Australian PV Association

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APVA Response to the Power of Choice Directions Paper, March 2012

May 2012

Summary of Key Points

- Because distributed generation (DG) was not in the Power of Choice review's Terms of Reference it has been included as more of a secondary issue than a particular focus
- However, DG, especially in the form of photovoltaics (PV), is likely to have a significant impact on the Australian electricity industry over the next 5 years
- The uptake and therefore impact of PV has most likely been underestimated because the cost of PV has been significantly overstated
- New business models for installing PV that do not rely on government support are entering the market and could drive significant uptake
- Electricity use has decreased in absolute terms every year since 2008/09, and ongoing uptake of energy efficiency (EE) and DG will likely continue this trend
- Reduced electricity sales will put increasing pressure on utilities' traditional revenue and business models
- Network operators will need to increase their Transmission Use of System (TUOS) and Distribution Use of System (DUOS) rates to maintain and augment the network
- This would further increase electricity prices and drive more EE and DG, further reducing sales
- This could result in increased opposition to EE and DG from wholesale generators, network operators and retailers
- Alternatively, new business models could be developed to help accelerate a new distributed energy (DE) market
- Such a market will require the development of appropriate regulatory arrangements as well as consideration of a range of other issues including:
    - Rights and technical standards for connection of DE technologies to the grid
    - Formalisation of the portability of DE services
    - Trading rules and requirements
    - Ancillary service requirements and rewards
    - Appropriate DUOS charges
    - The role and regulation of new energy service providers
    - Pass through of energy and network cost reductions due to DE to the owners or customers generally.

The APVA looks forward to active involvement in developing the new Australian Distributed Energy Market.

Introduction

We commend the AEMC for undertaking such a detailed assessment of energy efficiency. It has significant potential to reduce energy use and emissions, and is also one of the most complex options – and hence deserving of reviews such as this.

However, the focus of this submission by the APVA is on distributed generation (DG), and in particular, photovoltaics (PV). We understand that, although DG was not specifically included in the Terms of Reference for this Review, it has been included in both the Issues Paper and the Directions Paper, albeit as more of a secondary issue than a particular focus. As discussed below, DG (at least in the form of PV) is likely to have a significant impact on the Australian electricity industry over the next 5 years and beyond. There is a risk that inclusion of DG in the Power of Choice (PoC) Review, even at a relatively superficial level, will create the impression that no more needs to be done. Like EE, DG includes a large number of different technologies with different characteristics and applications. The APVA therefore requests that the AEMC acknowledge that DG has not been addressed to the level required, and recommends that a process equivalent to the PoC Review be established for DG, or Distributed Energy (DE) more generally.

The following firstly outlines why we believe the coming uptake of PV has been underestimated. As a result, to the extent that the Direction Paper addresses DG, it focuses only on measures to drive uptake in order to reduce demand peaks, when there is also a need for measures to optimise the integration of DG currently being installed. We then discuss the consequences of increased uptake of PV for network operators and electricity retailers, and how they may seek to restrict further uptake of all types of DG. We conclude that a Distributed Energy market is required – that would not only include DG but EE and demand side management (DSM) as well. Finally, we address some of the specific issues in Chapter 11 of the Directions paper, which covers DG.

Why the Impact of Photovoltaics has Been Underestimated

The Directions paper estimates there is 630MW of PV connected to the NEM. In fact there is currently (end 2011) slightly more than 1.15GW of grid-connected PV in the NEM, 1.2GW of grid-connected PV in Australia, and over 1.4 GW of PV installed in total – see Figure 1 below.[1]

[1] APVA, *PV in Australia 2011*, in press. Prepared for the International Energy Agency Cooperative Programme on PV Power Systems, by the Australian PV Association on behalf of the Australian Government.

