Impediments to the Uptake of Renewable and Distributed Energy

Discussion Paper

Ministerial Council on Energy Standing Committee of Officials

Renewable and Distributed Generation Working Group

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ACRONYMS USED IN THIS PAPER

AEMC – Australian Energy Market Commission

AER – Australian Energy Regulator

BCSE – Business Council for Sustainable Energy

COAG – Council of Australian Governments

COPEG – Draft National Code of Practice for Embedded Generation

DG – Distributed Generation

DUOS – Distribution Use of System charge

MCE – Ministerial Council on Energy

MCE SCO – Ministerial Council on Energy Standing Committee of Officials

NEL - National Electricity Law

MRET – Mandatory Renewable Energy Target

NEM – National Electricity Market

NEMMCO – the National Electricity Market Management Company

NSP - Network Service Provider

R&DG – Renewable and Distributed Generation

RDGWG - Renewable and Distributed Generation Working Group

TUOS – Transmission Use of System charge

URF - Utility Regulators Forum

WEPWG – Wind Energy Policy Working Group

EXECUTIVE SUMMARY

Increased uptake of renewable and distributed generation (R&DG) has the potential to deliver a range of important benefits including improved efficiency, system security, emissions reductions, regional and rural development, and new business and export opportunities. Some technologies, such as distributed generation (DG), are currently in a position to realise a number of these benefits while others (such as large scale renewables) require further developments to close the cost differential with conventional sources.

However, the emergence of new R&DG technologies in an energy market (with associated regulation and system management practices) that has been designed primarily to support large scale base load generation, presents a range of challenges in optimally developing Australia's R&DG base.

In this context, the Ministerial Council on Energy Standing Committee of Officials (MCE SCO) commissioned a paper to identify the issues affecting the uptake of R&DG. Through discussions with stakeholders the paper has identified a range of policy and technical issues, which fall into the following categories (noting that applicability of issues may vary according to technology):

- emerging technology issues (cost of R&DG generation, resource and business opportunity identification, project approvals, access rights to resources, consumer confidence);
- network pricing and price regulation (improved locational and cost reflective pricing);
- network connection arrangements (connection costs, reward for network services, use of systems charges, regulatory complexity, immature non-wholesale generation market); and
- network management and development (management of intermittent supply, information disclosure for planning, strategic network development, reliability risks, reliance on DG, treatment as negative load, and need for reserve capacity).

Although this paper discusses the comprehensive range of issues affecting the uptake of R&DG, the emerging industry issues are outside the terms of reference of this working group under the MCE. The paper's main focus therefore remains on those issues concerning the National Electricity Market (NEM), where the MCE has the authority to progress future work. For these issues, this paper identifies responses currently in place to overcome the challenges and seeks comments on other possible responses.

Responses currently in place include:

- the development of a draft National Code of Practice for Embedded Generation (COPEG) for MCE consideration, which will aim to address a number of the issues relating to small and medium DG;
- a MCE work program underway to address issues for large intermittent generation such as wind;
- the National Electricity Market Management Company (NEMMCO) review of technical standards;
- initiatives such as Solar Cities, Wind Energy Forecasting, and Advanced Electricity Storage Technologies, to address cost reflective pricing, load management and intermittency issues;
- the upcoming Australian Energy Market Commission (AEMC) transmission pricing review; and
- the transfer of specified retail and distribution functions to national regulatory arrangements and the transfer of economic regulation of distribution networks to the national regime by 1 January 2007.

Possible future MCE responses on which comments are sought include:

- the merit of further examination of distribution network pricing structures and regulation issues that may impede R&DG, for input into future proposed reviews including the development of national frameworks for distribution and retail regulation;
- consideration of the possible requirements and procedures to develop the market for the sale of power by small and medium generators;
- examination of the extent to which distribution network planning information and development processes can be made more transparent and accessible;
- investigation of options for mechanisms that will better enable network assets to be optimised in the design phase; and
- consideration of the future need for system management procedures and technologies necessary to accommodate increasing levels of R&DG.

The full set of issues, current and proposed responses, and requests for comment are summarised in the following table:

(Contd….)

Non-NEM issues		
Chapter Reference	**Issue**	**Response**
3	**Emerging technology issues**	
3.1	Renewable and distributed generation (R&DG) remains generally higher cost than conventional sources.	Federal, State and Territory Governments have a number of programs and policies in place to reduce generation costs of R&DG, or to otherwise address the higher relative generation costs of R&DG (see Appendix D).
3.2	Lack of comprehensive pre-competitive information on national renewable energy resources.	The Australian Government, as part of its package of measures set out in its Energy White Paper, *Securing Australia's Energy Future*, committed to working with the States and Territories to develop protocols to guide the collection of comprehensive and consistent pre-competitive data for all energy resources. Building on this commitment, the Department of the Environment and Heritage will work with the States and Territories to develop and publish renewable energy resource maps with appropriate overlays of networks and other constraints to development.
3.3	Limited ability of proponents to identify business opportunities.	The Business Council for Sustainable Energy has developed a cogeneration ready reckoner to assist evaluation of business opportunity. A limited number of industry tools are also available.
3.4	Licensing regimes for a number of newer renewable resources, such as geothermal energy, are currently underdeveloped and inconsistent across jurisdictions	Some jurisdictions are reviewing applicable regulations in order to identify and address gaps and inconsistencies between jurisdictions. Collaboration between jurisdictions is encouraged through the Council of Australian Governments.
3.5	Government project approvals processes can be complex and inconsistent across jurisdictions.	As further experience is gained with emerging renewable energy technologies it is expected that project approvals will become less onerous. The Australian Government Department of the Environment and Heritage is currently undertaking a review of the operation of the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*. The Australian Government has also published draft Supplementary Significant Impact Guidelines under the EPBC Act for wind farms. Individual jurisdictions or the Environment and Heritage Protection Council may wish to consider the need for further action in this area.
3.6	Building consumer and market confidence in R&DG products and services.	Jurisdictions and industry have put in place a number of measures to address these issues.

4.1	**Network pricing and price regulation**	
	Distribution network price regulation may not appropriately reward and facilitate the use of distributed generation (DG) (and demand-side response) as an alternative to network augmentation/development and a means of reducing network losses. Network pricing structures can distort locational incentives at transmission and distribution levels. Lack of transparent cost-reflective pricing and appropriate metering inhibits more accurate reflection of the value of DG in terms of managing network losses and constraints.	The MCE has agreed, subject to the necessary Cabinet approvals, to the transfer of specified retail and distribution functions to national regulatory arrangements, with enabling legislation by the end of 2006, and the transfer of economic regulation of distribution networks to the national regime by 1 January 2007. The transfer of economic regulation of distribution networks will provide an opportunity to establish nationally consistent transmission and distribution network pricing regulation that provides appropriate incentives for the efficient use of DG. The AEMC will progress a review of congestion management in 2006. Distributed generation issues could be raised in this context. Where suitable arrangements do not already apply, jurisdictions along with DNSPs may also wish to consider offering incentives to energy users for a demand side response in areas where growth related capital expenditure is required in the medium term. The MCE has produced an overview paper on common principles for the assessment of the costs and benefits of the roll-out of interval meters. An overview paper is available on the MCE website. Jurisdictions have an obligation to review the cost and benefits of interval meters if they have not already done so. Victoria has already mandated the roll-out of interval meters and some retailers and distribution network service providers are voluntarily trialling the use of interval meters. The Australian Government's Solar Cities program will also demonstrate the value of interval meters. The Utility Regulators Forum (URF) has considered the issue of metering requirements in the development of a draft National Code for Embedded Generation (COPEG). The draft COPEG will be considered by the MCE in the context of the development of a national framework for distribution. The MCE has agreed to a national access regime including network pricing. The AEMC is progressing work on transmission pricing. There may be an opportunity to consider network pricing for R&DG under these work streams.

4.2	**Network connection**	
4.2.1	Incremental connection costs can be potentially prohibitive for new R&DG projects, particularly where projects require network augmentations or provision of major new line.	Victoria has implemented an Act to enable least cost solutions to network upgrades which involve the connection of multiple wind sites, and that the project proponents are able to negotiate an equitable share of the connection/upgrade cost. The AEMC is currently undertaking a review of the Electricity Transmission Revenue and Pricing Rules. This could be an appropriate forum to consider connection cost issues particularly related to transmission. The AEMC will undertake a review of congestion management in 2006. This could be an appropriate forum to consider issues related to sharing network capacity. The URF has developed a draft COPEG. This work has considered a range of network connection issues. The draft COPEG will be considered by the MCE in the context of the development of a national framework for distribution regulation.
4.2.2	Distributed generators can have difficulty capturing the value of their network services in connection agreements with network service providers.	The URF has developed a draft COPEG which considers: • requirements that will facilitate more efficient and effective negotiation between R&DG proponents and network service providers; and • methodologies for calculating, and requirements for sharing, the value of network benefits (e.g. network technical support, avoided transmission use of system (TUOS) charges, avoided distribution use of system charges and avoided/deferred augmentation costs). The draft COPEG will need to be considered by the MCE in the context of the development of a national framework for distribution regulation. The avoided TUOS issue may also be considered as part of the upcoming review of transmission pricing to be undertaken by the AEMC.
4.2.3	Some forms of network use of system charges can be relatively prohibitive for smaller on-site generators which occasionally import or export to the grid	Jurisdictions, in consultation with distribution network service providers and regulators (in the context of pricing determinations) are identifying options to improve the flexibility of network tariffs and charges to provide appropriate incentives for DG (and demand-side solutions).

4.2.4	Network connection regulations, including technical standards, can be complex, unnecessarily onerous, or non-existent for small and medium scale R&DG.	Jurisdictional technical standards requirements were reviewed in the development of the draft COPEG. The draft Code incorporates protocols and timelines for network connection applications. The draft COPEG will be considered by the MCE in the development of a national framework for distribution regulation. NEMMCO is conducting a review of the conditions for connection of generation plants in the National Electricity Rules. The R&DG industry may wish to review existing and develop new guides to project development as appropriate. The industry may also wish to consider the value of developing a repository of approvals and compliance documentation using the information available at the Government Business Entry Point website (www.business.gov.au/Business+Entry+Point) which provides information on Federal and State Government regulation, licensing and other associated information.
4.2.5	The non-wholesale electricity market is less mature than the wholesale market. Relatively high transaction costs for individual small generators and lack of generalised business procedures may inhibit opportunities for small and medium renewable and distributed generators.	The URF has developed a draft COPEG, including specific procedures and requirements for the network connection of generators, including standard connection agreements and other requirements applicable to small and medium generators. However, the Code will only cover interactions between DG proponents and network service providers, not retailers. The draft COPEG will need to be considered by the MCE in the context of the broader energy market reform program which may affect the way it is carried forward. The Australian Government's Solar Cities program will trial innovative new market arrangements involving small scale renewable and distributed generators.

5.	**Network management**	
5.1	Increasing levels of intermittent and decentralised R&DG in the future may require changes to the way in which the network is managed.	The MCE is developing a detailed proposal for a semi-dispatch model to ensure system stability and security where capacity is constrained. The Australian Government is implementing a number of additional measures to address intermittency issues, including improved wind forecasting and encouraging electricity storage technologies initiatives. The Australian Government's Solar Cities program should provide real examples of new ways to manage small intermittent generation, in combination with other measures, within distribution networks.
5.2	There are not sufficient levels of transparency in network planning information, particularly forecast future loads, constraints, and proposed augmentations. As a result, R&DG proposals are limited in their ability to identify business opportunities that could bring network management benefits because the data with which to calculate connection costs and benefits of DG options is not available in most cases.	A Statement of Opportunities for generators and Annual National Transmission Statement within the NEM are released annually by NEMMCO. Some jurisdictions have established network development procedures that require network service providers to call for and transparently evaluate proposals for non-network solutions to constraint and network development needs (for example, NSW Demand Management Code of Practice). The URF has considered the issue of information disclosure in the context of connection negotiations as part of the development of a draft COPEG. The draft COPEG will need to be considered by the MCE in the development of a national framework for distribution regulation.
5.3	Current arrangements support incremental rather than optimised planning of network development. This may lead to sub-optimal deployment of R&DG assets.	The MCE, through the WEPWG, has previously identified this as an economic rather than technical issue which largely affects the development of wind generation. It noted that the issue remains a policy matter for individual jurisdictions.

