Questions on notice

Total Environment Centre

1. Have you analysed the impact of residential solar panels on peak demand?

   If so, did this analysis find that residential solar panels alleviate peak demand?

   The difference between peak demand and the average daily load has been estimated to be about 2kW. Given that small residential solar panel systems can also generate about 2kW:

   > Would the deployment of such systems across a significant proportion of residences make a significant contribution to peak demand, given that peak demand appears to occur on the hottest days, when solar power generation is also most effective?
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   > Given that demand peaks towards the late afternoon, is it potentially more favourable in terms of matching the timing of solar power generation to put the panels at high pitch angles on west facing roofs, rather than the traditional preference for north facing solar panels to maximise total power output?

TEC has not itself done this analysis, but others have. For instance, Mike Sandiford, Director of the Melbourne Energy Institute, has shown that "In South Australia, midday to early afternoon demand was down over the financial year 2011-12 by about 8% on the average for the period spanning mid- 2007 through mid-2009."[1] SA appears to have the highest per capita PV penetration of any state,[2] so the impact is likely to be less, but still significant, in other states.

In summary, the peak time for PV output depends on the orientation of panels. Most installed panels face north, so the peak output does not match the evening peak power period.[3] However, where panels face north-west or west, there is a close correlation between PV output and peak demand. To be precise, this correlation does not reduce energy demand in total, since there is no less demand as a direct result of the number of PV systems installed, but it does reduce the need for this demand to be met via the grid.

Regarding the average 2 kW difference between peak and average daily load, strictly speaking, installing more PV panels would not reduce demand as such; rather it would provide a local and renewable way of meeting this demand – but, as stated above, this depends on the orientation of panels. With more north-west and west-facing panels, homeowners will not be faced with exporting their output during the middle of the day (for little or no return in some states currently), then importing it in the evenings (at full retail rates). The downside is that power output decreases during the afternoon.

The optimum pitch for PV systems depends on latitude. Optimal power output would be obtained by systems that track the sun through the day. For fixed panels, the optimum orientation is a compromise between system power output and household energy demand.

In short, the Senator's thinking is quite correct. As well as more systems now being installed to take respond to peak demand rather than peak output, a raft of measures could be introduced at the State planning level to ensure "solar access" is maintained, from the design

of new subdivisions to rights in development application processes to a certain number of hours of daylight falling on rooves.

Other technological and regulatory changes could assist, such as the introduction of more private or local grids and "virtual power stations" which aggregate the output from individual households or small businesses for sale into the network. These have the potential to better balance supply and demand across the day.

This development is of concern for existing market participants. Peak periods are when **generators** make most of their money, since (mostly gas-fired) peaking plants are more expensive, and all generators are paid the same price for their successful bids into the spot market. According to Sandiford, up to a few years ago "hourly revenues on the South Australian wholesale market typically peaked at 3-4 pm in the afternoon at 5 times above base revenues",[4] but with a high PV penetration in that state, this price differential has now disappeared. With peak demand down, there is likely to be less need for building new infrastructure, which is primarily how **networks** earn their revenue. **Retailers** are responding to lower overall and peak revenues from PV-equipped households by increasing fixed daily charges, and in some cases by calling for the introduction of gross metering, which would require all output to be effectively exported to the grid at a lower rate than owners would be forced to pay for their total energy consumption.

It is, however, good news for small **consumers** – especially since the idea that PV systems are a form of middle class welfare have been comprehensively disproven, with installations highest in rural/regional and low income urban areas.[5] With PV systems approaching "socket parity" — that is, the cost of exported energy being around the same as the retail price — all PV owners need is to be paid around the same for any energy they export as for any energy they import from the grid.

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[1] See http://reneweconomy.com.au/2012/whos-afraid-of-solar-pv-38844.
[2] See Clean Energy Council, Review of the Australian PV industry, 2011, Table 1 (figures to mid 2011).
[3] The Productivity Commission's Electricity Network Regulatory Frameworks Draft Report, October 2012, notes that "existing non time varying tariffs do not encourage householders to orient units to the west to maximise generation in periods of peak demand late in the afternoon" (Overview, page 14).
[4] See http://reneweconomy.com.au/2012/whos-afraid-of-solar-pv-38844..
[5] See REC Agents Association, Research Note 3 – Geographical analysis of solar systems under the Renewable Energy Target: http://www.recagents.asn.au/raa-research-note-3-geographical-analysis-of-solar-systems-under-the-renewable-energy-target.