AUSTRALIAN ALLIANCE TO SAVE ENERGY

Creating an Energy-Efficient Australia

DISTRIBUTED GENERATION IN AUSTRALIA:

A STATUS REVIEW

Nicole Ghiotto, Chris Dunstan, Katie Ross

Report #3 of the Australian Alliance
to Save Energy Research Project

**Scaling the Peaks:
Demand Management and
Electricity Networks**

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DISCLAIMER

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Reports in this research project "Scaling the Peaks: Demand Management in Electricity Networks" include:

1. Dunstan, C., Ghiotto, N., Ross, K., 2011, *Report of the 2010 Survey of Electricity Network Demand Management in Australia.* Prepared for the Australian Alliance to Save Energy by the Institute for Sustainable Futures, University of Technology Sydney.

2. Dunstan, C., Ross, K., Ghiotto, N., 2011, *Barriers to Demand Management: A Survey of Stakeholder Perceptions.* Prepared for the Australian Alliance to Save Energy by the Institute for Sustainable Futures, University of Technology Sydney.

3. Ghiotto, N., Dunstan, C., Ross, K., 2011, *Distributed Generation in Australia: A Status Review*. Prepared for the Australian Alliance to Save Energy by the Institute for Sustainable Futures, University of Technology, Sydney.

4. Crossley, D., 2010, *International Best Practice in Using Energy Efficiency and Demand Management to Support Electricity Networks*. Prepared for the Australian Alliance to Save Energy by Energy Futures Australia.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

A2SE	Australian Alliance to Save Energy
AEMC	Australian Electricity Market Commission
DG	Distributed Generation
DM	Demand Management
EE	Energy Efficiency
ISF	Institute for Sustainable Futures
LM	Load Management
MCE	Ministerial Council on Energy
NSP	Network Service Provider

EXECUTIVE SUMMARY

Decentralised Energy (DE) comprises three types of resources: Distributed Generation, end use energy efficiency and peak load management. The key benefits of Distributed Generation, and DE in general, include: improved economic efficiency, reduced greenhouse gas (GHG) emissions, and improved reliability of electricity supply (Dunstan & Daly, 2009). These benefits can accrue to energy consumers, utilities and the environment. This report reviews the current status and practice in Distributed Generation (DG) in Australia, including the benefits, barriers, policies and current implementation of DG.

Demand Management (DM) involves deliberately employing these distributed energy resources as a means of avoiding or deferring investment in centralised power stations or electricity networks. In the recent survey of Demand Management stakeholders, perceptions were gathered on the barriers to DG[1]. Of the 25 specifically nominated barriers in the survey, the top seven barriers to DG were perceived to be:

1. Lack of coordination at a state/national level
2. Competing priorities in utilities limit consideration of DM
3. Absence of DM / environmental objective in the National Electricity Law
4. Connection process is too complex
5. Utility bias exists towards centralized supply
6. The negotiation framework for utilities and DG developers is not fully developed
7. Uncertainty around which costs should be charged to embedded generators

Other barriers to DG that were raised by survey respondents ranged from the lack of incentives for DG, to the inability to avoid Transmission Use of System (TUoS) and Distribution Use of System (DUoS) charges, to issues with ownership, stakeholders, complexity and registration.

Currently, there are over 25 policies at the state and federal level in Australia, which directly or indirectly impact on DG, including policies aimed at DM, climate change and renewable energy.

There have been various reporting mechanisms for DG in Australia, including the most recent Survey of Energy Network Demand Management in Australia (SENDMA). ISF delivered and compiled the SENDMA from 19 of the 20 Network Service Providers (NSPs) in Australia (Dunstan et al, 2011). A total of 624 MW of DM was reported from 73 distributed generators in the commercial / industrial sectors, contributing 78% of the DG capacity. DG also resulted in 56MW of peak reductions (15% of total DM reductions reported) in 2010/11. Aggregated data was reported for two large generators, showing energy production of 300 GWh in 2008/09, accounting for 90% of reported “energy savings” for DM projects across Australia in that particular year. DG projects accounted for $7.9M (16% of investment in DM technologies) in 2010/11 based on data for four DG projects areas.

The brief case studies of the cogeneration plant at the Crown Casino in Melbourne and the bio-energy plant, which services Camellia, NSW, offer insight into the value provided by DG and the barriers encountered by these two projects.

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[1]Dunstan, C., Ross, K., Ghiotto, N. 2011. *Barriers to Demand Management: A Survey of Stakeholder Perceptions*. Report #3 of the A2SE Scaling the Peaks Research Project.

1 INTRODUCTION

Australia's energy demand is growing. The official projected average annual growth rates of energy consumption and maximum demand until 2020-21 across the NEM are 2.3% (consumption) and 2.6% (summer maximum demand) (AEMO, 2011). This growth is a major driver of the substantial investment in Australia's electricity network infrastructure, in the order of $45 billion between 2010 and 2015 (Langham & Dunstan, 2011). This is having a major impact on the price of electricity. According to Energy Minister Martin Ferguson, "Residential electricity prices have increased by about 40 per cent over the last three years and are forecast to increase in the order of 30 per cent in the next three years to June 2013" and these prices reflect the cost of investment to maintain and replace aging assets (Shanahan, 2011). An increased focus on Distributed Generation could help meet the demand, decrease the level of network upgrades and offset the rising cost of electricity prices.

The Australian Alliance to Save Energy (A2SE) has commissioned Institute for Sustainable Futures (ISF), in conjunction with Energetics, Climate Works, and Energy Futures Australia, to carry out research on the potential role of energy efficiency and demand management in energy network planning. This research project, entitled "Scaling the Peaks: Demand Management and Electricity Networks" considers the network investment currently being planned by the energy industry and the opportunity to reduce both the required investment and emissions through implementing Energy Efficiency (EE) improvements, Load Management (LM) and Distributed Generation (DG).[2]

The research project also investigates best practice for demand management (DM) globally and the rationale for making DM the preferred investment option for the energy supply industry, including an examination of the risks of investing in stranded assets and the cost/benefits of investing in DM compared to current supply investments.