5.4	Network service providers' concerns about the reliability of R&DG may be a barrier to active uptake.	The industry may wish to consider the merits of publishing educational materials and case studies on DG technologies and the potential benefits of its use. The Australian Government's Solar Cities program will fund a number of demonstration projects around Australia that will provide network service providers with experience and understanding of the performance of small solar generators in combination with other measures. The URF has developed a draft COPEG which considers risk allocation between network service providers and distributed generators through provisions for dealing with non-conformance in network support contracts. The draft COPEG will need to be considered by the MCE in the context of the development of a national framework for distribution.
5.5	Reliance on DG can potentially reduce system reliability.	This is not considered to be an issue of serious concern to the MCE and, to the extent it might apply, would be addressed through generator/customer contractual arrangements on reliability of supply, and through network management and planning processes.
5.6	Treatment of exported distributed and non-market generation as negative load can distort market data.	This is not considered to be an issue which affects the uptake of R&DG in the NEM. NEMMCO has agreed to work with industry on information disclosure provisions for non-scheduled generation data and are also investigating options for a semi-dispatch model for non-scheduled generators which, along with appropriate metering, will provide better market data on these forms of generation. The AEMC is currently considering a proposed rule change on publication of non-scheduled generation information.
5.7	At significant levels of penetration, intermittent generation may affect the assessment of the need for reserve capacity and require additional conventional and peaking generation as back-up.	This is not considered to be a pressing issue for the management of the network. Through its existing powers under the National Electricity Law and Rules and on a continual improvement basis, NEMMCO is able to incorporate wind generation reliability into reserve capacity assessments. Consideration of the reliability of wind generation in terms of network augmentation is a matter for proponents to address and justify on a case-by-case basis.

1. INTRODUCTION

Objectives and Scope of this Paper

In November 2004 the MCE SCO requested the Renewable and Distributed Generation Working Group (RDGWG) to develop a public consultation paper to identify and analyse the key issues affecting the uptake of R&DG in the Australian context, with particular focus on those issues relating to the NEM, where the MCE has the authority to progress further work (see Appendix A for further detail).

The objective of this paper is, therefore, to identify and assess the potential barriers to such uptake and to identify, where appropriate, proposed options to address these issues.

Much work and action has already been done in this area (see Appendices B and D). However, due to their differing focuses and contexts, there may be gaps in, and diverging approaches to, addressing issues affecting the uptake of R&DG.

As such, this paper aims to:

- present a systematic and comprehensive overview of the issues affecting the optimisation of R&DG technologies in the market, recognising that issues unrelated to the NEM are generally outside the scope of the MCE and therefore this paper to address;
- identify responses currently underway to address NEM related issues; and
- suggest, and seek comments on, further responses for NEM related issues which aim to:
  - create an equitable market and regulatory environment for all participants, which reflects the true costs and benefits of participants in the network;
  - promote transparency and simplicity in the market and regulatory procedures;
  - integrate with the work currently underway in other MCE processes, particularly the Energy Market Reform agenda; and
  - integrate with the broader policy objectives of jurisdictions.

The further responses identified in this paper are intended as a focus for future efforts and analysis. Any future work will include a consideration of the costs and benefits of potential responses in a broader context and be guided primarily by the NEM objective, as follows:

> "…to promote efficient investment in, and efficient use of, electricity services for the long term interests of consumers of electricity with respect to price, quality, reliability and security of supply of electricity and the reliability, safety and security of the national electricity system."

Methodology

In preparing this paper, the views of selected key industry stakeholders were sought on issues impeding, and policy options for promoting, the increased uptake of R&DG. Case studies demonstrating impediments to R&DG were also sought (see Appendix C).

Relevant Federal, State and Territory government departments were approached to provide views on key R&DG issues, as well as a summary of existing initiatives to promote the uptake of R&DG (see Appendix D).

2. CONTEXT

2.1. What is Renewable and Distributed Generation?

For the purposes of this paper, renewable generation is taken to encompass generation technologies that use renewable energy sources eligible under the *Renewable Energy (Electricity) Act 2000* (see Appendix E).

Distributed generation (DG), or embedded generation, is defined as electricity generation that is connected to the local electricity distribution network rather than the transmission network.[1] DG encompasses a range of renewable and non-renewable generation technologies such as microturbines, fuel cells, photovoltaics, wind turbines, and diesel, gas and cogeneration engines.

R&DG can range in size from as low as several kWs (for example, small photovoltaic systems), to over 100 MW for renewable generators (for example, large wind farms) or large-scale industrial projects (for example, natural gas-fired cogeneration). Because the issues facing R&DG can differ between these different sizes of generator, the following classifications are used in this paper:

Small: < 20 kW. These generators are primarily for onsite use, often at a household level, but surplus output may be exported into the grid. Examples include rooftop photovoltaics and (small) fuel cells.

Medium: 20 kW to 5 MW, or < 30 MW and exports less than 20 GWh per year. Many generators in this category are used to power onsite industrial applications, but export surplus output into the grid to provide additional income streams. Some are directed primarily at energy export. Examples include sugar mills, micro-hydro and standby generators, such as diesel.

Large Intermittent: > 5 MW. These generators are normally governed by the National Electricity Rules. Their operation is usually directed towards electricity sales. By definition these technologies do not generate continuously and output can be unpredictable. Examples include larger scale wind farms.

Large Continuous: > 5 MW. These generators are normally governed by the National Electricity Rules. Their operation is usually directed towards electricity sales, although there may be a component of onsite use. Examples include gas turbines and cogeneration, and some biomass generators, such as wood waste.

2.2. Renewable and Distributed Generation in Australia

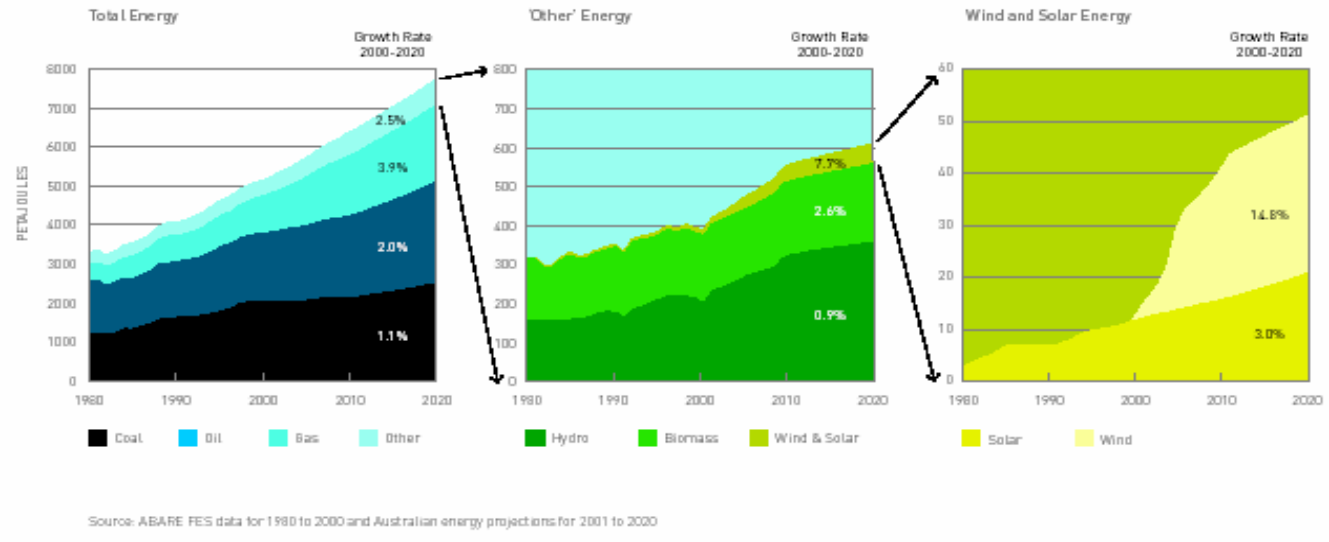
Australia currently has a growing renewable energy industry and DG has been identified as having significant growth potential.

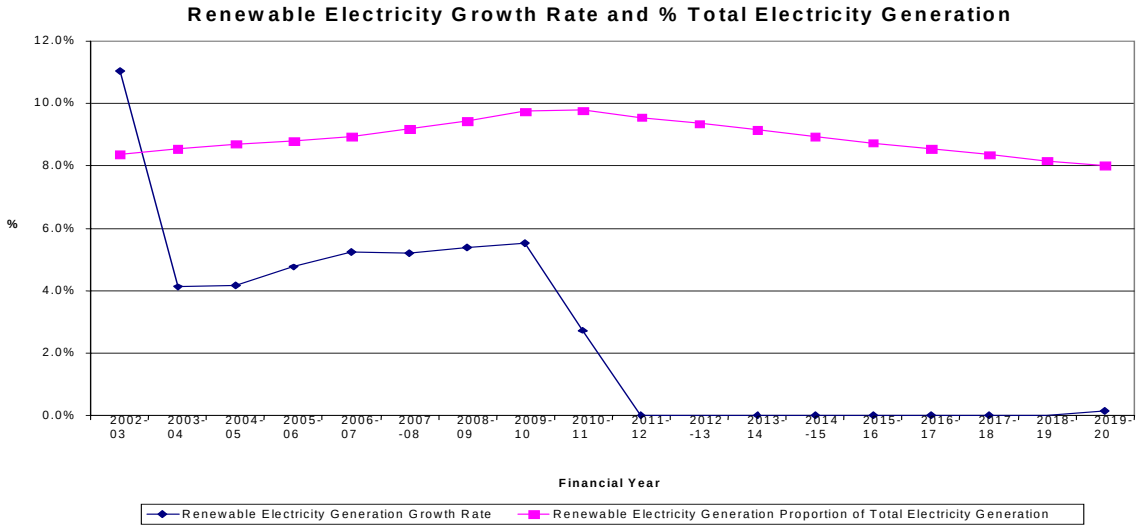
Australian Government reports[2] show that renewable energy is projected to grow at a rate of 2.5% per annum between 2000 and 2020. However, because of increasing demand for electricity the share of renewable energy is expected to fall over this period from its current level of just under 9% to approximately 8% in 2020 (although the share will first rise to around 10% in 2010-11).

[1] This is consistent with the definition of embedded generation used in the National Electricity Rules.

[2] Australian Bureau of Agricultural and Resource Economics, *Australian Energy: National and State Projections to 2019-30*, 2005, FES Data for 1980 to 2000 and Australian Energy Projection for 2001 to 2020.

Much of the growth to 2010-11 is being driven by the Australian Government's Mandatory Renewable Energy Target (MRET) measure. MRET has already stimulated over a billion dollars in renewable energy project investment with over 200 registered power stations representing a broad range of renewable energy technologies. It is expected that sufficient investment will be made to meet the requirements of MRET by around 2008. Without the stimulus that MRET provides to bridge the cost differential between renewable and conventional technologies, growth in renewable energy is projected to decline after this time.





In terms of DG, a June 2005 study by the National Institute of Economic and Industry Research[3] for NEMMCO reports that DG capacity in the NEM[4] was 1,765MW in 2003. Based on current policy settings, this is projected to grow to 3,795MW by 2020.

[3] National Institute of Economic and Industry Research, *Projection of embedded generation in the NEM, 2005:A report for the National Electricity Market Management Company Research*, June 2005

[4] Throughout the Australian energy market as a whole (NEM and non-NEM) *Electricity Australia 2004* (published by the Energy Supply Association of Australia) shows a total of 3,751MW of embedded and non-grid generation capacity as of 30 June 2004. This equates to approximately the entire generation capacity of South Australia.

2.3. Energy Market Regulation and Renewable and Distributed Generation

A mix of national and jurisdictional energy market regulation currently applies to R&DG.

At a national level, the National Electricity Law (NEL) and Rules set out requirements and procedures for the operation of the wholesale NEM and establish an access regime for electricity transmission and distribution networks. The NEL and Rules place obligations on the NEMMCO, electricity retailers, large generators, network service providers (NSP), and system operators. The NEL and Rules do not apply in Western Australia and the Northern Territory, as these jurisdictions do not participate in the NEM.

In addition to the NEM regulatory regime, each jurisdiction has regulatory responsibility for issues such as distribution and retail pricing, and licensing of distributors, retailers, and generators. Jurisdictional regulators are primarily responsible for administering distribution and retailing regulations, including the requirements of the NEL and Rules. A national regulator (the Australian Energy Regulator (AER)) is responsible for regulation of transmission and the wholesale market.

