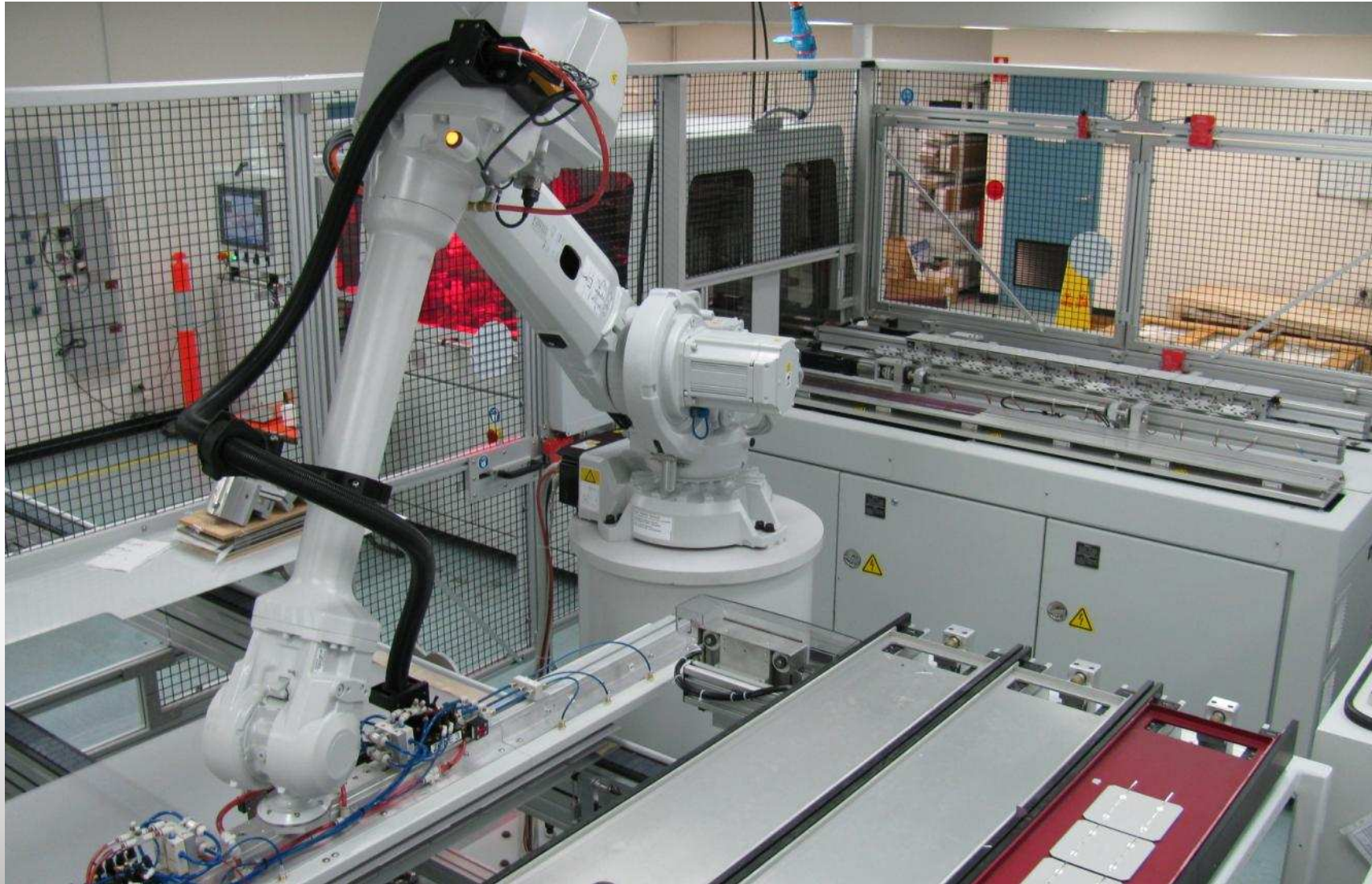


## Silex Solar Plant Capacity

- Silex Solar P/L acquired solar manufacturing facility at Sydney Olympic Park (SOP) in 2009 from BP Solar (Decommissioned state).
- Plant was re-commissioned, enhanced and Production recommenced approx 1 year ago in April 2010.
- The only integrated PV cell and panel manufacturing facility in Australia
- Solar Cell production capacity of 50MW p.a
- Expansion of panel production to 35 ~ 40MW p.a. near completion



