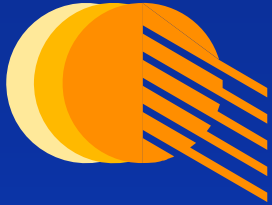


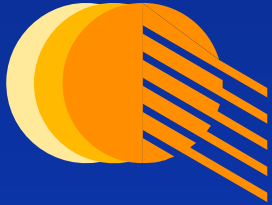
Feed-in Tariff Options

Muriel Watt & Juan Rivier

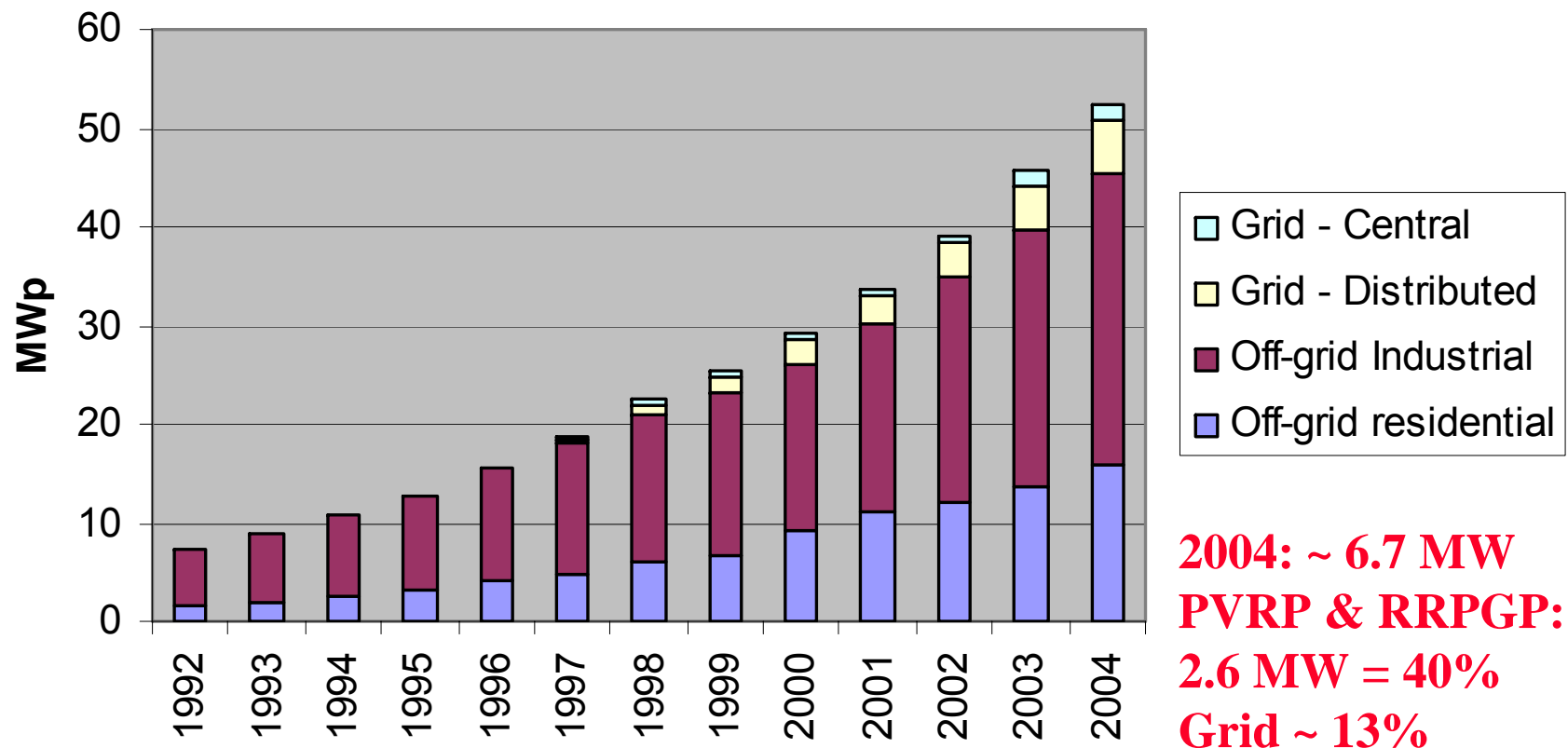
With thanks to BP Solar & Conergy



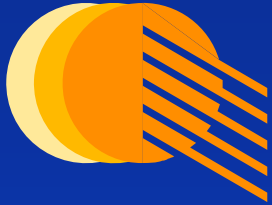
PV Market Trends



The Australian PV Industry



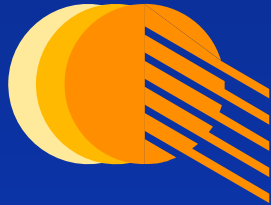
Cumulative Installations



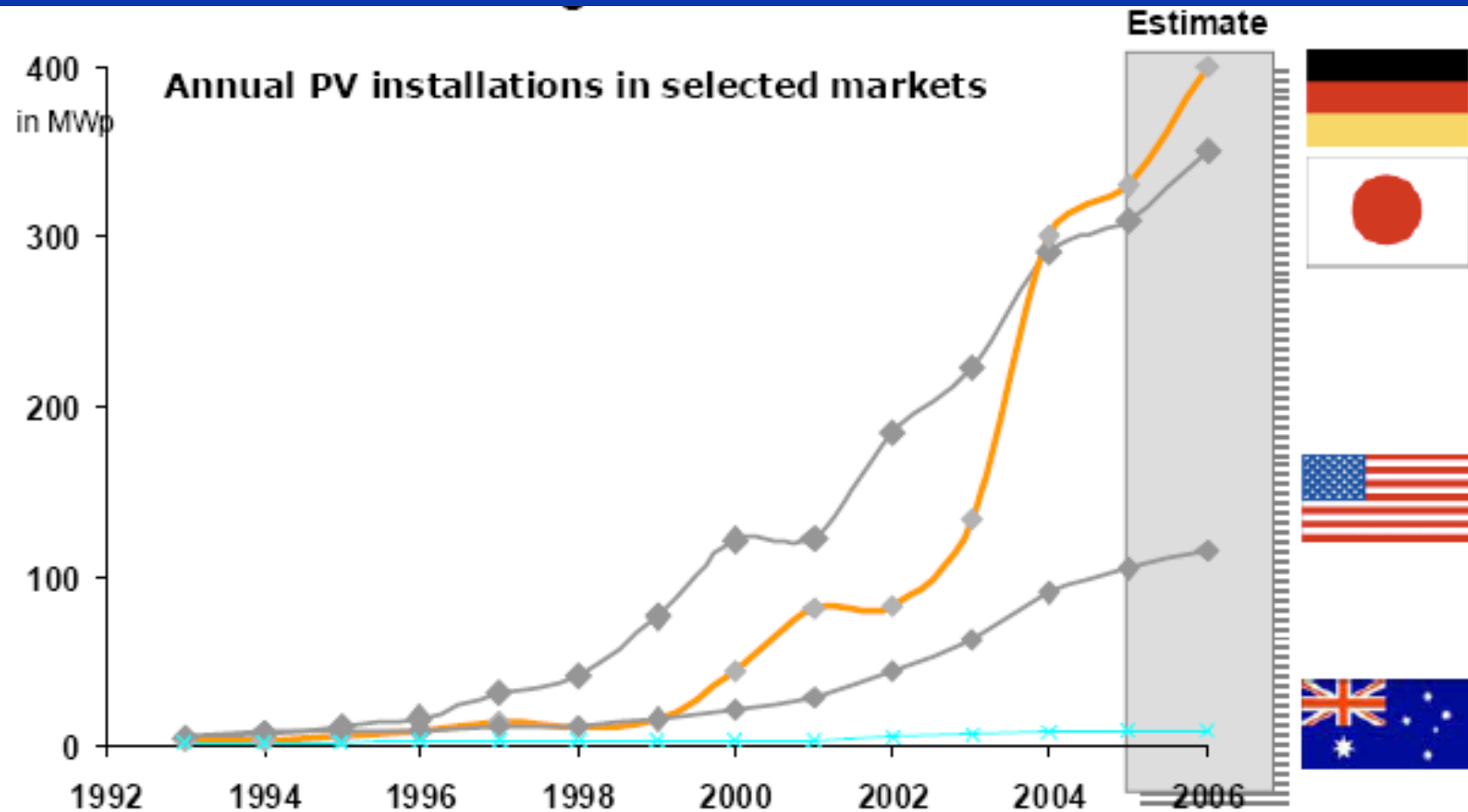
PV vs Other Renewables The RE Action Agenda