Because of this multiplicity of regulatory arrangements, there are differing approaches to the regulation of R&DG between jurisdictions. A report commissioned by the Utility Regulators Forum (URF) sets out the arrangements for the connection of DG in each NEM jurisdiction.[5] This report builds on a 2004 report commissioned by the MCE Standing Committee of Officials, which covers all jurisdictions.[6]

Looking to the future, the MCE is currently implementing a program of energy market reform.[7] One of the key objectives of this program is to establish a national framework for distribution and retail regulation. On 4 November 2005, the Ministerial Council on Energy agreed, subject to the necessary Cabinet approvals, to the transfer of specified retail and distribution functions to national regulatory arrangements, with enabling legislation by the end of 2006, and the transfer of economic regulation of distribution networks to the national regime by 1 January 2007.

The transfer of economic regulation of distribution networks potentially provides an opportunity to establish a nationally consistent approach to the treatment of R&DG, and more generally, to remove any impediments to R&DG in energy market regulation in a nationally consistent manner. In this context, a draft National Code of Practice for Embedded Generation (COPEG) has been developed by the URF for consideration by MCE, as a means to contribute to achieving these objectives (see Appendix A). The draft COPEG has been issued for comment in conjunction with this paper.

There are also a number of other work streams in the energy market reform program that are of relevance to R&DG, most notably on transmission and user participation. These are also detailed in Appendix A.

The MCE work undertaken through the energy market reform process is aimed at ensuring that an equitable and transparent environment is created in the NEM whereby all participants, including R&DG, can participate equally.

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[5] PB Associates, *Arrangements for the Connection of Embedded Generation: An Inter-Jurisdictional Status Report*, August 2005

[6] Charles River Associates, *Codes of Practice for Embedded Generation*, February 2004.

[7] See Ministerial Council on Energy, *Report to the Council of Australian Governments: Reform of Energy Markets*, December 2003 and more generally, www.mce.gov.au

2.4. The Benefits of Renewable and Distributed Generation

R&DG has significant potential to promote "…the long term interests of consumers of electricity with respect to price, quality, reliability and security of supply of electricity and the reliability, safety and security of the national electricity system" (the NEM objective) as well as other broader economic, social and environmental objectives, such as:

- reducing the greenhouse gas intensity of energy supply and improved environmental quality;
- economic benefits through the development and support of industries and export markets;
- regional and rural economic development and employment; and
- the provision of cost-effective electricity supply to isolated communities.

This potential arises for a variety of reasons, as set out in Box 1.

Box 1: Potential Benefits of Renewable and Distributed Generation

Small Intermittent Generators (*eg. rooftop solar photovoltaics, smaller scale wind generators)*

- Potential to provide grid with improvements in reliability of supply, particularly in fringe-of-grid areas;
- Potential to cost effectively supply power to areas in which access to the grid is not physically or economically feasible;
- Potential to supply electricity at times of peak demand;
- Provision of on-site power potentially reducing the need for network infrastructure investment;
- Increase diversity of supply which reduces fuel risks, improves security of supply, and increases consumer choice; and
- Lower greenhouse and other environmental emissions than conventional technologies.

Medium Continuous Generators *(e.g. gas turbine, biomass, cogeneration, micro-hydro, landfill gas)*

- Cogeneration can increase the overall efficiency of heat and power energy utilisation (including for cooling which can reduce peak load) and generate cost savings, greenhouse gas abatement and an additional income stream for businesses;
- Potential to reduce investment risks and costs as it allows more flexible incremental additions to generation capacity, to more closely match overall growth in demand;
- Distributed generation can reduce network demand and associated losses, defer investment in generation and network capacity, improve overall system security and whole-of-system load factors, and provide network and system support;
- Potential to supply electricity at times of peak demand, which can help to lower peak pool prices; and
- Increase diversity of supply which reduces fuel risks, improves security of supply, and increases consumer choice.

Medium/Large Intermittent Generators (*e.g. wind farms)*

- Lower greenhouse and other environmental emissions than conventional technologies;
- Potential to reduce investment risks and costs as it allows more flexible incremental additions to generation capacity, to more closely match overall growth in demand;
- Increase diversity of supply which reduces fuel risks, improves security of supply and increases consumer choice; and
- Potential to provide employment and economic benefits in regional areas.

Large Continuous Generators *(e.g. large scale hydro, geothermal, biomass, cogeneration)*

- Potential to provide base and/or peak load power generation with lower greenhouse and other environmental emissions;
- Increase diversity of supply which reduces fuel risks, improves security of supply and increases consumer choice;
- Provision of on-site power potentially reducing the need for network infrastructure investment;
- Cogeneration can increase the overall efficiency of heat and power energy utilisation (including for cooling to reduce peak load) and generate cost savings, greenhouse gas abatement and an additional income stream for businesses; and
- Potential to supply electricity at times of peak demand, which can help to lower peak pool prices.

As noted in Box 1 above, not all forms of R&DG may deliver equivalent benefits. For example enterprise level forms of DG such as small and medium gas turbines are particularly suited to reducing energy costs through deferring the need for network augmentation. Intermittent forms of generation, such as wind power, are less likely to be able to provide such benefits due to the need to maintain backup connection. That said, wind power is more likely to deliver reduced environmental emissions than gas turbines and work is currently underway to help address some of the issues associated with intermittency (for example, the improved wind energy forecasting and electricity storage initiatives).

2.5. The Challenges of Renewable and Distributed Generation

Realising the potential benefits of R&DG in a competitive national energy market presents a number of challenges, for policy makers and network managers and regulators. Box 2 highlights a range of issues identified through internal analysis and discussions with key stakeholders. While many of the issues identified differ between classes of technology or their application, it is evident that a degree of commonality also exists on certain issues.

Broadly speaking, the issues identified in Box 2 can be categorised as those relating to:

- the challenge of emerging technologies;
- ability to participate effectively and efficiently in markets; and
- the management of R&DG in electricity networks

The emerging nature of some R&DG technologies presents a range of cost, technical standards, resource identification, and project approvals issues. It is expected that as the technologies mature and markets, network managers, regulators, consumers, and project proponents become more familiar with the technologies, many of the issues identified will become less significant.

Other challenges arise because Australia's energy markets and their associated regulatory and system management practices have been, for historical reasons, designed primarily to support large scale base load generation from convention generation sources often located long distances from major load centres. As a result, there are a number of impediments in market design, rules, and operation relating to connection pricing and access which can affect the uptake of R&DG.

As the level of investment in R&DG grows, these impediments have become increasingly apparent and problematic. In addressing these issues, it is important to note that the NEM Rules are based on the principle of technology neutrality in terms of access and pricing. It is also important to recognise that the objective is to ensure that RD&G uptake is maximised in an economically efficient manner within a market structure.

The ongoing development of a competitive national electricity market provides an opportunity to address many of these issues to enable R&DG to compete on a commercial basis with other generation technologies.

Overcoming these challenges and realising the potential benefits of R&DG, requires that:

- the emerging technology issues are addressed adequately;
- R&DG proponents and consumers are able to effectively and efficiently participate in the market; and
- the network is capable of managing increased levels of R&DG in a cost-effective manner.

The following sections discuss these requirements and the issues identified in Box 2.

Box 2: Issues Relating to Various Renewable and Distributed Generation Technologies

Common Issues

- Government project approvals processes can be complex and inconsistent across jurisdictions.
- Generally higher average per-unit generation costs relative to conventional technologies;
- Network connection requirements for non-conventional technologies can be inconsistent, complex, inappropriate to technology and impose relatively high transaction costs;
- Current network planning tends to be on an incremental basis, rather than using a more strategic regional focus which may result in less consideration of these technologies;
- For small new or unfamiliar technology difficulties can be experience in obtaining planning approval and or financing and finding skilled labour and in access to support infrastructure eg for repair and maintenance; and
- Lack of locational and cost reflective pricing (and associated metering) means that economic signals for distributed and close to load generation are muted or lost.

Small Intermittent Generators *(e.g. rooftop solar photovoltaics, smaller scale wind generators)*

- Underdeveloped market framework for sale of power outside of the wholesale market may limit opportunities and result in relatively higher transaction costs;
- Small scale of generators means that individual network benefits are generally negligible until a critical mass is achieved;
- Intermittent nature of these technologies generally requires backup connection to the grid with little effective reduction in maximum network capacity;
- Current network system charges based on the potential capacity of a generator or minimum demand required, regardless of amounts exported or imported can create prohibitive and inequitable costs; and
- Continued implementation of standards and accreditation required to build confidence in products and services.

Medium Continuous Generators *(e.g. gas turbine, biomass, cogeneration, micro-hydro, landfill gas)*

- Lack of transparent information on network planning and current and prospective network constraints (e.g. substation fault levels) reduces developers' ability to identify prospective projects and accurately assess feasibility;
- Network charging arrangements can provide disincentives for DNSPs to consider DG as an alternative to network augmentation due to inability to adequately capture the value of DG and reduced income;
- Where DG displaces network augmentation and the local network is constrained, consumers can become exclusively dependant on the distributed generator and shutdowns may critically impair supply;
- Treatment of exported DG as negative load in the national electricity market distorts system demand data and network planning and system management decisions;
- Underdeveloped market framework for the sale of power outside of the wholesale market may limit opportunities and result in relatively higher transaction costs ;
- Current network system charges based on the potential capacity of a generator or minimum demand required, regardless of amounts exported or imported can create prohibitive and inequitable costs; and
- Proponents can have difficulty identifying opportunities which are outside of core business.

Medium/Large Intermittent Generators (*e.g. wind farms)*

- Concentrated levels of intermittent generation can present forecasting and scheduling difficulties for network management particularly when constraints bind;
- Lack of transparent generation data from non-scheduled generators can limit the ability of market players to adapt to, and plan for, increasing levels of this generation;
- New developments, particularly projects at fringe of grid, can face relatively high connection costs as they can be required to pay the full cost of the new line and/or network augmentation;
- Non-scheduled generators or market generators without appropriate metering equipment are not required to participate in ancillary service markets, meaning that they do not face causer pays network management costs;
- Treatment of non-scheduled generators as negative load in the NEM distorts system demand data and network planning and system management decisions; and
- At significant levels of system penetration, intermittent generators may require additional conventional reserve which could result in price distortions.

Large Continuous Generators (*e.g. large scale hydro, geothermal, biomass, cogeneration)*

- Licensing regimes for newer renewable resources such as geothermal energy are currently under developed and may be inconsistent across most jurisdictions;
- Biomass and cogeneration proponents can have difficulty identifying opportunities which are outside of core business; and
- New developments, particularly projects at fringe of grid, can face relatively high connection costs as they can be required to pay the full cost of the new line and/or network augmentation.

3. ENSURING EMERGING TECHNOLOGY ISSUES ARE ADDRESSED

The emerging nature of many R&DG technologies in electricity markets that have primarily developed around the needs of large scale conventional generation presents a number of challenges in promoting the optimal uptake of R&DG.

Emerging technology issues identified in Box 2 include higher generation costs, relatively poor publicly available resource data, difficulty in identifying business opportunities, accessing renewable energy resources, improving consumer and NSP confidence in product and services, and potentially complex and inconsistent project approval regimes across jurisdictions.

It is noted that many of the above issues are non-market in character and are generally beyond the remit of the MCE. However, relevant comments from interested parties are welcome.

3.1. Generation Costs

Issue: R&DG remains generally higher cost than conventional sources.

Response:
Federal, State and Territory Governments have a number of programs and policies in place to reduce generation costs of R&DG or to otherwise address the higher relative generation costs of R&DG (see Appendix D).

The most significant barrier to the uptake of R&DG is the relatively higher generation costs for renewable energy compared with conventional generation technologies (see Table 1). The costs of R&DG have decreased significantly over time. This, in part, has been a result of government policies in Australia and overseas, that support renewable energy technology development and commercialisation or which have created market opportunities for R&DG in order to drive industry development and thereby cost reductions. Although R&DG costs are projected to continue to decrease, it will be some time before they become fully cost competitive, unless utilised in niche applications.

Certain DG technologies, such as gas and cogeneration, are currently competitive with conventional technologies in a number of applications. However, they are still often considered to be an emerging occurrence in the network's traditionally large-scale base load generation and associated transmission structures.