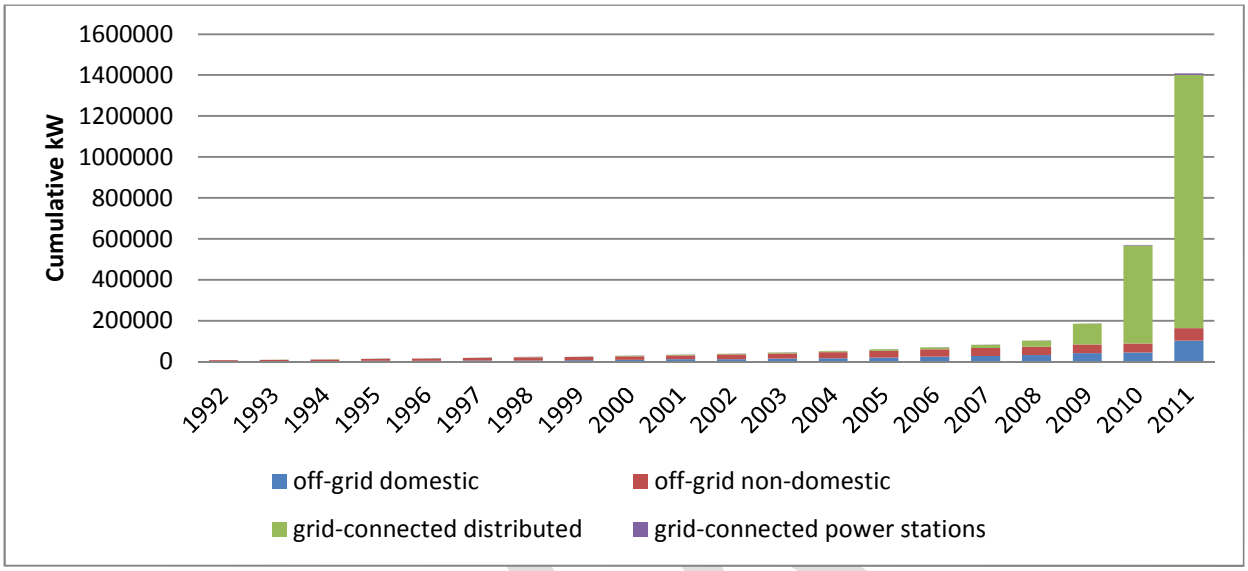

Figure 1: Cumulative PV installations in Australia[2]

The future uptake of PV has most likely been underestimated because the installed costs and resultant levelised cost of electricity (LCOE) of PV have been significantly overstated in many recent government reports. For example, the Australian Government's Energy White Paper assumed very high costs for PV (it assumed higher LCOE in 2030 than is already the case for 2012) and so projected that uptake would gradually decline after the end of the RET.[3] Figure 2 and Figure 3 show projected costs of PV electricity, without any REC or Feed-in Tariff subsidies, for commercial and residential PV systems plotted against projected prices of displaced electricity and the Net Present Value of that electricity. It can be seen that for both commercial and residential PV, average LCOE costs are now equal to or lower than retail electricity prices. This reducing cost trend is expected to continue. Global PV module and LCOE projections from Clean Edge[4] as shown in Figure 4 indicate similar trends.

[2] APVA, various years, *PV in Australia* reports. *PV in Australia 2011* is in press. Prepared for the International Energy Agency Cooperative Programme on PV Power Systems, by the Australian PV Association on behalf of the Australian Government.

[3] EWP, 2011. *Energy White Paper*, Australian Government.

[4] Clean Edge, 2012, *Clean Energy Trends 2012*, Clean Edge, The Clean Tech Market Authority, March 2012.

