GETTING THE FACTS RIGHT ON SOLAR

What is really driving higher electricity network costs, and how can they be fairly shared between consumers?

Summary of selected results from technical report titled

'*Impacts of PV, AC, other technologies and tariffs on consumer costs*'

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ABOUT THIS REPORT

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This summary for policy makers and the general public draws on an accompanying technical report which was researched and written by the APVI for the Centre for Policy Development, and peer reviewed by the Melbourne Energy Institute.

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ABOUT THE AUTHORS

AUSTRALIAN PV INSTITUTE

The Institute comprises companies, agencies, individuals and academics with an interest in solar energy research, technology, manufacturing, systems, policies, programs and projects.

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AT A GLANCE

Rising electricity prices have focused attention on network costs

- Electricity prices have increased nationally by 70 per cent in real terms between 2007 and 2012, making them a focus of both utilities and governments.
- Air-conditioners have been broadly recognised as the primary driver for increasing electricity prices, by increasing the amount of electricity networks must carry at any one time.
- Recently, solar photovoltaic has also become a focus, with suggestions for owners of solar systems to pay higher network charges.

Rooftop solar has been reducing higher network costs driven by air-conditioning

- The 70 per cent uptake of air-conditioners has increased costs for other households by about $250 per year.
- An average solar system actually reduces this cost impact.
- Even if as little as 10 per cent of solar capacity is available during the annual peak, it still reduces the cost impacts of air-conditioners.

Network regulatory reform must be carefully designed to avoid perverse outcomes

- The current direction of electricity reform could increase the cost impacts of air-conditioning for households, while limiting solar's contribution to offset this.
- Time-of-use pricing could make the so called 'death spiral' for networks worse by reducing their revenue, or increasing household bills.

A sensible solution is to charge customers for the peak amount of energy they demand

- To reflect the true cost of delivering electricity to consumers, network tariffs should include a charge based on the maximum demand customers place on the network at any time during the year, and the cost of network poles and wires to meet this demand.
- A demand charge is similar to households paying for the size of the water pipe they connect to.
- This is a fairer, more effective, and more efficient solution than higher fixed charges or disconnection fees.

SUMMARY FOR POLICY MAKERS

Over the last 5 to 10 years, many Australians have bought technologies that can affect both their own electricity costs and the bills of other households through their influence on network peak demand and the revenue expected by network service providers. Air conditioners (AC) are owned by about 70 per cent of households[1], solar hot water heaters (SWH) by almost 8 per cent[2,3], and solar photovoltaics (PV) by 10 per cent[4,5].

Electricity prices have increased nationally by 70 per cent in real terms between 2008-09 and 2011-12[6], making them a focus of both utilities and governments. Although ACs have been broadly recognised as the primary driver for increasing electricity prices[7,8,9], PV has also become a focus of utilities and government agencies, with calls for owners of PV systems to pay higher network charges.[10,11]

This research indicates that:

- The 70 per cent uptake of AC to date has increased costs for other households by about $250 per year[i].
- An average PV system actually reduces this cost impact.
- Even if as little as 10 per cent of PV rated capacity is available at peak periods, it still reduces the cost impacts of ACs. The cost reduction driven by PV depends on how much capacity is available during the annual load peak, with the actual found in the households used in this analysis to be between 10 and 20 per cent. The larger the PV system, the greater the reduction.

The type of tariff a customer is on has a significant impact on how AC and PV affect the electricity bills of other customers.

- Under the current Weighted Average Price of Capital (WAPC) regulations in most states, although a time-of-use (TOU) tariff resulted in the lowest costs imposed on other customers by either AC alone, or by AC combined with PV, this is only because network operators are receiving less revenue.
- Under the coming revenue cap regulations, a TOU tariff would increase the costs imposed on others by either AC alone, or by AC combined with PV; whereas a tariff with a demand charge component would result in the lowest costs for other customers.

Research for this report raises three significant questions for the future of Australia's electricity system, and what it costs to maintain.

- How can network costs be *fairly* distributed between different classes of customers?
- Can network charges be designed to make more *effective* use of the current grid and any future investment, if we see a return to peak demand growth?
- Can network charges be designed to support *efficient* options to supply and deliver electricity, as the current grid ages and distributed energy technologies become cheaper?

The answer to all three is to use a tariff with a demand charge component. This could be a fixed quarterly charge based on a household's annual peak demand and the cost of grid infrastructure to meet these demand peaks.

