



WIND GENERATION LICENSING STATEMENT OF PRINCIPLES

SEPTEMBER 2005

ELECTRICITY

Public Information about ESCOSA's activities

Information about the role and activities of the Commission, including copies of latest reports and submissions, can be found on the ESCOSA website at www.escosa.sa.gov.au.

TABLE OF CONTENTS

Glossary of Terms	iii
1. Introduction	1
1.1. Operation of Wind Generators in the NEM – Current Rules	2
1.2. Commission response to increase in Wind Generation Licence Applications	4
1.3. Draft Statement of Principles for Wind Generation Licensing	5
1.4. Final Statement of Principles for Wind Generation Licensing	5
2. The ESIPC Report	9
2.1. General Character and Variability of Wind Energy	9
> 30 minute variability	10
< 30 minute variability	10
2.2. Potential Impacts on Power Quality	11
2.3. Potential Impacts on System Security and Reliability	11
2.3.1 Connection Arrangements and Technical Standards	11
2.3.2 Operation and Management of the Power System	13
2.4. Potential Impacts on Price	15
2.5. Summary of Conclusions from the ESIPC Report	16
Recommendation 1: Appropriate technical standards	16
Recommendation 2: State of the art wind energy forecasting	16
Recommendation 3: Optimised dispatch of non-scheduled generation	16
Recommendation 4: Proper cost allocation and market design measures	16
2.6. Stakeholder views on the ESIPC report	16
2.7. Wind Energy Technical Advisory Group	20
3. ESIPC Recommendations and the Legislative Framework	21
3.1. Electricity Act	21
3.2. ESC Act	22
3.3. Other considerations	23
3.4. Attainment of the Commission's Objectives	23
3.4.1 Primary Objective	23
(i) The price of electricity supply	23
(ii) The quality of electricity supply	25
(iii) The reliability of electricity supply	25
3.4.2 Subsidiary Objectives	26
3.5. Other Issues	27
3.5.1 Distribution vs transmission connected wind generators	27
3.5.2 Geographical Location	27
3.6. Impacts of the ESIPC report on the Commission's objectives	28



4. Implementation of ESIPC recommendations	31
4.1. Implementation Options	31
4.2. Assessing the Options	31
4.2.1 Option 1	31
4.2.2 Option 2	32
4.2.3 Option 3	32
4.3. The Commission's power to impose licence conditions	32
5. Conditions	35
5.1. Preconditions	35
5.1.1 Requirement for connection agreement	36
5.1.2 Demonstrated capacity to meet technical standards	37
5.1.3 Other conditions precedent	39
5.1.4 Conclusion on preconditions	40
5.1.5 Licensing Principle 1	40
5.2. Licence conditions	40
5.2.1 Technical standards	40
5.2.1.1 Fault ride through	42
5.2.1.2 Reactive power	43
5.2.1.3 Data to NEMMCO	44
5.2.1.4 Control equipment operation	45
5.2.1.5 Application of technical standards to small generators	45
5.2.1.6 Licensing Principle 2	45
5.2.2 Optimised Dispatch	47
5.2.2.1 Background	47
5.2.2.2 Submissions	50
5.2.2.3 Conclusions on scheduled requirement	51
5.2.2.4 Licensing Principle 3	51
5.2.3 Wind Energy Forecasting	52
5.2.3.1 Background	52
5.2.3.2 Submissions	53
5.2.3.3 Conclusions on forecasting	54
5.2.3.4 Licensing Principle 4	54
5.2.4 Cost Allocation	55
5.2.4.1 Background	55
5.2.4.2 Submissions	56
5.2.4.3 Conclusion on cost allocation	57
5.3. Existing Wind Generation Licensees	58
5.4. Other issues	59
5.5. Summary of Principles	60
5.6. Transitional nature of licence conditions	62
6. Next Steps	65

GLOSSARY OF TERMS

AEMC	Australian Energy Market Commission, established under section 6A of the <i>Trade Practices Act 1974 (Cth)</i>
AGC	Automatic Generator Controls
AGO	Australian Greenhouse Office
COMMISSION	The Essential Services Commission of SA, established under the ESC Act
ELECTRICITY ACT	<i>Electricity Act 1996 (SA)</i>
ESC ACT	<i>Essential Services Commission Act 2002 (SA)</i>
ESCOSA	The Essential Services Commission of SA, established under the ESC Act
ESIPC	Electricity Supply Industry Planning Council
FCAS	Frequency Control Ancillary Services
kV	Kilovolt
kVA	kiloVolt ampere
MCE	Ministerial Council on Energy
MRET	Mandatory Renewable Energy Target
MW	Mega Watt
NCA	Network Connection Agreement
NEC	National Electricity Code
NECA	National Electricity Code Administrator
NEM	National Electricity Market
NEMMCO	National Electricity Market Management Company
NER	National Electricity Rules
NSP	Network Service Provider
PASA	Projected Assessment of System Adequacy
PoE	Probability of Exceedence
SA	South Australia
TCA	Transmission Connection Agreement
VAR	A unit of electrical power in an AC circuit equal to the power dissipated when 1 volt produces a current of 1 ampere
WETAG	Wind Energy Technical Advisory Group

1. INTRODUCTION

One of the functions of the Commission, under section 5(1)(a) of the *Essential Services Commission Act 2002* (the ESC Act), is the licensing of entities carrying on operations (generation, transmission, distribution and system control) within the South Australian electricity supply industry.