This report complements the larger research project by briefly reviewing the current status and practice of DG in Australia.

To provide a concise update on the DG experience in Australia, information relating to DG was distilled from various sources, including the other reports in this series and work carried out by the CSIRO Intelligent Grid (iGrid) Research Program. To reflect on current practice of DG, data are drawn from the inaugural Survey of Electricity Network Demand Management in Australia (SENDMA) and previous related surveys. Two case studies of DG in practice also presented.

It is expected that this information will be valuable for electricity customers, DM service providers, policy makers and electricity network businesses themselves.

[2] For more information and access to the Scaling the Peaks reports, visit: http://www.a2se.org.au/activities/research.

2 STATUS OF DISTRIBUTED GENERATION

Summarized below are the benefits and barriers of DG, as well as the policies put in place to address these, to provide a sense of the current status of DG in Australia.

2.1 DISTRIBUTED GENERATION DEFINED

Distributed Generation (DG) can be described as any form of energy generation that is "distributed" or "embedded" within the electricity network. For the purposes of this review, and consistent with convention in Australia, DG is specifically defined as energy generators distributed or embedded within the network, typically less than 30MW, and includes, but is not limited to, cogeneration, trigeneration, diesel, fuel cells, standby generation, as well as renewable generators such as wind, small scale hydroelectric, biomass/biogas and solar (including thermal and photovoltaics). This review is also concerned with electricity generators, including cogeneration and trigeneration that produce thermal as well as electrical energy.

In comparison, "centralised generation", traditionally the more common model of electricity generation in Australia, refers to large scale power stations that are built for scale, and are often located away from their loads, transmitting electricity long distances. Electricity is transported to end users via transmission and distribution networks, which results in line losses of electricity. On the other hand, DG generally takes the form of larger numbers of small generators, located close to the end user or load.

DG is often discussed in a similar context to smart or intelligent grids, as the benefits of DG, as well as other forms of distributed energy, lend themselves to greater co-ordination via a grid complemented with a higher level of communication and control. An intelligent grid is one in which various forms of distributed energy (including DG, energy efficiency and peak load management) can be monitored and controlled to maximize use of network resources, without compromising network reliability.

2.2 BENEFITS OF DISTRIBUTED GENERATION

There are various benefits to DG that have not been fully realised to date. Benefits can be categorised in three ways: those that provide improved economic efficiency, those that provide greenhouse gas (GHG) emissions savings, and those that improve reliability of electricity supply (Dunstan & Daly, 2009). These benefits are potentially available to energy consumers, utilities and the environment.

Examples of improved economic efficiency:

- Lower energy bills (particularly in the case of cogeneration and trigeneration where loads for heating and cooling are high)
- DG provides customers with additional choice on infrastructure priorities (e.g. with cogeneration and supplying heat/cooling requirements as well as on-site electricity).
- Energy is used closer to load, so there are less transmission losses
- If generation is controllable (e.g. cogeneration, trigeneration, standby generators, fuel cells) then generation can be called upon to provide energy when required by loads, thus reducing peak load issues, and subsequent network investment. This also has the benefit of allowing low cost options to meet the peak demand.

- DG provides opportunities for least cost GHG emissions reductions.

Examples of reduced greenhouse gas emissions:

- Energy is used closer to load, so there are less transmission losses – this also leads to lower greenhouse gas emissions
- Distributed generators can be fuelled by low or zero emission sources (such as renewable or gas), or make use of waste heat, increasing the efficiency and reducing the overall emissions of the generator
- Smart grids allows for high penetration of intermittent generators

Examples of improved reliability / energy security:

- Less power outage. Although centralised supply brings the benefits of low cost due to its large scale, failure of one generator can have a high impact. However if a distributed model is used, failure of a much smaller unit can be more easily handled by the network, reducing the severity and impact of the fault
- DG also provides the ability to better control own usage of power on site.

Most of these benefits are also associated with intelligent grids, which can facilitate greater application of distributed generation.

2.3 BARRIERS TO DISTRIBUTED GENERATION

The two main sources for this section are the Institutional Barriers to the Intelligent Grid (Dunstan and Daly, 2009), and the recently completed Barriers to Demand Management Report (Dunstan et al, 2011).

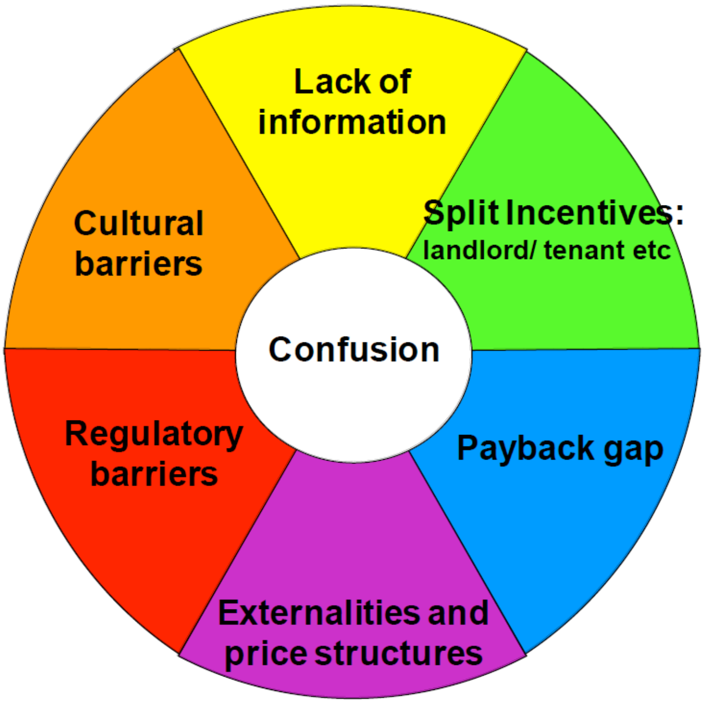
The Institutional Barriers to iGrid (Dunstan and Daly, 2009) suggests a classification of six institutional barriers to demand management, including distributed generation, being:

1. Imperfect information - lack of access to relevant information;
2. Split incentives - the challenge of capturing benefits spread across numerous stakeholders;
3. Payback gap - the difference in the acceptable periods for recovering investment between energy consumers (and Distributed Energy proponents) and large centralized energy supply utilities;
4. Inefficient pricing – the failure to reflect costs (including environmental costs) properly in energy prices;
5. Regulatory barriers - the biasing of regulation against distributed energy resources;
6. Cultural barriers - resistance to, and scepticism about, the use of Distributed Energy on the part of individuals and organisations (including utilities, regulators and policy makers); and

Additionally, barriers can be created by the “confusion” arising from the interaction of the above barriers.