Table 1: Estimated Costs of Electricity Generation from Renewable Technologies	
Technology	**Cost ($/MWh)**
Coal	31-40*
Natural Gas Combined Cycle	37-44*
Photovoltaics	400-800
Wind	60-80
Small Hydro	40-70**
Large Hydro	10-81**
Bagasse	30-100
Biomass	50-75
Geothermal hot rocks	40-130***
Tidal	80-150
Landfill gas, sewage gas	40-60
Cogeneration – large gas turbines	40-50
Cogeneration – small steam reciprocating gas engines	60-70
Source Australian Government, *Renewable Energy Technology Roadmap*, 2002 * Sinclair Knight Merz, *New entrant prices and wholesale price projections*, Energy Users Association of Australia Energy Price and Market Update Seminar, June 2003 **Australian Bureau of Agricultural and Resource Economics, *Excluding Technologies from the Mandatory Renewable Energy Target*, June 2003. *** Lower range Geodynamics Limited March 2005. Upper range *Renewable Energy Technology Roadmap*.	

There are a number of policy approaches that are being implemented in Australia to reduce R&DG generation costs or otherwise or otherwise address the higher relative generation costs of R&DG including:

- Creating markets for green certificates through schemes such as the Mandatory Renewable Energy Target and the NSW Greenhouse Gas Abatement Scheme. The extra income provided by green certificates can improve the commercial viability of R&DG projects. In doing so, green certificate schemes can underpin industry development by supporting the capacity expansions necessary to deliver economies of scale and improved industry capacity, which, in turn, reduces R&DG capital and operating costs over time;
- Subsidies for the capital cost of purchasing renewable generation equipment (for example, the Photovoltaic Rebate Program);
- Supporting technology research, development and commercialisation aimed at reducing R&DG capital and other costs;
- Promoting the availability of consumer choice schemes that enable end users to purchase their electricity from renewable generation (for example, accredited Green Power);
- Developing markets for fuel inputs used by R&DG (for example, the gas market), which could drive operating costs down; and
- Pricing externalities, most notably greenhouse gas emissions, from fossil fuel generators.

The use of such measures raises a number of important issues and is a matter for policy consideration by individual jurisdictions.

3.2. Renewable Energy Resource Information

Issue: Lack of comprehensive pre-competitive information on national renewable energy resources.

Response:
The Australian Government, as part of its package of measures set out in its Energy White Paper, *Securing Australia's Energy Future*, committed to working with the States and Territories to develop protocols to guide the collection of comprehensive and consistent pre-competitive data for all energy resources. Building on this commitment, the Department of the Environment and Heritage will work with the States and Territories to develop and publish renewable energy resource maps with appropriate overlays of networks and other constraints to development.

The development of renewable energy resources relies fundamentally on access to information on renewable energy resources and potential constraints to resource development, such as proximity to networks.

Such information tends to be undersupplied in private markets and therefore Governments often collect and provide pre-competitive resource information to address this market failure. It also reduces the risk and cost of identifying and evaluating investment opportunities by providing for economies of scale in the collection and collation of information.

While some information on renewable energy resources has been collected,[8] or is in the process of being collected, information on renewable energy resources is incomplete and/or could be presented in a manner that better facilitates the identification of opportunities for renewable energy resource development.

3.3. Identifying Market Opportunities

Issue: Limited ability of project proponents to identify business opportunities.

Response:
The Business Council for Sustainable Energy (BCSE) has developed a cogeneration ready reckoner to assist evaluation of business opportunity. A limited number of industry tools are also available.

Proponents of R&DG projects may lack the capacity and knowledge to evaluate potential opportunities for R&DG projects due to immaturity of the market and because energy generation is not the primary business focus of the proponent (for example, cogeneration projects).

The BCSE provides some assistance to potential cogeneration proponents in the form of a ready reckoner and financial evaluation assistance (supported by the NSW Government). Australian Pork Limited has also developed an evaluation tool in relation to piggery waste generation projects.

The development of transparent market arrangements and associated information through the MCE on-going energy market reform agenda will assist in better identification of business opportunities. However, the question of whether there is a need for further development of business tools is a matter for consideration by the industry and individual jurisdictions.

[8] For example the Victorian Government Wind Atlas, NSW assessments of bioenergy (forest residues, landfill and sewage gas, wet wastes) and small scale hydro power and wind, bioenergy, solar and geothermal assessments referenced in *Securing Australia's Energy Future* (pp 56-57).

3.4. Accessing Renewable Energy Resources

Issue: Licensing regimes for a number of newer renewable resources, such as geothermal energy, are currently under developed and inconsistent across jurisdictions.

Response:
Some jurisdictions are reviewing applicable regulations in order to identify and address gaps and inconsistencies between jurisdictions.

Collaboration between jurisdictions is encouraged through the Council of Australian Governments (COAG).

Development of some forms of renewable energy resources require regulations that provide secure and unambiguous rights to the resource, for example, water licences for hydro-electricity, leases for geothermal energy and licence/leases for wave and tidal resources. While technologies such as hydro-electricity are well established with clear resource exploration and development frameworks, a number of the newer renewable resources (such as geothermal, tidal and wave) have only selectively been addressed, most recently in the development of legislation providing for the granting of rights to geothermal resources.

Resource access and licensing regimes are outside the remit of the MCE. Collaboration between jurisdictions is encouraged through the COAG.

3.5. Environment and Social Impact Regulation

Issue: Government project approvals processes can be complex and inconsistent across jurisdictions.

Response:
As further experience is gained with emerging renewable energy technologies it is expected that project approvals will become less onerous.

The Australian Government Department of the Environment and Heritage is currently undertaking a review of the operation of the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*. The Australian Government has also published draft Supplementary Significant Impact Guidelines under the EPBC Act for wind farms.

Individual jurisdictions or the Environment and Heritage Protection Council may wish to consider the need for, and the value of, action in this area to minimise transaction costs and streamline approval processes.

Development of R&DG projects can give rise to environmental and social impacts including the amenity impacts of wind farms, the ecological impacts of large-scale hydro-electricity, and particulate emissions from some forms of DG.

Such impacts are regulated through a variety of land-use planning and environmental licensing requirements. While this is appropriate, regulations may present impediments to investment in R&DG due to the relative lack of established policies for the treatment of newer RD&G technologies, the complexity and multiplicity of approvals processes, and inconsistency of requirements between jurisdictions. Some of these issues can also affect conventional forms of generation.

Some work has already been done to address these issues, particularly in relation to wind farm development.[9] Although approvals processes for R&DG will eventually be less onerous and time consuming as experience with R&DG projects accumulate, there are a number of further actions that could assist in this area. These include:

- developing nationally coordinated and comprehensive land-use and environmental planning policies for relevant renewable energy resource development, most notably in relation to wind farms;
- accrediting DG technologies to help streamline environmental protection licensing; and
- determining acceptable benchmarks and appropriate limits on particulate emissions from relevant forms of DG.

However, these actions lie outside the policy and regulatory responsibilities of the MCE and are a matter for policy consideration by jurisdictions.

The Australian Government Department of the Environment and Heritage is currently undertaking a review of the operation of the EPBC Act. The Australian Government has also published draft Supplementary Significant Impact Guidelines under the EPBC Act for wind farms.

3.6. Building Consumer Confidence

Issue: Building consumer and market confidence in R&DG products and services.

Response:
Jurisdictions and industry have put in place a number of measures to address these issues.

Consumer confidence in products and services is critical in promoting the benefits of emerging R&DG technologies and in overcoming perceptions or concerns over reliability. R&DG product standards and accreditation of R&DG installers can assist in assuring consumers, NSPs, system operators and regulators that a particular product/installation will meet acceptable performance and safety levels. This may encourage the uptake of R&DG and assist in streamlining connection procedures, particularly in relation to technical standards and requirements.

There are a number of Australian Standards of relevance to renewable power systems.[10] It is unclear the extent to which these standards are being applied. The development of further standards against which R&DG products and installations could be certified may be of value.

The BCSE currently runs a service to accredit persons that can demonstrate competence in designing and installing renewable power systems.

The need for further action in this area is outside the remit of the MCE and is a matter for the R&DG industry and consideration by jurisdictions.

[9] For example Australian Wind Energy Association and Australian Council of National Trusts, *Wind Farms and Landscape Values: Stage One Report – Identifying Issues;* Victorian Government, *Policy and Planning Guidelines for the Development of Wind Energy Facilities in Victoria* and Australian Wind Energy Association, *Wind Farms and Birds: Interim Standards for Risk Assessment*, 2005

[10] For example: AS 4509 Stand-alone Power Systems; AS 4086 Secondary batteries for SPS; AS 3000 Electrical Wiring Rules and AS 4777 Grid Connections of Energy Systems via Inverters.

4. FACILITATING THE UPTAKE OF MARKET OPPORTUNITIES

The majority of barriers affecting the uptake of R&DG relate to current market, regulation and systems management arrangements in the NEM. These issues are discussed in the next section and fall into the following categories:

- network pricing and price regulation; and,
- network connection.

4.1. Network Pricing and Price Regulation

Issue:

- **Distribution network price regulation may not appropriately reward and facilitate the use of DG (and demand side response) as an alternative to network augmentation/development and a means of reducing network losses.**
- **Network pricing structures can distort locational incentives at transmission and distribution levels.**
- **Lack of transparent cost-reflective network pricing and appropriate metering inhibits accurate reflection of the value of DG in terms of managing network losses and constraints.**

Response:

- The MCE has agreed, subject to the necessary Cabinet approvals, to the transfer of specified retail and distribution functions to national regulatory arrangements, with enabling legislation by the end of 2006, and the transfer of economic regulation of distribution networks to the national regime by 1 January 2007. The transfer of economic regulation of distribution networks will provide an opportunity to establish nationally consistent transmission and distribution network pricing regulation that provides appropriate incentives for the efficient use of DG.
- The AEMC will progress a review of congestion management in 2006. Distributed generation issues could be raised in this context.
- Where suitable arrangements do not already apply, jurisdictions along with DNSPs may also wish to consider offering incentives to energy users for a demand side response in areas where growth related capital expenditure is required in the medium term.
- The MCE has produced an overview paper on common principles for the assessment of the costs and benefits of the roll-out of interval meters. An overview paper is available on the MCE website. Jurisdictions have an obligation to review the cost and benefits of interval meters if they have not already done so.
- Victoria has already mandated the roll-out of interval meters and some retailers and distribution network service providers are voluntarily trialling the use of interval meters. The Australian Government's Solar Cities program will also demonstrate the value of interval meters.
- The Utility Regulators Forum (URF) has considered the issue of metering requirements in the development of a draft COPEG. The draft COPEG will be considered by the MCE in the context of the development of a national framework for distribution.
- The MCE has agreed to a national access regime including network pricing. The AEMC is progressing work on transmission pricing. There may be an opportunity to consider network pricing for R&DG under these work streams.

Comment Sought:

Noting the range of work currently underway, particularly the development of a national framework for distribution regulation by 1 January 2007 and the draft COPEG, comment is sought on the merit and form of further work to examine of distribution network price issues which could serve as input into future reviews of distribution network pricing.

Transmission network pricing and regulation is the responsibility of the AER as per the NEL, while distribution network pricing and regulation is currently the responsibility of State regulators. On 4 November 2005, the Ministerial Council on Energy agreed, subject to the necessary Cabinet approvals, to the transfer of specified retail and distribution functions to national regulatory arrangements, with enabling legislation by the end of 2006, and the transfer of economic regulation of distribution networks to the national regime by 1 January 2007. Economic regulation of the distribution network will involve setting the rates of return that investors in infrastructure are allowed to make by carrying electricity. Responsibility for functions including dispute resolution, community service obligations, tariff equalisation, and the licensing of and setting of the more technical aspects of regulation is proposed to remain state based.

Transmission and distribution network pricing is subject to a high degree of averaging despite the fact that network constraint driven energy costs can vary significantly depending on the location and timing of generation, and demand. As a result, potential locational and temporal price signals are not utilised and the efficient placement of generation and network infrastructure relative to load is not fully promoted.

Marginal loss factors (the energy loss between two defined network points) applied to generation provide some locational price signals. However, because loss factors are often averaged at a distribution level, potential investors in DG may not receive such signals. Furthermore, loss factors are only applied to generators participating in the wholesale market, and do not apply to many small and medium R&DG, participating in the retail market.

While the disclosure of network information, such as the location of constraints, can help to address this, it is an imperfect substitute for economic price signals. The removal of price averaging may be difficult, as it raises equity issues, although the use of cost-reflective pricing may assist in alleviating these concerns.

