Solar PV makes sense (and dollars) for Australia

Australia should continue to encourage the deployment of Solar PV systems because:

- They save Australia money. They produce power when wholesale electricity prices are at their highest. This reduces wholesale electricity prices with the savings flowing through to all electricity users.
- They are becoming cheaper and cheaper while fossil fuel based generation is becoming more and more expensive. Solar PV is no longer a high cost, green frill, it's an increasingly important part of overall electricity generation.
- They are modular by nature and can be positioned right next to where it will be used – the most cost effective place to locate electricity generation.
- They are the most popular form of power generation in Australia – according to the polls and the more than a million people that already live in nearly 500,000 solar powered homes.
- They produce emissions free electricity and can grow to be a major contributor to Australia's achievement of emissions reductions and the Renewable Energy Target.
- They can reduce, defer or enable the redirection of network infrastructure investment.

We need a stable policy environment based on sustainable economics, which will enable informed decision making by consumers and investors in Solar PV systems by:

- Providing Solar PV system owners with a "fair and reasonable price" for the power they export. Solar power, produced within the network, provides financial benefits to the market way in excess of the base value of the energy itself. This has been demonstrated and accepted by energy market players in Australia and internationally (and is known as the Merit Order Effect or MOE) but not used to calculate and reward Solar PV in Australia.
- Australia is investing almost $100 Billion on its electricity network this decade. This investment should be directed to enable the Australia to benefit from new, distributed energy technologies and maintain its low cost energy advantage into the future rather than reinforcing legacy energy strategies an assets. The latter will isolate Australia from the benefits of billions of dollars being invested in energy technology advancement around the world.

What will it cost?

- Solar PV generates sufficient value to fund its own deployment – no subsidy is required.
- Allocating an appropriate portion of the value generated by solar PV to the people responsible for its creation (the owners of the solar PV system) will create the incentive for the economically efficient deployment of solar PV.
- The residual value, which is generated by solar PV but not allocated to the owners of the solar PV system, will flow through as lower electricity costs to all electricity users.
- This approach will produce savings, not costs, for all electricity users – it is a net financial benefit approach that doesn't rely on Government subsidies.
- The size of the financial benefit will increase as Solar PV based generation grows.

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Introduction

This paper has been prepared to provide an informed view of Australia's current electricity industry, which is unencumbered by the vested interests of the very large utilities. This paper also explores how Solar PV provides an economic benefit to the community by lowering electricity costs, and some implications for energy policy.

Specifically this paper presents:

1. The absurdity of Australia's electricity industry – highlights key cost drivers, which are forcing electricity bills higher, and how this works in the favor of large electricity utilities
2. The true economics of Solar PV – considers the economic benefit of Solar PV generated electricity and the ongoing trend of ever lower costs
3. A debunking of myths regarding Solar PV – including, for example, it's impact on grid stability and cost of reducing emissions
4. Implications for energy policy – considers how a fair and reasonable feed in tariff for Solar PV exported to the grid can provide a sustainably funded, economically efficient, mechanism, which reduces costs for all electricity users

The absurdity of Australia's electricity industry

Australians are hurting from rampant increases in electricity costs, which have a greater impact on the poor and electricity intensive industries such as manufacturing. Electricity costs have risen by a compounded average growth rate of 10%pa over the last 5 years[1]. They are expected to increase even further in the coming years with:

- Nearly $100 billion in electricity infrastructure investment planned for decade to 2020[2]
- Structural changes associated with our move towards a Clean Energy Future through pricing carbon dioxide emissions
- Increasing global fossil fuel prices and the increasing connection of our local market to these prices

While there has been public debate on the issues and drivers around rising electricity costs, this has tended to avoid the absurdity of our current electricity industry, specifically:

- Australia's National Electricity Market (NEM) which trades wholesale electricity for all eastern states is:
  - One of the most volatile markets in the world where electricity prices range between negative numbers and $12,500/MWh[3], when the average retails price is approximately $220/MWh[4]
  - 1% of the time across the year accounts for over 30% of the value trading – that is: only 3.5 days worth of trading accounts for over 30% of the revenue in the NEM across an entire year[5]

[1] Australian Bureau of Statistics - Electricity Price Index represents the electricity component of the consumer price index, Australian Bureau of Statistics(Category 641.0)

[2] Blake Dawson Report, Scope for improvement 2011 – Project Risk: Getting the Right Balance & Outcomes, pg.35, *Energy Supplies Association of Australia*

[3] National Electricity Rules Version 46, *Last updated on the 10th November 201,* pg.153

[4] ROAM Consulting report to Australian Government, The Treasury, "Additional Projections of Electricity Generation in Australia to 2050", September 2011.