**2010 Target: \$4billion in revenue,
including \$1.8billion in exports**

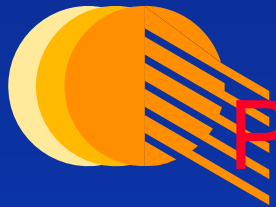
2004	Total RE Industry	PV Industry
Annual Revenue	\$1,052m	\$204m
Export Sales	\$241m	\$100m
Employment	6,200	1,100



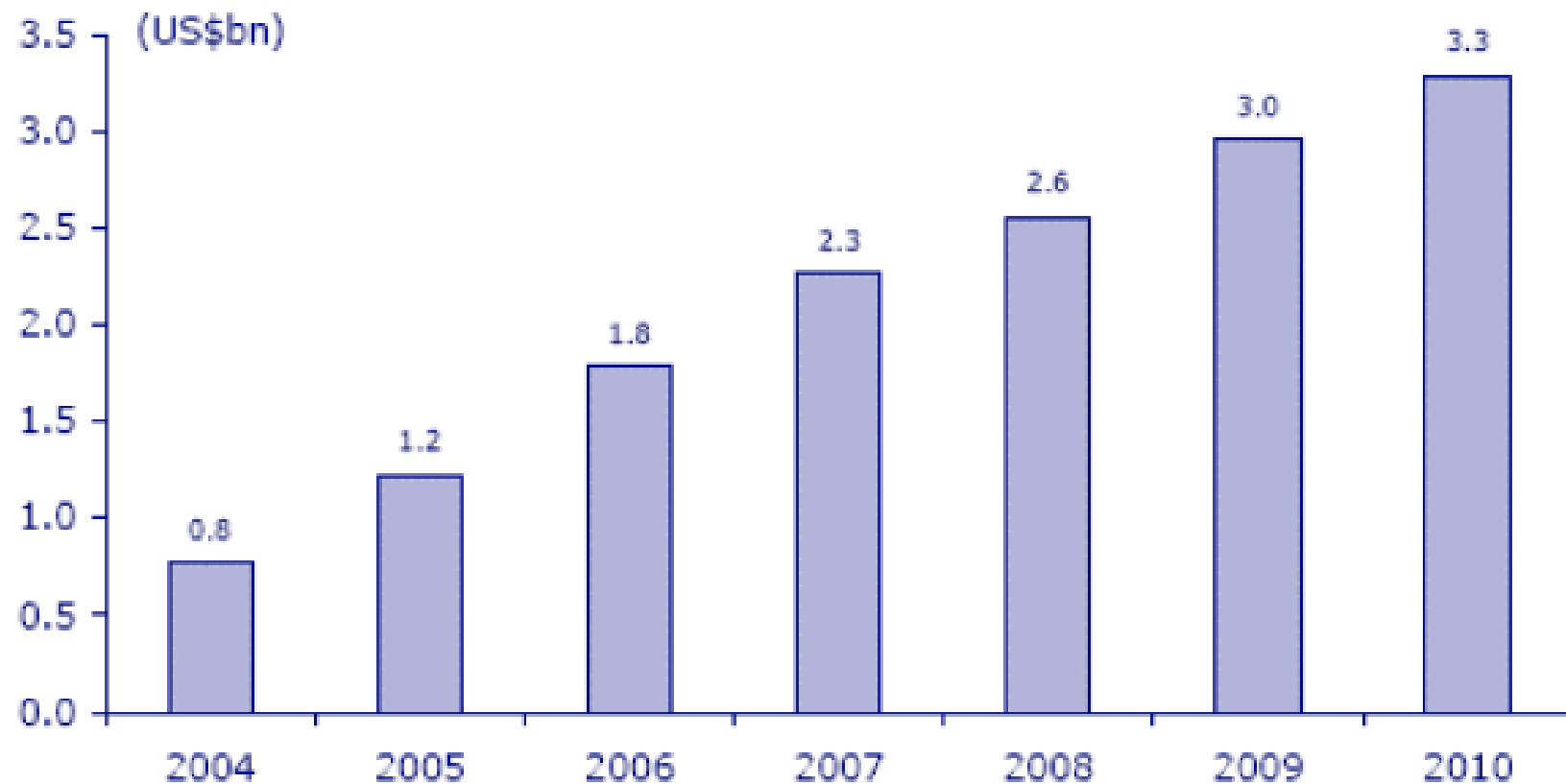
Australian and International PV Installation trends