The MCE has requested the AEMC to conduct a review of congestion management in the NEM. The review is expected to be finalised in early 2007 and involve extensive industry consultation. Issues relating to congestion in the distribution system could be raised within that review consultation process, and benefit from the review's findings.

Network pricing regulations, particularly at a distribution level, do not provide NSPs with appropriate incentives to use R&DG as an alternative to network development or to mitigate against network losses. Nor do these regulations adequately reward R&DG for providing these benefits. Regulations vary between jurisdictions, but common concerns are as follows.

- NSPs generally do not bear the cost of network losses and therefore have no incentive to invest in or contract DG as a means of reducing losses;
- network pricing does not signal the locational costs of network constraints. This reduces incentives on NSPs to find the lowest cost means of resolving constraints, which in some cases may be DG. Cost-reflective network pricing can also improve the economics of DG projects;[11]
- averaging costs of network pricing dampens the price signals and incentives related to time varying loads;

[11] East Cape, *Efficient Network Pricing and Demand Management*, February 2002 (prepared for the NSW Demand Management Inquiry).

- DG costs cannot be capitalised and rolled into the asset base of the relevant NSP. DG solutions to network constraints therefore do not compete on equal footing with network investment;
- the revenue of distribution businesses is tied to system throughput under the widely-used price regulation approach. DG can reduce system use and therefore revenue, creating a disincentive for investment in/use of (and connection of) DG;
- NSPs may be rewarded through growth incentive payments for growth in peak demand, rather than energy consumption. This may create disincentives to manage peak demand (for example, through DG); and
- regulations may provide insufficient clarity on whether the use of DG to manage network losses would be considered a prudent investment.

Retailers face risks due to volatile prices in the spot market, and generally manage these risks through financial contracts with generators rather than DG (or demand side management). However, the use of DG by retailers and end-users at times of peak demand can provide a cost-effective means of managing the risks and costs associated with exposure to peak prices. DG can also benefit retailers through the avoidance or reduction of transmission and distribution costs.

Reasons for retailer preference for traditional sources of generation include:

- the use of load profiling means that retailers may not be able to benefit from the use of DG (as network use of system charges may be levied on the basis of a profile, rather than electricity throughput);
- lack of understanding of DG options and technologies;
- technical characteristics of some R&DG options making their generation less predictable or reliable; and
- available fossil fuel generation can be purchased relatively cheaply and with a lower risk profile than R&DG.

For end-users, a key impediment to the use of DG is the lack of cost-reflective pricing at the retail level, which means end-users receive limited price signals and insufficient incentives to find energy supply alternatives. The roll-out of interval meters, in conjunction with more cost-reflective tariffs for end users would allow retailers to benefit from the use of DG. Victoria has announced the mandatory roll-out of interval meters from 2006. The MCE has produced an overview paper on common principles for the assessment of the costs and benefits of the roll-out of interval meters. Jurisdictions have an obligation to review the cost and benefits of interval meters if they have not already done so. Interval metering is also expected to be trialled as part of the Australian Government's Solar Cities program.

Metering for small and medium R&DG is generally governed by jurisdictional arrangements. In some cases, R&DG proponents are required by metering codes or by NSPs to install a bi-directional meter or even two separate meters (to measure import and export separately). Such requirements may impose additional expenses, particularly for small R&DG.

While a substantial amount of work has been done to resolve these concerns,[12] further progress towards a stable and nationally consistent incentive-based regulatory regime involves promoting the efficient use of DG as a means of managing congestion, reducing network losses and avoiding or deferring augmentation.

[12] Most notably reforms implemented in response to the NSW Demand Management Inquiry

4.2. Network Connection

4.2.1. Connection costs

Issue: Incremental connection costs can be potentially prohibitive for new R&DG projects, particularly where projects require network augmentations or provision of major new line.

Response:

- Victoria has implemented an Act to enable least cost solutions to network upgrades which involve the connection of multiple wind sites, and that the project proponents are able to negotiate an equitable share of the connection/upgrade cost.
- The AEMC is currently undertaking a review of the Electricity Transmission Revenue and Pricing Rules. This could be an appropriate forum to consider connection cost issues particularly related to transmission.
- The AEMC will undertake a review of congestion management in 2006. This could be an appropriate forum to consider issues related to sharing network capacity.
- The URF has developed a draft COPEG. This work has considered a range of network connection issues. The draft COPEG will be considered by the MCE in the context of the development of a national framework for distribution.

Comment Sought:

Noting the range of actions currently underway, comment is sought on the need and form of further work to develop solutions specific to R&DG connection cost issues. This should bear in mind MCE's requirement for a technology neutral treatment of connection.

Network connection costs can be a key factor in the viability of R&DG projects (as well as conventional generation projects). R&DG must negotiate with the NSP what proportion of network connection costs they will be required to pay.

These costs include those incurred in relation to all the connection assets constructed for exclusive use of the generation applicant and which connect the generating plant to the network connection point; and network augmentation costs including network protection and voltage control equipment up to the boundary of the distribution network. The degree of any required network augmentation will vary for each project, and the cost of such augmentation will depend upon the capability of the network to accommodate DG while maintaining secure and reliable supply.

The basis of assessing and assigning costs associated with connecting an embedded generator to the network is generally not transparent to all parties. Augmentation of existing network assets may provide benefits to other network users, creating difficulties in assigning these costs. Furthermore, DG may provide other benefits to network users, for example, through improved system security. Quantifying and assigning these benefits is difficult.

Also of concern may be:

- standby charges (which take effect if the load at a site with DG exceeds the limit specified in its connection agreement or network support contract);
- 'postage stamp pricing' (where variable consumption charges are highly averaged across the distribution network, masking the true value of locating DG at points where the greatest value can be realised); and
- revenue caps for transmission network service providers (which may limit the timeframe) over which avoided transmission use of system (TUOS) payments are made. Minimum chargeable

demand may also be a disincentive to distributed generators, as the actual level of electricity consumed is disregarded. This is where a connection agreement may set out a minimum chargeable load. These costs may add to the fixed costs of operating a DG, and there are concerns that such charges may be set artificially high to discourage DG entry because of commercial considerations.

The National Electricity Rules require connection agreements (including costs) to be fair and reasonable but no further guidance is provided. It may be necessary to develop further requirements and/or guidance relating to what is considered fair and reasonable, to ensure that this occurs.

This guidance could be provided in the form of an appropriate connection negotiation framework for use by negotiating parties (NSPs and R&DGs). The framework could incorporate information disclosure requirements and dispute resolution procedures to help to ensure connection costs are fair and reasonable. For smaller generators, standardising the cost of connection may be appropriate.

Allowing third parties to supply and construct connection assets could also minimise the costs of connection by making construction a contestable service. Different approaches across regions could be streamlined. In addition, competition for the provision of network connection asset construction services could lead to efficiency gains, greater choice for customers and increased transparency.

In some circumstances, it may be inequitable to require proponents to pay network augmentation costs if other (current or future) users of the network benefit from the augmented network assets. Conversely, where network augmentation costs are incurred but not paid by the generator, consumers are required to bear the cost.

There are various approaches that may address this issue. For example, by providing a rebate if future network users are able to connect as a result of the network augmentation previously paid for, or by passing the cost of assets that benefit all network users through to consumers. Alternatively, proponents could be given the option of paying augmentation costs over time through annualised payments, as the upfront payment of both network connection and augmentation connection costs may make R&DG projects uneconomic.

Current regulatory arrangements within the NEM contain no clear rules for sharing network access where capacity is constrained. This is a potential issue for all forms of generation technology. However, it often arises in relation to renewable generators, such as wind farms, situated at the end of long network lines.

The lack of clear rules for dealing with this issue may discourage R&DG investment, particularly if new generation connects to the network that was not factored in to initial project viability assessments. It may also create network security risk for NSPs, who currently manage network security and stability under conditions stipulated in their connection agreements with generators.

The MCE Wind Energy Policy Working Group (WEPWG) in its May 2005 report, *Integrating Wind Farms into the NEM,*[13] identified this as an issue. It proposed development of a semi-dispatch model, whereby normally non-scheduled generators would be subject to scheduled dispatch when network constraints bind. A detailed proposal for semi-dispatch to assist NSPs and the NEMMCO in managing network security and stability is currently being developed

In addition, the AEMC will undertake a review of congestion management in 2006. This issue could be appropriately considered in this review.

[13] Wind Energy Technical Advisory Group, *Integrating Wind Farms into the NEM*, May 2005

4.2.2. Rewarding the provision of network services

Issue: Distributed generators can have difficulty capturing the value of their network services in connection agreements with NSPs.

Response:

- The URF has developed a draft COPEG which will consider:
  - requirements that will facilitate more efficient and effective negotiation between R&DG proponents and NSPs; and
  - methodologies for calculating, and requirements for sharing, the value of network benefits (e.g. network technical support, avoided TUOS, avoided DUOS charges and avoided/deferred augmentation costs).
- The draft COPEG will need to be considered by the MCE in the context of the development of a national framework for distribution.
- The avoided TUOS issue may also be considered as part of the upcoming review of transmission pricing to be undertaken by the AEMC.

Comment Sought:

Noting the development of a draft COPEG, comment is sought on the need and shape of further work, possibly as input to the development of the national framework for distribution regulation.

As previously discussed, the use of R&DG services by NSPs, most notably the management or resolution of network constraints and the reduction of network losses, is a potentially significant source of value for R&DG proponents, NSPs and the market more generally. However, the use of such services is currently limited.

R&DG technologies have varying characteristics that can provide a range of benefits to the network and electricity market. However some of these characteristics can also create additional difficulties that require solutions different to those for traditional generation. Ideally, all benefits and costs would be accounted for in the price renewable and distributed generators, customers, retailers NSPs pay and receive for services (cost-reflective pricing). Importantly, many costs and benefits are spread across a range of participants and it can be difficult to accurately attribute these. This may not be promoted under current market and regulatory structures.

R&DG could be installed as back-up generation, to augment peak supply, manage network limitations and to sell generation. Some R&DG can also provide technical services such as voltage and frequency control, deferred/avoided network augmentation, environmental benefits, and network security services. Generators may consider entering into contracts with the local NSP, retailer or other generator. The ability to do this will, in part, depend on the specific technology capability.

One exception to this is avoided TUOS charges. The NEL and Rules require distribution businesses to pay this to distributed generators and specifies a methodology for determining the amount payable.[14] However, some stakeholders have expressed concern about these Rule provisions[15] as distribution businesses are not paying avoided TUOS based on actual avoided transmission costs, but rather based on the variable components of the TUOS charge.

[14] *National Electricity Rules*, clause 5.5

[15] For example, the Energy Networks Association in their submission to the RDGWG.

For network-related services such as constraint and loss management, negotiating an appropriate return may be difficult for R&DG proponents due to an unequal bargaining position, differences in available information and the transaction costs involved. These difficulties may be addressed through the development of rules and/or guidelines for the negotiation of connection agreements that encompass such features as:

- protocols for dealings between parties;
- information disclosure requirements;
- transparent methodologies for determining the value of avoided network costs, network support services and reduced network losses;
- rules and/or guidelines relating to the sharing of network benefits that appropriately reward R&DG proponents, yet provide incentives for the use of R&DG by NSPs and deal appropriately with reliability concerns;
- dispute resolution processes;
- standard contracts where appropriate; and
- standard offers for network support payments where appropriate.

NSPs may be reluctant to seriously consider R&DG options as an alternative to network augmentation. Use of an appropriate (reliable) R&DG will lead to decreased use of the network and a subsequent reduction in revenue received by the NSP. Approved investment and/or augmentation in the network by the NSP, on the other hand, will be included in the Regulated Asset Base of the NSP on which regulated revenue is calculated. Incentives to encourage savings of investment and augmentation are unclear in the current market arrangements.

Another impediment to more reflective rewards for the provision of network services is that network benefits associated with small generators can be small and difficult to quantify. For this reason, such benefits are often disregarded and remain unrewarded. However, when aggregated with other generators (particularly co-located generators), R&DG can provide for sizable benefits with a low, diversified reliability risk. The development of facilities for aggregating R&DG (and demand-side response), for example, through the entry of aggregators into the market,[16] can help to address this. Some commercial aggregation services are beginning to emerge within the electricity market framework although there is a need to ensure appropriate incentives exist within the market to support this.