Demand charges lead to more equitable, effective and efficient outcomes for households and the electricity system, compared to current standard or TOU tariffs:

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[i] This estimate does not include the costs of additional peak generation, and is therefore lower than a 2013 Productivity Commission estimate of $350 per year (see PC, 2013, page 351).

- Costs are more *fairly* distributed, as cross-subsidies to air-conditioners are significantly reduced. The research here indicates that under a demand charge tariff, if 20 per cent more customers installed air-conditioning this would add around $37 per year to other households' bills, compared to $80 per year or higher on a standard or TOU tariff.
- A demand charge is more likely to encourage all consumers to smooth annual peak demand, make more *effective* use of existing infrastructure, and deferring new network capital investment. By comparison, a TOU broadly targets daily peaks in demand, rather than annual peaks. A standard tariff targets neither.
- A demand charge caters for the full range of emerging distributed energy technologies which are popular with consumers and may prove to collectively provide the most *cost-efficient* electricity supply and delivery options, as decisions about network capital replacement are made. Compared to other tariff options, a demand charge optimises the impacts of these technologies on other households' bills.

A well designed demand charge tariff can also address other equity considerations that a standard or TOU tariff may not:

- A TOU lowers distribution networks' revenue from customers with AC, but significantly increases retailers' revenue. This leads to either unsustainable losses for networks (under a WAPC) or higher costs for other households (under a revenue cap). By comparison, a demand charge tariff allows distribution networks to recoup more of their revenue from the customers which drove network investment, and provides only a small increase in retailers' revenue.
- Demand charges can be designed to reduce the impact on low-income households and low-energy using households of recent investment in network upgrades, or falling demand, or both. They can do this by reducing their costs directly (where households make smaller contributions to peak demand), and by deriving more of the required network revenue from other households with large and peaky loads.

If demand charges are to be used it is critical that they are accompanied by an education campaign that lets households know how they will affect their bills, and most importantly, what options they have to reduce their demand peaks and therefore their bills.

PV's ability to reduce demand peaks was modelled here by superimposing it on demand peaks caused by AC. This is justified to date because as PV installations have increased, so has AC. In fact, AC uptake is significantly higher than PV uptake to date.

Opinions remain divided over whether growth in electricity consumption and annual peak demand will resume, or continue to fall.[12,13] Key uncertainties include manufacturing industry demand for electricity, the rate of uptake of distributed technologies such as solar PV and battery storage, the success of energy efficiency policies, and whether air-conditioner use will increase.

If total demand increases, PV can be used to help reduce peaks and should be rewarded accordingly. If total demand does not increase, this would in part be due to PV, in which case utilities should be allowed and enabled to alter their business models to participate in the DE market. This requires equal competition between demand-side and supply-side options to manage peak demand, and integrated resource planning for electricity networks. The regulatory framework needed to facilitate this discussed in detail in Passey et al.[12]

However, one thing is certain – Australia's electricity system is going through a period of rapid change.

As this report demonstrates, policy decisions based on evidence would favour demand charges over time-of-use tariffs, and over a blunt approach of putting extra levies on solar consumers.

SUMMARY RESULTS

This section summarises results from the scenarios most relevant to upcoming policy decisions. They include results from two separate sources of household load and PV output data. The accompanying technical report provides full results from all scenarios modelled.

1. DNSPs receive less income under a TOU tariff

Table 1 compares the changes to TNSP, DNSP and retailer income as a result of a customer[ii] moving from a Standard tariff to a TOU tariff. In both cases, although the income of both TNSPs and retailers increases significantly, DNSP income decreases. This result applies under both WAPC and revenue cap regulations. As discussed above, this is an unexpected outcome if TOU tariffs are intended to generate income for distribution networks.

Table 1. Residential Annual Bill for 'Responsible customers': Baseline Outcomes, TOU compared to Standard tariff (incl. GST) – First order impact

	Percentage change in income	
	Blacktown data	**Ausgrid 270 data**
Transmission	104.9%	169.0%
Distribution	-22.9%	-23.7%
Retail	23.1%	20.7%
Total	9.6%	9.6%

2. PV reduces the price impact of ACs under current WAPC regulations in most states

Figure 1 compares the impacts on other households when 20 per cent more households install either AC or AC+PV when the DNSP is regulated under a WAPC. This represents the current regulatory environment and so illustrates the impacts that AC and PV have been having to date. It can be seen that AC significantly increases costs for other households and that PV reduces this impact.

