Energy White Paper 2014 –
Issues Paper submission template

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Submission to the Energy White Paper 2014

Energetics is an independent specialist management consultancy with 30 years experience in energy and carbon management. We deliver measurable outcomes to address key business needs in areas including energy management, meeting compliance obligations, identifying and developing business opportunities, reducing costs and improving productivity. We have a national multi-disciplinary team of over 100 professionals in five offices across Australia.

One of the benefits Energetics has gained by working across many sectors of the Australian economy has been the insights we've gained into the practical effects of government policies and programs. We have seen, for example, that energy efficiency measures require a policy framework that takes into account both financial and non-financial barriers, such as information gaps, split incentives, competing business objectives and capital rationing. Our experience has also shown that energy efficiency and energy productivity (GDP per unit of energy used), has significant potential within Australia. Australia's energy productivity is low and increasing at half the rate of competitors. Recent energy price rises (especially escalation of gas prices) will bring Australia in line with European energy prices, but with substantially lower energy productivity.

There is a need to encourage and support investment in world best practice energy efficient technologies, investment in better metering and reporting of energy to support improved energy management, and the ability of businesses to utilise solid wastes (including processed municipal wastes), biomass and biogas as alternatives to natural gas as a fuel for boilers.

Our comments focus on the relationship between economic benefit, business productivity, energy efficiency and demand management, and the role of alternative and emerging energy sources in the future energy mix. The issues paper topics addressed across this submission are therefore "Regulatory Reform and Role of Government", "Driving Energy Productivity" and "Alternative and Emerging Energy Sources and Technology". We consider these topics for their potential value to both the nation's economy and individual businesses with an understanding of the practical application of policy and program measures.

Electricity is decreasing and demand "peakier" so what does this mean for energy efficiency and demand management?

Electrical peak demand has been growing at a much higher rate than average demand and this trend is further exacerbated by the fall in electricity sales recorded over the last two to three years. Between 2005 and 2011, peak demand increased at a rate of approximately 1.8% per year, while total energy grew 0.5% per year.[1] As a result, energy consumption has become 'peakier'. For instance, in 2010-11 the top 0.5% of demand in Victoria occurred over approximately 30 hours, whereas this top demand occurred over more than 45 hours in the previous four years.[2]

[1] AEMC, Final Report Power of choice review – giving consumers options in the way they use electricity, 30 November 2012

[2] NERA and Oakley Greenwood, Benchmarking NEM Wholesale Prices Against Estimates of Long Run Marginal Cost, 12 April 2012

Lowering peak demand is likely to lead to lower electricity prices through its impact on both network costs and wholesale market prices. A reduction in peak demand will reduce the requirement for additional network investment leading to lower network charges. By lowering peak demand, fewer high price events are likely to occur in the wholesale electricity markets, which will flow through to lower retail electricity prices.

Energetics has recently undertaken modelling of the NSW electricity market to assess the impact of a range of measures on peak demand and energy use. The key findings of that modelling exercise are discussed below as they help inform the national debate on peak demand management and the benefit of deferring investments in power generation and network capacity.

Finding: Many demand management measures are already cost-effective

The study shows that a number of the demand management measures modelled are already cost-effective from the perspective of the whole electricity supply chain (i.e. the avoided costs of supplying electrical energy and demand outweigh the costs of purchasing and installing the demand management measure) and the perspective of the end-user. However, this potential is not being implemented at present. This suggests that there are barriers to the uptake of measures other than cost.

The barriers to demand management were examined in a recent study[3] and are summarised in the table below. It shows the outcomes of a survey of stakeholders which explored the barriers to effective demand management. **The lack of a coordinated approach to demand management at a state or national level was seen as being the greatest barrier to demand management**. Next was the absence of an energy saving or environmental objective in the National Electricity Law.

Table 1: Barriers to demand management

Demand management option	Most significant barriers
Energy efficiency	A coordinated approach to demand management is lacking at a state/or national level
	Absence of demand management / environmental objective in National Electricity Law
	Utility bias towards centralised supply
Distributed generation	A coordinated approach to demand management is lacking at a state/or national level
	Competing priorities in utilities limit adequate consideration of demand management
	Absence of demand management / environmental objective in National Electricity Law
Load management	A coordinated approach to demand management is lacking at a state/or national level
	Absence of demand management / environmental objective in National Electricity Law
	Utility bias towards centralised supply
Time-of-use tariffs	A coordinated approach to demand management is lacking at a state/or national level

[3] Dunstan, C., Ghiotto, N., Ross, K. (2011b), Barriers to Demand Management - A Survey of Stakeholder Perceptions. Report for the Australian Alliance to Save Energy by the Institute for Sustainable Futures, University of Technology, Sydney accessed at http://www.a2se.org.au/activities/research

Demand management option	Most significant barriers
	ToU tariffs don't represent cost of providing energy at a given time or location
	Absence of demand management / environmental objective in National Electricity Law

The Energy White Paper should therefore consider the development of a suite of coordinated measures to address demand management in a similar way to the National Strategy for Energy Efficiency's proposed coordinated policies and programs.