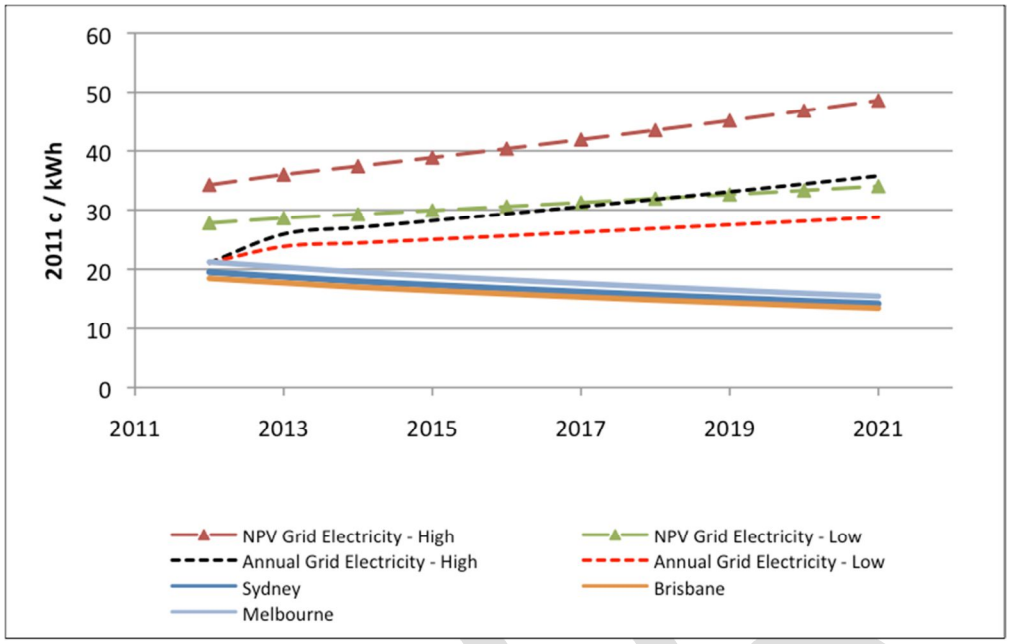

Figure 2: LCOE projections for commercial PV systems vs high and low grid electricity price projections - excludes Solar Credits and Feed-in Tariffs[5]

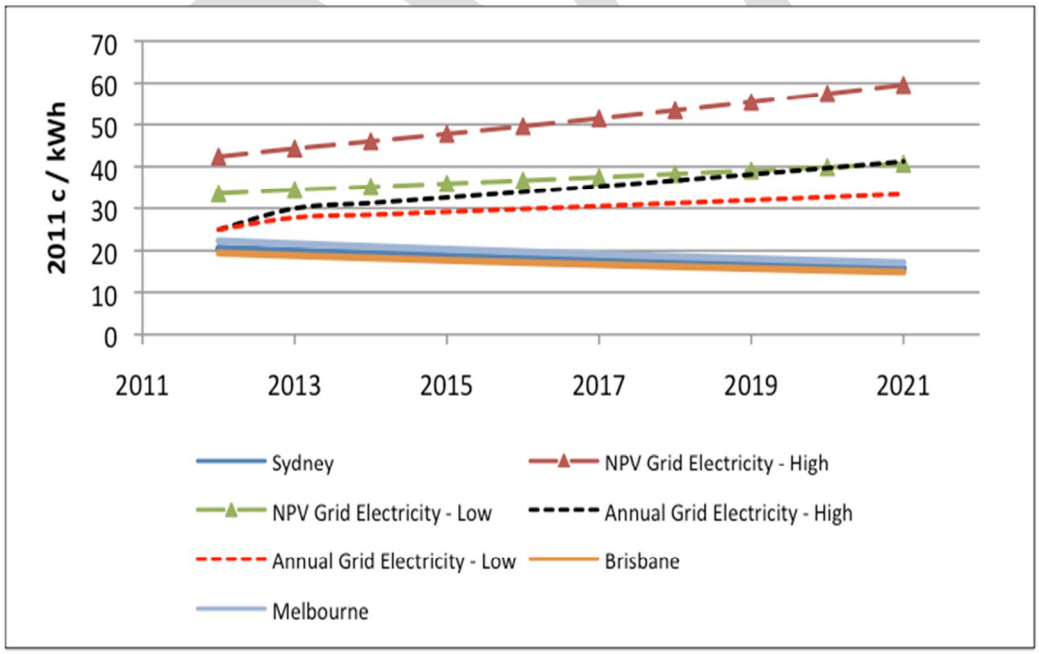

Figure 3: LCOE projections for residential PV systems vs high-low grid electricity price projections – excludes Solar Credits and Feed-in Tariffs[6]