As at 30 June 2004, sixteen electricity generators had been issued with generation licences by the Commission, authorising operations in South Australia.¹ The total installed name-plate capacity of those generators was 3,454 MW (noting, however, that the capacity does not include the capacity of non-dispatched generators, such as wind generators, as those generators are regarded as reductions in demand for the purposes of the National Electricity Market).²

In its 2003-04 Annual Performance Report, the Commission identified that one of the emerging licensing issues for 2004-05 was an expected increase in applications for generation licences authorising the operation of wind generators in South Australia. That increase was attributed, in part, to the Federal Government's Mandatory Renewable Energy Target (MRET) scheme, which requires electricity retailers to source specified amounts of their electricity purchases from renewable energy sources.

As anticipated, since November 2004 the Commission has received a significant number of generation licence applications pursuant to Part 3 of the *Electricity Act 1996* ("Electricity Act") from wind generator proponents in South Australia.³

As at 30 November 2004, the Commission had approved the licensing of seven wind generators, with a total capacity of about 450 MW. Therefore, adding the wind generation capacity to the total installed name-plate capacity for dispatched generators, there was approximately 3,900 MW of licensed generation capacity in South Australia by the end of November 2004. That is to say, approximately one eighth of South Australia's licensed generation capacity at that time came from non-conventional sources.

In addition to the currently licensed wind generators however, an additional eleven licence applications have been received for generation licences for wind generators since November 2004, with a total installed capacity of an additional 1,260 MW.⁴ Table 1 and Figure 1 provide summary details of the wind generators already licensed and those for which licence applications are pending. Detailed information about each application is available from the Commission website, www.escosa.sa.gov.au.

¹ Essential Services Commission, *2003-04 Annual Performance Report*, November 2004, Table 1, page 14.

² Electricity Supply Industry Planning Council, *Annual Planning Report*, June 2004, page 38.

³ An application for licence is considered to have been formally made once the requirements under s.16(1), (2) of the Electricity Act are satisfied.

⁴ One of these relates to an application to vary an existing licence (i.e. that for Lake Bonney WindPower) to increase the capacity for which the wind generator has already been licensed from 80 MW to 240MW.



Were those wind generators all to be issued with licences, the total installed generation capacity in South Australia would rise to approximately 5,100 MW, with approximately 1,700MW of that total amount (or roughly one-third) being attributable to wind generators.

Ordinarily, the introduction of new generation capacity into South Australia would not present any issues, from a licensing perspective, for the Commission. However, the nature of wind generators, as compared with conventional coal or gas-fired generators, does present particular licensing issues for the Commission.

To better understand the issues facing the Commission in respect of the licensing of wind generators, it is appropriate to briefly outline the manner in which wind generators currently operate within the National Electricity Market (NEM).

1.1. Operation of Wind Generators in the NEM – Current Rules

While it is the Commission's role to authorise a generator to carry on generation operations in this State, the actual operations of the generator must generally be carried out in accordance with the requirements of the National Electricity Rules (NER).⁵ Those requirements were established in the late 1990's (in the then National Electricity Code), following the commencement of the NEM, and while generally regarded to be "technology neutral", were not conceived with regard to a large amount of wind generation capacity being installed.

Clause 2.2.1(a) of the NER establishes a requirement for a person owning, controlling or operating a generating system that supplies electricity to a transmission or distribution network to register with NEMMCO as a generator. This requirement applies regardless of the energy source being used by the generating system. Significant penalties apply if such operations are carried on without the operator being registered.⁶ In registering with NEMMCO as a generator, a person must classify each generating unit as a *scheduled* (clause 2.2.2) or *non-scheduled* (clause 2.2.3) generator, and as a *market* (clause 2.2.4) or *non-market* (clause 2.2.5) generator. NEMMCO regularly publishes a list of registered generators in the NEM, including the classification of each into the above categories.⁷

In general, a generating unit with nameplate rating of 30 MW or greater is to be classified as a scheduled market generator and hence is required to be operated in accordance with the co-ordinated central dispatch process operated by NEMMCO under the provisions of Chapter 3 of the NER. This means that the generating unit must bid its generation capacity for each trading period into the NEM, and is subsequently dispatched by NEMMCO in order to match the demand on the system. This process ensures optimal dispatch of generation whilst maintaining the security of the power system.

⁵ The National Electricity Rules (NER) replaced the former National Electricity Code (NEC) on 1 July 2005.