## Newly Installed Automated Panel Assembly Equipment



## Newly Installed large format (4.5m X 2.3m) automatic Laminator



## Solar Cell Process Lines in Operation



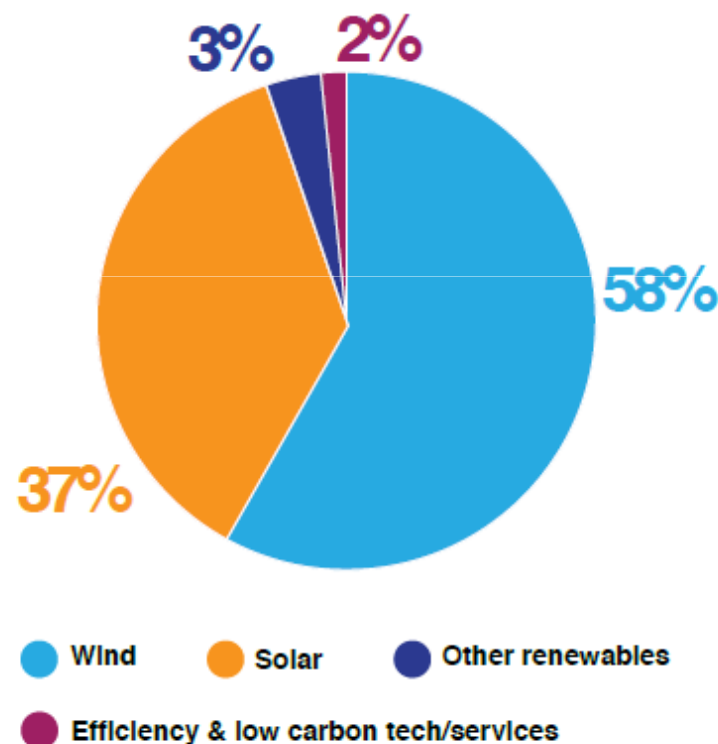
## Finished SilexSolar 265W Panel



# Australian Solar Market Situation

Australia's 2010 clean energy investments increased sharply to \$3.3 billion, placing it 12th among G-20 members.

#### DISTRIBUTION OF INVESTMENT BY SECTOR (2005-10)



Source: Who's winning The Clean Energy Race ?  
2010 Edition (March 2011)

## ***Australian market over 320MW in 2010 CY – up from 70~80 MW in 2009 CY***

Australian predicted market size in MW for 3 scenarios.

- *BaU – Business as Usual*
- *Green Led industry - Modest Growth*
- *Industry Led – Aggressive Growth*

Sector Total	2009	2010	2011	2012	2013	2014	2015
BaU	71,242	299,000	260,495	315,001	439,265	495,663	340,530
Green Led	71,242	327,702	377,624	445,554	616,640	685,393	720,952
Industry Led	71,242	355,084	490,903	701,103	970,276	1,061,215	1,106,955