[5] APVA, 2011, *Modelling of PV & Electricity prices in the Australian Commercial Sector, 2011*, updated 2012, by the Australian PV Association for the Australian Solar Institute.

[6] APVA, 2011, *Modelling of PV & Electricity prices in the Australian Residential Sector, 2011*, updated 2012, by the Australian PV Association for the Australian Solar Institute.

Total Installed PV System Prices and Costs of Electricity (Global Average)

Year	System Price ($/W)	LCOE Range (cents/kWh)
2007	$7.20	28 - 47
2008	$7.00	27 - 45
2009	$5.12	20 - 34
2010	$4.55	18 - 30
2011	$3.47	14 - 23
2012*	$2.69	11 - 19
2013*	$2.43	10 - 17
2014*	$2.19	9 - 15
2015*	$2.02	8 - 14
2016*	$1.87	7 - 14
2017*	$1.73	7 - 13
2018*	$1.60	6 - 12
2019*	$1.48	6 - 11
2020*	$1.37	6 - 10
2021*	$1.28	5 - 10

*Source: Clean Edge, Inc., 2012. 2007 through 2011 are actual figures and *2012 through 2021 are estimates. Figures calculated using Clean Edge cost projections and the NREL Levelized Cost of Energy (LCOE) Calculator. ASSUMPTIONS: Discount rate: 6%; Capacity factor: 16-26%; O&M cost: $6-$26/kW.*

Figure 4: Global average historical and projected PV module and LCOE trends

The rapidly increasing uptake of PV in Australia is only partly due to decreasing system component prices and government support. It has also been driven by novel business models, initiated by the bulk installation approach – where large numbers of customers were signed up, enabling significant economies of scale. This approach developed into business models which essentially applied the bulk installation approach on an ongoing basis, based on large numbers of installations and smaller margins.

The industry in Australia has now developed to an extent that new business models that do not rely on government support are entering the market. For example, 'solar-leasing' has been a game changer in the United States and is said to be responsible for three quarters of DG PV sales in California and two thirds of DG PV sales in the rest of the US.[7] These models involve installation of a free PV system (which is owned by the installer) on a customer's roof and a guarantee of electricity at a rate that is well below current retail rates, indexed only with inflation. Under an alternative model the PV electricity is higher than current rates but is not indexed to inflation.

Thus, despite reduced government support, a growth rate of 15% per year from 2014 is entirely possible, and, adding in an anticipated 400 MW of PV installed under Solar Flagships Stage 1 and Stage 2, results in a cumulative installed PV capacity in Australia of 8.5 GW by 2020, as shown in Figure 5. Although this amount of PV would meet only about 5% of total demand, the vast majority of this would be in the form of DG on the commercial and residential distribution networks. Even if installation rates drop to pre-2011 levels and no Flagship projects proceed, Australia is likely to have over 4 GW installed by 2020.

[7] Parkinson, G. 2012, Pay-As-You-Go Solar Arrives in Australia, Renew Economy.