⁶ Refer Part 2 of Schedule 1 (The National Electricity Law) of the *National Electricity (South Australia) Act 1996*.

⁷ Refer http://www.nemmco.com.au/registration/mo_rq044v215.pdf

At present, however, wind generators are not classified as scheduled generating units within the NEM. Instead, wind generators operate as non-scheduled generating units. Non-scheduled generating units are generators typically with nameplate rating less than 30 MW, and do not participate in NEMMCO's central dispatch process; non-scheduled generating units simply generate electricity as they determine.

While it is generally the case that the criteria for classification as a non-scheduled generator is a nameplate rating of less than 30 MW, a person may apply to NEMMCO to approve classification of a generating unit with nameplate rating greater than 30 MW as non-scheduled if, for example, the physical and technical attributes of the relevant generating unit are such that it is not practicable for it to participate in central dispatch, or if the output of the generating unit is intermittent. At present, all operating wind generators have a non-scheduled classification on that basis.⁸ The Commission notes that when the NER were devised the proposed amount of unscheduled wind generation capacity proposed for South Australia was not envisaged.

A market generating unit is one for which the generation output is not purchased in its entirety by the "local retailer" as defined in the NER (the local retailer for SA is AGL SA Pty Ltd) or by a market customer located at the same connection point.⁹ A market generator must sell its generation output through the wholesale (spot) market operated by NEMMCO under the provisions of Chapter 3 of the NER. A non-market generator, for which generation output is purchased in its entirety by the local retailer or by a market customer, does not participate in market settlements. Operating wind generators have adopted market (e.g. Starfish Hill, Cathedral Rocks, Wattle Point) and non-market (e.g. Canunda) classifications.

It is also to be noted that electricity generators are either synchronous or asynchronous in nature. Large conventional generators are normally synchronous machines which lock themselves to the frequency of the power system when generating. Many wind turbine generators are asynchronous, or induction, generators whose characteristics are not as supportive of the power system. In recognition of the difficulties in integration of larger amounts of simple induction generators into power grids worldwide, wind turbine manufacturers have developed more sophisticated generators (doubly fed induction generators and synchronous-synchronous designs) incorporating power electronics. The technical standards in the NER do not deal properly with asynchronous generators or these newer variants.

The effect of the intermittent nature of wind generators (that is, they generate electricity only when the wind blows rather than in response to market needs), and the classification of wind generators connected to the NEM as non-scheduled, is that the output of such generators is not treated by the NEM as generation capacity per se, but rather as "negative demand". That is to say, for the purposes of establishing system security and

⁸ see www.nemmco.com.au/operating/participation/044.htm.

⁹ There are no South Australian market customers operating in the NEM.



settling the market, NEMMCO regards the output of wind generators as being reductions in demand on the system.

In overall terms, therefore, while there are acknowledged environmental benefits arising from the installation of wind generators, the nature of the output of those generators (asynchronous, non-dispatched) as compared with the requirements of the entire electricity network is such that when the proportion of wind generation within the network rises, questions arise as to the impacts of that wind generation.

This is particularly so in light of the current rules of the NEM, as established through the NER. As discussed above, the present NER was conceived on a basis that did not envisage significant amounts of wind generation within the NEM, and therefore does not cater for that circumstance.

The Commission understands that NEMMCO is presently investigating the impacts of wind generation, and exploring possible changes necessary to the NER to respond to wind generation capacity increases.

1.2. Commission response to increase in Wind Generation Licence Applications

The nature of wind generator output, combined with the lack of definitive regulatory controls at the NEM level, and the dramatic increase in the number of electricity generation licence applications by wind generator proponents means that the Commission, acting in accordance with the imperatives of the statutory licensing regime, is not in a position to treat wind generation licence applications in the same way as other, more conventional, generation licence applications which are not attended by the same concerns in relation to network impacts. That is to say, within the legislative framework established under the Electricity Act, there are grounds to regard wind as different to other generation licence applications: at present the Commission cannot apply the same “rules” and still meet its statutory obligations.

Therefore, in November 2004, the Commission issued a public statement expressing concern about the potential network, power system and market impacts associated with a large level of wind generation capacity in the SA power system.

It indicated that any new generation licence applications associated with wind generators would be referred to the Electricity Supply Industry Planning Council (“ESIPC”) for advice about such impacts. All subsequent wind generation licence applications have been referred to ESIPC.

The Commission sought general advice from ESIPC on:

- ▲ the impacts that the proposed wind generators developments might have on the achievement of the Commission’s principal objective under the ESC Act, i.e. on the long term interests of SA consumers with respect to the price, quality and reliability of electricity;

- ▲ the impacts that the proposed developments might have on the electricity market, market prices, network operations and system security; and
- ▲ whether there were any limits to the amount of wind generation capacity that could be developed in particular regions, having regard to transmission line capacity and diversity.

The Commission received a report from ESIPC on this matter on 6 April 2005.