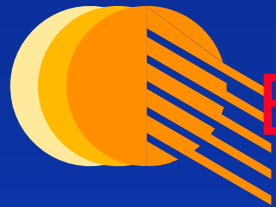
Source: Sarasin 2004



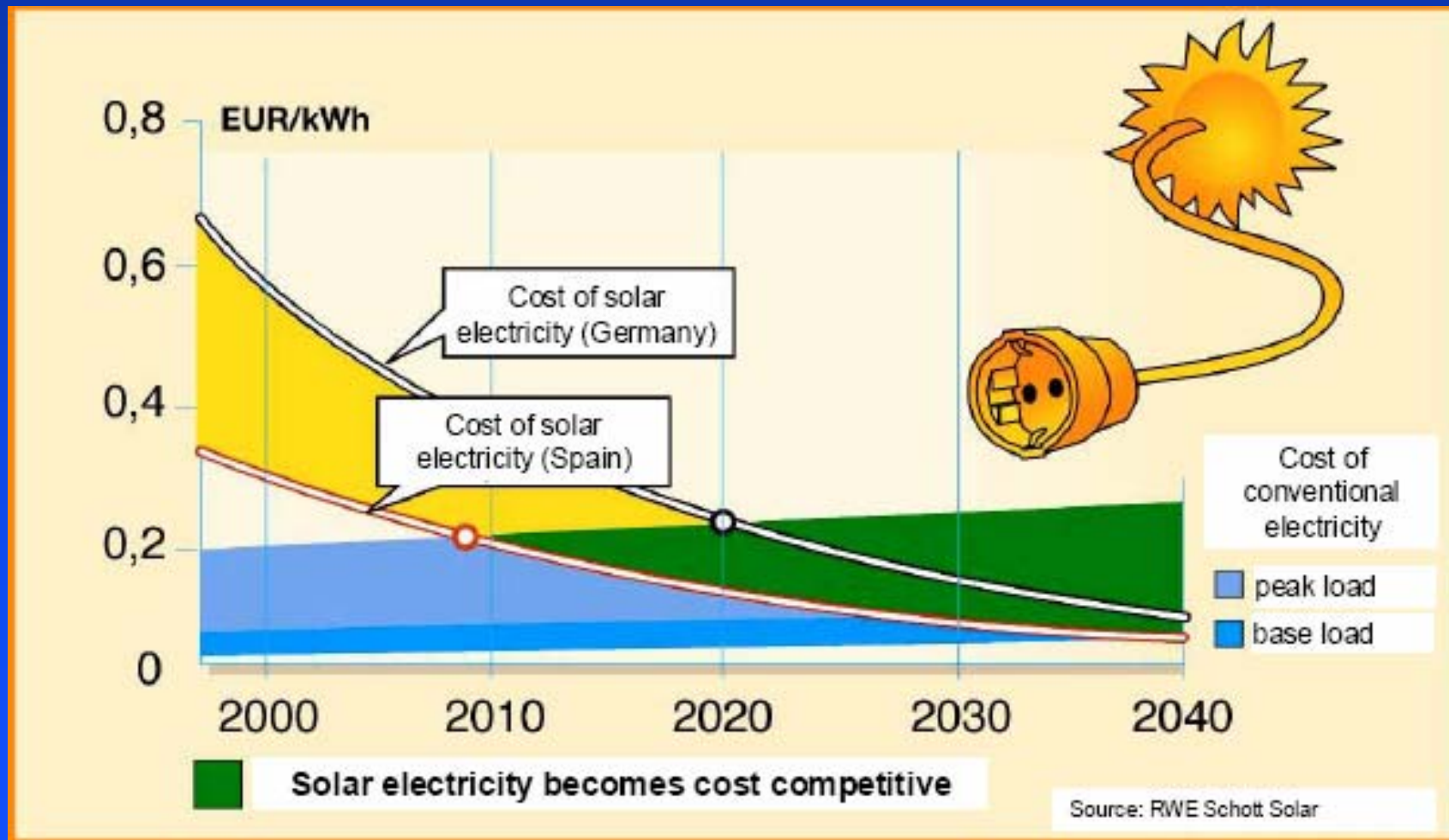
Projected World PV Market Value

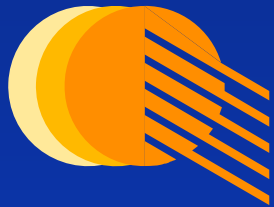


Source: CLSA Asia-Pacific markets



European Projected Break-even points





Australian PV Industry Roadmap

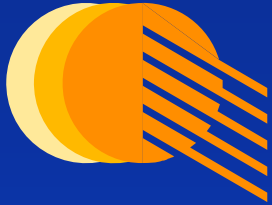


- **Business as Usual**

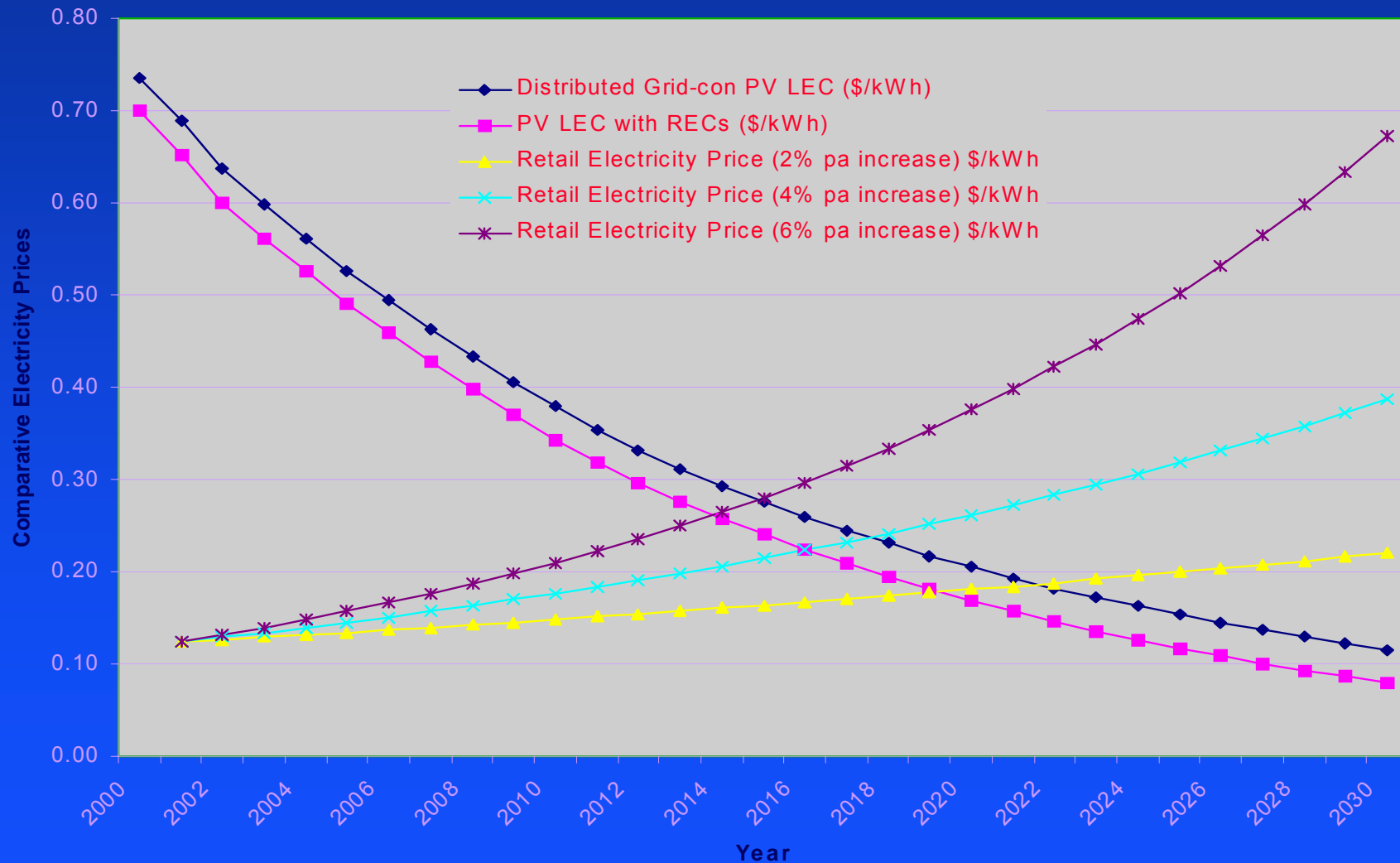
- Module imports 90% long-term. No export
- BOS imports 50% long term. Export 50%