These barriers can be graphically portrayed as shown in Figure 1 (Dunstan and Daly, 2009).

Figure 1. Institutional barriers to distributed energy



The purpose of analyzing institutional barriers is to develop effective strategies to overcoming these barriers. This particular classification system is intended to be as far as possible collectively exhaustive, in encompassing all potential institutional barriers to DG, as well as being mutually exclusive, in that barriers will typically fit within one category.

For the recently completed companion report, *Barriers to Demand Management: A Survey of Stakeholder Perceptions*, a list of specific barriers were posed in an on-line survey to demand management stakeholders across Australia. In order to understand the perception of barriers to Demand Management, respondents were asked to state their level of agreement as to whether these barriers actually presented problems in areas including Distributed Generation (DG), Energy Efficiency (EE), Load Management (LM) and Time of Use meters (ToU).

The complete list of proposed barriers is shown in Table 1 (Dunstan et al, 2011).

Table 1. Institutional Barriers presented in DM Barriers Survey

Imperfect Information	
I1	Limited experienced / skilled DM service providers
I2	Lack of data on costs, reliability, potential from DM precedents
I3	Lack of information about network constraints
Split Incentives	
S4	Competing priorities in utilities limit consideration of DM
S5	Disaggregated electricity market - DM benefits hard to capture
S6	Landlord-tenant relationship
Payback Gap	
G7	Lack of capital, financiers, funds for DM project proponents
G8	Consumers / utilities want shorter DM payback than for supply
G9	Utilities have easier access to finance than DM providers
Price structures	
P10	Lack of carbon price
P11	Local peak / network constraints not reflected in power prices
P12	ToU tariffs don't represent time / location cost of energy
Regulatory Barriers	
R13	Electricity suppliers profit from electricity sold, DM cuts profits
R14	Networks don't invest in DM unless constraint is imminent
R15	Regulatory processes (security, reliability) don't consider DM
R16	Regulatory Test (RIT) limits assessment of DM
R17	High $ threshold of Regulatory Investment Test restricts DM
Cultural Bias	
B18	Lack of state / national government consideration for DM
B19	Utility bias towards centralised supply
B20	Electricity suppliers lack expertise / experience with DM
B21	Absence of DM / environmental objective in National Electricity Law
B22	Electricity consumers lack interest in saving energy
B23	Consumers want to use power when & how they choose
B24	Electricity suppliers prefer CAPEX to OPEX, DM is OPEX
Coordination	
C25	Lack of coordination at state / national level

In the same survey, eight barriers specific to distributed generation were also posed to respondents who wished to comment further on issues around distributed generation (Dunstan et al, 2011).

Table 2. Barriers specific to Distributed Generation in the DM Barriers Survey

Proposed barriers relating specifically to Distributed Generation		**Category**
D1	Negotiation framework for utilities & DG developers not developed	Cultural Bias
D2	Connection process is too complex	Regulation
D3	Uncertain which costs should be charged to embedded generators	Price Structures
D4	Uncertainty re: who is recipient for resultant avoided network costs	Price Structures
D5	Generation licensing requirements/standards complex & expensive	Regulation
D6	Uncertainty re: impact of DG connection on network performance	Imperfect Information
D7	Uncertainty re: who's responsible for managing power quality risks	Split incentives
D8	Concerns about local environmental impacts of DG	Imperfect Information

Respondents were asked to state whether they strongly agreed, agreed, were neutral, disagreed or strongly disagreed that the above statements presented barriers to DM.

The seven most highly rated barriers for DG are presented below (Dunstan et al, 2011).

Table 3. High priority barriers to Distributed Generation

Priority	Barrier (short description)	Category	Id.
1	Lack of coordination at state/national level	Coordination	C25
2	Competing priorities in utilities limit consideration of DM	Split Incentives	S4
3	Absence of DM / environmental objective in National Electricity Law	Cultural Bias	B21
4	Connection process is too complex	Regulation (Distributed Generation)	D2
5	Utility bias towards centralised supply	Cultural Bias	B19
6	Negotiation framework for utilities & DG developers not developed	Cultural Bias (Distributed Generation)	D1
7	Uncertain which costs should be charged to embedded generators	Price Structures (Distributed Generation)	D3

All categories of respondent types, including utilities, government, end users, energy service providers, and all 'Others' most strongly agreed that the "Lack of coordination at state/national level" is a barrier to DG.

Three of the barriers specific to DG ranked in the top seven along with four of the more general Demand Management barriers.

Respondents were also invited to list barriers that were not identified in the survey. As Table 4 shows, respondents' comments on barriers to DG ranged form the lack of incentives to DG to the inability to capture Transmission Use of System (TUoS) and Distribution Use of System (DUoS) charges to issues with ownership, stakeholders, complexity and registration.