1.3. Draft Statement of Principles for Wind Generation Licensing

On 17 June 2005, the Commission released a Draft Statement of Principles for Wind Farm Licensing for a seven week period of consultation.¹⁰

That Draft Statement summarised the findings of the ESIPC report, which, in broad terms concluded that there are significant risks associated with the introduction of large amounts of wind generation to the South Australian market at present, but also noted that there may be ways in which system operations could be changed in the future which would accommodate wind generation.

Based on those findings, the Commission prepared a set of principles (as contained in the Draft Statement) that it considered could provide an interim solution to the difficulties identified by ESIPC, leading to the granting of additional licences authorising wind generation in South Australia in the short term.

Importantly, the Commission stressed that any such principles are only intended to be a transitional measure for addressing the difficulties identified by ESIPC. Any final solutions should necessarily be implemented on a market-wide basis through a vehicle such as the NER. Nevertheless, on the basis that there are not presently any such final solutions in place, the draft principles developed by the Commission were designed to allow the introduction of wind generators in South Australia while preserving system and market integrity until such time as market-wide solutions are established.

1.4. Final Statement of Principles for Wind Generation Licensing

This Statement of Principles sets out the Commission's final position on the principles it will adopt in the granting of electricity generation licences in respect of wind generators in South Australia. Importantly, the principles contained in the paper are intended to apply only until such time as the Commission is satisfied that national market arrangements are in place which account for increased levels of wind generation in the NEM or particular regions of the NEM.

In preparing this Statement of Principles, the Commission has had regard to a number of sources of information. The most important of these have been the April reports of ESIPC and the Wind Energy Technical advisory Group (WETAG), submissions received on the

¹⁰ A copy of the Commission's Draft Statement of Principles may be accessed at http://www.escosa.sa.gov.au/webdata/resources/files/050615-D-WindFarm_StatofPrinc-FINAL.pdf



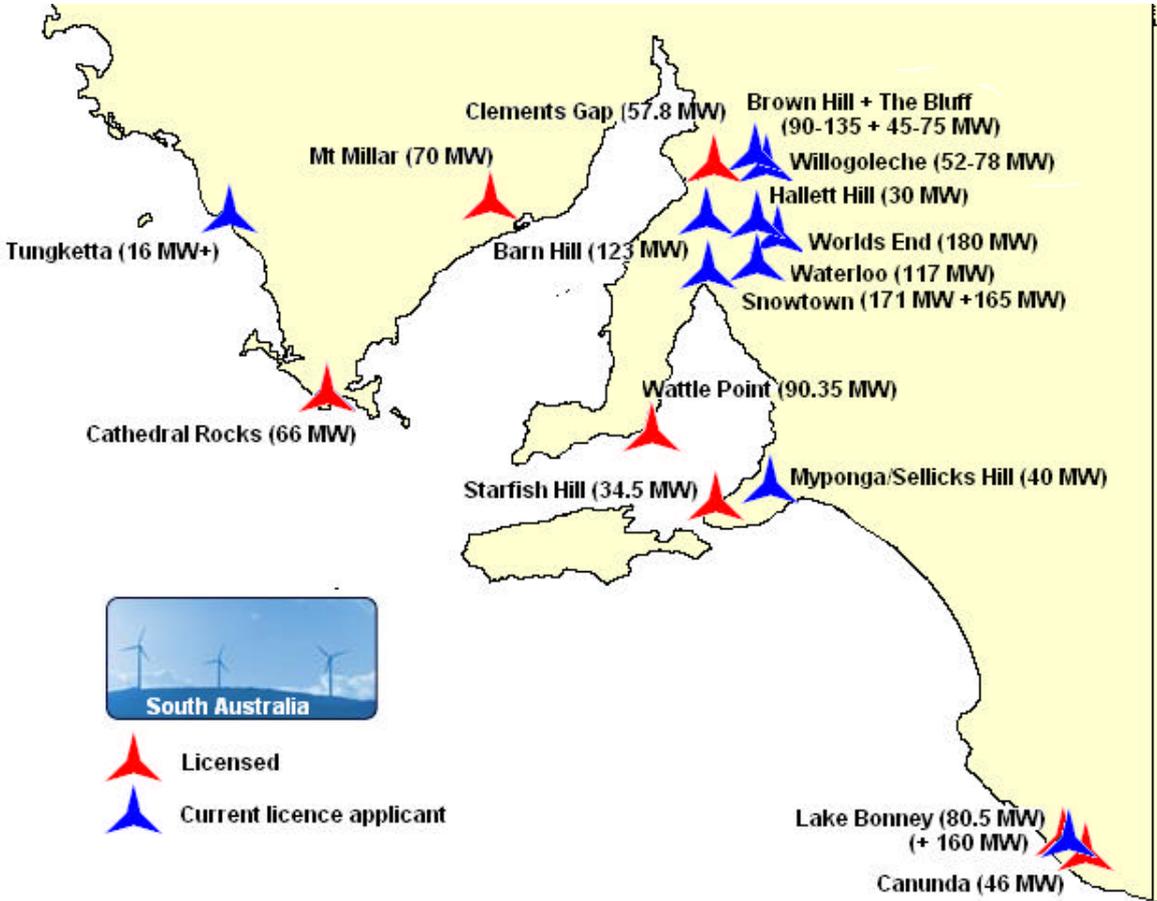
Draft Statement of Principles, further advice received from ESIPC in respect of those submissions and further work undertaken by ESIPC.