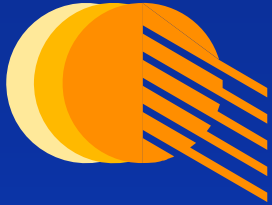
- **Sunrise 350**

- Module imports 25%. Export 50%
- BOS imports 25%. Export 50%



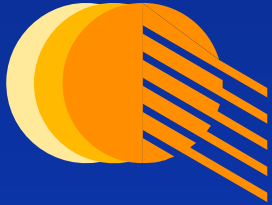
Australian PV and electricity price forecasts



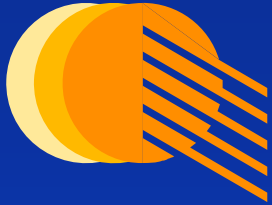


BAU or Scenario 350 in 2010

	BAU	Sunrise 350
Annual Aus installed (MW)	16	127
Cumulative Aus Capacity (MW)	120	350
Module exports (MW)	20	445
Sales \$m	80	1,180
Australian share of the global market (%)	<1	7
Jobs	310	5,300

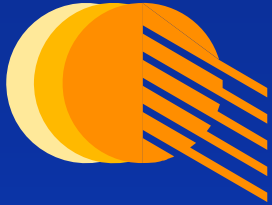


Can Feed-in Tariffs
drive the grid market?



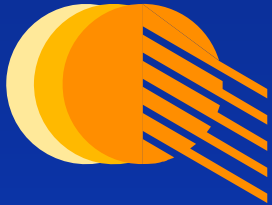
Definitions

- Feed in tariffs (FITs) aim to offer customers who invest in PV, or other renewable energy technologies, an electricity buy-back rate which facilitates an economic payback within the life of the system
- First used in Austria at a local government level (rate based incentives)
- An enhanced tariff is mandated and paid for via a levy on electricity sales
- The tariff for the year of installation is guaranteed for a set period, typically 15 to 20 years
- FITs can attract huge investment in renewables if appropriately structured
- now available in several European countries