Table 4. Additional barriers suggested by respondents to DM Barriers Survey

Distributed Generation	Category	Respondent
Lack of transparency of process for connection	Imperfect Information	DM Provider
Unclear view of how precincts and use of public networks to export energy should be handled	Imperfect Information	Utility
Reluctance of Property Developers of High density residential & Commercial buildings to install Cogeneration units and Hot/cold water pipes for space heating and cooling - adds to complexity, cost and risk for them; Owners Corporation reluctant to take on risk - requires third party service party provider; economic viability of building co-generation units versus 'district' cogeneration and future apartment owners reluctant to take on management	Imperfect Information and Cultural Barriers	Government
(The) substation (paid for by DG operator) then becomes the property of the Distribution Company.	Split Incentive	Other
Gas availability at potential DG sites.	Payback Gap	Other
For distributed renewable energy generation the upfront cost of setting up a substation and connecting to the grid is a major constraint.	Payback Gap	Other
Uncertainty and lack of incentives for embedded generation (such as medium-scale distributed solar) limit its application. (This is obviously closely linked to issues around the inability to capture the network benefits of the technology IE: avoided network infrastructure, TUoS & DUoS charges, etc; as well as the lack of cost-reflective pricing, both in terms of ToU and carbon costs. However it is worth identifying this simply as a lack of incentive, as this may be the best way to overcome these other protracted barriers.	Price Structures	Other
National electricity rules need to be amended to allow for fair use of system charges to decentralised energy generators - thereby avoiding TUOS charges altogether.	Price Structures	Government
Inability to transfer electricity across licensed boundaries that limits DG operability and economics	Regulatory Barriers	Government
Regulations need to be changed to allow decentralised energy generators to sell directly to local customers and thereby not be subject to low wholesale prices for exported electricity.	Regulatory Barriers	Government
Processes and charges for registration of DG in the NEM are there regardless of whether you want to register 100kW or 2,000MW. This is too complex and far too burdensome on smaller DG installations.	Regulatory Barriers	Other
Registration processes & requirements for DG.	Regulatory Barriers	DM Provider
Cost of participating in the NEM for small generators is prohibitive - need a DE License regime.	Regulatory Barriers	Government
Sheer range of stakeholders involved in implementing 'precinct' level energy supply & demand solutions	Confusion	Government
DG: lack of federal, long term feed in tariffs, subsidies and other incentives impedes adoption of DG, storage and DM initiatives at the residential and small business level	Not a barrier (Lack of Incentive)	DM Provider

As noted, some of these barriers had not been identified previously as specific institutional barriers, while other are similar to specific DG barriers proposed to survey recipients.

2.4 POLICIES FOR DISTRIBUTED GENERATION

This section offers a brief introduction to the current policies in place and summarises policy suggestions to stimulate uptake of DG.

2.4.1 POLICY IN PLACE

The tables below summarise the policies, incentives and reporting requirements in place in each state and territory, for demand management, renewable energy and climate change. While not all of these policies directly target DG, all of them either currently do or potentially could support DG.

Table 5. Renewable Energy Policies, Incentives and Reporting in Australia

Renewable Energy	**State**							
Policy Name	**QLD**	**NSW**	**ACT**	**VIC**	**TAS**	**SA**	**WA**	**NT**
Solar Bonus Scheme www.cleanenergy.qld.gov.au/solar_bonus_scheme.cfm	X							
Solar Bonus Scheme – for small solar and wind generators www.industry.nsw.gov.au/energy/sustainable/renewable/solar/solar-scheme		X						
Electricity Feed-in tariff – for solar and wind generators www.environment.act.gov.au/energy/fit			X					
Community Energy Grants www.environment.act.gov.au/energy/community_energy_grants			X					
Premium Feed-in tariff – small scale solar Standard Feed-in tariff – medium scale solar, wind, hydro and biomass www.new.dpi.vic.gov.au/energy/sustainable-energy/solar-energy/solar-energy-for-consumers/feed-in-tariffs				X X				
Renewable Energy Fund – King and Flinders Islands www.dier.tas.gov.au/energy/renewable_energy_fund					X			
Residential Feed-in tariff –small scale solar (suspended 1 August 2011) www.energy.wa.gov.au/2/3654/64/residential_.pm							X	
GreenPower www.greenpower.gov.au/home.aspx	X	X	X	X	X	X	X	X
LRET (Large Renewable Energy Target) SRES (Small Renewable Energy Scheme) www.orer.gov.au/publications/lret-sres-basics.html	X	X	X	X	X	X	X	X

Table 6. DM Policies, Incentives and Reporting in Australia

Demand Management	State							
Policy Name	**QLD**	**NSW**	**ACT**	**VIC**	**TAS**	**SA**	**WA**	**NT**
DMIS (Demand Management Incentive Scheme) www.aer.gov.au	X	X	X	X	X	X		
DAPR (Distribution Annual Planning Report) www.aer.gov.au/content/index.phtml/itemId/743331	X	X	X	X	X	X		
NEM (National Electricity Market) Rules www.aemc.gov.au	X	X	X	X	X	X		
Efficiency Benefits Sharing Scheme (EBSS) www.aer.gov.au/content/index.phtml/itemId/709340	X	X	X	X	X	X		
Annual DM (Demand Management) Plan	X							
AER (Australian Energy Regulator) Performance Reporting www.aer.gov.au		X	X	X				
Learning by doing fund www.aer.gov.au		X	X					
D-factor www.aer.gov.au/content/index.phtml/itemId/718194		X						
DM (Demand Management) Code www.aer.gov.au		X						
DMPP (Demand Management & Planning Project) www.planning.nsw.gov.au		X						
Energy Savings Scheme (ESS) www.ess.nsw.gov.au		X						
Distribution System Planning Report (DSPR) www.esc.vic.gov.au/NR/rdonlyres/39BF3B54-C879-434F-9D62-339EA5614618/0/ElectricityDistributionCode20070901showchanges.pdf				X	X			
Annual Planning Reports www.aemo.com.au/planning/apr.html				X	X	X		
WAEM (Western Australia Electricity Market) Rules www.imowa.com.au/market_rules.htm							X	
Victorian Energy Efficiency Target (VEET) www.esc.vic.gov.au/public/VEET/				X				
S45 Electricity Reform Act www.nt.gov.au								X