A key aspect in determining which generators can provide which services is whether generation can be relied on when required. This is an issue with intermittent generation, specifically wind and solar, as it is not able to generate as required.

[16] An aggregator has recently entered the market in Victoria.

4.2.3. Network use of system charges

Issue: Some forms of network use of system charges can be relatively prohibitive for smaller on-site generators which occasionally or irregularly import or export to the grid.

Response:
Jurisdictions, in consultation with distribution network service providers and regulators (in the context of pricing determinations) are identifying options to improve the flexibility of network tariffs and charges to provide appropriate incentives for DG (and demand-side solutions).

Comment Sought:
Comment is sought on the need for further analysis of tariff structures for small scale on-site R&DG as input to the development of the national framework for distribution regulation.

The structure of network use of system charges may provide an impediment to R&DG particularly where generation is primarily for onsite use, but power is occasionally exported or imported. The structure of network charges may provide an impediment to R&DG particularly where generation is primarily for onsite use, but power is occasionally exported or imported. Embedded generators, like all plant and equipment, may be subject to occasional failure, in which case a full network connection needs to be maintained to give the customer adequate reliability of supply. This is accentuated when the generator is a single unit with no redundancy capability. In such situations the customer still pays its maximum demand charge, unless it can be otherwise negotiated with the NSP, thereby reducing the potential energy cost savings, and hence the business case for the embedded generator diminishes. While such charges are generally imposed by NSPs as a means of managing reliability risks, they may act as an impediment to R&DG.

4.2.4. Network connection regulations

Issue: Network connection regulations, including technical standards, can be complex, unnecessarily onerous, or non-existent for small and medium scale R&DG.

Response:

- Jurisdictional technical standards requirements were reviewed in the development of the draft COPEG. The draft Code incorporates protocols and timelines for network connection applications. The draft COPEG will be considered by the MCE in the development of a national framework for distribution.
- NEMMCO is conducting a review of the conditions for connection of generation plants in the National Electricity Rules.
- The R&DG industry may wish to review existing and develop new guides to project development as appropriate. The industry may also wish to consider the value of developing a repository of approvals and compliance documentation using the information available at the Government Business Entry Point website (www.business.gov.au/Business+Entry+Point) which provides information on Federal and State Government regulation, licensing and other associated information. Government programs described in Appendix D may provide a source of funding for such work.

Comment Sought:
Noting the development of a draft COPEG and review of technical standards by NEMMCO, comment is sought on the need and shape of further work by the MCE.

There are multiple and sometimes complex regulatory requirements associated with the development of R&DG projects covering issues such as environment protection and land-use planning, technical and safety standards, metering and electricity licensing. This multiplicity and complexity may unnecessarily add to the transaction costs associated with R&DG project development. While this issue may be

common to all forms of generation projects, the relatively small capacity of some R&DG projects may make this a more significant issue for R&DG project development.

Guides to the development of R&DG projects have been developed, most notably by the BCSE,[17] although these guides relate primarily to network connection. There may be a need to enhance these guides or develop separate guides relating to R&DG project development more generally. Developing a repository of approvals and compliance documentation may also assist R&DG proponents to meet regulatory requirements.

There may be some scope for better streamlining of regulatory processes and requirements applicable to R&DG projects. One area identified as having scope for improvement is connection agreements. Some proponents have expressed concerns that the lack of clear and binding timelines for connection processes makes project scheduling difficult. This could be addressed through development of a connection negotiation framework incorporating timing requirements.

The technical standards that generators must satisfy prior to connection can be quite complex. For some technologies, particularly new forms of R&DG, appropriate standards may not exist. As a result, satisfying technical standards can be a significant source of transaction costs for R&DG proponents.

In terms of the appropriateness of standards, the WEPWG in its report, *Integrating Wind Farms into the NEM*, recommended a routine review of technical standards. NEMMCO has approached NEM jurisdictions proposing an immediate review of relevant Rule requirements. WEPWG has proposed principles to guide this and future reviews.

4.2.5. Electricity supply opportunities for small and medium generators

Issue: The non-wholesale electricity market is less mature than the wholesale market. Relatively high transaction costs for individual small generators and lack of generalised business procedures may inhibit opportunities for small and medium R&DG generators.

Response:

- The URF has developed a draft COPEG, including specific procedures and requirements for the network connection of generators, including standard connection agreements and other requirements applicable to small and medium generators is being considered. However, the Code will only cover interactions between DG proponents and distribution network service providers not retailers. The draft COPEG will need to be considered by the MCE in the context of the broader energy market reform program which may affect the way it is carried forward.
- The Australian Government's Solar Cities program will trial innovative new market arrangements involving small scale renewable and distributed generators.

Comment Sought:
Noting the development of the draft COPEG and the national framework for distribution regulation, comment is sought on the need and shape of further possible work on the development of generalised business procedures for small and medium R&DG.

Small and medium scale R&DG generally cannot sell their power through the wholesale market due to regulatory restrictions and/or high transaction costs. Outside of the wholesale market, however, there is only a limited market framework for the sale of power, based on Power Purchase Agreements with local

[17] Australian Business Council for Sustainable Energy, *Guide for the Connection of Embedded Generation in the National Electricity Market* and *Technical Guide for the Connection of Renewable Generators to the Local Electricity Network*, 2004.

retailers. R&DG proponents seeking to negotiate such agreements generally face inequality in information, understanding and bargaining position, and high transaction costs.

Developing a more robust and competitive market for the sale of power by small and medium generators could help to address these issues and thereby enhance electricity supply opportunities. This may require, among other things, regulatory changes to provide proponents with greater flexibility in the way they sell their power, for example, the ability to sell fixed and unpredictable output separately, or participation in the market through aggregation. Encouraging retailers and networks to offer contracts for buy-back rates and rebates in appropriate circumstances (for example, where network benefits will be delivered) could also encourage a more competitive market.

The use of a standard negotiation framework and standardised contracts could facilitate effective participation in the market by R&DG proponents, as would the more widespread use of interval metering and time-of-supply tariffs. Problematically, the costs of such metering can be prohibitive, particularly for smaller household-level DG. Net or bi-directional metering with tariffs that recognise the value of power supplied may therefore be appropriate.[18]

In the medium to long term, the Australian Government Solar Cities program aims to trial new and innovative market arrangements that signal and reward the use of small scale solar power as well as other measures. The Australian Government will monitor the results of the Solar Cities trials and use these results to inform MCE consideration of arrangements for small generators.

[18] Net metering involves the use of a single accumulation meter that runs forwards when power is imported from the grid and backwards when it is exported. Bi-directional meters measure import and export separately. Interval meters have the capability to measure use according to the time of use.

5. DEVELOPING A SYSTEM THAT CAN MANAGE INCREASED LEVELS OF RENEWABLE AND DISTRIBUTED GENERATION

5.1. Network Management

Issue: Increasing levels of intermittent and decentralised R&DG generation in the future may require changes to the way in which the network is managed.

Response:

- The MCE is currently developing a detailed proposal for a semi-dispatch model to ensure system stability and security where capacity is constrained.
- The Australian Government is implementing a number of additional measures to address intermittency issues, including improved wind forecasting and encouraging electricity storage technologies initiatives.
- The Australian Government's Solar Cities program should provide real examples of new ways to manage small intermittent generation, in combination with other measures, within distribution networks.

Comments Sought:

Comment is sought on the need and form of future possible work by MCE or NEMMCO to improve active system management practices and emerging technologies so as to accommodate increasing levels of R&DG

Regulation and management of the current electricity system has largely been developed around a model of electricity supply involving large base-load generation systems supplying power to loads, generally over long distances. The National Electricity Rules, for example, assume that R&DG opportunities are limited and have a small impact on the system.

However, R&DG is increasing its proportion in the overall electricity mix. System regulation and management needs to be developed to facilitate its further uptake. There is also a need for the development of technologies and information systems that can minimise the potential for adverse impacts on the system by R&DG, while maximising the efficient and effective contribution to energy supply from R&DG.

The need to deal appropriately with increased uptake of intermittent generation is a prime example. Increasing amounts of intermittent generation can create difficulties in scheduling and forecasting, particularly when constraints bind, which adversely affects the reliability and security of the network.

The WEPWG has examined this issue in relation to wind energy and its report, *Integrating Wind Farms into the NEM*, and identified a number of intermittency related issues, namely:

- that at high levels of penetration and when network constraints are binding, there is a need for a mechanism to manage the impact of intermittent generation on network flows, such as through a proposed semi-dispatch model;
- that wind farm modelling is required to determine system security implications for different levels of wind generation and the need for any special operating arrangements;
- that disclosure of non-scheduled generation data should be considered to enable market players to more readily adapt to, and plan for, increasing levels of non-scheduled generation;
- that all market generators, regardless of whether appropriate metering is installed, should contribute to the cost recovery of Regulation Frequency Control Ancillary Services; and
- that improved forecasting of wind generation is required to enable better system management.

The WEPWG is currently working with NEMMCO to progress these issues and introduce appropriate Rule changes, where necessary. The Australian Government committed funding to the development of a wind energy forecasting system in its June 2004 Energy White Paper, *Securing Australia's Energy Future*, and the Department of Environment & Heritage is working with NEMMCO and researchers to augment NEMMCO's wind energy forecasting capabilities.

Over the longer term, increasing levels of R&DG is likely to require the adoption of advances in network technology and development of a more active approach to system management and control that can manage intermittency and variation in supply across seasons and times of day; is capable of dealing with greater decentralisation of the power system; and can manage islanding. Such an evolution will enable the potential benefits of R&DG to be realised whilst ensuring system stability is maintained and avoiding the risk of stranded assets.

The development of more advanced energy storage technologies, over the longer term, will also help to manage intermittent generation. The Australian Government also committed funding to the development of more advanced energy storage technologies, to complement renewable energy generation in particular, in the Energy White Paper. The program will focus on the following priorities:

- On-grid, megawatt size storage for large wind energy systems;
- On-grid, kilowatt sized storage for household photovoltaic electricity systems; and
- Remote Area Power Supplies and other renewable electricity applications.

Within the distribution networks managed by NSPs, there may be no commercial incentive for NSPs to build knowledge and undertake research and development into more active network management, given the current structure of regulation applying to those businesses. The Australian Government's Solar Cities program, another Energy White Paper initiative, will provide a means of demonstrating alternative network management arrangements involving small solar generators and load management systems.

The Solar Cities trials, which will be conducted in at least four cities including Adelaide, over a period of seven years, will provide NSPs with operating, real-life examples of the contributions that photovoltaic power generators, smart metering, load management, and variable pricing systems can make to improve distribution network management. By doing so, it is hoped that NSPs will adopt the more effective network management systems that are expected to emerge from the trials.

5.2. Network Planning and Information

Issue: There are not sufficient levels of transparency in network planning information, particularly forecast future loads, constraints, and proposed augmentations. As a result, R&DG proposals are limited in their ability to identify business opportunities that could bring network management benefits because the data with which to calculate connection costs and benefits of DG options is not available in most cases.

Response:

- A Statement of Opportunities for generators and Annual National Transmission Statement within the NEM are released annually by NEMMCO.
- Some jurisdictions have established network development procedures that require NSPs to call for and transparently evaluate proposals for non-network solutions to constraint and network development needs (for example, NSW Demand Management COPEG).
- The URF has considered the issue of information disclosure in the context of connection negotiations as part of the development of a draft COPEG. The draft COPEG will need to be considered by the MCE in the context of the development of a national framework for distribution.

Comment Sought:
Comment is sought on the extent to which network planning information may be made more transparent and accessible.

Regulatory requirements relating to information disclosure as part of transmission and distribution network planning and development and distribution network connection negotiations currently vary between jurisdictions and in many cases may not provide adequate information on opportunities for R&DG project developers, including on technical and commercial issues that may highlight emerging network constraints. Wide release of information is important in delivering efficient and effective disaggregated planning and operation.

A significant amount of information is released about the wholesale generation and transmission sectors, where market forces and alternative providers are more established. A Statement of Opportunities for generators and an Annual National Transmission Statement are released every year by NEMMCO. Equivalent opportunities are not yet always published in distribution networks for R&DG and demand management schemes. NSPs may have some concerns over disclosure of certain information due to customer confidentiality requirements.