Finding: A spatially targeted approach to peak demand is likely to achieve significantly greater value than a broad based state-wide approach

Programs that tackle peak demand in the specific areas (zone substation areas) where there are constraints are more cost-effective than broadly-based programs. For networks with relatively slow, if not falling total load growth, which is anticipated in the NEM over the coming years, distribution capacity costs typically represent a large share of the investment required (compared to generation and transmission capacity costs).

High area- and time-specific avoidable distribution network costs are a reflection of this increasing contribution of distribution costs relative to generation and bulk transmission costs in the overall electricity supply cost. This means that the system-wide average avoidable network cost is much lower than the avoidable distribution cost specific to constrained zone substation areas. Energetics' modelling of the NSW electricity market confirmed this - programs that focused on particular network constrained areas were more effective than broad-based state-wide schemes. The targeted approach delivered a 16% greater reduction in peak demand (MW), and delivered 116% more economic benefit (NPV) to NSW energy users than the broad based approach. This is because a broad-based approach does not take into account area-specific and time-specific avoidable costs for constrained zone substation areas, which can be many times the cost of the state-wide average avoidable network costs.

Each constrained zone network area has a different load profile, with peak demand varying by location and time. The maximum demand peak will depend upon the characteristics of the local area – the mix of industrial, commercial and residential end-users, the local climate conditions and the features of the local network infrastructure. To maximise value, the selection of measures to address peak demand in a local constrained area would need to account for the characteristics of the peak and, in particular, the season and the time of day that the peak occurs.

The results of the Energetics modelling for the NSW electricity market are similar to outcomes observed elsewhere.[4]

So when designing demand management programs to reduce peak demand or concurrently address peak demand and energy efficiency, it is essential to understand the impact of specific measures and favour measures which are coincident with peaks (e.g. evening for residential,

[4] For example, similar issues were discussed in "National Action Plan for Energy Efficiency (2010) - Coordination of Energy Efficiency and Demand Response", Charles Goldman (Lawrence Berkeley National Laboratory), Michael Reid (E Source), Roger Levy, and Alison Silverstein

afternoon for commercial and industrial) and that are implemented in targeted network areas with identified constraints within the next four to five years. In particular there could be an interest in amending the allocation methodology of broad-based energy savings schemes in order to align with the objective of peak demand reduction so that the impact of these schemes on non-participants is more attractive.

Finding: Energy efficiency delivers the greatest benefit in both a broad based and targeted approach

This next table shows the measures that provided the maximum benefit in terms of peak demand reduction.

Table 2: Measures with the highest economic potential from whole electricity supply chain perspective

Measure description	Category	Peak demand reduction (%)	$/kVA	Electricity reduction (GWh)	NPV (m$)
Direct load control of air conditioning units	LM	4.6%	-21	0	53
Time of use metering with Critical Peak Pricing	LM	2.8%	-57	0	235
Industrial cogeneration	DG	2.6%	-117	2,305	440
Direct load control of pool pumps	LM	1.0%	-16	0	9
Time of use metering	LM	0.8%	-136	0	169
Standby Power Controller	EE	0.8%	-349	644	279
Remove pre-1996 fridges	EE	0.7%	-169	510	107
Low flow shower rose	EE	0.4%	-217	123	90
HVAC controls	EE	0.3%	-182	145	59
Voluntary Curtailable Load - industrial	LM	0.3%	-50	1	8

The findings of Energetics' modelling of the NSW electricity market show that energy efficiency (EE), load management (LM) and distributed generation (DG) all offer significant benefits to NSW under both a targeted and broad-based approach.

The load management (LM) measures provide the greatest impact on the peak demand (provided dispatchability is coincident with the peak period driving capacity investments). However, their impact on energy consumption was much lower and so they offered smaller net benefits to the whole supply chain than measures that tackled both energy efficiency and peak demand. **Energy efficiency has the highest economic value of any measure type under both approaches**, and has more than twice the net present value of the other measures in a broad based approach. This is because, by reducing both overall and peak demand, energy efficiency reduces the costs associated with peak demand events, as well as the costs associated with delivering electricity at other times. Load management technologies are more efficient at lowering peak demand, but have little effect on energy consumption at other times, and therefore have less effect on costs.

The Energy White Paper should therefore consider the role of programs that maximise the national benefit by offering both energy savings and peak demand reductions.