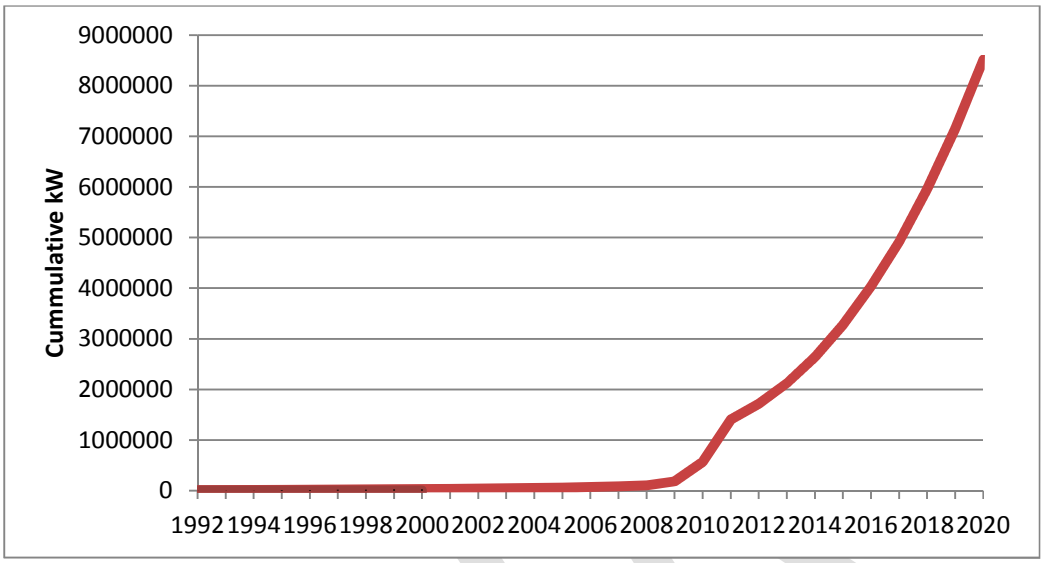

Figure 5: Past and Possible Installed PV Capacity in Australia

This means that, for PV at least, while there are still some issues that need to be addressed to enable optimal uptake in the short term, especially in the commercial sector, of increasing importance are the issues created by significant uptake of PV over the next 5 years. While these include ensuring safety standards are maintained and optimising the impacts of PV on networks, of most relevance to this Review is the likely impact on the current business models of both network operators and electricity retailers.

Potential Impacts on Retailers and DNSPs

We note that the Directions paper does not acknowledge the current decline in electricity use, its causes or its impacts. Rather, the report assumes continued demand growth. In contrast, the latest AEMO Electricity Statement of Opportunities showed electricity demand 5% lower than forecast for 2011/12, having decreased in absolute terms every year since 2008/09 – see Figure 6.[8] AusGrid has also reported declining residential usage.[9]

[8] AEMO, 2011, Electricity Statement of Opportunities, for the National Electricity Market, Update 2 March 2012.

[9] ABC, 2011, Power consumption makes historic drop, ABC News August 15, 2011, http://www.abc.net.au/news/2011-08-15/power-consumption-makes-historic-drop/2839394.