Table 7. Climate Change Policies, Incentives and Reporting in Australia

Climate Change	State							
Policy Name	**QLD**	**NSW**	**ACT**	**VIC**	**TAS**	**SA**	**WA**	**NT**
NSW Greenhouse Gas Reduction Scheme (GGAS) www.greenhousegas.nsw.gov.au		X						
Climate Change Fund www.environment.nsw.gov.au/grants/ccfund.htm		X						
ClimateConnect grant program www.earnyourstars.tas.gov.au/shared_content/grants/climateconnect_grants					X			

Table 8. Renewable Energy Policies, Incentives and Reporting in Australia

Renewable Energy	**State**							
Policy Name	**QLD**	**NSW**	**ACT**	**VIC**	**TAS**	**SA**	**WA**	**NT**
GreenPower www.greenpower.gov.au/home.aspx	X	X	X	X	X	X	X	X
LRET (Large Renewable Energy Target) SRES (Small Renewable Energy Scheme) www.orer.gov.au/publications/lret-sres-basics.html	X	X	X	X	X	X	X	X
Solar Bonus Scheme www.cleanenergy.qld.gov.au/solar_bonus_scheme.cfm	X							
Solar Bonus Scheme – for small solar and wind generators www.industry.nsw.gov.au/energy/sustainable/renewable/solar/solar-scheme		X						
Electricity Feed-in tariff – for solar and wind generators www.environment.act.gov.au/energy/fit			X					
Community Energy Grants www.environment.act.gov.au/energy/community_energy_grants			X					
Premium Feed-in tariff – small scale solar Standard Feed-in tariff – medium scale solar, wind, hydro and biomass new.dpi.vic.gov.au/energy/policy/greenhouse-challenge/feed-in-tariffs				X X				
Renewable Energy Fund – King and Flinders Islands www.dier.tas.gov.au/energy/renewable_energy_fund					X			
Residential Feed-in tariff –small scale solar www.energy.wa.gov.au/2/3654/64/residential_.pm							X	

2.4.2 POLICY IN DEVELOPMENT

The following policies are also in development by various stakeholders (Crossley, 2011).

National Connections Framework for Electricity Distribution Networks

The Ministerial Council on Energy (MCE) has developed a streamlined route to connection for distributed generators into the distribution network, consisting of standard and negotiated connection agreements. , including a disputes process. Currently the Australian Electricity Market Commission (AEMC) is incorporating the changes into the National Electricity Rules.

AEMC review of Demand-Side Participation in the NEM

The AEMC reviewed the National Electricity Rules, to determine if there were barriers to DM, and if so, could be changed. Stage 1 (Development of a framework of the role of DM in the NEM) and 2 (Analysis of how the then Rules disadvantaged DM) of this review are completed (late 2009), and Stage 3 (A broader review beyond the Rules, including impact on the electricity market supply chain) is in progress (AEMC, 2011).

National Framework for the Economic Regulation of Distribution

The MCE are reviewing the National Electricity Rules to balance the incentives and obligations for DNSPs to invest in non-network alternatives with those for network infrastructure, and to encourage adoption of the most efficient options (DRET, 2011).

2.4.3 POLICY SUGGESTIONS

Dunstan et al (2010), suggest seven policy areas relating back to the seven types of barriers discussed in Section 3.2.1. The following 20 policy options or tools to enable distributed energy in Australia are identified and mapped on the policy palette below, not necessarily in order of importance (Dunstan et al, 2010). See the Appendix A for further explanation of each policy option.

Figure 2. Policy Palette for Developing Distributed Energy

1: Decouple electricity sales from network profits
2: Reform National Electricity Rules
3: Streamline DG Licensing
4: Carbon Price
5: Cost reflective pricing
6: Network support payments
7: Distributed Energy Fund
8: Reform feed-in tariffs
9: Public recognition & awards
10: Streamline network negotiation process
11: DE Ombudsman
12: Annual DE Review
13: Training & skills development
14: Energy audits & technical support
15: Network planning info
16: DE handbook & advisory service
17: Resource assessments & case studies
18: Extend retailer EE targets
19: DE targets & reporting
20: DE Coordination Agency

Use of these policy tools is likely to be more effective if a suite of policy options is implemented addressing a range of institutional barriers. Coordination of policy option implementation is also important to reduce the risk of fragmentation and duplication.

3 CURRENT PRACTICE IN DISTRIBUTED GENERATION

The previous section outlined the benefits, barriers and policies for DG projects in Australia. Here we discuss projects that have been implemented to date, and in two cases, what factors have enabled or hindered their implementation.

3.1 DISTRIBUTED GENERATION REPORTING TO DATE

There are various lists of DG in Australia, including those listed below. Currently there is no completely comprehensive and up to date list of Distributed Generators in Australia.

3.1.1 SURVEY OF ELECTRICITY NETWORK DEMAND MANAGEMENT IN AUSTRALIA

ISF delivered and compiled the Survey of Electricity Network Demand Management in Australia (SENDMA) from 19 of the 20 Network Service Providers (NSPs) in Australia, which included reporting of DG in network areas known to NSPs. Specifically each NSP was asked to report on quantity and size of distributed generators in the residential, commercial and industrial sectors within their network area. This survey was completed in April 2011, but is not comprehensive because a) not all NSPs completed the DG part of the survey, and b) not all DGs are known to NSPs.

Ten of the NSPs responded with some data in the area of DG, with a variety of responses ranging from small-scale residential PV connected to their networks, to multi MW embedded generators, including cogeneration, mini-hydro, wind, etc. They also included generators both owned by the NSP and owned by customers. A total of 84,853 distributed generators were reported by these ten NSPs.

The vast majority of the DG projects (84,780) were residential distributed generators, reported mostly as small scale photovoltaics (PV). An additional 64,000 applications for connection have been made as of collection of the data, and their connection status was not known in all cases.

A total of 624 MW installed capacity was reported from 73 distributed generators in the commercial / industrial sectors, with small-scale residential solar PV projects representing 174 MW of installed capacity (Dunstan et al, 2011) (**Table 9**).