Measures to address electrical peak demand

There are a number of cost-effective measures to reduce peak demand and therefore improve the productivity of the national electricity system.

Direct load control

Our modelling of the NSW electricity market shows that direct load control has great potential to tackle peak demand. Direct load control allows network service providers to remotely reduce the load from consumers' equipment and appliances at times of peak demand. Direct load control has been used extensively in New South Wales, Victoria and Queensland to manage hot water heating; this is currently the only widespread form of direct load control in Australia.

Direct load control of swimming pool pumps is used to a lesser extent in Queensland and there have been trials of direct load control of residential air conditioners.[5] There is significant additional potential for the direct load control of both pool pumps and air conditioners, as was highlighted in our modelling.

Australian Standard AS/NZS 4755 enables the take up of smart appliances and direct load control capability, by ensuring interoperability between energy market participants and demand response enabling systems including the Advance Metering Infrastructure.

The Energy White Paper could consider actions that favour a wider use of automated demand response across the electricity markets and that improve the understanding of consumers' inclination for automation systems.

Voluntary demand response

Voluntary demand response, whereby customers are paid to reduce demand during peak periods, can be highly effective at reducing peak demand and the resulting need for increased network investment. There are currently multiple barriers to the provision of demand response in the National Electricity Market, including:

- Aggregators currently cannot directly register as market participants, and so they cannot compete directly with generators nor can they earn the market price for implementing demand response. Instead, aggregators need to go through retailers.
- Many retailers have limited interest in demand response. In particular, the largest retailers are vertically integrated - they own generation as well as retail assets - and therefore manage their spot price risks internally.

It is our opinion that the NEM would become attractive to greater demand response if a number of proposed changes to the National Electricity Rules (NER) were implemented, specifically:

- Creation of a new type of market participant, a "demand curtailment participant' and the introduction of demand-side bidding mechanism to the NEM.

[5] Futura Consulting, "Power of choice – giving consumers options in the way they use electricity. Investigation of existing and plausible future demand side participation in the electricity market", 2011

- Unbundling of services at the connection point. This would allow more than one market participant to offer services to customers, or facilitate provision of services to the market. An increase in demand-side activities could result.
- Reduce barriers to standby generators supporting networks in times of constraints.
- Increase incentives, and reduce barriers, to network service providers for implementing demand-side projects.

The introduction of a Demand Response Mechanism is part of the Rule changes recommended by the Australian Energy Market Commission (AEMC) in its Power of Choice - Stage 3 Demand Side Participation review. We note that during its last meeting in December 2013, the Standing Committee for Energy and Resources requested the Australian Energy Market Operator defer lodgement of the rule change proposal and undertake further assessment on the proposed demand side bidding mechanism.

The State of the Energy Market issued in December 2013 by the Australian Energy Regulator highlighted high spot market volatility (e.g. events above $200 per MWh) despite a sharp decline in the number of extreme prices (e.g. events above $5,000 per MWh) over the recent years. On this basis, we support the AEMC recommendations.

The Energy White Paper could define a clear roadmap to the implementation timeframe of the proposed demand response mechanism, providing some certainties to energy market participants.

Smart meters and behaviour change

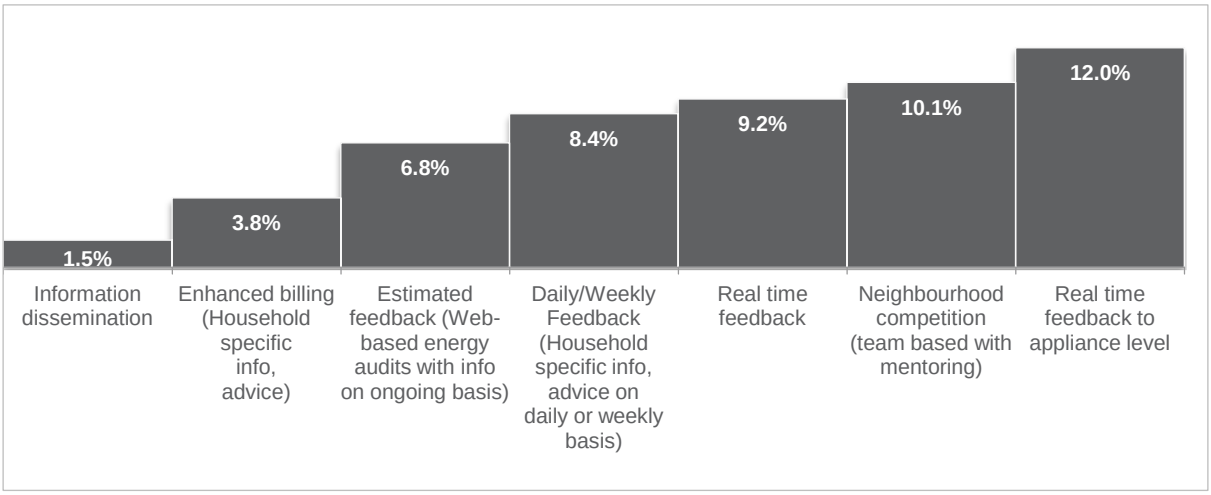
Behaviour change programs attempt to influence an individual or organisation to change their energy use patterns, habits or processes, rather than programs which target discrete one-off consumer investment decision such as the purchase of energy efficient equipment. Studies have highlighted the potential energy savings from behaviour change programs relative to investment decisions. For instance, “Conservation, lifestyle, awareness and low-cost actions” account for 57% of US household potential energy savings compared to 43% for “investment decisions”. [6]