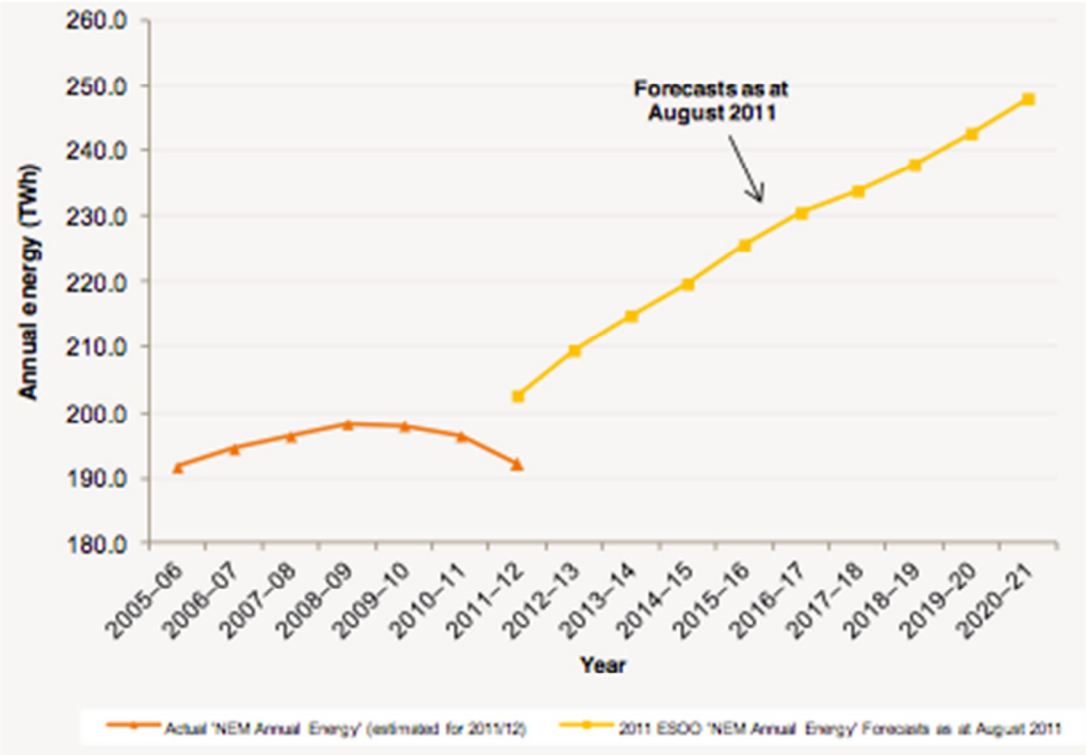

Figure 6 Forecast and Actual NEM Annual Energy 2005/06 to 2020/21 [8]

This decline in electricity use can be attributed to a range of factors, including the GFC and cooler summers (although this cause is dispelled by IES[10]), as well as increasing electricity prices, the uptake of PV, solar water heaters, energy efficient appliances and energy efficient homes.[8]

With the levelised cost of PV electricity now at, or below retail electricity costs in many areas, and continuing to decrease, an increasing number of households and businesses will install PV, with or without government subsidies. This increase in distributed PV is likely to decrease electricity demand below that previously projected. Electricity retailers, which are liable parties under the Renewable Energy Target are seeking a revised target for 2020, on the basis that the original target was meant to represent 20% of electricity demand, but would now be higher[11]. (It should be noted that liable parties campaigned strongly at the start of the program in 2001 for the target to be set at a GWh limit, rather than remaining as a percentage of electricity usage, on the grounds of certainty. Electricity demand grew strongly in the following decade.) Increased uptake of other distributed energy services is also likely to increase, driven by a variety of technologies in addition to PV, such as cogeneration, fuel cells and various storage technologies. Similarly, energy efficiency technologies, including solar water heaters, are already reducing electricity use and, as highlighted in the Issues paper and the Directions paper, have significant potential for much greater reductions. These modular, rapidly deployed and low emissions options have the potential to reduce costs and increase reliability of future electricity supply for customers in an environment of approaching generation capacity constraints, network constraints and future environment policy uncertainties.

[10] Intelligent Energy Systems, 2012, What is driving the decline in electricity demand?, Insider Issue 13, 3 May, 2012

[11] Climate Spectator, 2012, Origin's opportunistic RET resistance, 3 May 2012, http://www.climatespectator.com.au/commentary/origins-opportunistic-ret-resistance

Any significant reduction in electricity consumption, especially per customer, will put increasing pressure on utilities' traditional revenue and business models. The current retail market depends on kWh sales and a daily service availability charge. Network operators also depend on kWh sales and network access charges.

In order to pay for both existing distribution networks[12] as well as augmentations, Transmission Network Service Providers (TNSP) and Distribution Network Service Providers (DNSP) will need to increase their TUOS and DUOS rates respectively (to the extent that they can under their Revenue Cap and their Weighted Average Price Cap, as well as in new Determinations), which will be passed on by retailers and so increase consumers' electricity costs. This in turn will drive increased uptake of DG and EE, further reducing TUOS and DUOS income, driving higher TUOS and DUOS rates in an unsustainable cycle.