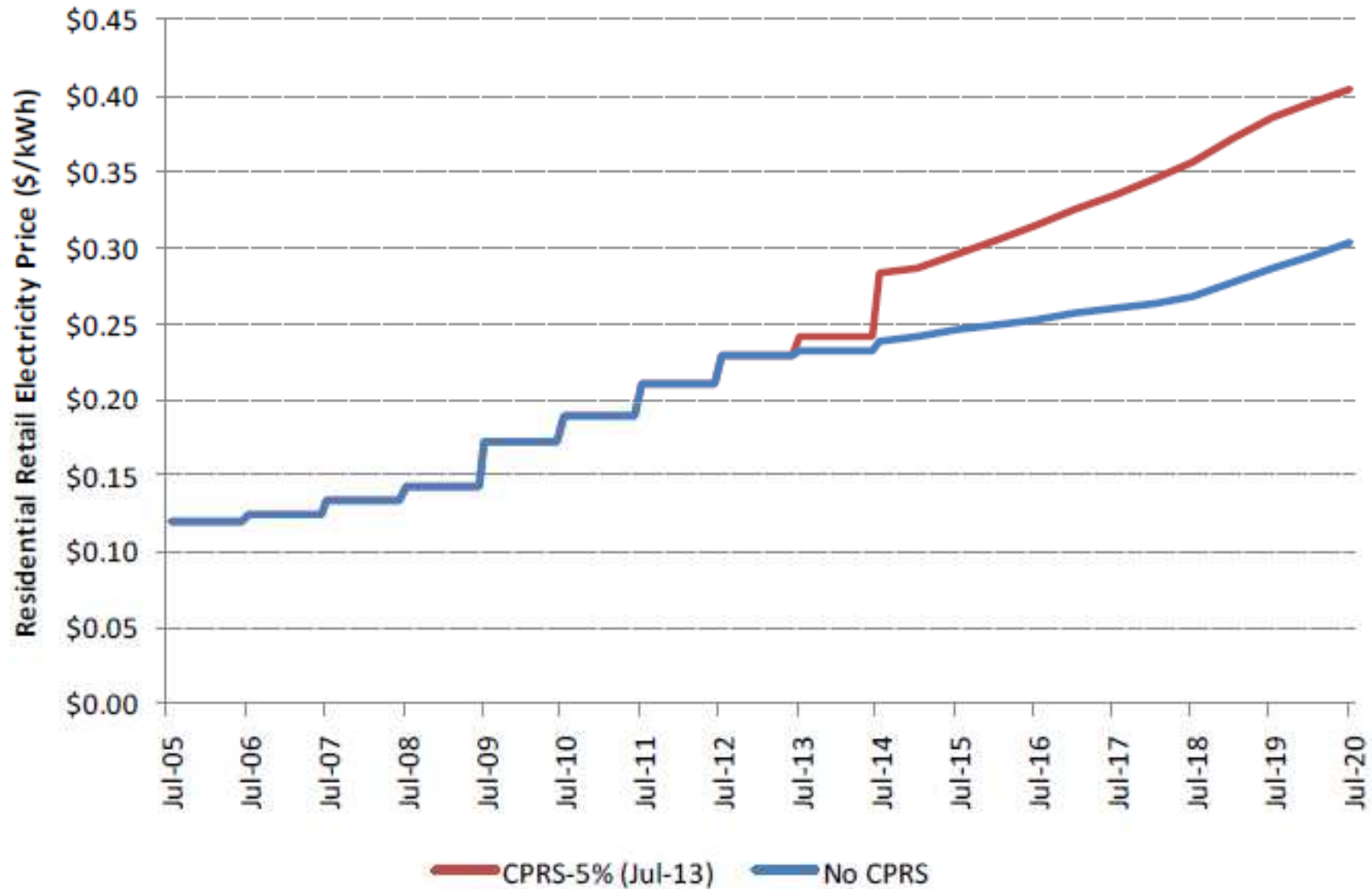
*Table Source : SunWiz Report 2010, PV Industry Forecasts.*

# Australian Solar Market

Table 1: A summary of the annual installation rates for each market sector, under the three scenarios.

<b>Total Market</b>	<b>Sector Total</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>
	BaU	71,242	299,000	260,495	315,001	439,265	495,663	340,530
	Green Led	71,242	327,702	377,624	445,554	616,640	685,393	720,952
	Industry Led	71,242	355,084	490,903	701,103	970,276	1,061,215	1,106,955
<b>Residential Market</b>	<b>GCD</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>
	BaU	65,269	295,313	193,832	186,497	199,664	227,735	290,575
	Green Led	65,269	323,203	309,077	285,052	339,485	368,389	405,719
	Industry Led	65,269	350,234	417,946	512,259	611,060	656,588	658,079
<b>Commercial Market Sector</b>	<b>GCC</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>
	BaU	938	1,080	60,967	122,367	231,867	260,000	40,000
	Green Led	938	1,380	61,667	152,333	265,900	305,000	300,000
	Industry Led	938	1,680	65,100	178,300	343,300	385,000	420,000
<b>Off Grid</b>	<b>OGND</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>
	BaU	1,672	2,406	2,257	2,676	3,176	3,772	4,483
	Green Led	1,672	2,887	2,822	4,015	5,558	6,601	7,845
	Industry Led	1,672	2,935	3,386	5,353	7,940	11,316	17,932