  - This is like buying an apple a day for $1 and on the hundredth day the green grocer charging you $50 for an apple!
- Australia's network providers are regulated to meet the busiest one-hour of demand across the year. This is absurd and unnecessary.
  - This is analogous to building as many lanes of roadway needed so that when you went for a drive you would never be impacted by congestion.
  - How many lanes of roadway would be required on each and every road to ensure a high level of service for every hour of the year?
  - But the roads metaphor does not fully capture the absurdity because unlike road users, electricity users have no way of understanding how changing their behavior, such as, travelling an hour later, may effect their costs.
  - Sizing capital investments for the future busiest one-hour leads to exponential increases in capital required – and results in spiraling energy costs.
  - This is like our green grocer forcing you to pay him for always having an apple set aside for you and every one of his customers, every day!
  - The increasing costs in the electricity industry reflect the 'tail' very much wagging the 'dog'.

But to underscore the absurdity the end payer; the electricity user; has limited oversight to understand how their behavior drives cost increases

So how and why did the electricity industry arrive here?

The outcomes are not absurd for the powerful market players involved in the energy industry – the owners of legacy assets and enormous market power. Volatility in wholesale markets has the following effects:

- Generators and Gen-tailers (vertically integrated owners of generators and retailers) can charge their customers more than they otherwise would.
- Independent retailers without generators (or long term off-take agreements with generators) are disadvantaged through greater downside risks from high prices. As these independent retailers tend to be smaller and less credit worthy they tend to be less able to secure attractive long-term electricity off-take agreements with generators.
- Electricity costs more for end users.
- Gen-tailers gain market power over smaller retailers

Perversely, the higher capital investment in networks that is required to meet the "peak 1 hour" enables network operators to increase their profits through regulated asset rules. Regulators set maximum allowable revenue for networks to achieve a 'fair' return on capital meaning network operators are incentivized to maximise capital investments to increase their profits and enterprise value.

The close-knit community of Generators, Distributors and Retailers has a common cause of protecting their investment in assets – centralised generation and hierarchical network assets designed for yesterday's energy world rather than Australia's current and future energy needs.

[5] Melbourne Energy Institute researches analysis of AEMO data with 1% of time account for 30% in 2010 and 37% 2009

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The electricity industry is big; mission critical; based on legacy assets; complex and covered by a mixture of Federal and State policy and legislation. It is also a cornerstone in Australia's economy. The lack of visibility (transparency) of the economics of the sector combined with the conflicting commercial incentives for the major energy players impairs Australia's ability to reduce emissions, to harvest the economic benefits of new technologies and to be proactive in its response to the changing requirements of the market.

The true economics of Solar PV

The benefits of solar power

The value of solar generated electricity exported to the grid is only now being properly considered.[6] Previously, the Solar PV generated electricity had been valued either for electricity used on site by the retail electricity rate or, for electricity exported to the grid, by either the wholesale electricity rate or by generous, government-mandated subsidies. Neither of these recognise the true economic value of Solar PV generation.

There are a number of contributors to the value of exported solar power:

1) Direct benefits
   a) The Energy value, if it were traded on the wholesale National Electricity Market at 7c/kWh, which reflects the wholesale electricity price at the time of day that Solar power is produced.
   b) Avoided market and regulator based fees and charges valued at 0.1c/kWh.
   c) Avoided network losses. Because solar power is consumed close to where it is produced, less electricity is "lost" during transmission around the network, worth on average around 2c/kWh.[7]
2) Indirect benefits. There are a number of indirect contributions to the value of exported solar power; benefits that reflect how Solar PV's impact on the dynamic electricity market:
   a) Merit Order Effects. Solar PV actually reduces wholesale electricity prices and volatility. This value driver is over and above the value of the energy (1a) described above. Australia's wholesale electricity market is particularly volatile. Only 1% of the time accounts for over 30% of cash flows through the National Electricity Market in a year.[8]

      This volatility cost is borne by *all* electricity users and is a significant challenge for retailers.