In recent years the tightening of utility energy efficiency standards in the United States has increased the accountability of energy efficiency programs. For example, US companies such as OPower and Efficiency 2.0 have created innovative business models based upon delivering robustly measured energy savings to utilities via improved household billing information and online interactive tools. These approaches have delivered energy savings of between 2% and 6% per household.[7] The impacts of the various programs is summarised in Figure 1.

[6] “People-Centered Initiatives for Increasing Energy Savings”, Karen Ehrhardt-Martinez, and John Laitner (eds.), ACEEE, 2010

[7] “Social norms and energy conservation”, Hunt Allcott, Journal of Public Economics, Volume 95, Issues 9–10, October 2011, and “Scaling Behavior-Based Programs: The Tradeoffs of Opt-In vs. Opt-Out Design”, T Scaramellino, . Presentation at the Behavior, Energy and Climate Change Conference, December 2011

Figure 1: Average household electricity savings by program type[8]



Many of the measures in Figure 1 rely on informing consumers of their electricity use. Smart meters provide the means to do this.

Pricing initiatives

Smart meters are also an enabling platform for alternative approaches to billing and moving towards a more cost reflective pricing. Prices can act as a signal, telling customers when to conserve or delay their electricity consumption.

Most domestic electricity tariffs shield consumers from the true cost using electricity during peak periods. Therefore it is no wonder that peak demand is rising especially with the ever-increasing penetration of air-conditioning systems in this segment of the market. Many jurisdictions overseas have successfully implemented time-of-use tariffs that pass cost signals onto consumers in a way that tempers the growth in peak demand. Energetics believes that similar approaches should be considered in Australia for all residential customers, together with a roll-out of smart meters and in-home displays. Beyond time-of-use tariffs, we particularly favour critical peak pricing coupled with enabling technologies. Our studies showed that time of use pricing and time of use pricing linked to critical peak pricing (CPP) or peak time rebates (PTR)[9] offer further reductions in electricity use and peak demand (see **Error! Reference source not found.**).

We also suggest the rapid and wide-scale introduction of kVA-based demand charges for commercial and industrial customers in jurisdictions that are still only applying kW-based tariffs. Such a charge directly incentivises reductions in apparent power demand and power factor improvement.

We do not favour the trend shown over the last few years towards the application of an increasing proportion of fixed price components. We understand the interest in such tariff structures for the

[8] "Advanced Metering Initiatives and Residential Feedback Programs: A Meta-Review for Household Electricity-Saving Opportunities", Karen Ehrhardt-Martinez, Kat Donnelly and John Laitner. ACEEE, 2010

[9] Critical peak pricing refers to the pre-announced increase in the per unit electricity price during peak demand events to incentivise reductions in peak electricity demand. Peak demand rebate refers to a program offering a bill credit for customers who reduced their energy use when requested by the distribution business during a specific peak time event.

Network Service Providers as it provides more certainty for their revenue streams. However we believe that this removes incentives for end-users to reduce their electricity consumption and peak load. We also do not favour the application of billing capacity (demand) charges based on long-term (e.g. 12 months) capacity ratchet level to large commercial and industrial customers. We believe that monthly demand charges are more likely to incentivise the implementation of load management measures (e.g. load shifting).

We note that there is a reluctance to expose consumers to tariff structures that result in less resourced households being penalised. In consideration of this we note that:

- less resourced households are currently being penalised anyway through higher prices; and
- there are other mechanisms available to government to compensate less resourced households and these mechanisms do not lead to a distortion of the electricity market.

The uptake of time-of-use tariffs and CPP/PTR is limited by the proportion of households currently with smart meters and appropriate tariffs. Approximately 10% of NSW households have a smart meter installed[10] but only some of these are subject to time of use tariffs. In our study into embedded generation, we recommended that subject to a cost-benefit analysis, the Commonwealth, states and territories explore changes to building regulations to require the installation of smart meters on any new building and any renovation that requires work done by a licensed electrician.[11]

The Energy White Paper should consider actions that could favour the roll-out of an Advanced Metering Infrastructure, an increase in more cost reflective pricing options from the retailers and a larger adoption by end-users including in the residential sector.