Although any exported electricity will generate DUOS income when it is onsold, the tendency towards minimal payments for exported electricity is driving the installation of smaller systems (but still an increasing number and hence greater total capacity). The minimal payments for export are also making the use of hybrid grid-connected PV/battery systems more economically viable (instead of being exported, electricity is stored for later use, especially to offset high TOU tariffs), with an increasing number entering the market. Battery prices are rapidly declining, driven largely by technology developments and economies of scale due to electric vehicle uptake. The use of batteries will enable the installation of increasingly larger PV systems sized to meet total customer demand – further reducing DNSP and retailer revenue, and possibly resulting in stranded assets if batteries are used to meet demand peaks. Of course, increasing penetration of air conditioning loads will increase demand peaks and so exacerbate the problem. However, uptake may be reaching saturation now, and usage will be ameliorated by increasing building energy efficiency codes.

The Need for a Distributed Energy Market

If kWh sales continue to fall, one response to maintain retailer and network operator revenue may be to increase service availability and network access charges (as may already be occurring in order to stabilise retailer income from customers on TOU tariffs). However customers are unlikely to respond favourably to increasing bills as their electricity use decreases. Another response could be increasing opposition to DG, not only by DNSPs and retailers but also by wholesale generators as their profits are eroded by the combination of reduced sales and the merit order effect. There is evidence of this already occurring, with restrictions being placed on new PV installations in some areas and significant tariff reductions offered to customers applying for PV connections.

It is likely that new business models will need to be developed to cater for a new market in distributed energy services (DG and EE), rather than just electricity sales. This would apply to both network operators and retailers, providing appropriate incentives for distributed generation and demand reduction. New market structures should encompass incentives for the grid services which PV inverters can provide, including reactive power and voltage support, whilst also creating opportunities for associated storage and load control. Importantly, measures that support DG are also likely to support vehicle-to-home (V2H) and vehicle-to-grid (V2G) from electrical vehicles, which, if properly managed, could significantly reduce residential evening peaks – and vice versa, if appropriate regulatory arrangements are not in place.

[12] According to the Directions paper, only about half of the capital expenditure for both TNSPs and DNSPs is to meet demand growth, and so significant income will still be required even in the absence of the need for augmentation.

Customers would need to actively participate in these new business models and markets, marking a significant change from the past customer role as a passive recipient paying for a service to someone that actively manages their load with some combination of DG, EE and DSM. A Distributed Energy (DE) market would allow the associated benefits to be traded, perhaps separately from existing markets. The latter would facilitate the establishment of new energy service companies, would empower customers to trade on their own energy investments and would break the trend to increasing consolidation of the electricity retail sector. New regulatory arrangements need to be put into place as soon as possible to cater for this new market to avoid perverse customer behaviour and uncompetitive practises from the incumbent gentailers.

The Directions paper goes some way towards addressing the issues associated with a DE market and the assessment approach in Section 2.3 would likely form an appropriate basis for developing a DE market. The need for portability of DG services has been recognised and minimum technical standards and connection agreements need to be established. Further issues to be considered, in addition to those discussed above, include:

- How to value and encourage the provision of ancillary services including frequency control, reactive power and voltage support. Inverters can be configured to provide such services automatically, although the DNSP's permission may be needed.
- How to correctly value the extent to which DG uses the electricity network when it exports electricity, given that it would use a much smaller amount of the network than electricity transported from the transmission network connection point. With gross metered PV, the electricity could be used by the household producing the electricity, yet full DUOS charges would apply when that electricity is onsold. Similarly, with net export, full DUOS charges would apply even for electricity used by the neighbour. Such DUOS charges have been a major justification for exported electricity to be valued at only the wholesale rate plus losses. If export to the grid is to be encouraged, for example for smart grids or for dispatchable DG to offset peak demand, use of grid charges should reflect actual grid usage, in addition to any incentives provided to encourage export during peak times.
- The impact of the merit order effect on wholesale generator revenue and the extent to which the benefits are passed on to consumers is now a major issue, especially when renewable energy support programs, such as the RET and Feed-in tariffs, are being blamed for electricity price increases. Under regulated tariffs in NSW the benefit currently stays with the retailer because their tariff is based on the higher of the long run marginal cost of the generator required to meet demand and the market price, where the former is currently greater. The BMU (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety) in Germany formally reports on the value of the merit order effect every year, in part based on work they commission, when they evaluate the uptake of renewable generation and the effectiveness of associated policies.