      MOE is not a new concept. It has been used by the major Australian utilities to support the introduction of wind power**.** Analysis of Germany's electricity market concludes "the value of the merit order effect due to renewable energy was calculated to be in the order of €3-5 billion. Once the actual market value of electricity produced by the renewable energy installations was added to that, the

[6] SKM MMA 'Value of Generation from Small Scale Residential PV Systems' July 2011. On going research by the University of Melbourne, which is referenced within this paper.
[7] Independent Pricing and Regulatory Tribunal (IPART) NSW "Solar feed-in tariffs" Draft Report November 2011, p45
[8] Melbourne Energy Institute researches analysis of AEMO data with 1% of time account for 30% in 2010 and 37% 2009

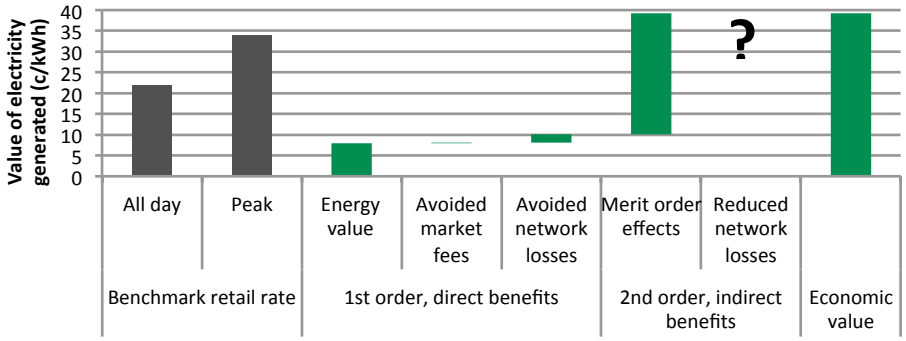
net benefits to consumers outweighed the costs of the German renewable energy support payments (Feed-in-Tariffs)".[9]

Modeling by the University of Melbourne of the impact of greater levels of Solar PV on the National Electricity Market has also demonstrated this effect (Figure 2).

b) Reduced network loss factors. Solar PV leads to higher levels of generation embedded in the local network and to lower network losses, which benefits all electricity users within the local network. So while (1b) above represents the *avoided* losses by electricity not being lost on route to the site, (2c) recognizes that the loss factors will be reduced for all users due to the solar PV project. This benefit has yet to be quantified.

Figure 1 considers the additional economic value of electricity generated by embedded, Solar PV and to inform sizing of a potential feed-in-tariff assigns this value to electricity exported to the grid.

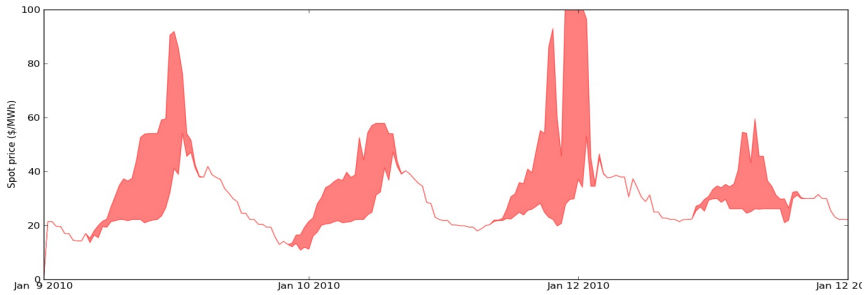
Figure 1 – Economic value of solar exports



Solar PV delivers significant value for all electricity users

Source: Benchmark retail rate references IPART website and ROAM Consulting report to Australian Government, The Treasury, "Additional Projections of Electricity Generation in Australia to 2050", September 2011. Direct benefits reference IPART 'Solar Feed-in tariffs" Draft Report November 2011. Indirect benefits references 'Economic Value of Solar PV Generation', August 2011, University of Melbourne, and assumes 35% of electricity generated is exported.

Figure 2 Impact of solar on wholesale spot electricity prices



Solar PV reduces wholesale prices

The shaded area represents the modeled reduction of wholesale prices due to an additional 5GW of Solar PV.