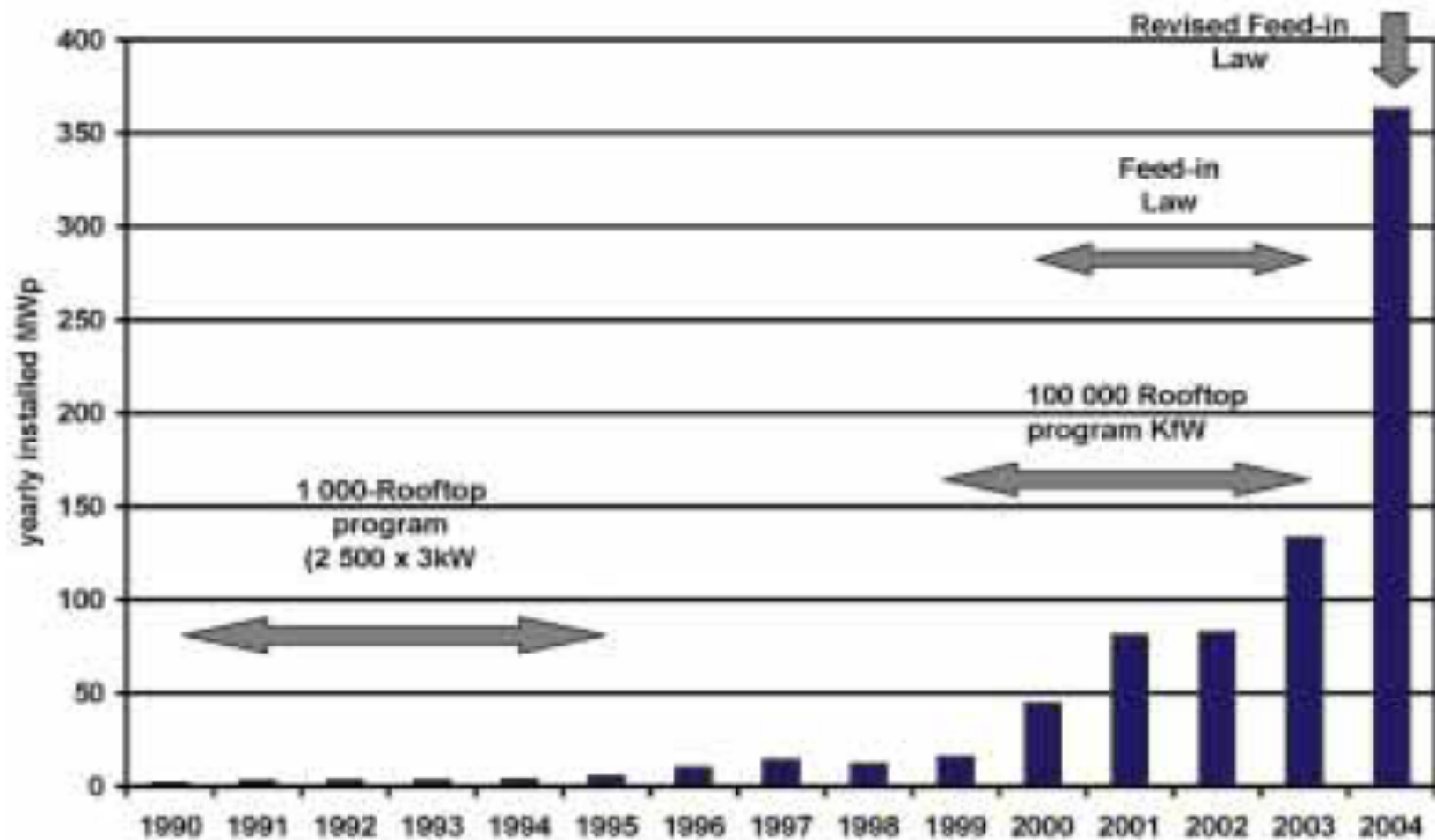


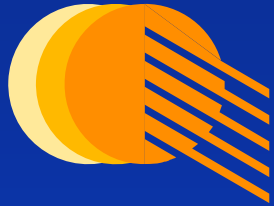
German PV support

- 1990-1999 - 1000 rooftop program
 - low interest loans
- 1999-2003 - 100,000 rooftop program
 - interest rate of 1.91% until installed capacity reached 300MWp
- Since 2000 - enhanced feed-in tariff
 - started at around €0.50
 - increased in 2004, after the soft loans ceased
 - Current rates are available for a period of 20 years and vary with system size and type
 - Facades qualify for a higher tariff, on the basis that output will be lower
- FITs for wind also
 - Installation targets met earlier than planned



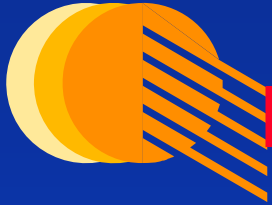
German PV market growth





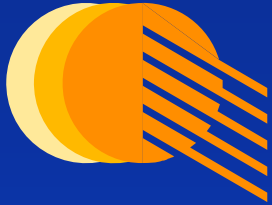
Feed in Tariffs Germany from 2004

- Free surfaces (not roofs): 45.7 c€/kWh
- Roofs 30 to 100 kWp 54.6 c€/kWh
- Facades < 30 kWp: 62.4 c€/kW
- Facades > 100 kWp 59 c€/kWh
- Roofs < 30 kWp: 57.4 c€/kWh
- Roofs > 100 kWp: 54 c€/kWh
- Facades 30 to 100 kWp: 59.6 c€/kWh



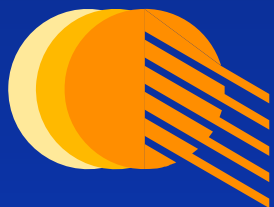
Results for PV in Germany by 2004

- Germany overtook Japan with the highest level of PV installations – 363 MWp
- Installed capacity in Germany reached 794 MWp
- Industry turnover €1.7 billion
- 20,000 people employed in the sector
- Average electricity bill increased by 0.16% (~ A\$1.78 per annum)



Feed-in Tariffs in Spain

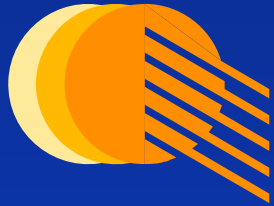
Juan Rivier



Installed RES & CHP in SPAIN

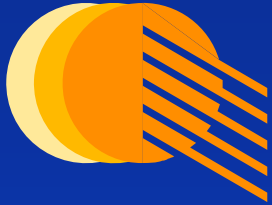
RES and CHP	Installed capacity (MW)	Energy production (GWh)	Percentage of total consumption
CHP	5744,92	18087,4	7,32%
Photovoltaic	16,3	16,6	0,01%
Wind	7849,2	15225,3	6,16%
Hydro < 50 MW	1660,7	4600,4	1,86%
Biomass	29,0	127,5	0,05%
Agricultural, industrial, and other wastes	1375,4	6040,5	2,45%
Total	16675,5	44097,6	17,85%

Source: Monthly report on energy production of RES and CHP (CNE), April 2005



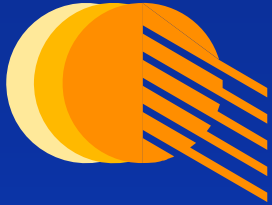
Spanish National Plan for 2010

RES	Targets set by the National Plan to support RES for the year 2010 (MW)	
	Published in 1999	Revision in 2005
Wind	13,000 (initially 8,974)	20,155
Photovoltaic	115	400
Solar Thermal	200	500
Hydro < 10 MW*	720	2,199
Hydro 10 - 50 MW*	350	3,257
Biomass	1,708	2,039
Solid Wastes	168	189



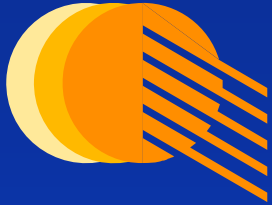
Legal Framework for RES installations

- **Past regulation: RD 2818/1998**
 - **Feed-in tariff** model or market price + premium
 - Specific to each technology
 - Revised every 4 years
 - **No market participation**: right to be dispatched
 - **Limited technical obligation**
 - **Alternative option**: access to the wholesale market (RD 841/2002)
 - Participation in all the electricity markets
 - Assumption of deviation costs
 - Possibility of aggregation



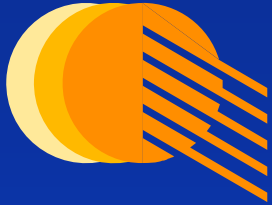
Legal Framework (2)

- Today regulation: RD 436/2004
 - Feed-in tariff model
 - Obligation of production prediction for generators > 10MW
 - Revision every 4 years for new installations only
 - Alternative option: full access to the wholesale market + premium + incentive
 - Participation in all the electricity markets
 - Assumption of deviation costs
 - Possibility of aggregation
 - Modulated Reactive Energy incentive
 - Incentive to cope with dips (wind parks)



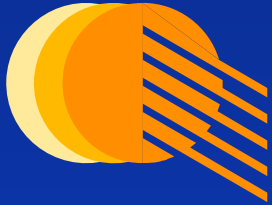
Legal Framework (3)

- **Connection Standards**
 - Specific standards for photovoltaic $< 100\text{kVA}$ connected to LV network
 - Out of date standards for other technologies (1985)
- **Licensing procedures**
 - Very long and complicated: several authorities and market agents
 - Regulated contract with the Distribution Company
- **Administrative requirements to access the market**
 - May be a barrier to small generators
 - Possibility of avoiding most of the requirements by using a broker



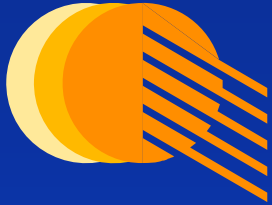
Legal Framework (4) Photovoltaics

- Past regulation (RD 2818/1998)
 - 0.66 A\$/kWh for $< 5\text{kWp}$
 - 0.36 A\$/kWh for $> 5\text{kWp}$
 - Revised every 4 years
- Today regulation (RD 436/2004)
 - 0.66 A\$/kWh for $< 100\text{kWp}$
 - 0.36 A\$/kWh for $> 100\text{kWp}$
 - Permanent for the whole life cycle of every installation (upgrade of more than 50% of the investment cost is considered the end of the life cycle)
- Connection standard
 - Specific mandatory connection standard for LV PV installations $< 100\text{kWp}$ since year 2000