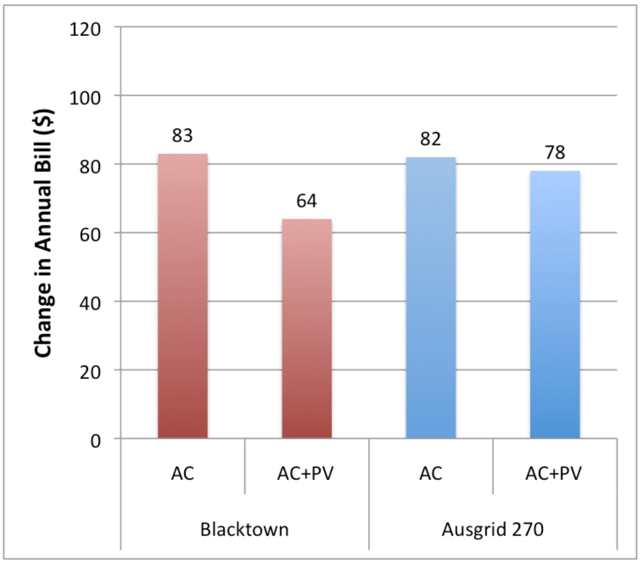

Figure 1. Third Order Impacts of AC and PV on 'Other Customers' Annual Electricity Bill, WAPC regulation, 'Responsible Customer' on a Standard tariff

[ii] The customer is without AC in the example shown in Table 1, however this effect occurs with all customer types assessed.

3. Demand charge most effective at reducing cost impacts of AC

Figure 2 compares the effect of different tariffs on the impacts on other households when 20 per cent more households install AC and the DNSP is regulated under a revenue cap. Although the absolute levels of the impacts differ between the datasets, the relative impacts are similar, with a Demand charge tariff being the most effective at reducing other households' costs, and a TOU tariff being the least effective.

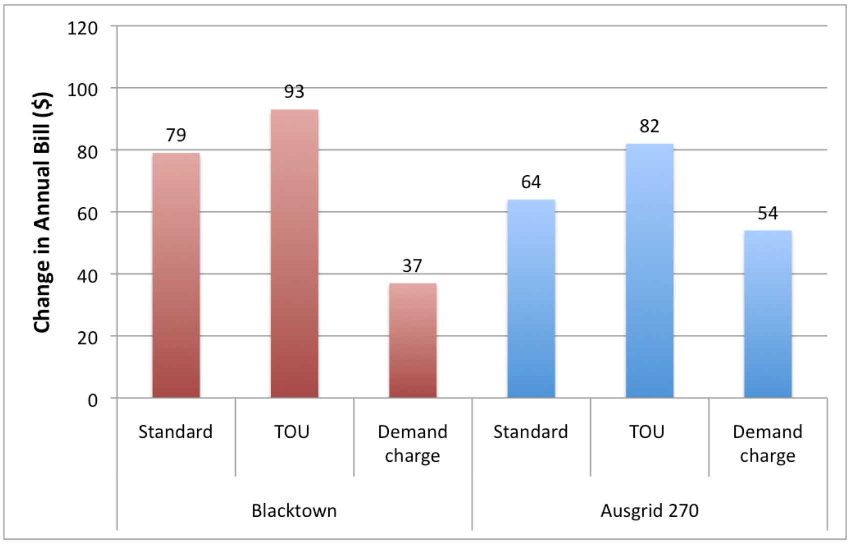

Figure 2. Third Order Impacts of AC on 'Other Customers' Annual Electricity Bill, revenue cap regulation, 'Responsible Customer' on a Standard, TOU and Demand charge tariff

4. PV reduces the impact of AC on a Demand charge tariff under coming revenue cap regulation

Figure 3 compares the effect of TOU and Demand charge tariffs on the ability of PV to reduce the cost impact of AC on other households, when the DNSP is regulated under a revenue cap. Under a TOU tariff, PV slightly increases the cost impact of AC on other households. In contrast, a Demand charge tariff results in PV reducing the cost impact of AC.