Table 1: Wind generation developments as at 30 September 2005

WIND GENERATOR, PROPONENT	ULTIMATE HOLDING COMPANIES	LOCATION IN SA	OUTPUT CAPACITY (MW)	NETWORK SERVICES PROVIDER	LICENSING STATUS
Starfish Hill, Tarong Energy Corporation Ltd	Tarong Energy Corporation Limited	Fleurieu Peninsula	34.5	ETSA Utilities	Licensed (Jan. '02)
Lake Bonney, Lake Bonney WindPower Pty Ltd	Babcock & Brown; National Power Partners	South-east	80.5 (Stage 1)	ElectraNet	Licensed (Jul. '02)
Wattle Point, Wattle Point Wind Farm Pty Ltd	Southern Hydro Pty Ltd	Yorke Peninsula	97.35	ElectraNet	Licensed (Apr. '04)
Mt Millar, Mt Millar Wind Farm Pty Ltd	Tarong Energy Corporation Limited	Eyre Peninsula	70	ElectraNet	Licensed (Sep. '04)
Cathedral Rocks, Cathedral Rocks Wind Farm Pty Ltd	Hydro Tasmania; Corporacion Energia Hidroelectrica de Navarra SA	Eyre Peninsula	66	ElectraNet	Licensed (Nov. '04)
Canunda, Canunda Power Pty Ltd	International Power plc	South-east SA	46	ETSA Utilities	Licensed (Oct. '04)
Clements Gap, Pacific Hydro Clements Gap Pty Ltd	Pacific Hydro Limited	Mid-north	57.8	ElectraNet	Licence to be issued (approved Oct. '04)
Snowtown, Snowtown Wind Farm Pty Ltd	TrustPower Limited	Mid-north	171 (Stage 1) 165 (Stage 2)	ElectraNet	Application made (Dec. '04)
Lake Bonney, Lake Bonney WindPower Pty Ltd	Babcock & Brown; National Power Partners	South-east	159.5 (Stage 2)	ElectraNet	Application made (Dec. '04)
Myponga/Sellicks Hill, Sellicks Hill Wind Farm Pty Ltd	TrustPower Ltd	Fleurieu Peninsula	40	ETSA Utilities	Application made (Dec. '04)
Willogoleche, Willogoleche Power Pty Ltd	International Power plc	Mid-north	52 - 78	ElectraNet	Application made (Dec. '04)
Brown Hill, AGL Power Generation (Brown Hill) Pty Ltd	The Australian Gas Light Company (AGL)	Mid-north	90 - 135	ElectraNet	Application made (Jan. '05)
Tungketta Hill, Ausker Energies Pty Ltd	Ausker Pacific Co. Pty Ltd; Tacit Pty Ltd; ABAN Lloyd Chiles Offshore Ltd (trustee)	Eyre Peninsula	16	ETSA Utilities	Application varied (Mar. '05)
The Bluff, AGL Power Generation (Brown Hill) Pty Ltd	The Australian Gas Light Company (AGL)	Mid-north	45 - 75	ElectraNet	Application made (Mar. '05)
Waterloo, Waterloo Wind Farm Pty Ltd	Hydro Tasmania	Mid-north	117	ElectraNet	Application made (Mar. '05)
Barn Hill, Stanwell Corporation Limited	Stanwell Corporation Limited	Mid-north	123	ElectraNet	Application made (Mar. '05)
Worlds End, Worlds End Wind Farm Pty Ltd	Energreen Wind Pty Ltd	Mid-north	180	ElectraNet	Application made (Mar. '05)
Hallett Hill, Wind Prospect Pty Ltd	Wind Prospect Group Limited	Mid-North SA	30MW	ETSA Utilities	Application made (Jun. '05) ¹¹

¹¹ This application was referred to the Electricity Supply Industry Planning Council in June 2005 and has therefore not been considered as part of the ESIPC Wind Study of April 2005.

Figure 1: Wind Generator location map



Map adapted from ElectraNet sources

2. THE ESIPC REPORT

This section of the paper summarises the findings of the report from ESIPC on the impacts of wind generator developments.¹² The Commission sought the views of wind generator developers, non-wind generators, NEMMCO and other relevant stakeholders on the conclusions and recommendations of the report. ESIPC itself initiated a process of consultation on the report. Stakeholder comment is discussed in the context of the Commission's response to the ESIPC report.