Insufficient consideration of DG in network planning and development could be managed by requiring NSPs to publish planning information,[19] transparently assessing whether emerging constraints could be addressed through non-network solutions such as DG and, if appropriate, seeking and evaluating proposals for such solutions from the market.[20] NSPs could also be required to make standing offers to purchase demand reduction under standard contracts, performance requirements, and prices.

Provision of network information may help ensure appropriate and transparent consideration and use of DG options in network planning and development, and help to build understanding and capacity on the part of distribution businesses and DG proponents.

[19] This may include appropriately specific information on upcoming network investment priorities, load data and network constraint information and hot spot maps.
[20] A number of jurisdictions have already introduced such requirements e.g. *Demand Management for Electricity Distributors: NSW Code of Practice* (September 2004)

In addition, network information about available and anticipated future capacity at potential connection points and the technical characteristics of supply and demand in those locations may assist electricity supply projects (as opposed to service supply projects) identify sites and/or size developments in a way that ensures an appropriate quantity and quality of grid access is available (and is likely to be into the future).

Network information is also important in the context of network connection negotiation, particularly in relation to the basis for calculating connection costs and returns for network benefits provided by DG.

5.3. Strategic Network Development

Issue: Current arrangements support incremental rather than optimised planning of network development. This may lead to sub-optimal deployment of R&DG assets.

Response:

The MCE, through the WEPWG, has previously identified this as an economic rather than technical issue which largely affects the development of wind generation. It noted that the issue remains a policy matter for individual jurisdictions.

Comment Sought:
Comment is sought on further possible work to identify mechanisms that could better enable the optimisation of shared network assets during the initial design phase as part of the development of a national transmission planning approach already being progressed through the MCE reform agenda

Current arrangements support the development of network connection assets for each generation project individually. However, development of the network in this manner may lead to the economically sub-optimal development of the network where a number of generation projects are ultimately clustered in the same area. It may also inhibit 'pioneering' generation investment, particularly in wind farms, because it may require the initial developer in a region to pay the full cost of extending/augmenting the network, while subsequent developers in the same region can connect to and utilise the extended network at a much lower cost. Development in this manner can also lead to a situation where the capacity of connection assets is insufficient and it is necessary to limit network access.

The WEPWG report, *Integrating Wind Farms into the NEM*, recognised this as an issue affecting the optimal development of wind generation connections to the network through shared assets. WEPWG noted that, while not specific to R&DG, this issue was particularly relevant to wind energy. Most importantly, WEPWG noted that this was an economic policy issue, rather than a technical issue. Measures which go beyond the Regulatory Test[21] to encourage transmission network development in strong wind areas are a policy consideration for governments.[22]

[21] The Regulatory Test requires that the benefits to *energy market participants* outweigh the costs of the proposed network augmentation/development. The Test therefore does not consider benefits and costs accruing to those outside of the energy market nor unpriced environmental and social benefits and costs.

[22] The Victorian Government has introduced modified distribution price regulation rules and government grants to address this issue – see *Electricity Industry (Wind Energy Development) Act 2004* and Wind Energy Support package.

5.4. Reliability of Renewable and Distributed Generation

Issue: NSP concerns about the reliability of R&DG may be a barrier to active uptake.

Response:

- The industry may wish to consider the merits of publishing educational materials and case studies on DG technologies and the potential benefits of its use.
- The Australian Government's Solar Cities program will fund a number of demonstration projects around Australia that will provide NSPs with experience and understanding of the performance of small solar generators in combination with other measures.
- The URF has developed a draft COPEG which will consider risk allocation between NSPs and distributed generators through provisions for dealing with non-conformance in network support contracts. The draft COPEG will need to be considered by the MCE in the context of the development of a national framework for distribution.

Comment Sought:

Comment is sought on further work to examine the allocation of responsibility for network reliability in service standards and network pricing regulations applicable to R&DG.

Concerns regarding the reliability of R&DG have impacted their ability to be considered and valued as a generator in the market. Some of the concerns have arisen due to the immaturity of the market for DG services and the limited understanding and experience by NSPs of R&DG. Concerns about reliability are both actual and perceived. Perceived risks can be addressed through education and experience. Actual risks can be managed through the appropriate allocation of responsibility for network reliability, for example in the non-compliance terms of network support agreements or through exemptions (in relation to DG) from the service incentive provisions of network pricing determinations.

Understanding and experience can be built through the publication of case studies and other educational materials as well as demonstration projects such as those that will be funded through the Australian Government's Solar Cities program. NSPs could also be funded through regulated revenue to build capacity and undertake trial and learning-by-doing exercises.[23]

5.5. Reliance on Distributed Generation

Issue: Reliance on DG can potentially reduce system reliability.

Response:

This is not considered to be an issue of serious concern to the MCE and, to the extent it might apply, would be addressed through generator/customer contractual arrangements on reliability of supply, and through network management and planning processes.

Where local network capacity is approaching, or at constraint, and DG displaces network augmentation, DG consumers may become exclusively dependant on the generator, as back-up supply from the grid may not be possible at times of critical load. Hence, maintenance and shutdowns of the generator may actually reduce system reliability for those customers and others in the region. Additionally, if the DG is owned by the site, and the business fails or decides to move or shut down the plant, other customers in the region will be affected.

[23] The *2005-10 Electricity Distribution Price Determination* of the Essential Services Commission of South Australian provides ETSA with an allowance for such activities.

For example, suppose an industrial site requires an additional 100kVA in a region where the maximum network capacity is already committed. The site owner decides not to pay a significant augmentation charge to upgrade the network but that a more economic alternative would be to install a DG to supply to the site and other customers in the region. However, at times of generator maintenance, the infrastructure in the region may not be able supply additional power to the development and other customers reliant on the DG due to network constraints.

While the above outcome may be theoretically possible in certain circumstances, it is considered highly unlikely for the following reasons:

- The decision to favour DG over network augmentation would include the need for (and cost of) back-up supply for the DG;
- Where DG back-up was considered unnecessary and the site owner was prepared to accept loss of power at times of shut down, it is unlikely that they would be able to enter into commercial arrangements to supply other customers without such back-up provisions (where continuity of supply was critical for those customers); and
- It is unlikely that a region would be allowed to remain in such constraint conditions over a lengthy period of time.

It is therefore considered that, to the extent that this issue could potentially apply, it will be addressed through generator/customer contractual arrangements on reliability of supply, and through network management and planning processes.

5.6. Treatment as Negative Load

Issue: Treatment of exported distributed and non-market generation as negative load can distort market data.

Response:
This is not considered to be an issue which affects the uptake of R&DG in the NEM. NEMMCO has agreed to work with industry on information disclosure provisions for non-scheduled generation data and are also investigating options for a semi-dispatch model for non-scheduled generators which, along with appropriate metering, will provide better market data on these forms of generation. The AEMC is currently considering a proposed rule change on publication of non-scheduled generation information.

Exported DG and generation from non-scheduled generators, such as some wind farms, are outside of the NEM wholesale market. As such, their contributions are treated as negative load (i.e. subtracted from the market defined load) and so are not included in the overall generation profile of the network. As these forms of capacity increase, market data may become increasingly distorted, which can have subsequent impacts on price and demand data, making them less accurate.

Inaccurate market data can adversely affect the processes which rely on this data, such as conclusions and decisions required for network planning and system management. In addition, it results in R&DG treated as sales outside the NEM, reducing its potential to capture benefits through greater output at times of peak load.

While this issue could become significant at high levels of R&DG, it is not a barrier which affects the uptake of R&DG. Rather it is a product of the manner in which generation in the current system is

recorded and managed. It is also not clear that this is an issue that is currently of significant impact or likely to be so in the short to medium term.

NEMMCO has agreed to progress the disclosure of non-scheduled generation data in consultation with industry as well as investigating options for the development of a model for semi-despatch generation for current large scale non-scheduled generators. This, in conjunction with appropriate metering arrangements, will assist in network management and allow greater participation by R&DG in the NEM price market.

5.7. Reserve Capacity

Issue: At significant levels of penetration, intermittent generation may affect the assessment of the need for reserve capacity and require additional conventional and peaking generation as back-up.

Response:

- This is not considered to be a pressing issue for the management of the network. Through its existing powers under the NEL and Rules and on a continual improvement basis, NEMMCO is able to incorporate wind generation reliability into reserve capacity assessments.
- Consideration of the reliability of wind generation in terms of network augmentation is a matter for proponents to address and justify on a case-by-case basis.

Transparent assessment of the supply and demand balance in the NEM is required to induce appropriate investment in generation and also for NEMMCO to contract for reserve plants (through conventional generation) in the event that medium term reserves are insufficient. At significant levels of system penetration, the variability and non-scheduled nature of intermittent generation can impact on its reliability and therefore its ability to contribute to meeting NEM forecast demand. This uncertainty could impact NEMMCO ability to assess the need, and contract, for reserve capacity. At these levels of penetration, the construction of new additional conventional reserve and use of more expensive peaking generation may also be required to respond to fluctuations in supply and demand caused by intermittent generators. Price distortions are likely to result in such instances.

This issue has been considered by WEPWG, which concluded that at the present time, the incorporation of wind generation reliability into reserve capacity assessments can be undertaken by NEMMCO within its existing powers under the Rules and through NEMMCO internal procedures on a continual improvement basis. Similarly, the way in which the reliability of wind generation is considered in terms of network augmentations is a matter for proponents to address and justify on a case-by-case basis.

APPENDICES

Appendix A

Ministerial Council on Energy Working Groups and Processes

Renewable and Distributed Generation

The Renewable and Distributed Generation Working Group (RDGWG) will provide strategic advice to the Standing Committee of Officials (SCO) on policy directions required for removing impediments to, and promoting the commercial uptake of R&DG technologies in the Australian energy market. The MCE/SCO requested that the RDGWG will undertake the following priority tasks:

- Monitor and assess energy market-related activities on R&DG across jurisdictions and identify potential administrative, regulatory and other barriers to their increased uptake.
- Prepare an Issues Paper setting out those issues and considerations of importance to the uptake of R&DG technologies within the energy market.
- As directed by SCO, provide strategic advice on actions required to address specific impediments to and facilitate the uptake of R&DG technologies.

In accordance with this request, it has produced this discussion paper and coordinates the following workstreams:

- *Embedded Generation*
  In response to a request from the MCE Standing Committee of Officials, the URF has developed a draft COPEG through its Embedded Generation Working Group.

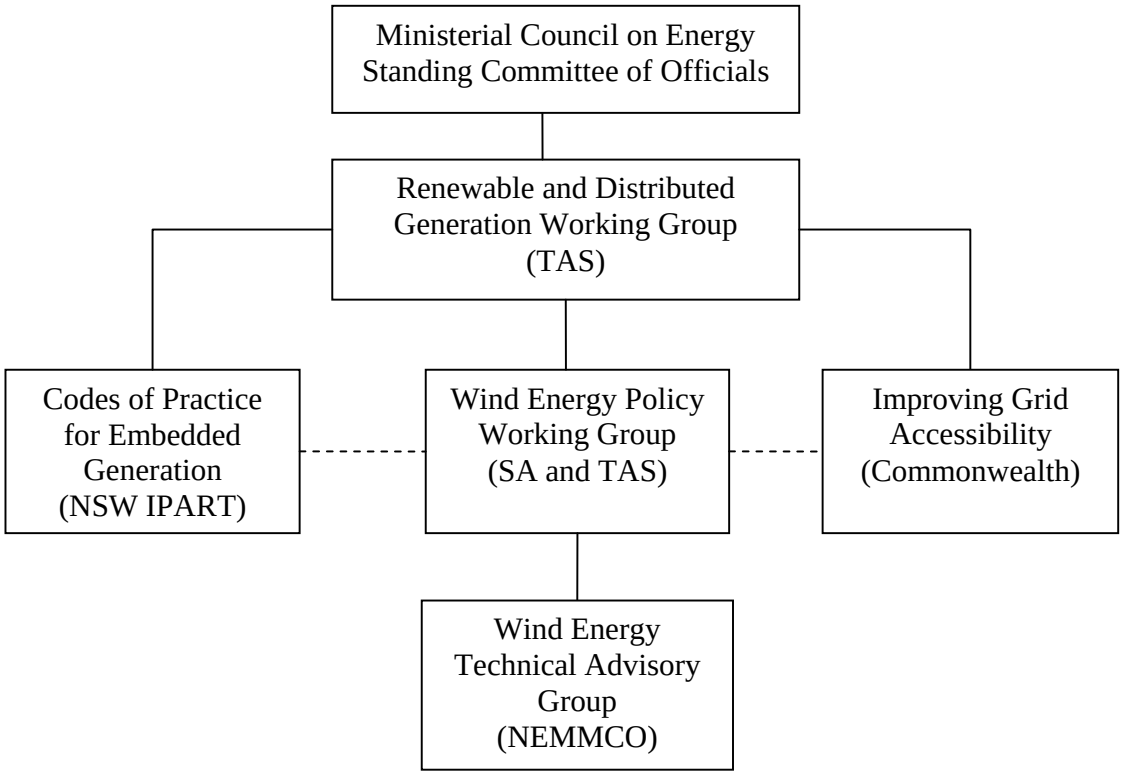
  The Code will primarily deal with procedural issues associated with the network connection of embedded generation. Issues it is likely to cover are detailed in this discussion paper and include:
  - protocols for connection negotiations and information disclosure;
  - methodologies for calculating and requirements for sharing the value of network benefits provided by R&DG; and
  - requirements relating to the calculation and payment of connection costs;

  A consultant has prepared a draft report and Code which is expected to be released for public comment and provided to the URF by November 2005, with a final report by early 2006. The draft COPEG will then be submitted to the MCE for consideration in the context of the broader energy market reform program, which may affect the way it is carried forward.