Networks and distributed generation

Our work on embedded generation[12] showed that on balance, the more widespread take-up of distributed generation is likely to be beneficial to the networks by deferring capital expenditure to expand the networks. This is particularly so in the case of dispatchable local generation (e.g. cogeneration) and non-dispatchable renewable energy generation whose output matches peak demand (e.g. solar PV in commercial areas or solar PV coupled with batteries). This will have the effect of reducing the total electricity resource cost and so take pressure off power prices.

There has been extensive discussion of the value of distributed generation to reduce the total resource cost of electricity generation and distribution. Much of this discussion in the Australian context was captured in the CSIRO Intelligent Grid report.[13] The report provides a detailed analysis of distributed generation (DG) across a number of areas including impacts on the distribution network. As part of the CSIRO work, Senergy Econnect was commissioned to model the impact of DG on four real world SP Ausnet feeders. They concluded that DG is of benefit in reducing network losses and improving voltage profiles as well as being of some value in postponing network upgrades.

[10] It is unclear how many of these households are on ToU tariffs (NSW Government 2007).

[11] "Inclusion of Energy Generation in Building Energy Efficiency Standards", Department of Climate Change and Energy Efficiency, May 2012

[12] ibid.

[13] "Intelligent Grid - A value proposition for distributed energy in Australia", CSIRO Report ET/IR 1152, 2009

Specifically, the modelling showed a significant reduction in network losses (which are in the order of 6.6%[14] in Australia) particularly in rural areas.

The CSIRO study also found clear evidence that a demand side policy, promoting the take-up of solar PV would have significant benefits. These findings strongly support the installation of significant commercial PV (that is, PV capacity installed on the roofs of commercial premises), in addition to residential-based PV. The correlation between commercial peak demand and peak PV output is a significant benefit of broader uptake of distributed solar PV.

There is much less correlation between residential peak demand and peak solar PV output therefore the potential for peak lopping is reduced. This is discussed in a recent Ausgrid research paper[15] published in October 2011 which assessed the potential for solar PV installations to defer investment in network infrastructure across their network. Peak demand, and therefore the need for network upgrade work, is driven by particularly hot or cold periods when demand for heating and cooling increases the demand for electricity. The peak output of optimally sited solar PV panels is around midday, depending on their orientation, and this peak does not relate particularly well to the residential peak demand which occurs in 3.30pm to 4pm in summer and 6pm to 7pm in winter (after sunset). By this time of the day, the output from PV is dropping thereby reducing the potential impact of PV generation on peak demand.

Energetics recommends that options to extend the output of solar PV panels into the period when the residential peak occurs be explored in the Energy White Paper. These options could include panels that face north-west or the installation of batteries, subject to studies of the cost effectiveness of such options. Batteries are discussed in more detail below.

Some stakeholders in the electricity market have raised other barriers to the expansion of rooftop solar PV systems:

- Stability and control of the network. The question of network stability has been studied extensively in Europe. A good summary is provided in a recent IEA report.[16] The IEA highlighted the range of control measures available to network operators to deal with problems that could arise due to large take-up of solar PV systems. Most of the potential problems listed in the report are yet to become tangible problems at the time the report was written. Furthermore, even the issues with the potential to become problems in the future are generally not serious issues, and can either be dealt with sufficiently with existing technologies or else avoided with proper planning and design.
- Cost recovery. We note the recent decision by the Arizona Corporate Commission to impose a small capacity-based fee to home operators of photovoltaic systems that rely on net metering to feed excess solar electricity into the grid. Proposals to alter the existing network tariff structures in Australia in the face of rapidly growing deployment of grid-backed-up distributed energy systems merely highlight the weakness of the business models of the network service providers and are inappropriate if the target is just solar PV systems. During consultations that were part of the study into embedded generation, we heard comments suggesting that the network service providers are required to invest up to $7300 for each kW of distributed

[14] World Bank development indicators; http:\\data.worldbank.org/indicator

[15] "Effect of small solar Photovoltaic (PV) systems on network peak demand", Ausgrid, 2011

[16] "Overcoming PV grid issues in the urban area". International Energy Agency, 2009

generation. While this may well be true in some cases, other consumer devices also place load on the networks. For instance, the 2012 Energy White Paper cites an example of a 2kW air conditioner imposing a cost on the network service provider of up to $7000. The difference of course is that the solar PV system represents a loss of revenue for the network service provider whereas the residential air conditioner increases electricity consumption and hence revenue. *Energetics supports the use of market based mechanisms and therefore a move towards more cost reflective network pricing.*

The Energy White Paper could consider supporting further review of the network value of distributed generation and cost-sharing arrangements for distributed generator.