Conclusions

The Power of Choice Directions paper has begun the important task of defining the requirements and processes needed for the establishment of a Distributed Energy (DE) market in Australia. The detailed review of energy efficiency and demand management contained in the paper must now be complemented by a similarly detailed review of the requirements for distributed generation, with all three being essential components of a well functioning DE market. The urgent need for such a market to be established is demonstrated by the rapid rise in DE uptake and resultant problems already being felt by the incumbent electricity generation, distribution and retail market players.

Consideration needs to be given to range of issues, including:

- Rights and technical standards for connection of DE technologies to the grid
- Formalisation of the portability of DE services
- Trading rules and requirements
- Ancillary service requirements and rewards
- Appropriate DUOS charges
- The role and regulation of new energy service providers
- Pass through of energy and network cost reductions due to DE to the owners or customers generally.

The APVA looks forward to active involvement in developing the new Australian Distributed Energy Market.

Attachment A: Background on the APVA

The APVA is an association of companies, government agencies, individuals, universities and research institutions with an interest in solar photovoltaic electricity. In addition to Australian activities, we provide the structure through which Australia participates in an International Energy Agency (IEA) programme called PVPS (Photovoltaic Power Systems), which in turn is made up of a number of activities concerning PV performance and implementation. Further information is available from www.apva.org.au.

APVA Objective

The objective of the Australian PV Association is to encourage participation of Australian organisations in PV technology and industry development, policy analysis, standards and accreditation, advocacy and collaborative research and development projects concerning photovoltaic solar electricity.

APVA membership provides:

Information

- Up to date information on new PV developments around the world (research, product development, policy, marketing strategies) as well as issues arising
- Access to PV sites and PV data from around the world
- International experiences with strategies, standards, technologies and policies
- Australian PV data and information
- Standards impacting on PV applications

Networking

- Access to international PV networks (PV industry, government, researchers) which can be invaluable in business, research or policy development or information exchange generally
- Opportunity to participate in international projects, with associated shared knowledge and understanding
- Opportunity to meet regularly and discuss specific issues which are of international, as well as local interest. This provides opportunities for joint work, reduces duplication of effort and keeps everyone up to date on current issues.

Marketing Australian Products and Expertise

- Opportunities for Australian input (and hence influence on) PV guidelines and standards development. This ensures both that Australian products are not excluded from international markets and that Australian product developers are aware of likely international guidelines.
- Using the information and networks detailed above to promote Australian products and expertise.

- Working with international network partners to further develop products and services.
- Using the network to enter into new markets and open new business opportunities in Australia.

The International Energy Agency PV Power Systems Programme (IEA PVPS)

One principal activity of the APVA is to manage Australian participation in the PVPS Programme. This work is arranged by Tasks, each with its own commitments of time and resources. Support is provided by the Australian Solar Institute. At present Australia participates in:

Task 1: PV Information Exchange and Dissemination

Task 11: PV Hybrid Systems within Mini-grids

Task 14: High Penetration of PV in (Smart) Electricity Grids

and maintains an interest in:

Task 8: Very Large-Scale PV Systems

Task 9: PV in Developing Regions

Task 12: Environmental Health & Safety for PV Systems

Task 13: PV System Performance

For further information on the Australian PV Association visit: **www.apva.org.au**

For further information on the IEA PVPS Programme visit **www.iea-pvps.org.**