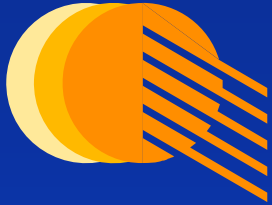
Lessons learned

- Importance of connection standards definition
- Fixed premium is more effective in promoting a technology, if it is high enough.
- What is being discussed now is the efficiency and sustainability of such support
- Rules different for small penetration than for well established technologies
- Licensing procedures are too complicated
 - Depends too much on political and administrative decisions: Galicia, Navarra and Castilla-La-Mancha are the most successful, while other regions have not given yet a single permission



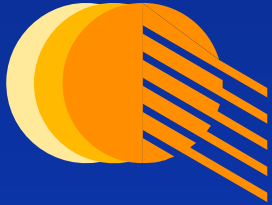
Main barriers to the development of RES

- Technical requirements:
 - Connection standards, Monitoring and communication devices, dips
- Network capacity to evacuate generated energy.
- Administrative processes
- Economic support
 - Too low or too high
- Network connection deep-costs



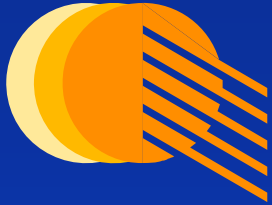
An Australian Feed-in Tariff?





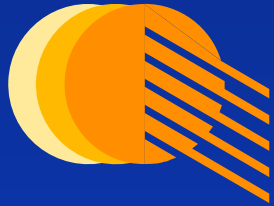
Australian Government Support for Renewables

- PVRP
 - 17% of market
 - May end 2007 - will grid market be sustained?
- RRP GP
 - 22% of market
 - Trend to larger systems -> wind, concentrators?
 - Restrictions on water pumping
 - Implications of removal of diesel fuel excise
- MRET
 - Proposed increase in deeming period for PV & size of deemed systems
 - Tapering off from 2005
- Solar Cities
 - Short term grid sales -> longer term impact?
- Renewable energy R&D funding
 - Industry priorities need to be defined
 - Opportunities for product & systems development



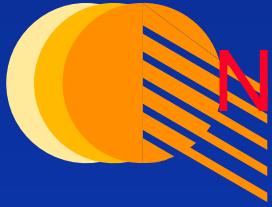
General FIT Issues

- Could be set at State or national level
- Need to be clear about objectives – industry development, distributed generation, emissions reduction etc
- An appropriate starting tariff would be need to be agreed, based on installed costs, expected PV output and timing, electricity tariffs
- The guaranteed tariff should be decreased each year but available for an agreed period of time
- The feed-in tariff cost could be spread across selected customer types (eg. residential and/or commercial only), particularly to avoid the more sensitive industry sectors

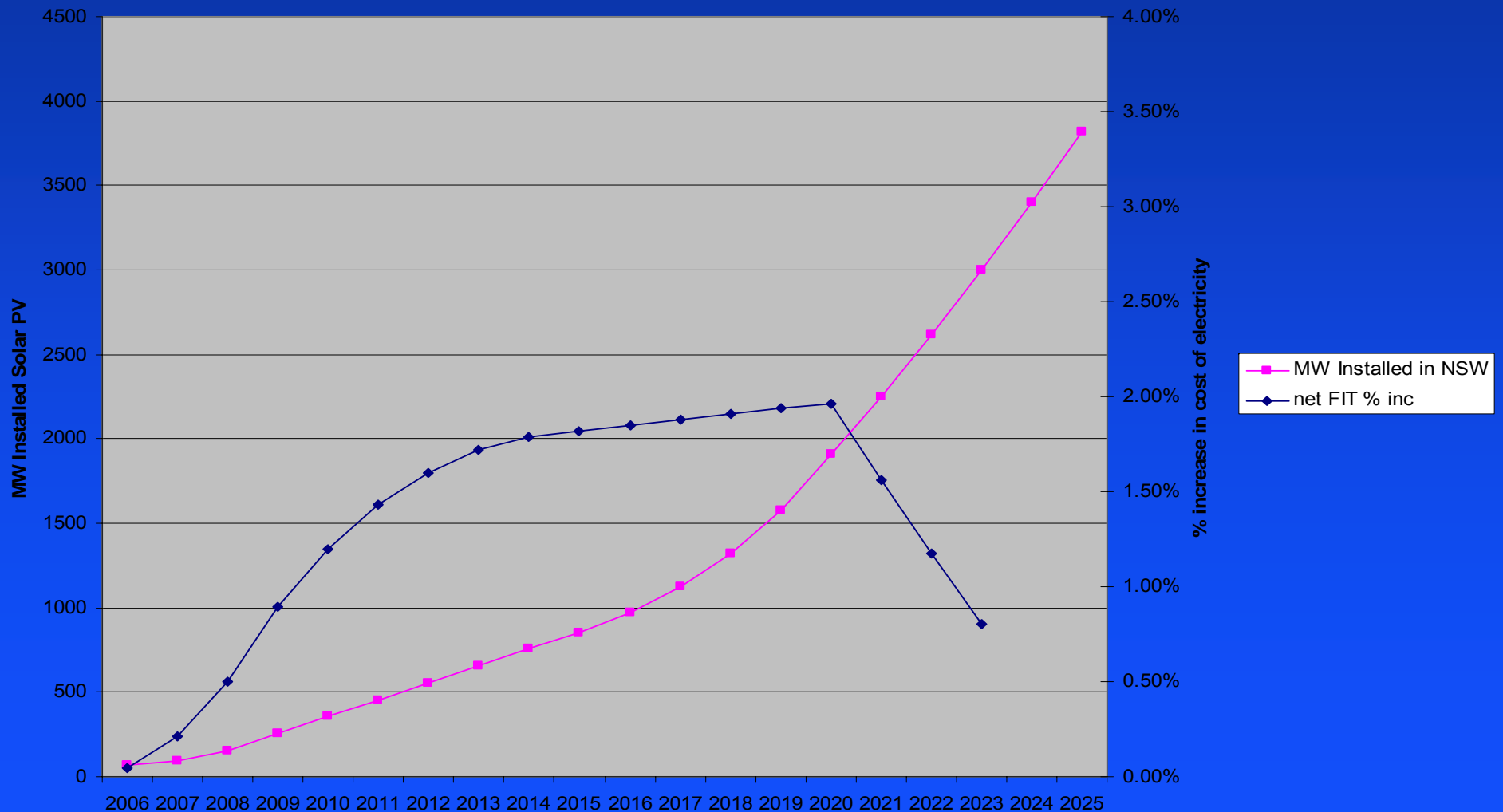


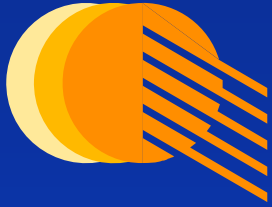
Example – Australia-wide FIT

- FIT starts at 85c/kWh and available for 20 years
 - FIT decreased by 7% per annum for 15 years to 31c/kWh
 - Standard tariff - flat retail beginning at 12c/kWh and inflating at 3%
 - That is, incremental FIT begins at 73c/kWh and ends at 12c/kWh
 - Installed system price of \$11,500
 - 1458 kWh/kWp
 - FIT cost spread across residential and commercial customers
- Australian PV Industry Roadmap target of 350MW installed capacity by 2010 would be met