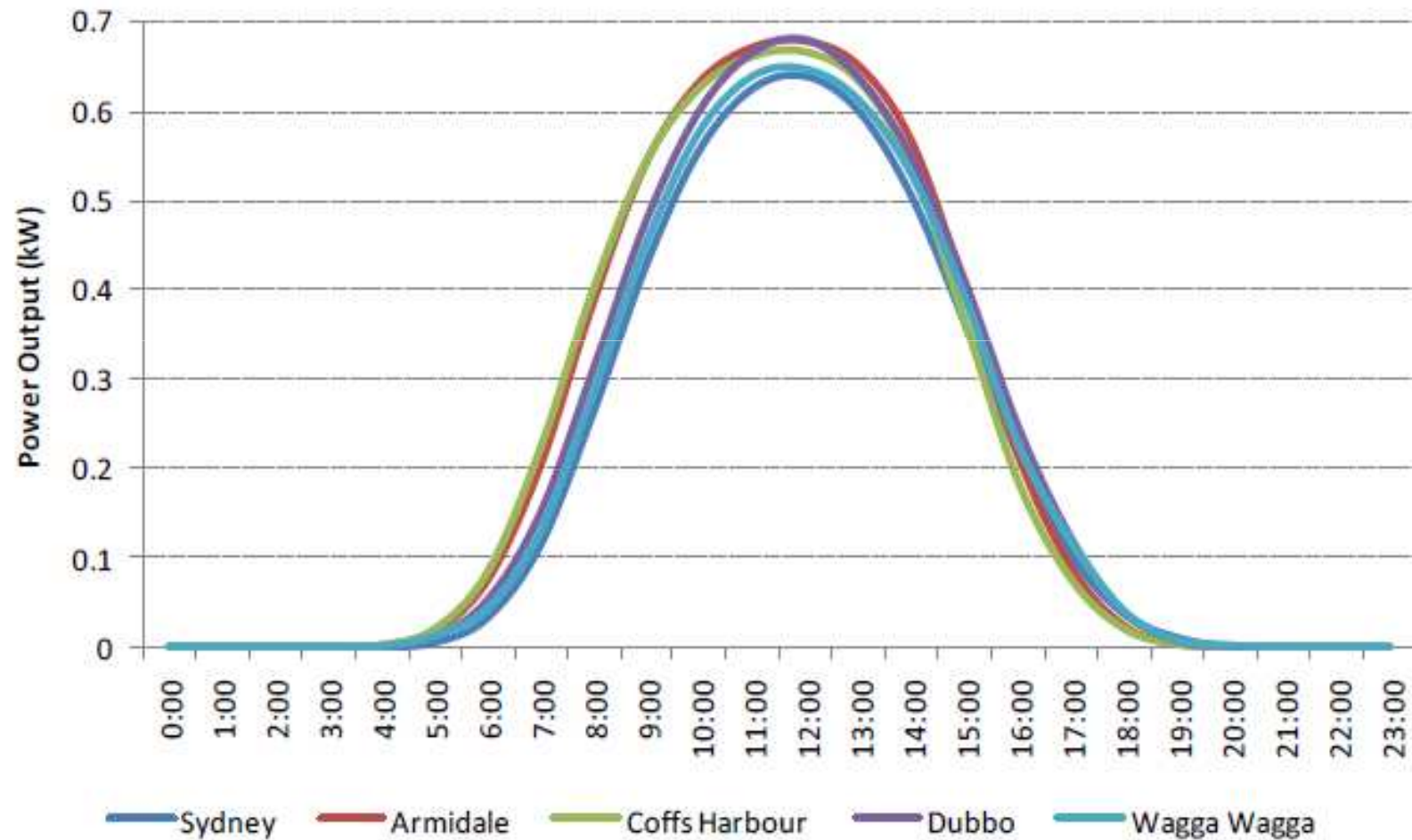
## Predicted Rising Electricity Prices



Source: IPART (2010) and Australian Treasury (2008) adjusted for revised CPRS start date and inflation

