Centre for Energy and Environmental Markets

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Social and Private Valuations of Commercial Photovoltaic Systems in Australia

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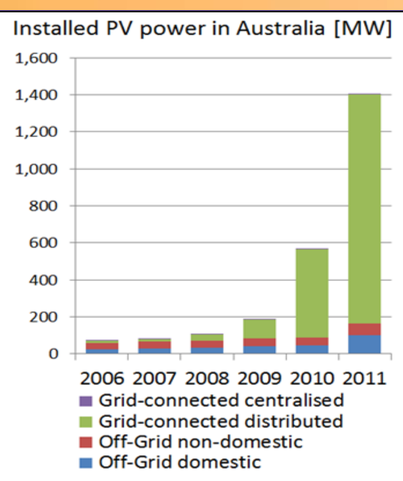
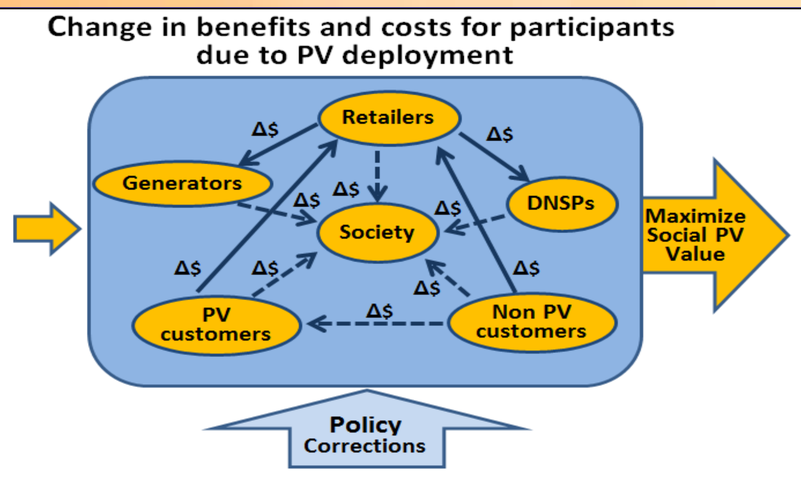
1. Background

PV systems on commercial premises are a potentially valuable option for addressing the energy security, reliability and environmental challenges of our electricity industry. The societal value of such systems is multi-faceted including energy, environmental and potential social benefits and costs. Some of these are challenging to calculate as they represent externalities to current market arrangements, which also have other failings. However, decisions to implement systems depends primarily on the commercial attractiveness to commercial energy users, and this depends on tariff arrangements and any additional policy settings. A key role for such policy is to align societal values with commercial incentives facing key stakeholders so that their commercially oriented decisions maximize societal welfare. In this paper we assess the current and future marginal social and private value of a commercial PV system for society, retailers, distribution network service providers (DNSPs) and PV customers in the NEM using different pricing arrangements and carbon cost scenarios. Our results show that commercial returns of deployment vary considerably for different stakeholders, with moderate returns for system owners yet adverse impacts on DNSPs. This suggests a possible need for addressing policies given these systems provide a significant social benefit.



Source: APVA, 2012. PV in Australia 2011. Prepared for the IEA.



2. Research Question and Methodology

- Economic benefits and costs of commercial PV systems for **society, retailers, DNSPs** and **PV customers**?
- What is the **contribution** that each of them should make to afford an **economically efficient PV deployment aligned with the social PV value** based on such assessment?

Case Study: Australian NEM and the state of NSW

PV output and wholesale price data (2009/10)

$PV\ elec_t$	Actual half-hourly PV generation data of a 42kW system with an average production of 1,255 kWh/kW/year.	w_t	Actual half-hourly wholesale electricity prices for NSW adjusted by loss factors obtained from AEMO.