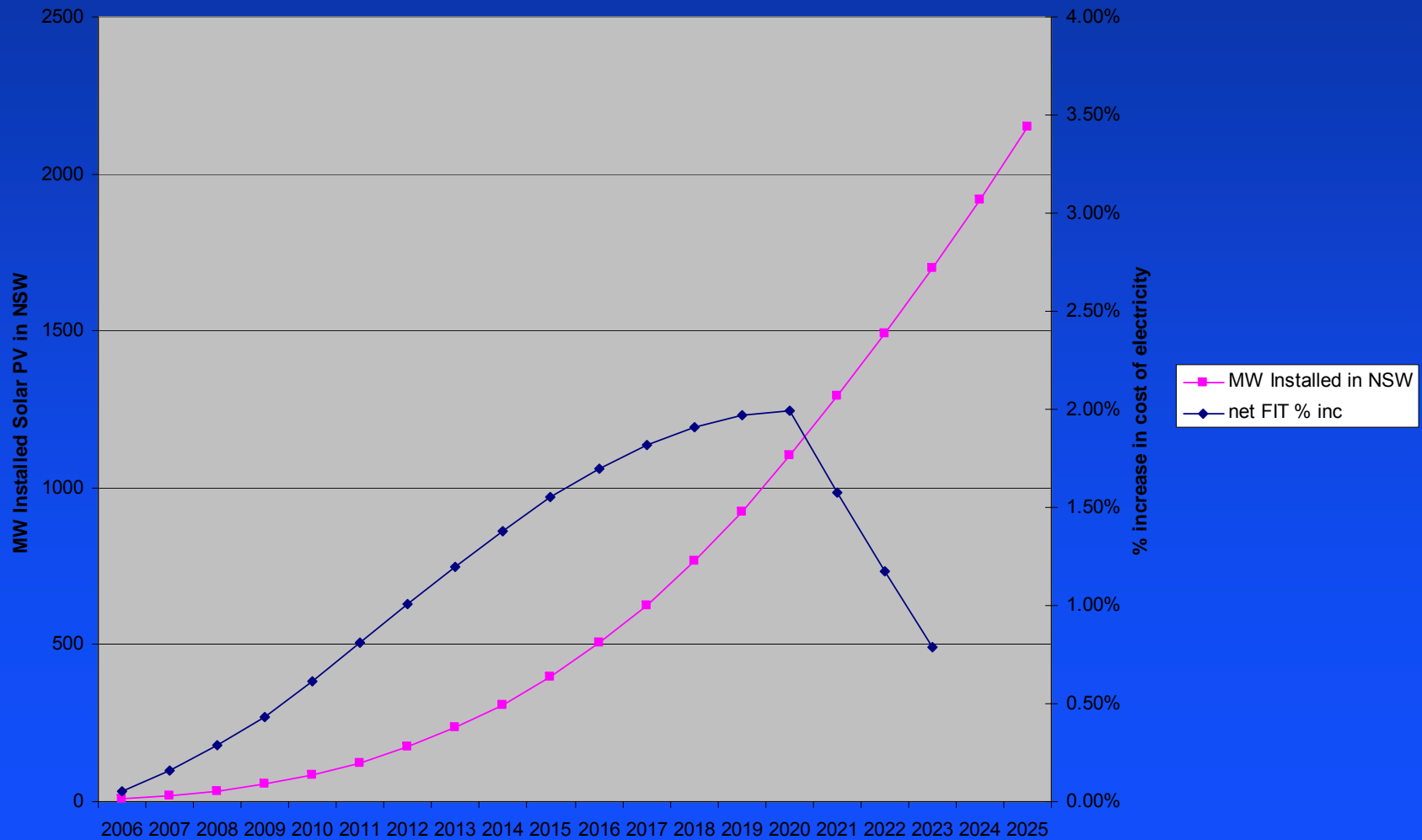


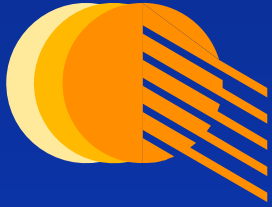
Net FIT Cost & Cumulative PV Installed Australia wide (res, comm cust)



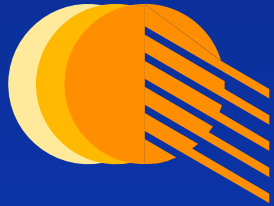


A possible NSW FIT (res, comm + 70% ind customers)