## Profile of Daily Output of a Solar System

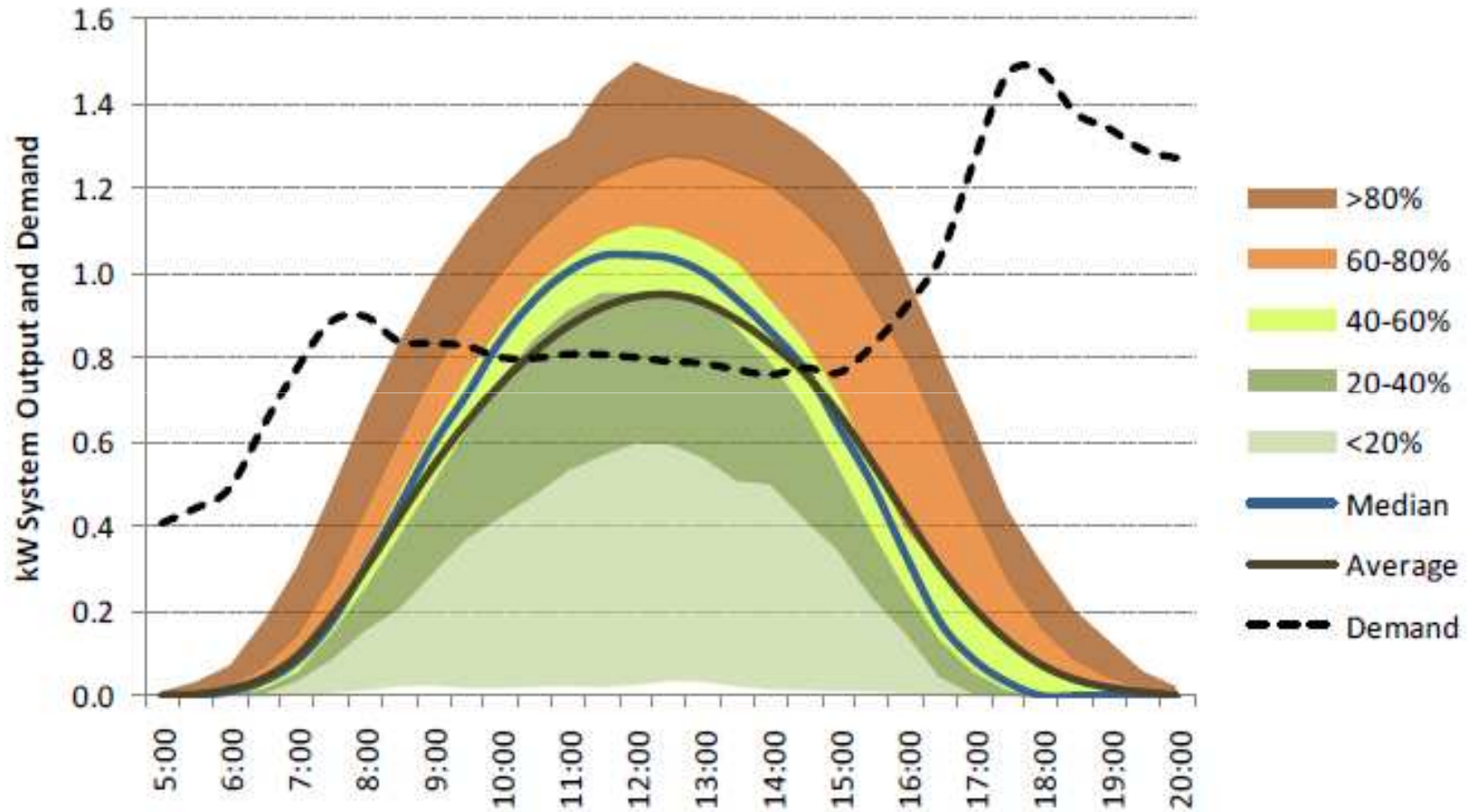
Figure 4.6 Average daily PV electricity generation by geographic location per kW system capacity



Source AECOM (2010)

# Demand and Solar Output

Figure C.2 Average electricity demand and variation in system output for a 1.5 kW PV system located in Sydney



Source AECOM analysis based on data provided by EnergyAustralia and various historical weather datasets

## Case Studies – Residential System Data

	<u>Residential</u>	
System Size - kW's	1.5	3
Gross Capital Cost	\$8,000	\$16,000
Less REC's Rebate (Approx)	\$5,500	\$6,500
Net Capital Cost (Approx)	\$2,500	\$9,500
Cost of Power - LCOE = c/kWh	\$ 0.16	\$ 0.28
Approx Payback at 20c Tarrif	4 years	8 years
Approx Roof Area (m <sup>2</sup> / kW)	8	7.5
Total approx area in m <sup>2</sup>	12	22.5
Approx L X W	3.5m X 3.5m	4.8m X 4.8m
	Flat on pitched roof	

N.B. a 1 kW rated Solar System will produce approx 1500 kWhs/ Ann

## Case Studies – Commercial System

	<u>Residential</u>		<u>Commercial Systems</u>	
System Size - kW's	1.5	3	50	500
Gross Capital Cost	\$8,000	\$16,000	\$265,000	\$2,000,000
Less REC's Rebate (Approx)	\$5,500	\$6,500	\$39,500	\$350,000
Net Capital Cost (Approx)	\$2,500	\$9,500	\$225,500	\$1,650,000
Cost of Power - LCOE = c/kWh	\$ 0.16	\$ 0.28	\$ 0.22	\$ 0.18
Approx Payback at 20c Tarrif	4 years	8 years	> 10 Years	> 10 Years
Approx Roof Area (m <sup>2</sup> / kW)	8	7.5	13	13
Total approx area in m <sup>2</sup>	12	22.5	650	6500
Approx L X W	3.5m X 3.5m	4.8m X 4.8m	25.5m X 25.5m	80.6m X 80.6m
	Flat on pitched roof		Frames spaced to minimise shading	
N.B. a 1 kW rated Solar System will produce approx 1500 kWhs/ Annum				

# Questions ?



End - Thank you