Social value parameters		Private arrangement parameters	
G_t	Actual half-hourly total NEM generation data.	R_t	**AGL - Retailer** ***- PowerSmart***: peak 44.1 [¢/kWh] , shoulder 18.7 [¢/kWh] and off peak 10.3 [¢/kWh]. ***- LoadSmart***: peak 29.8, shoulder 24.5 and offpeak 12.3¢/kWh. Capacity 29.7[¢/kW/day].
I_t	Half-hourly weighted average CO_2 emission intensity factor in NSW.	N_t	**Ausgrid - DNSP** ***- EA225***: peak 24.1 [¢/kWh] , shoulder 5.9 [¢/kWh] and off peak 2.3 [¢/kWh]. ***- EA302***: peak 10.3, shoulder 8.2 and off peak 4.4 [¢/kWh]. Capacity 29.7 [¢/kW/day].
SCC	Social cost of carbon: 130$/t$CO_2$ for A1B scenario and 68$/t$CO_2$ for LES.	g	Regulated green surcharge in NSW=0.98 ¢/kWh.
H_t	Average health damage costs of black, brown coal and natural gas power plants in Australia.	RoC	Retail operating costs in NSW=1.15 ¢/kWh.

Social Model

Energy = $w_t \times PVelec_t$

Losses = $2 \times \alpha \times G_t \times w_t \times PVelec_t$

Envir. = $\left(I_t \times SCC + H_t\right) \times PVelec_t$

Future social PV value:

Projections of w_t under a no carbon price scenario and SCC under a A1B and LES climate change scenarios.

Private Model

Retailer = $\left(-R_t + N_t + w_t + g + ROC\right) \times PVelec_t$

PV customer = $R_t \times PVelec_t$

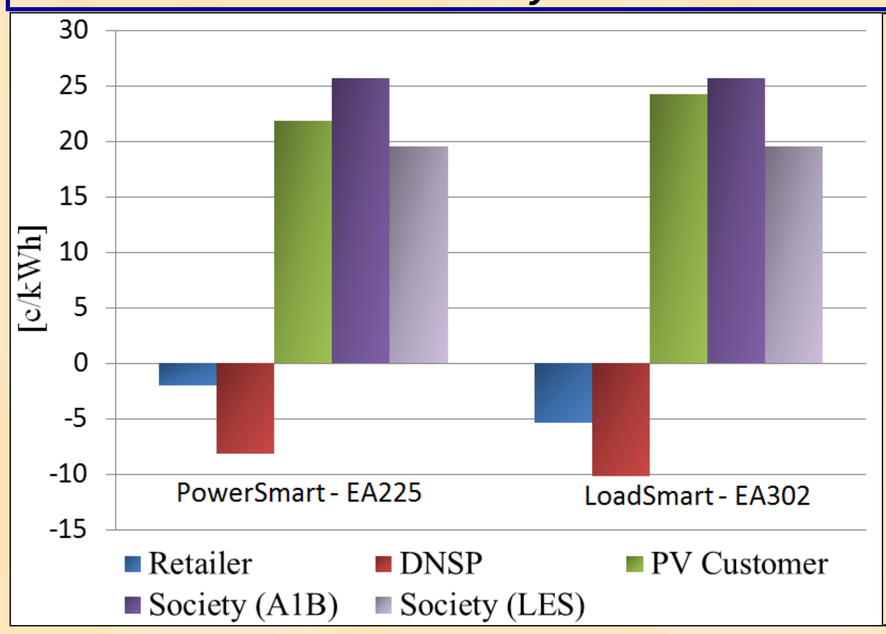
DNSP = $-N_t \times PVelec_t$

Future private PV value:

w_t and R_t projections under CEF and HPS Australian carbon price scenarios.