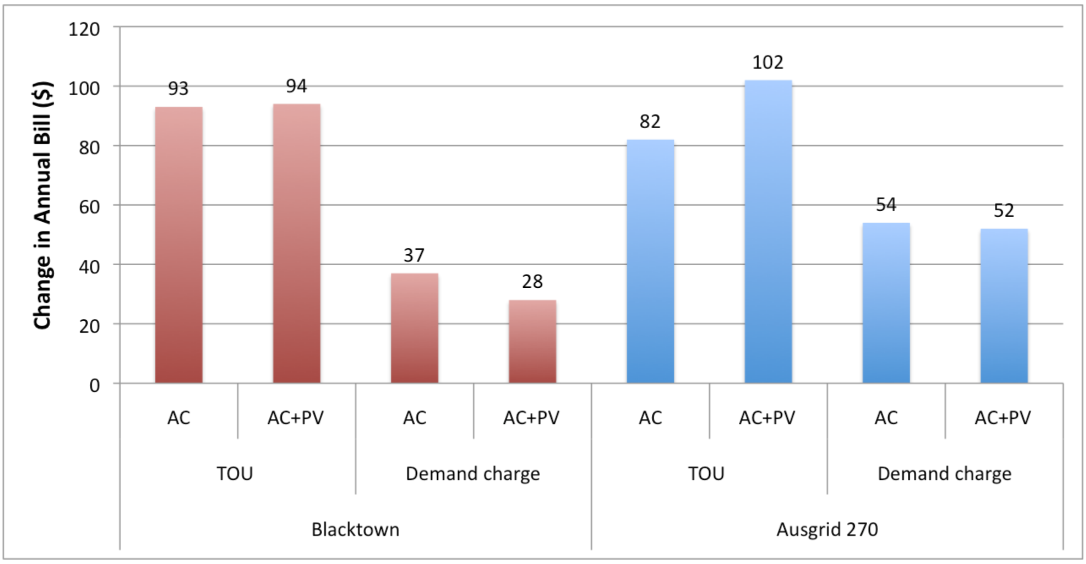

Figure 3. Third Order Impacts of AC and PV on 'Other Customers' Annual Electricity Bill, revenue cap regulation, 'Responsible Customer' on a TOU or Demand charge tariff

OVERVIEW OF RESEARCH METHOD

Detailed analysis is essential to understand the complex interactions between new technologies, tariff structures and the existing electricity system.

Technologies such as PV and air conditioning (AC) not only affect the electricity bills of households that install them, but can also affect the bills of other households. For example, PV decreases peaks in demand (reducing network costs that must be paid by others), and decreases a household's electricity use (increasing network payments required by others). AC does the opposite. These two counteracting effects complicate the assessment of the real impacts of such technologies.

The impact of different technologies on the costs faced by 'Other customers' is very dependent on whether the distribution network (DNSP) is regulated under a weighted average price cap (WAPC) or a revenue cap. Under a WAPC, where a technology reduces electricity use (and therefore makes lower network payments), the cost is incurred by the DNSP. Under a revenue cap, this cost is passed through to all customers in the form of higher tariffs.

DNSPs in Queensland are currently regulated under a revenue cap, and NSW and the ACT are changing to revenue cap regulation as of 1 July 2014. It is likely that other states will change to revenue cap regulation in their next Regulatory Determination periods.[iii]

For this research, a new model was developed that can quantify these effects based on real data for both household load and PV output. The data used for the full analysis was from 61 houses in Blacktown, and the most significant outcomes were confirmed using data from 270 houses distributed throughout the Greater Sydney area.

Three different tariffs were assessed: Energy Australia's Standard and TOU tariffs, and a Demand charge tariff that was custom designed to not increase costs for the average user. Data from the Productivity Commission and the Energy Supply Association of Australia were used to calculate the impacts of demand peaks on network costs.

The impacts of AC, PV, PV+battery, SWHs and energy efficiency were all modelled. To make the outcomes comparable, 20 per cent of households were assumed to take up each option. The financial outcomes were separately quantified for the households that take them up, other households, TNSPs, DNSPs and retailers.

PV's ability to reduce demand peaks was modelled here by superimposing it on demand peaks caused by AC. This is justified to date because as PV installations have increased, so has AC. In fact, both the total volume and rate of AC uptake is significantly higher than PV uptake to date. In the future, if total demand increases, PV can be used to help reduce peaks. If total demand does not increase, this would in part be due to PV.

[iii] SA's next regulatory period starts on the 1 July 2015, Victoria's on 1 Jan 2016 and Tasmania's on 1 July 2017. Note that the revenue caps are reset each Regulatory Period.

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