DG was used as a form of peak load management, resulting in 56MW of peak reductions (15% of total reductions reported) in 10/11. Of the four projects that had relevant data to report, the most cost-effective project had a cost of $122/kW, and the least cost-effective (by this measure) had a cost of $8,000/kW. This compares to incentive payments of $70 to $190 /kVA for DM projects, indicating that some distributed generation projects can provide value for money when looking at peak load management options.

Aggregated data was reported for 2 large generators, showing energy production of 300GWh in 08/09, accounting for 90% of reported "energy savings" for DM projects across Australia in that particular year. An additional three generators reported a total of 1.1GWh for 10/11. One of these projects had a cost-effectiveness of $30,000/MWh, however no data was available for the other two projects.

DG projects accounted for $7.9M (16% of investment in DM technologies) in 10/11, based on data for four DG projects. Only one project had enough data to carry out a cost benefit analysis. This particular commercial DG project cost $0.95M with a benefit of $2.2M, resulting in a cost benefit ratio of 0.43, indicating that some distributed generation projects can be cost-effective.

Table 9. DG Projects Reported by Network Service Providers

Organisation	Sector											
	Residential			**Commercial**			**Industrial**			**Other**		
	# of DGs	Total capacity (MW)	% owned	# of DGs	Total capacity (MW)	% owned	# of DGs	Total capacity (MW)	% owned	# of DGs	Total capacity (MW)	% owned
ActewAGL	3,051	5.9	0	-	-	-	-	-	-	-	6.73	0
Aurora Energy	Survey not received											
Citipower	-	-	-	-	-	-	-	-	-	-	-	-
Country Energy	16,500	43	0				2	60	0			
Electranet Pty Ltd	-	-	-	-	-	-	-	-	-	-	-	-
Energex	40,224	77	0	20	32	0	-	-	-	-	-	-
Energy Australia	25,000	45	0	-	-	-	-	-	-	43	268.5	41%
Ergon Energy	-	-	-	3	3.36	0	-	-	-	-	-	-
ETSA Utilities	-	-	-	-	-	-	-	-	-	-	-	-
Horizon Power	1	1.46	0	1	0.5	100%	-	-	-	-	-	-
Integral Energy	-	-	-	1	1.3	100%	-	-	-	-	-	-
Jemena	-	-	-	-	-	-	-	-	-	-	-	-
Power and Water Corp	-	-	-	-	-	-	-	-	-	-	-	-
Powercor Australia	Included in Citipower											
Powerlink Queensland	-	-	-	-	-	-	-	-	-	-	-	-
SP AusNet	-	-	-	-	-	-	1	-	-	-	-	-
Transend Networks	-	-	-	-	-	-	-	-	-	-	-	-
Transgrid	-	-	-	-	-	-	-	-	-	-	-	-
United Energy Distribution	-	-	-	-	-	-	-	-	-	-	-	-
Western Power	4	2	0	1	0.012	100%	-	-	-	-	-	-
TOTAL	84,780	174.36		26	37.17		3	60		43	275.23	

This Table reports 546 MW of installed capacity, as opposed to the 798 MW referred to above. A significant amount of data is missing from this summary as it was requested that certain project/s were to not be publically disclosed by Organisation.

3.1.2 CLEAN ENERGY COUNCIL

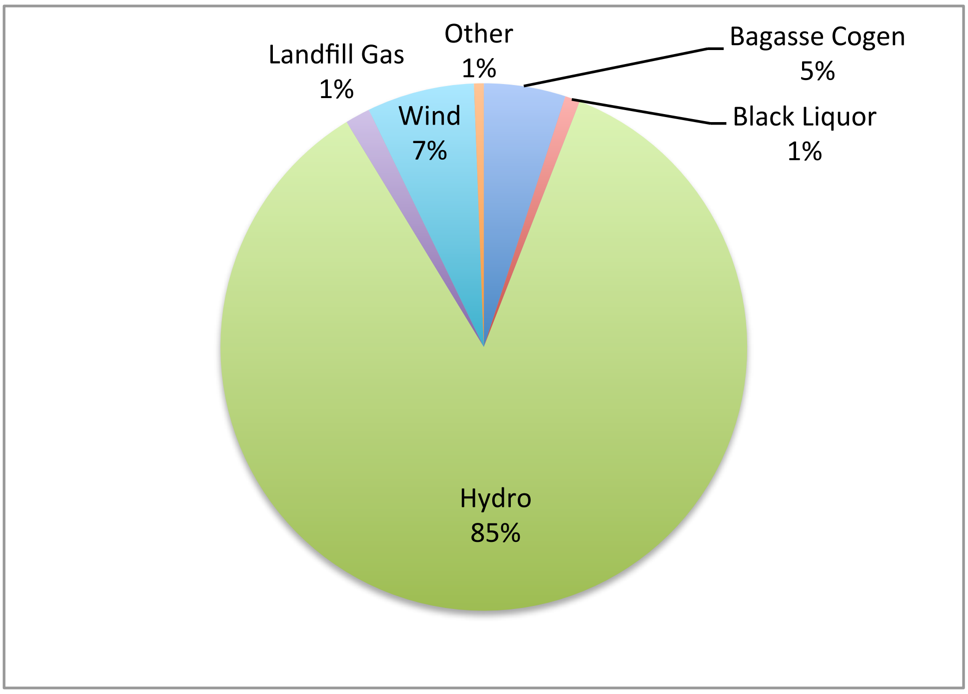
The Clean Energy Council (CEC) keeps a comprehensive current list of renewable energy generators (>100kW) in Australia, available on their website (CEC, 2011). It lists 12.4 GW (as of 21 July 2011) of installed renewable energy generators. However this includes DG that is greater than 30MW in capacity and does not include DG that runs on non-renewable fuels, including low emission fuels such as gas and coal seam methane, as well as other fuels including diesel standby generators used specifically for network load management.

3.1.3 BUSINESS COUNCIL FOR SUSTAINABLE ENERGY

The former Australian Business Council for Sustainable Energy (BCSE – now part of the CEC) maintained a comprehensive list of sustainable energy generators in Australia, including large and small scale renewable, gas and coal gas generators.