ISO50001 and EEO

The Energy Efficiency Opportunities Program (EEO) has been a great success. In their review of the EEO program[17], ACIL Tasman concluded that the EEO Program was responsible for at least 40 percent of the energy efficiency improvements in the Australian industrial sector. Further, they determined that the Program was cost efficient and conservatively estimated that the ratio of industry's cumulative benefit to cumulative cost attributable to the EEO Program was 3.67, net of implementation and compliance costs.

The EEO program is approaching the end of life, which raises the possibility that the gains achieved by the EEO program will be dissipated over time. Energetics believes that the answer to this lies in the widespread adoption of ISO50001 compliant Energy Management Systems by business. Launched in 2011, ISO50001 is a voluntary international standard that establishes a cross-industry framework for energy management within industrial plants and commercial facilities. ISO50001 is adopted by business with the primary purpose of driving cost reduction by reducing energy use. The obvious benefits of load reduction to the electricity generation and distribution sector imply that energy efficiency standards and programs can play a significant role in managing secure, reliable and affordable energy supply to Australian businesses, households and institutions.

Analysis of uptake rates by Verdantix[18] indicates that Germany is the leading market for certification (over half of all certifications as at June 2013), driven in part by tax breaks offered to participating corporations. Outside of Europe, India is the largest market, followed by Korea. There is very little adoption of the program in Australia at present. Unsurprisingly, uptake in general has been favoured by energy-intensive industrial firms.

The federal governments Energy Efficiency Opportunities (EEO) program applies to over 315 of Australia's largest energy users and encourages participants to analyse energy use within their boundaries, identify opportunities to reduce energy use and make decisions on these opportunities in line with their objectives to improve energy performance. Alternative compliance mechanisms that incorporate the use of ISO 50001 certification should be considered, particularly for those participants that have been registered with the EEO program since its inception (2005/06) and have demonstrated compliance with the requirements to date. In relation to this, the International Energy Agency (IEA), in

[17] "Energy Efficiency Opportunities Program Review: Energy Efficiency Opportunities Program End of First Full Five Year Cycle Evaluation – Final Report", ACIL Tasman, Prepared for Department of Resources Energy and Tourism, April 2013

[18] Verdantix, "Where is ISO 50001 gaining traction", 2013.

a recent publication[19], encourages governments to require large, energy-intensive industry, and encourage other industrial energy users, to conform to ISO 50001 or an equivalent energy management protocol.

Encouragement of the use of externally-certified ISO50001 as a policy approach may be timely, given potential changes to the EEO program announced in the Mid-Year Economic and Fiscal Outlook for 2013-2014. Although the details are not yet clear, changes to the funding arrangement of the EEO program would seem to imply significant changes to the program after June 2014.

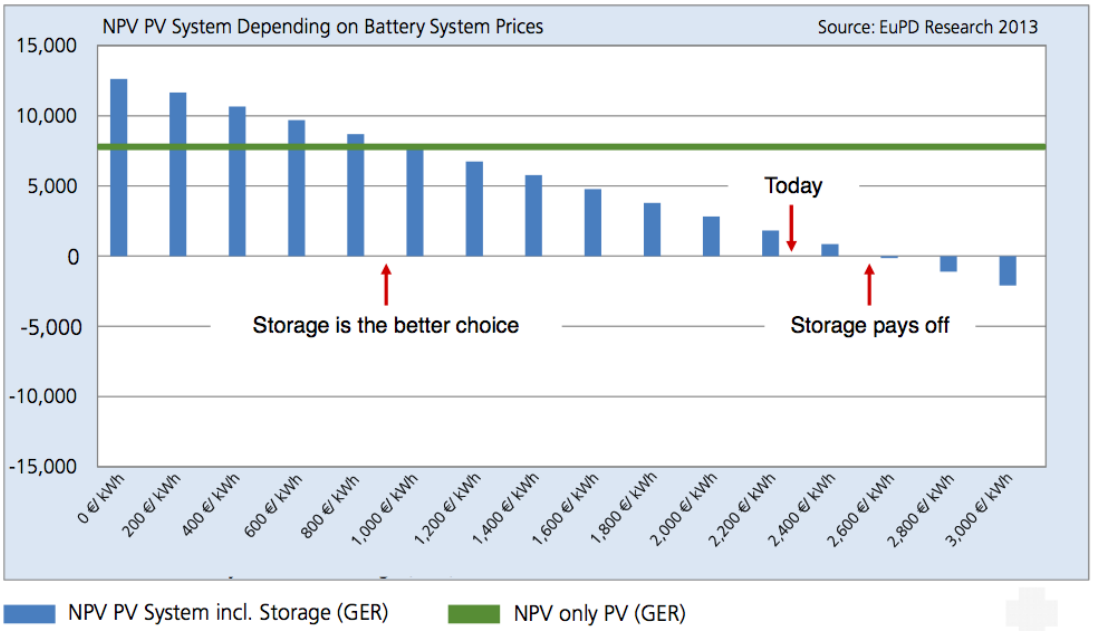
The Energy White Paper should consider strategies to encourage to adoption of ISO50001 Energy Management Systems by businesses.