- *Wind Energy Policy*
  The WEPWG is working to provide advice, information, and recommendations to the Renewable and Distributed Generation Working Group on issues related to intermittent electricity generation into the National Electricity Market. The Wind Energy Technical Advisory Group, with industry representation, was formed to assist the policy group with the analysis of technical matters.

A report by the Technical Advisory Group, *Integrating Wind Farms into the NEM*, was released for public comment in May 2005 and the WEPWG is currently working with NEMMCO to implement the recommendations of the report.

- *Improving Grid Accessibility*
  The Improving Grid Accessibility (IGA) initiative is an Australian Government commitment outlined in the Energy White Paper, *Securing Australia's Energy Future*. It involves working with the States and Territories through the Ministerial Council on Energy (MCE) to identify and address the impediments to R&DG. The initiative has been brought under the auspices of the RDGWG. This work program will take forward actions identified in this paper, which are not being addressed elsewhere.



National Energy Market Reform

In 2003, the Ministerial Council on Energy agreed to a package of reforms to Australia's energy market covering the following workstreams:

- *Governance and Institutions*
  The Governance and Institutions workstream provides information on legislative and regulatory arrangements, and undertakes work to develop the industry levy, the AEMC and the AER.

  The AER and the AEMC have been established.

- *Economic Regulation*
  The key activity under the Economic Regulation work stream is the development of a National Framework for Electricity and Gas Distribution and Retail Regulation, which is a

key component of the energy market reform package announced in the December 2003 MCE report to COAG, *Reform of Energy Markets*.

All states and territories, except WA, have agreed to transfer their retail and distribution regulatory functions, other than retail pricing, to the AER. Distribution pricing regulation is scheduled to be transferred to a national framework by the AEMC. Both are expected to be enabled by no earlier than 1 January 2007.

- *Electricity Transmission*
  The Electricity Transmission workstream provides information on the transmission work program under the categories of transmission planning and network investment, regional structures and network performance, and economic regulation. The December 2003 MCE report to COAG, *Reform of Energy Markets*, announced a number of transmission-related reforms in the areas of network planning, the regulatory test, transmission pricing regulation, and congestion management.

  The Chapter 6 Transmission Pricing review, conducted by the AEMC, is expected to commence by the end of 2005.

- *User Participation*
  The User Participation workstream provides information on improving user participation and further developing consumer advocacy arrangements in the Australian energy market. This group is currently developing an action plan to identify and remove regulatory, market and technical barriers to demand-side response. It is also investigating the potential role alternative market arrangements may play in promoting demand-side response.

  Many of the barriers to demand-side management are also barriers to DG. A work program for demand side response is expected to be in place by the end of 2005.

- *Gas Market Development*
  The Gas Market Development workstream provides information on the expanded gas market program and the development of gas market principles.

  A market development plan working group is expected to be established and operational by the end of 2005.

Energy Efficiency

The Energy Efficiency Working Group advises on the performance of Australia's end-use energy efficiency policies and programs, including information available to consumers. Currently, the Energy Efficiency Working Group is addressing:

- Implementation of the National Framework for Energy Efficiency package of measures including energy efficiency programs for appliances and equipment, energy efficiency standards for buildings, and energy efficiency measures across the commercial, government and industrial sectors;
- The MCE's Indigenous Action Plan, and
- Coordination of trade related trans-Tasman energy efficiency policies and programs.

An examination of options for the National Framework for Energy Efficiency stage two will take place after the final report of the PC enquiry into energy efficiency has been considered. A case study of energy services in indigenous communities is expected to be complete by July 2006.

Energy Security

In April 2004, the Ministerial Council on Energy agreed to establish a new Energy Security Working Group with ongoing responsibility for managing the National Liquid Fuel Emergency Response Plan and developing emergency response protocols for the gas sector.

- *National Gas Emergency Response Protocol*
  MCE is developing an emergency response protocol for the natural gas sector to be applied in the event of major supply interruptions.

  A report on protocol implementation is expected to be delivered by October 2005.

- *National Oil Supplies Emergency Committee (NOSEC)*
  NOSEC is the main executive channel through which Australian Governments, in cooperation with industry, formulate the overall management response to a widespread fuel shortage. NOSEC reports to the Ministerial Council on Energy and comprises officials from the Australian Government, the State and Territory Governments and the oil industry.

  Further development of the National Liquid Fuel Emergency Response Plan is expected to be complete by the second quarter of 2006.

Appendix B

Key Studies on Barriers to Distributed and Renewable Generation

Alternative Technology Association, *Impediments to Grid Connection of Solar Photovoltaics: The Consumer Experience*, May 2005

Australian Business Council for Sustainable Energy, *The Australian Photovoltaic Industry Roadmap*, June 2004

Australian Cogeneration Association, *Removing Impediments to Cogeneration and Renewable Generation in the National Electricity Market*, June 2000

Australian Wind Energy Association, *The Cost Convergence of Wind Power and Conventional Generation in Australia*, June 2004

Charles River Associates, *Codes of Practice*, February 2004

Charles River Associates, *Distribution Network Barriers to Embedded Generation*, October 2002

Charles River Associates, *Information Paper: Embedded Generation in South Australia*, 2003

East Cape (for the Independent Pricing and Regulatory Tribunal), *Efficient Network Pricing and Demand Management*, February 2002

Essential Services Commission of South Australia, *Embedded Generation: Issues Paper*, November 2003

Independent Pricing and Regulatory Tribunal, *Distributed Generation Discussion Paper*, March 2002

Independent Pricing and Regulatory Tribunal, *Inquiry into the Role of Demand Management and Other Options in the Provision of Energy Services: Final Report*, October 2002

PB Associates, *Arrangements for the Connection of Embedded Generation: An Interjurisdictional Status Report*, July 2005.

Sinclair Knight Merz, *Distributed Electricity Generation Scenario Study*, October 2002

Wind Energy Technical Advisory Group, *Integrating Wind Farms into the NEM*, January 2005

Appendix C

Stakeholder Submissions and Case Studies on Barriers and Impediments to Renewable and Distributed Generation

Submissions

Australian Business Council for Sustainable Energy
Australian Wind Energy Association
Centre for Distributed Energy and Power, CSIRO
Energy Networks Association
Energy Users Association of Australia
Renewable Energy Generators Association

Case Studies

Royal Adelaide Hospital – cogeneration project
- capital cost

Coopers Brewery – cogeneration project
- project revenue risk

Beasley Industries – solar hot water systems
- technology commercialisation

Solaris Technology – photovoltaic
- generation costs, development controls, accredited installers and maintenance services, technical standards and guidelines

LMS Gas Energy Power – landfill gas
- generation costs, access to network capacity

Energy from animal wastes projects
- capital costs, intermittency/variations in supply, environmental planning regulation, connection costs, design and operating standards

Residential, housing development and school photovoltaic projects
- connection and buy-back terms and conditions, metering requirements, connection processes, connection costs

Hydro Tasmania – wind farm
- identification of appropriate sites, environmental approvals processes and requirements, network connection, technical standards, generation licensing

Wind Corporation Australia Limited – wind farms
- technical standards, contribution to peak load, financial returns, load control, network losses, connection charges, reliability, pricing methodologies, shared connection assets

Appendix D

National, State and Territory Renewable and Distributed Generation Initiatives

A supplementary document with overviews and details of each of the following programs is available at www.mce.gov.au under Renewable and Distributed Generation.

Australian Government

- Mandatory Renewable Energy Target (MRET)
- Low Emissions Technology Demonstration Fund (LETDF)
- Solar Cities Program
- Renewable Energy Development Initiative (REDI)
- Advanced Electricity Storage Technologies
- Wind Energy Forecasting Capability
- Photovoltaic Rebate Programme (PVRP)
- Renewable Energy Commercialisation Programme (RECP)
- Renewable Energy Equity Fund (REEF)
- Renewable Remote Power Generation Programme (RRPGP)
- Renewable Energy Action Agenda (REAA)

State and Territory Renewable Energy Initiatives

- Green Power

Australian Capital Territory

- Greenhouse Gas Abatement Scheme
- Wind Farming
- Government Electricity Contract
- ACT Energy Wise

New South Wales

- NSW Government Purchase of Green Power
- Solar in Schools
- Wind Energy Information and Data
- Sustainable Energy Resource Assessments and Information
- BASIX
- Australian Building Greenhouse Rating Scheme
- NSW Greenhouse Gas Abatement Scheme
- Minimum Performance Standards for NSW Government Offices under the Australian Building Greenhouse Rating Scheme
- Energy Smart Home Rating Scheme / National Australian Built Environment Rating System
- National Emissions Trading Scheme
- State Based Increase to the Mandatory Renewable Energy Target
- Energy Directions Statement White Paper
- NSW Greenhouse Strategy

Queensland

- Solar Cities Trial ($5 Million Package)
- Green Energy Purchase Program

- Queensland Sustainable Energy Innovation Fund
- Centre for Low Emission Technology
- Geo-thermal Exploration Act
- 13% Gas Scheme

South Australia
- Solar Hot Water Rebate Scheme
- Renewable Energy Target: State Strategic Plan
- Solar Schools Program
- South Australia's Sustainable Energy Research Advisory Committee (SENRAC)
- Biodiesel use by metro trains and buses

Tasmania
- Residential Remote Area Power Supply (RAPS)
- Bass Strait Islands Solar Hot Water Trial
- Tasmanian Hydrogen Stakeholders Network (THSN)

Victoria
- Renewable Energy Strategy
- State-Based Mandatory Renewable Energy Target Scheme
- Renewable Energy Support Fund
- 10% Government Green Power purchase
- Centre for Energy and Greenhouse Technologies
- Green Power Promotion and Awareness Campaign
- Solar Hot Water Rebate
- Victorian Solar Innovation Initiative
- 5 Star Standard for new homes
- Information on Victoria's renewable energy resources
- Geothermal Energy Resources Act
- Policy and planning guidelines for development of wind energy facilities in Victoria
- Victorian Wind Atlas
- Wind Energy Development Act

Western Australia
- Renewable Energy Target of 6 per cent by 2010
- Government purchase of renewable energy
- Renewable Energy Production Subsidy
- Funding Support for Innovative Renewable Energy Projects
- Solar Water Heater Subsidy
- Sustainable Energy Development Office (SEDO) Grants Committee
- Solar Schools Program
- Electricity Reform
- Renewable Energy Strategy
- Bioenergy Strategy
- Renewable Energy Advocacy
- Planning Bulletin No. 67 – Guidelines for Wind Farm Development

Appendix E

Renewable Energy Sources
Listed in the
Renewable Energy (Electricity) Act 2000

Hydro

Wind

Solar

Bagasse co-generation

Black liquor

Wood waste

Energy crops

Crop waste

Food and agricultural wet waste

Landfill gas

Municipal solid waste combustion

Sewage waste

Geothermal – aquifer

Tidal

Photovoltaic and photovoltaic Renewable Stand Alone Power Supply systems

Wind and wind hybrid Renewable Stand Alone Power Supply systems

Micro hydro Renewable Stand Alone Power Supply systems

Solar hot water

Co-firing

Wave

Ocean

Fuel cells

Hot dry rocks