In 2006, the then Business Council for Sustainable Energy compiled its annual report (Clean Energy Report 2006) to include not only renewable energy, but all forms of sustainable energy generation, including cogeneration, coal seam methane, natural gas. It listed 9.78 GW of sustainable energy generators installed in Australia in 2006 (not including large scale natural gas generation) (BCSE, 2006). This was the last comprehensive report of sustainable energy generating capacity in Australia, as relevant to distributed generation, so does not capture what has been installed since.

Figure 3. Sustainable generation capacity by fuel type



The majority of renewable generation capacity was hydro (7095 MW) followed by wind (548 MW) (BSCE, 2006).

3.1.4 OFFICE OF THE RENEWABLE ENERGY REGULATOR

The Office of the Renewable Energy Regulator (ORER) collects information on all running renewable energy generators through the Large-scale Renewable Energy Target (LRET) and the Small-scale

Renewable Energy Scheme (SRES), and a subset of this information is mapped on their website (ORER, 2011b). In 2010, the generating capability of renewable power stations was estimated at 12,200 GWh and in that year, a combined capacity of 305 MW of small-scale solar PV was installed (ORER, 2011a). As of 7 September 2011, there were 24,521,220 registered Small-scale Technology Certificates and 42,109,158 Large-scale Generation Certificates (ORER, 2011c).

3.2 CASE STUDIES

Two brief case studies presented below of recently commissioned distributed generators highlight some of these successes of and barriers to distributed generation in Australia in recent times.

3.2.1 COGENERATION AT THE CASINO (CROWN CASINO, MELBOURNE)

Quick facts

The cogeneration plant at the Crown Casino consists of 6 x 1MW units installed to provide 6 MVA electrical, covering 30% of its energy requirements, as well as hot water for space heating, domestic hot water and cooling. It commenced full-time operation in 1999, and the subsequent 2 x 450kVA units were installed in Crown administration centre in 2008. The plant is run between 7am and 11pm on weekdays to coincide with Citipower's peak times. Crown Casino can also take advantage of using energy in off peak times by shutting off generators between 11pm and 7am.

Why DG in this instance

Electricity generation was a big advantage when planning the Casino, due to the high load of the complex. Use of cogeneration has proven a cost-effective way to provide energy for the site, including waste heat for hot water and steam. The units also provide back-up generation for the site, which were required by legislation. The cost of the original plant was $3M, reducing energy bills by $500k per annum. When compared with diesel generator as backup as the alternative, the plant paid itself of in less than 2 years.

Stakeholders

Crown Casino is the owner of the plant, and has a network agreement with CitiPower. The installation subcontractor was Electric Power Systems Australia, the same for stage 1.

Barriers encountered

The Crown Casino has many existing relationships with relevant stakeholders, including in government and the relevant utilities. This meant that development and installation of both plants did not encounter some of the usual barriers faced by installers of cogeneration / equipment. Also, the second plant was much easier to install than the first, given existing relationships, and familiarity with the technology and processes.

The legislative requirement meant that Crown Casino was required to install a back-up generator to keep the gaming floors running in the case of a loss of supply. Choosing cogeneration / trigeneration was a cost effective solution to this. Because Crown Casino will never export power (the trigeneration plant supplies 30% of the casino's load), network connection agreements were fairly straightforward.

Although some developers of distributed generation projects have faced issues dealing with fault level requirements of the local NSP, Crown Casino used local NSP approved contractors to conduct fault studies, ensuring that the required information was presented to the relevant NSP, allowing for easier approvals.

Contribution to local network constraint / power supply

- Is the plant in a network constrained area? What is the contribution to network issues?

Being so close to the Melbourne CBD, having a new development that did not require all its energy to be sourced from the grid was an advantage.

- Is the plant used for network peak generation or on-site demand? Is power exported or used on site?

Cogeneration plant is used purely for on-site demand and does not export (only provides 30% of on-site requirements). However timing of generator use is consistent with network peak demand requirements, and generators are turned off to take advantage of off peak pricing.

3.2.2 BIOENERGY FROM FOOD WASTE (EARTHPOWER, SYDNEY)

Quick facts

A 3.9 MW (3 x 1.3 MW) cogeneration plant was installed at Earthpower's food waste to energy facility at Camellia, Sydney, NSW. Municipal, commercial and industrial food waste is delivered to the plant, and processed in an anaerobic digester to produce biogas. Similar to natural gas, the biogas provides fuel for the cogeneration units supplying electricity to the local network. Waste heat from the cogeneration unit is used to heat digesters and dry sludge to produce fertilizer. The plant operates 24 hours a day, 7 days a week. The plant also produces organic-based fertilizer from the residual product of the digestion process.

The plant was established by Babcock & Brown Environmental Investments in 2001, and was installed and commissioned by McConnell Dowell in 2003 at a cost of $35M. Due to the current level and quality of waste received at the plant at this time, the cogeneration plant currently runs one unit (1.3 MW) at maximum output at a time, five to seven days a week.

Why DG in this instance

The Camellia location was chosen due to it being close to the geographic centre of Sydney, to potentially collect food waste from all over Sydney. The cogeneration plant size was matched with the expected output gas from the anaerobic digesters and expected level of food waste fuel.

Electricity generated from these plants is considered renewable under the MRET scheme, and is sold as eligible renewable energy, and is also eligible for the NSW Greenhouse Gas reduction scheme.

Stakeholders

Babcock & Brown sold the Earthpower plant to Transpacific Industries and Veolia Environmental Services in 2007, the current owners of the plant.

Barriers encountered

During plant establishment, there were lengthy supply agreement negotiations for both network connection and power purchase agreements. The plant required sophisticated switchgear to be able to synchronise with and export to the grid.

The current owners are waste management companies - their expertise would have been valuable early in the design process. Lack of knowledge of the project initiators have resulted in a less than optimal plant design.

Lessons learnt include having waste supply agreements in place prior to go ahead of the plant – the plant design parameters were much more stringent than the current waste stream the plant receives, although this has improved overtime through waste supplier engagement and education.