Source: 'Economic Value of Solar PV Generation', August 2011, University of Melbourne

Solar PV costs are reducing

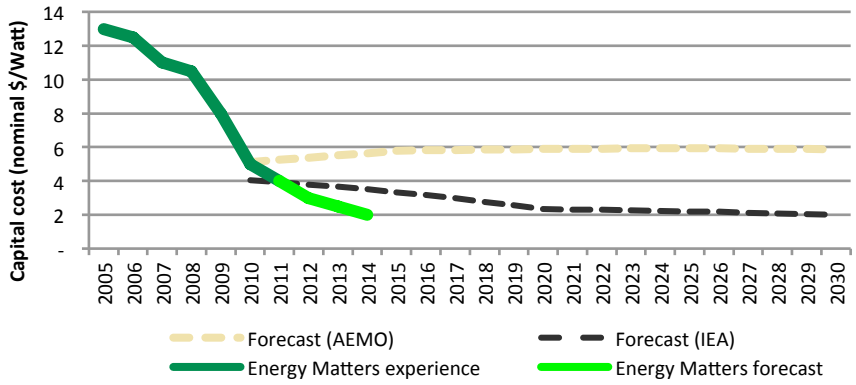
The economic benefits of Solar PV will continue to increase as the cost of solar technology decreases and the cost of fossil fuel based energy increases.

The cost decreases are due to the reducing cost of Solar PV components, which are similar to that seen in other electronic products, such as, plasma televisions, mobile phones, and the like. Solar PV's trajectory of reducing costs is not available to traditional electricity generation technologies, which are mature and have flat cost curves going forwards. Figure 1 highlights this disparity, and references the current

[9] Stensuss, F. et al (2008), "The merit-order effect: A detailed analysis of the price effect of renewable electricity generation on spot market prices in Germany", Energy Policy, 36, pp3086-3094

assumptions of the Australian Electricity Market Operator (AEMO), the International Energy Agency, and our rates, which are lower again.

Figure 1 Solar PV sales price (before renewable energy certificates and GST exclusive)

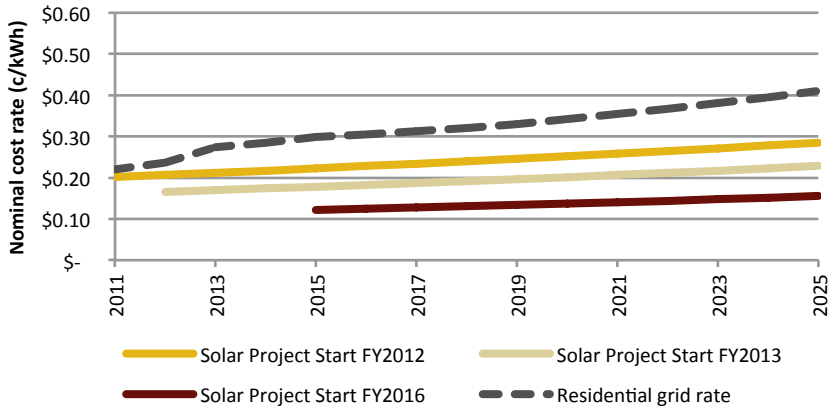


Solar PV costs are lower and reducir faster than energ planners may be aware

Source: 'Fuel resource, new entry and generation costs in the NEM', AEMO 2011
'Technology Roadmap – Solar PV' International Energy Agency, 2010

Energy economists calculate the Levelised Cost of Electricity (LCOE) to compare generator technologies using consistent economic assumptions. LCOE's calculate a cost rate for electricity (cents per kilowatt-hour) generated over the assumed life of the asset (20 years), given the capital and operating costs, and a cost of capital (typically assumed around 10% real). Figure 3 presents the LCOE of solar and forecasts the competing retail price for electricity from the grid.

Figure 3 Generation costs (Example based on 30kW solar system located in Sydney, net of renewable energy certificates)



Solar PV can protect the community from escalating bills

Source: ROAM Consulting report to Australian Government, The Treasury, "Additional Projections of Electricity Generation in Australia to 2050", September 2011. Solar project modeling by Energy Matt (assumes Small-scale Renewable Energy Scheme).

Solar PV deserves better Press

Some of the current myths about Solar:

- It's expensive.
  Solar PV is not expensive. While it's been negatively effected by resolvable policy conflicts it provides net benefits today and continues to get cheaper.
- Solar causes grid instability
  Blaming solar for grid instability is like blaming commuters for public transport congestion. Adding devices to a network does inpact the network. But, Solar

has less impact than, say, air conditioners (estimated to impact the network 30x than solar PV) and ETSA in South Australia say they have had had 2 problems with 60,000 installs. In the long run, distributed generation (like solar) will add to the strength and efficiency of the grid - some adaptation to the new world may be required.