Batteries cannot be ignored

The 2014 Energy White Paper must address the potential impact of batteries on the electricity networks. In particular, the coupling of batteries with solar PV systems in the residential sector will magnify both the positive and the negative impacts on solar PV on the networks.

Batteries are coming. The economic status quo is well presented in the following graph, which was included in a talk given by Markus Hoehner CEO of the International Battery and Energy Storage Alliance at the San Francisco InterSolar conference in July 2013. The graph shows the current situation in Germany, where the installation of an appropriately sized battery to support solar PV is cost effective in the residential market i.e. the solar PV system with battery has a positive net present value (NPV). However, the NPV is lower than the NPV of a solar PV only system and so the storage system is not yet adding value. Interestingly, that situation would be different if the cost of the electricity rises or if the cost of the batteries fell from the current €2250/kWh to around €900/kWh.

NPV PV system and battery prices – Germany



[19] International Energy Agency (IEA), "25 Energy Efficiency Policy Recommendations – 2011 Update", 2011.

Action is being taken to try to drive down the cost. Since 1 May 2013 the German government has provided an energy storage subsidy, which provides a grant to lower the upfront cost of installing an energy storage solution in a PV system up to 30kW in size. The subsidy equates to euro €600/kW, or a maximum of 30% of the eligible costs, for a battery-based energy storage system installed in a new PV system. Just as the German support for solar PV helps drive down the cost of solar PV, so should the support for storage drive down the cost of batteries.

Germany is not the only jurisdiction promoting energy storage. On 17 October this year, the California Public Utilities Commission (CPUC) established an energy storage target of 1,325 megawatts by 2020, with installations required no later than the end of 2024. The objectives of the proposal were the optimisation of the grid, the integration of renewable energy and the reduction of greenhouse gas emissions to 80 percent below 1990 levels by 2050, as per California's goals. The recommendation built on work by the Electric Power Research Institute (EPRI) and by DNV KEMA Energy & Sustainability (DNV KEMA). For instance, the work by the EPRI[20] showed that the majority of storage scenarios considered had a benefit to cost ratio above 1.0. These scenarios covered three different general use cases, including transmission-connected bulk energy storage, short-duration energy storage to provide ancillary services, and distribution-connected energy storage located at a utility substation.

Citi[21] explored the coming growth in energy storage. Germany provides a good example of the trend. The high solar penetration rates are inevitably steering Germany towards power storage to stabilise the grid and to mitigate the need for capacity payments to keep conventional power plants available, but off-line. Citi saw batteries as being more economically efficient for addressing peak demand than alternatives like capacity payments to generators.

In the first week of December 2013 solar power installations in Australia reached 3GW in total. This follows the passing of the one-million solar power systems milestone in April. One in seven Australian dwellings now has a solar PV system. In South Australia, the figure is one in four. The state with the largest volume of solar PV is Queensland with almost 1 GW of installed capacity. According to SunWiz[22], businesses are purchasing solar power with approximately 5% of recently installed systems exceeding 8kW in size.

Analysis also performed by SunWiz showed that at midday on 29 September, solar power contributed around 9.3% to electricity demand in the National Electricity Market, and 28% of South Australia's demand. The penetration of solar PV in South Australia is similar to the levels seen in Germany where PV power can cover more than 30% of demand on sunny days.[23] These numbers are important in the light of the research done by Citi[21] which highlighted the need for network operators to look for storage based solutions to better manage their networks when the penetration of solar is relatively high.

All drivers point to the growing importance of energy storage. The broad global trend of winding back feed-in-tariffs for small-scale solar power make it less desirable to export power generated by solar panels and consumers will look to batteries to allow them to get maximum value from the solar panels. The cost of batteries should continue to fall, encouraged by the setting of targets in Germany,

[20] "Cost-Effectiveness of Energy Storage in California", EPRI, June 2013

[21] "Battery storage – the next solar boom?", Citi Research, April 2013

[22] "Special Announcement: Australia reaches 3GW of PV", available from http://www.sunwiz.com.au/index.php/2012-06-26-00-47-40/269-3gw-of-australian-pv.html

[23] "Recent facts about photovoltaics in Germany", Harry Wirth, Fraunhofer ISE, Sep 12, 2013

California and elsewhere. Finally, the expanding penetration of solar PV into the networks will drive network operators to look for storage based solutions to better manage their networks. We note especially SPAusNet recent commissioning of a hybrid 1MW/1MWh grid energy storage and diesel generation system to trial how storage could play a role in their network.