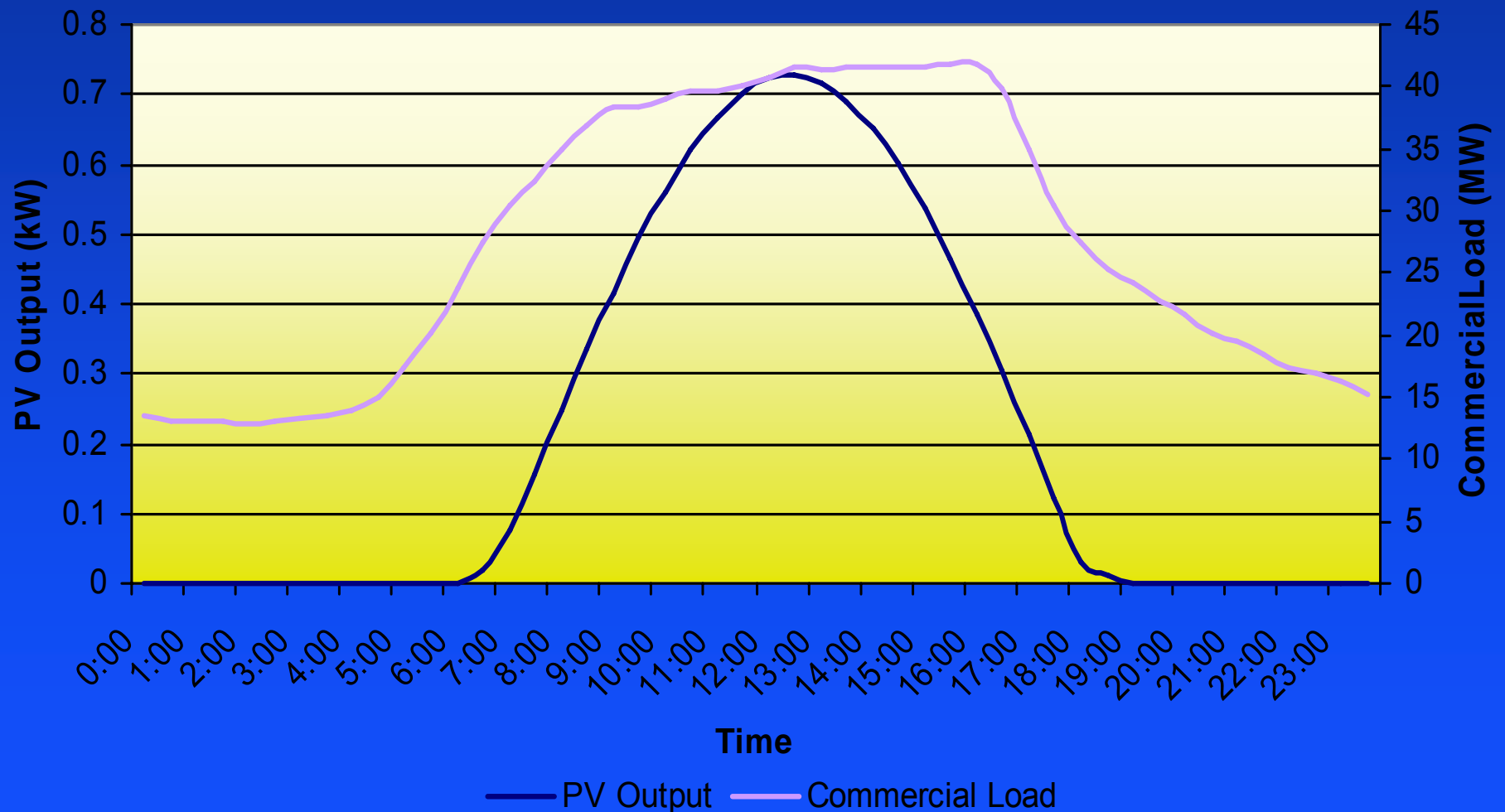


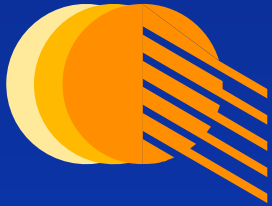


Other Considerations



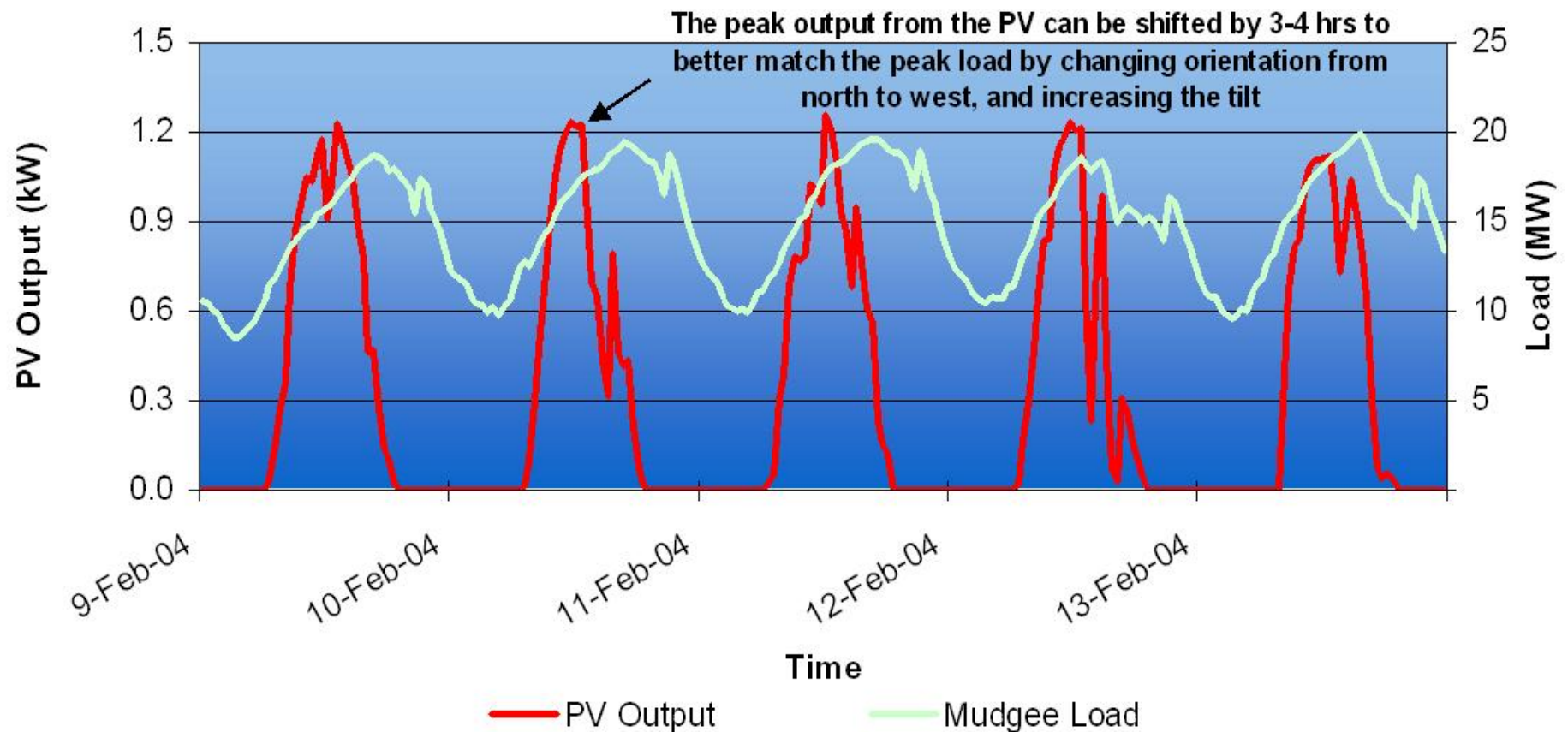
PV Output & Commercial Load

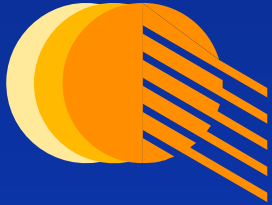




PV Output & Residential Load

PV output compared to demand from a predominantly residential substation feeder for the highest demand week during summer





FIT Implementation Issues

- Finance
- Likely public take-up
 - Germany (green interest, local self reliance, disposable income, age profile)
- Fast tracking trade skills
- Insurance / liability issues
- Utility response - OK with small penetrations, more issues once PV starts to be noticeable
- Not compatible with net metering → need for electronic or 2nd meter