- Solar gets too much subsidy
  It is true that some schemes were over generous - they are gone and were argued against by solar industry leaders. The reality is that virtually all energy production gets subsidies such as:
    - Exploration tax benefits
    - Free/subsidized/undervalued fuel
    - Excise exemptions for diesel

  While subsidies for other industries (automotive, tourism, education, agriculture, health care) create a dependence on more subsidies, Solar PV is demonstrating a reducing need for subsidy

- The industry is full of "fly-by-nighters"
  While it is true that some unethical players joined the sector when the incentives were too high a rational and fair value for solar power wont provide these players with the fast buck they seek. The majority of solar PV companies are ethical customer focused employers.

- Solar is great for the wealthy
  The reality is that paying a rational, fair value for solar power reduces all electricity costs. Apart from in some areas (particularly NSW) where incentives were too aggressive, Solar PV has been taken up by lower income households who want to protect themselves from future energy price rises rather than the wealthy.

- Solar doesn't help reduce emissions
  It does. It operates for a long time without fuel and current best practice volume manufacturing processes continue to reduce the embedded energy in systems. Appropriately installed systems quickly replace embedded energy.

  Clearly, electricity produced by Solar PV is electricity produced without emissions. But when it generates electricity on-site at a lower rate than the daytime electricity rate, then Solar PV is delivering carbon abatement for less than the price on carbon. When Solar PV can deliver electricity for 2c/kWh less than the retail price, then solar PV is delivering carbon abatement for a negative cost (that is a profit). This is occurring now in many locations in Australia.

Implications for policy

Systematic analysis of actual data shows the true economics of Solar PV to be attractive now and increasingly so into the future – providing a net benefit to the community.

Ongoing funding of Solar PV programs from government balance sheets is not sustainable and counter to the user-pay system prevalent in the energy sector and the best interests of the Australian Economy and Environment.

Solar PV makes sense (and dollars) for Australia

Providing a fair value for electricity exported from solar PV systems is equitable, sustainable and may be implemented in perpetuity (albeit with regulator oversight) is the shortest path, best value policy approach that also provides a net benefit to the economy.

A fair value return for exported electricity:

- Ensures a fair price for electricity exported to the grid, and enables the economic value generated by Solar PV to be made accessible to investors large and small.
- Is not a subsidy, hidden tax or economically inefficient mechanism.
- Overcomes the current, hidden market failure that is slowing investment in Solar PV, placing upward pressure on electricity prices inhibiting emissions reductions.

With over 28GW of solar PV potential on Australia's rooftops[10] there is ample scope for solar to become a key component of our generation mix in the future. And, Solar PV's modular nature enables large volumes to be delivered efficiently through medium scale projects. Indeed, this is precisely the economic 'sweet spot' for solar; where costs are lowest and benefits are highest.

The combination of the provision of a fair value for exported energy and long-term confidence in sustainable and stable policy will enable consumers to benefit from, and contribute to, our clean energy future.

[10] Independently estimated by Energy Matters (28GW) and The University of Melbourne (30GW), both conservatively assuming only 20% of rooftops being suitable for solar

About the Australian Solar Round Table

The Australian Solar Round Table (the Round Table) is a group of CEOs of Australia's largest and most professional Solar Energy Companies that has been formed to provide industry leadership, stakeholder education and to earn market confidence for the Residential and Commercial Solar market in Australia. The Round Table was formed in August 2011 and currently represents about 25% of the Australian solar marketplace. Its membership will expand as likeminded CEOs are invited to join.

Currently, the Round Table membership is:

- Jeremy Rich, CEO, Energy Matters
- Simon Schauble, CEO, Nu Energy
- Steve McRae, CEO, Ingenero
- Richard Turner, CEO, ZEN Energy Systems
- Jenny Lu, CEO, Suntech Power Australia
- Zygmunt Nejman, CEO, SMA Technology Australia

The Round Table uses objective, fact-based data to develop and communicate industry strategies and policies that are empathic to the needs of the stakeholders in the industry, Governments and the broader community. Members contribute their resources and experience to establish critical mass and a strong voice.

Dave Holland of Right Angle business Services facilitates the Round Table on behalf of the member CEOs.

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