However, the prices for batteries coupled with renewable energy generators such as wind are comparable to the cost of power at remote off-grid sites such as mines that use diesel generators. Australia also has a relatively large number of electricity users on the fringe of the networks, especially in remote areas of Queensland, NSW and Western Australia. A study commissioned by the Clean Energy Council[24] argued that fringe and remote electricity systems would seem to be ideal first candidates for energy storage deployment. The modelling discussed in the report showed that a material opportunity exists for storage to support fringe and remote electricity systems and the total commercial market for storage in Australia could be approximately 3,000 MW by 2030.

In an earlier paper[25], we showed how a battery connected to a solar PV system will provide a house with power for most of the year. The house will still need a grid connection to deal with abnormal conditions, and this clearly will have a significant detrimental impact on the revenue of the network service provider under their current business models. However, batteries whether they are connected to solar PV systems or not will provide the means for houses to tightly control their peak demands and so take pressure of the networks.

Energetics therefore believes that the Energy White Paper must initiate the national debate on the role of batteries in Australia's electricity market. This could include consideration for electric vehicles and appropriate ways of influence charging batteries during off-peak time.

[24] "Energy Storage in Australia, Commercial Opportunities, Barriers and Policy Options", Clean Energy Council, November 2012

[25] "Does 'Affordable' Solar PV really change everything?", Gordon Weiss, Australia's Second Summer Study on Energy Efficiency & Decentralised Energy, 2013

Summary of questions for consideration

The Security of Energy Supplies

The Government seeks comment on:

- ways community expectations can be better understood and reflected in reliability standards;
- the value of developing fuel reserves to meet Australia's international oil security obligations, and augment domestic security;
- ways to increase new gas sources to meet demand and measures to enhance transparency in market conditions; and
- issues relating to the regulation of energy infrastructure.

Regulatory Reform and Role of Government

The Government seeks comment on:

- priority issues, barriers or gaps within the COAG energy market reform agenda;
- possible approaches and impacts of review of tariff structures including fixed network costs, further time-of-use based electricity tariffs and the use of smart meters;
- possible measures to promote greater price transparency in gas markets; and
- areas where further privatisation of government-owned assets would contribute to more effective regulatory frameworks and better outcomes for consumers.

Growth and Investment

The Government seeks comment on:

- commercial or market initiatives that could enhance growth and investment in the energy and resources sectors;
- areas where approvals processes could be further streamlined while maintaining proper environmental and social safeguards;
- further ways that regulatory burdens could be reduced while maintaining appropriate levels of disclosure and transparency in energy markets; and
- the impacts of variable land access policy and ways the community could be better informed and engaged on development in the energy sector.

Trade and International Relations

The Government seeks comment on:

- how to grow the export of value-added energy products and services;
- ways to remove unnecessary barriers to continued foreign investment in Australia's energy sector;
- ways to strengthen support for access to export markets; and
- ways to support business to maximise export opportunities for Australia's energy commodities, products, technologies and services, including the value of Australia's participation in the variety of international forums.

Workforce Productivity

The Government seeks comment on:

- the nature of any current skills shortages being experienced and how these could be addressed by and with industry;
- the capacity of industry and education sector-led programs to meet long-term training and skills development needs of the energy and resources sectors; and
- specific long-term training and skills development needs for alternative transport fuel, renewable energy, energy management and other clean energy industries.

Driving Energy Productivity

The Government seeks comment on:

- the current suite of energy efficiency measures, ways these could be enhanced to provide greater energy efficiency or possible new measures that would enhance energy productivity;
- the use of demand-side participation measures to encourage energy productivity and reduce peak energy use; and
- measures to increase energy use efficiency in the transport sector.

Alternative and Emerging Energy Sources and Technology

The Government seeks comment on:

- ways to encourage a lower emissions energy supply that avoids market distortion or causes increased energy prices;
- the need to review existing network tariff structures in the face of rapidly growing deployment of grid-backed-up distributed energy systems, to ensure proper distribution of costs;
- additional cost-effective means, beyond current mandatory targets and grants, to encourage further development of renewable and other alternative energy sources and their effective integration within the wider energy market;
- how the uptake of high efficiency low emissions intensity electricity generation can be progressed;
- any barriers to increased uptake of LPG in private and commercial vehicles and CNG and LNG in the heavy vehicle fleet; and
- any barriers to the increased uptake of electric vehicles and advanced biofuels.