The findings of ESIPC were developed from two perspectives, viz a detailed South Australian specific analysis using local data, actual projects and real market conditions; and a review of the international experience with wind generation. The local analysis considered situations in which 400 MW, 500 MW, 800 MW and 1,000 MW of wind generation capacity were installed across the State, based upon the currently licensed developments, as well as additions of certain of the other proposed developments¹³ as detailed in section 1 of this paper.

This section also summarises the findings of the WETAG report on the technical matters associated with integrating wind generation into the NEM released for comment in April 2005

2.1. *General Character and Variability of Wind Energy*

ESIPC concluded that South Australia has an excellent wind resource. Based on modelling of wind generators' outputs, annual capacity factors between 32% and 40% are achievable, which is considered high by international standards. The wind resource shows, on average, a consistent diurnal variation, with wind energy outputs peaking in late afternoon.

Nevertheless, the variability of the wind resource complicates the prediction of wind generators' outputs within short time frames.

Variability would appear to be the single largest challenge to the integration of wind energy into the National Electricity Market as it affects a broad range of market mechanisms from the security of dispatch to the management of contractual risk instruments. (ESIPC report, p. 8)

The impact of variability is most significant where it is large in relation to system demand, and this is most likely to be the case for the 800 MW and 1,000 MW cases at times of low demand. ESIPC concluded that diversity in locations of wind generators across the State would assist in managing the effects of variability. In addition, adequate forecasting of wind variability is an important pre-requisite to effective management of the wind resource.

¹² Refer http://www.esipc.sa.gov.au/downloads/Planning_Council_Wind_Report_to_ESCOSA.pdf.

¹³ These were Myponga/Sellicks Hill, Lake Bonney (Stage 2), and Snowtown (Stages 1 and 2).



The ESIPC analysis considered variability at several levels, including:

> 30 minute variability

Modelling was used to determine the probability of wind generators' output varying by certain amounts in specified timeframes. In the 400 MW and 500 MW cases, the hourly variability achieved on a "once per annum" basis was less than one contingency for South Australia (260 MW). However, for the 800 MW and 1,000 MW cases, the hourly variability was significantly greater than two contingencies in the State.

Without comprehensive forecasting of these events or additional constraints in the National Electricity Market to instruct other generators to be operating, it may be difficult to ensure that sufficient generating capacity would be available. (ESIPC report, p. 14)

< 30 minute variability

A statistical approach was used to assess variability of wind generation at time scales less than 30 minutes.¹⁴ Different timeframes within this category are important in terms of control mechanisms available in the NEM.

In the 5 minute timeframe, the NEM dispatch process would be issuing instructions to the available generators to change their output to accommodate variations in wind and demand (the "Ramp Rate" controls in the NEM). Variability at the 3 sec level cannot be compensated for in the existing NEM dispatch instruction arrangements, relying instead on the automatic generator controls (AGC) in the NEM.

This service is currently part of the existing Frequency Control Ancillary Service (FCAS) market arrangements. Variations with a timeframe between 0 and 3 sec, which impact on system frequency, are not able to be managed through the regulation FCAS, and can only be offset by power system inertia. The ESIPC report suggests that latest technology wind turbines have control systems that should smooth out fluctuations in the 0 – 3 second timeframe.

Table 2 shows the 1% Probability of Exceedence (PoE) variations in wind generators' output for the 400 MW and 1,000 MW cases over and above any diurnal patterns for the studied timeframes – for 30 minute timeframes and below.

¹⁴ This approach involved correlating wind generation output data obtained from the Starfish Hill wind generator with Bureau of Meteorology wind data to provide representative information for other wind generator sites.

Table 2: 1% PoE variations (MW)

TIMEFRAME	400 MW CASE	1,000 MW CASE
3 hour	208	647
1 hour	117	390
30 min	77	252
30 min*	70	221
5 min*	20	37
3 sec*	4.9	8.3

* exclude diurnal variability

2.2. Potential Impacts on Power Quality

The NER sets out system standards for power quality (voltage, voltage fluctuations, harmonic distortion and voltage imbalance). These are very location specific, and are dealt with as part of the process for negotiation of a connection agreement between the wind generation proponent and the network service provider (either ElectraNet for connection to the transmission network, or ETSA Utilities for connection to the distribution network).

ESIPC concluded that power quality issues arising from wind generators were being managed effectively under present arrangements.

Appropriate standards are in place and the utility is monitored to ensure these standards are met. The technical capabilities of today's wind turbines and the approaches available through the connection arrangements and supplementary plant ensure that any potential power quality issues can be managed. The Planning Council is satisfied that the combination of improving machine types and the commendably high quality of network agreements delivers adequate assurances that power quality will not be adversely affected by increased levels of wind generation. (ESIPC report, pp18-19)

2.3. Potential Impacts on System Security and Reliability

ESIPC concluded that variability of wind output raises potential issues concerning security and reliability of the power system. It notes that management of system security in the NEM relies on:

- ▲ Setting appropriate requirements on generation plant prior to permitting connection of that plant to the grid; and
- ▲ Ongoing operation and management of the power system through market incentives, market mechanisms, and NEMMCO's powers.