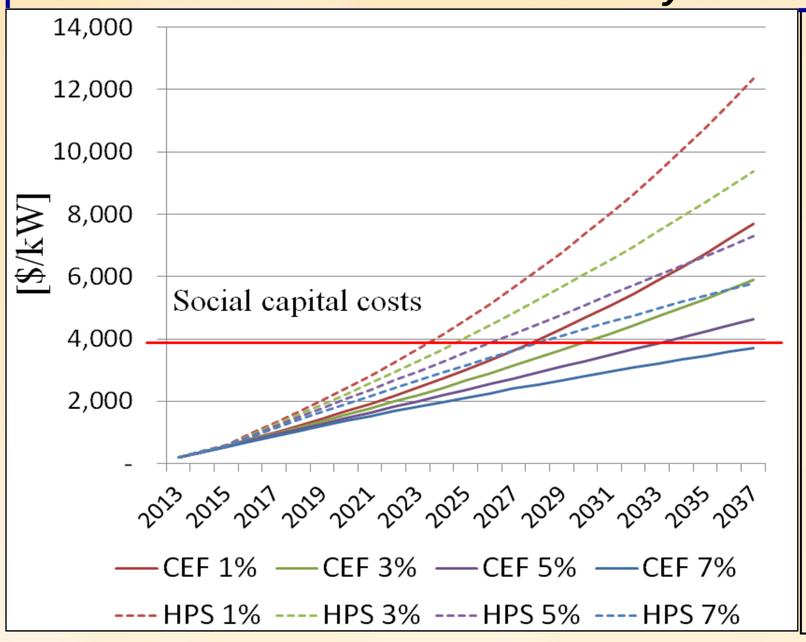
3. Financial Impact on Participants

Annual PV value for industry stakeholders under two TOU tariffs



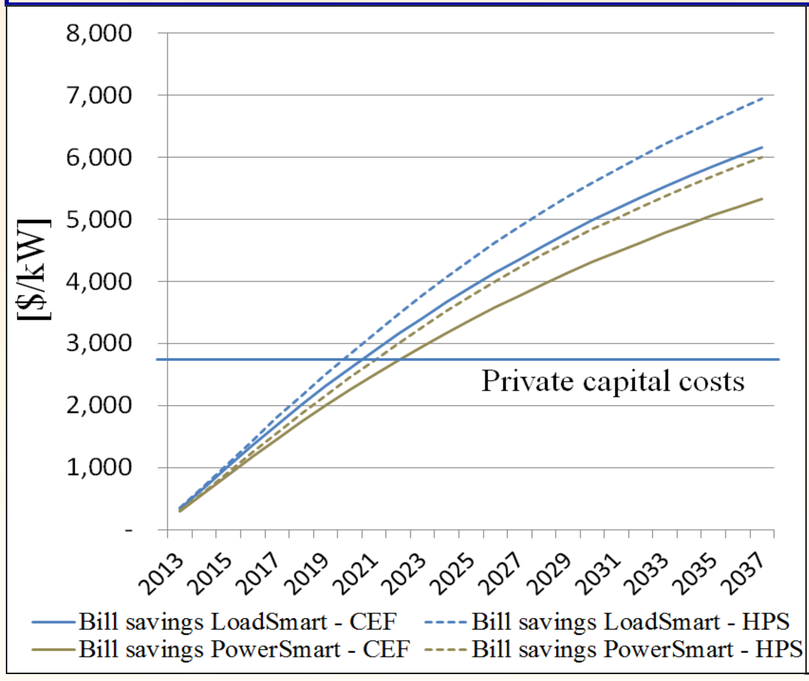
- DNSPs experience much higher losses in revenues than retailers.
- TOU tariffs that adds charges per kW of peak intensify the financial impact on participants.

Cumulative PV value for the society for different discount rates



- This particular commercial PV system is socially **beneficial for all scenarios** since expected total benefits exceed total costs.
- It presents **social payback periods of 11 to 15 years** for the A1B scenario and **14 to 23 years** for the LES.

Cumulative PV value for commercial PV customers (5% disc. rate)



- Under a HPS this commercial PV system is more profitable for owners than under the CEF scenario.
- Bill savings makes financial sense for owners, offering **payback periods** ranging from **8 to 10 years.**
- Business tariffs that include **demand charges offer a higher PV value** for owners due to the general good match between peak demand in commercial loads and high PV output.

4. Conclusions and Future Work

- **Alignment between social economic PVelec values, commercial arrangements and any PV support policies** is crucial to have an efficient deployment of these systems.
- Financial impacts of commercial PV systems varies considerably for industry stakeholders.
- This particular commercial PV system is socially beneficial.
- **Modest impacts on** the customer profitability for **retailers** while **NSPs** would seem to clearly **experience loss of revenue** due to reduced sales.
- Under current pricing arrangements **payback period for** commercial PV **owners** ranges from **8 to 10 years**.

Acknowledgments

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