Contribution to local network constraint / power supply

- Is the plant in a network constrained area? What is the contribution to network issues?

The Earthpower plant supplies power into Endeavour Energy's network fed by the Camellia Transmission Substation. This substation is currently at capacity, feeding loads around Camellia industrial zone, as well as zone substations for the Parramatta CBD. Network augmentation is currently proposed for increasing demand in Parramatta, and DM programs are in place to defer this capital investment (Integral Energy, 2010).

- Is the plant used for network peak generation or on-site demand? Is power exported or used on site?

Plants can supply on-site demand of 2MW, but there is also potential to export up to 1.9 MW of generated electricity into the Endeavour Energy network. There is currently no agreement with Earthpower and the NSP or power purchaser to generate at particular times of day, yet Earthpower has the capacity to manage its fuel source to optimize biogas output to generate when required.

4 CONCLUSION

With electricity consumption, demand, bills and carbon emissions increasing, Distributed Generation offers significant opportunities to address these trends. However, there are institutional barriers to the uptake of Distributed Generation. The highest priority barriers to Distributed Generation, as identified by a survey of industry stakeholders, include: the lack of coordination at the state and national government level; competing priorities in utilities that limit the consideration Distributed Generation; and, the absence of a clear Demand Management or environment objective in the National Electricity Law.   Policy currently being developed may help to alleviate some of these barriers, but additional policy initiatives are likely to be required to redress the current imbalance against Distributed Generation.

There is also a clear need for better data collection and reporting on Distributed Generation. Ideally, this should be undertaken annually and be consistent across Australia. The 2010 Survey of Electricity Network Demand Management sought to establish a benchmark in DM and DG reporting for network service providers. Ten of the twenty network businesses reported a total of 798 MW of DG power capacity for the three financial years of 2009-2012 (Dunstan et al, 2011).   By contrast, the Clean Energy Council reports a total installed capacity of 12,418 MW of “clean energy”, which includes large scale centralised renewable energy generators, but excludes small scale natural gas cogeneration. The definitions and reporting requirements should be standardized to build a comprehensive database of existing DG installations and to provide better insight into the scale and take-up of this important and growing area of clean energy. In addition to consistent and comprehensive reporting, greater availability of reliable case studies would facilitate better sharing of experience about developing Distributed Generation and ways to overcome the barriers to its wider application.

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APPENDIX A – OPTIONS FROM THE POLICY PALETTE

Descriptions of policy tools listed in Figure 2, the policy palette.

Regulation and regulatory reform

Option 1: Decouple network business profits from electricity sales

Description: Reform economic regulation which currently financially penalises network businesses that reduce their electricity sales volume by supporting Distributed Energy.

Option 2: Fair treatment of Distributed Energy in National Electricity Rules

Description: Change the National Electricity Rules to require DNSPs to implement Distributed Energy options wherever they are cheaper than network augmentation.

Option 3: Streamline licensing requirements for Distributed Generation

Description: Streamline the complex and costly licensing requirements and procedures required for distributed generators to produce and supply electricity to the grid. This involves the review of generation, distribution and retail licensing requirements across the relevant types and scales of DG operators.

Pricing Reform (including external environmental costs)

Option 4: Impose a price on carbon pollution

Description: Introduce an adequate market price on carbon, such as by means of the proposed Carbon Pollution Reduction Scheme (CPRS).

Option 5: More cost-reflective network pricing

Description: Widely implement time-of-use pricing and deploy smart meters to residential and business customers.

Option 6: Default Network Support Payments

Description: Establish a standard or default network support payment to be paid by the network business to distributed generators exporting power to the main grid. Ensure that network businesses are not disadvantaged in providing such payments.

Incentives

Option 7: Distributed Energy Fund

Description: Establish a fund to specifically support Distributed Energy development.

Option 8: Reform Feed-in Tariffs

Description: Reform feed-in tariffs in order to support load management and energy efficiency.

Option 9: Public recognition and awards

Description: Publicly recognise leadership in developing Distributed Energy options.

Facilitation

Option 10: Streamline network connection negotiation process

Description: Establish a clear and consistent framework governing the processes and timeframes surrounding the negotiation of generator connection agreements between DG operators and local DNSPs.

Option 11: Distributed Energy Ombudsman

Description: Establish "Distributed Energy Ombudsman" with the knowledge, technical engineering skills and authority to assist in dispute resolution between Distributed energy proponents and utilities.

Option 12: Annual Distributed Energy Review

Description: State and Territory Governments should undertake and publish a comprehensive annual distributed energy review.

Option 13: Training and skills development

Description: Establish an industry training program for distributed energy options, building on existing "Green jobs" training efforts. The program is likely to cover different targeted streams for different types of participants. Options for building on should be explored.

Option 14: Integrated energy audits and technical support

Description: Supporting the implement of energy efficiency and load management measures by linking energy audits to technical support, incentives and high level corporate commitment.

Information

Option 15: Better information on network constraints and avoidable costs

Description: DNSPs to provide easily accessible, up-to-date and relevant demand and network planning information.

Option 16: Consolidate and disseminate information on Distributed Energy

Description: Develop a Distributed Energy website and/or 'Handbook' to provide information and guidance for Distributed Energy proponents on areas such as: network connection processes (where relevant), costs, rights, responsibilities, financing, and legal requirements.

Option 17: Resource Assessments and Case Studies

Description: Publish comprehensive and accessible assessments of the opportunities for and successful case studies of Distributed Energy in Australia.

Targets

Option 18: Extend Retailer Energy Efficiency Targets

Description: Extend mandatory energy efficiency targets to capture more of the available cost effective energy efficiency potential.

Option 19: Targets and Reporting for Distributed Energy Development

Description: State and local governments should establish annual targets for Distributed Energy. This would involve a publicly announcement of targets for DG and DM in 2009 for each year from 2010 to 2020 and annual reporting to track the progress.

Coordination

Option 20: Agency to coordinate Distributed Energy development

Description: Nominate an agency with appropriate resources and authority to co-ordinate a Distributed Energy strategy.