The ESIPC report deals with each of these areas in relation to the connection and operation of wind generators in the South Australian power system.

2.3.1 Connection Arrangements and Technical Standards

The NER outlines the range of technical requirements that may be imposed on generators seeking to connect to a transmission or distribution network. The



detailed technical standards to be applied in a particular case are negotiated as part of the connection process with the network service provider, with an overriding objective of such negotiations being maintenance of the power system's stability and security. The ESIPC report noted that the NER technical standards are not well adapted to be applied to unscheduled and asynchronous generators such as wind turbines.

The technical standards are not rigid and the connection process involves the setting of a number of "negotiated access standards". Negotiated standards are normally applied to wind generators' ability to ride through low voltage disturbances and to their ability to generate and absorb reactive power. (ESIPC report, p. 20)

ESIPC noted that the performance assessment of a proposed wind generator is based on a dynamic model of the relevant type of wind turbine, and that there are doubts about the accuracy of such models and their wider applicability in studying system stability. It suggested that the "automatic access standard" of the NER, while more onerous than typically negotiated standards, will contribute to providing a secure power system with higher levels of wind generation.

The automatic access standard requires synchronous generators to have the ability to generate and absorb considerable quantities of reactive power. This could be applied to wind generators and achieved either through the use of state of the art turbine equipment or through the use of appropriate network support equipment (e.g. static VAR compensators).

Generators are also required to remain connected and operational (often described as the ability to "ride through") through a severe disturbance. Wind generators usually negotiate a standard based on their ability to ride through a severe but single credible transmission fault modelled with given loads and other generation on-line and assuming primary protection clears all faults. With a large and growing amount of wind energy on the system, the ability to predict power system configuration is difficult and ESIPC recommended a more prescriptive ride through capability.

The short-term variability of wind generator output may also require the imposition of new standards, e.g. requiring wind generators to smooth output over time scales from a few seconds up to 5 minutes. Remote control of wind output through market security systems will also be necessary to maintain system security.

ESIPC concluded that higher technical standards will need to be imposed on future wind generators, and in particular that they have the ability to:

- ▲ ride through a prescriptive and more severe low voltage event;
- ▲ generate and absorb reactive power and to control voltage;
- ▲ smooth short term fluctuations in output; and
- ▲ be remotely controlled and to curtail output where necessary.

ESIPC therefore suggested that new standards consistent with these requirements should be developed, but that the NER automatic access standards combined with NEMMCO's remote data and control requirements provide a reasonable interim step.

2.3.2 Operation and Management of the Power System

The ESIPC report noted that the ongoing management of system security is delivered through NEMMCO's market systems, which are designed to deliver "security constrained, optimised dispatch". Security and reliability also depend on appropriate market incentives placed on generators participating in the NEM, including FCAS markets. In reviewing the impacts of wind generators on reliability and security of the South Australian power system, ESIPC was therefore required to analyse the market impacts, particularly to examine likely dispatch patterns, examine ramp rate adequacy, and consider the effects on conventional generators.

The addition of wind energy increases the variability and uncertainty already inherent in the operation of the power system (e.g. through demand fluctuations). ESIPC modelling shows that, in the 400 MW and 500 MW cases, wind energy increases overall variability by 20 – 30%, with a similar deterioration in average forecasting accuracy. Indeed, market data suggests that this effect is already being observed. ESIPC suggested that this impact is undesirable, but nevertheless is manageable. In the 800 MW and 1,000 MW cases, however, the average variability in wind output exceeds the average variability in demand and demand forecast accuracy. In these cases, variability in wind output is the dominant cause of variability and uncertainty in market operations. The ESIPC analysis suggests that concentration of wind generators in one location exacerbates the effects of such variability.

It is therefore essential that high quality wind generation forecasts be available to the market.

Without excellent wind generation forecasting we should expect a significant deterioration on the forward demand forecasts which are vital for other generators trying to make efficient plant commitment decisions. (ESIPC report, p. 25)

The ESIPC modelling also showed that the potential for rapid changes in wind output would place pressure on the effective management of ramp rates. In particular, for the 800 MW and 1,000 MW cases, the ramp rate of generation already in operation was insufficient to manage ramp rates associated with wind generation variations, requiring the commitment of additional generation. Again, high quality wind generation forecasting is essential to address this impact.

With accurate forecasts of these types of rapid rate of change events and appropriate dispatch optimisation mechanisms the generators and the market operator could more effectively optimise the dispatch of all of the generators in the network. (ESIPC report, p. 26)



The ESIPC analysis considered the possibility that the South Australian power system might become insecure due to high levels of wind generation, particularly at times of low demand. Modelling results suggested that high levels of wind generation occur less frequently at times of low State demand. However, where the two coincide, the system security implications need to be managed. In particular, a credible contingency could lead to system instability. This is a particular issue in the 800 MW and 1,000 MW cases.

In most circumstances where the output from the wind-farms is significant with respect to demand, South Australia will be exporting power mitigating, to some degree, the risk of a credible contingency causing significant instability. The issue remains that under these circumstances the technical requirements for operating the network within its safe working envelope may require additional capacity from conventional generation beyond that which would be available on the basis of market offers to maintain system integrity during a forced outage. (ESIPC report, p. 29)

The ESIPC report suggested that the system security pressures could be relieved if wind generators were integrated into the economic optimisation of the NEM, since this provides NEMMCO with the power to ensure that system security will be maintained in the most efficient way.

NEMMCO has been supplied with data and analysis by the ESIPC and is undertaking its own detailed analysis of the potential impacts of larger amounts of wind generation on the security of the power system. NEMMCO has retained international consultants DlgSILENT to assist in this work, which should be completed in the coming months.

Finally, the market analysis conducted by ESIPC showed that increased use of wind generation in South Australia would reduce average gas consumption for electricity generation purposes, and also increase the volatility of gas usage. This could have implications for gas supply and price, particularly in respect of the allocation of demand charges between gas customer classes.

In summary, the ESIPC report noted that classification of wind generators as non-scheduled has the potential to lead to unacceptable market distortions at higher levels of wind generation. Key market participation issues for wind generation are:

- ▲ Non-participation in the normal market bidding process to determine which generators operate to satisfy market demand;
- ▲ NEMMCO is unable to manage market stability and security through its normal market optimization techniques;
- ▲ Currently wind generation is treated as a negative demand rather than a source of supply, so that neither the forecast nor the actual quantity of wind energy are visible to the market, making it difficult for participants to manage their market involvement; and

- ▲ Wind generators do not participate in the markets for ancillary services, which are an important part of the market design, operating on a causer-pays basis and allowing NEMMCO to manage the market within secure limits.

2.4. Potential Impacts on Price

The ESIPC report drew some general conclusions regarding market outcomes and price impacts from the system modelling. Such conclusions are highly dependent on the assumed bidding strategies adopted by conventional generators.

The modelling showed that, as the level of wind generation increases, there is an increase in the level of exports and a decrease in the level of imports. However, in general South Australia remains a net importer from the Eastern States grid. In addition, about half of wind generator output displaced South Australian conventional generation, particularly gas-fired generation.

The modelling also showed that the energy output from wind generators is significant with respect to energy growth in South Australia. Even at 400 MW of wind generation capacity, the energy generated covers five years of demand growth. ESIPC suggested that this would have significant impacts on investment from conventional generation.

Increased wind generation increases competition in the generation sector and, in the case of simpler bidding strategies (e.g. Short Run Marginal Cost cases) causes spot (wholesale market) prices to fall. More complex bidding strategies (e.g. Long Run Marginal Cost cases) are more reflective of commercial reality, and the ESIPC analysis suggested that, for such cases, the spot price becomes more volatile with high levels of wind generation (i.e. increased occurrence of both lower and higher spot prices). Volatility in the wholesale price would in all probability flow through to a higher price to consumers in the retail market in the longer term (noting that in respect of small customers, the Commission's three and a half year retail price path will provide medium term stability).

The ESIPC report also noted that wind variability will impose additional costs on other market participants (and hence upward pressure on price) associated with the need to recover fixed costs over shorter operation times and with increased costs of market ancillary services. In addition, there may be a need for increased flexibility in gas supply arrangements, since the modelling suggested that wind generation largely displaces gas-fired generation.

The ESIPC report suggested that there is no clear outcome in relation to the impact of increased amounts of wind generation on prices. It concluded that the market should be adapted to ensure efficient operation, pricing and cost allocation through applying the causer pays principle to ancillary services, applying optimal market dispatch to wind generators, and increasing the transparency and accuracy of information to the market (e.g. through improved forecasting).



2.5. Summary of Conclusions from the ESIPC Report

ESIPC concluded that 500 MW of wind generation capacity in the South Australian power system has only “modest” network, power system, and market impacts. Beyond that level, the risk of such impacts increases significantly. ESIPC suggested that there is no absolute “limit” on the amount of wind generation capacity that could be installed in South Australia, provided that appropriate market-based measures are put in place. Such measures would impose additional economic constraints on wind generator developments, ensuring that market forces determine an appropriate level of wind generation in South Australia. These measures are incorporated into four key recommendations as follows:

Recommendation 1: Appropriate technical standards

New wind generators should be required to conform to the automatic access standards under the NER. In the medium term the technical standards should be aligned with emerging world’s best practice. Most modern wind turbines are already capable of meeting these standards

Recommendation 2: State of the art wind energy forecasting

The market needs to be informed to allow participants to make efficient decisions on the commitment of plant and scheduling of fuel. Otherwise, costs could rise and security be put at risk.

Recommendation 3: Optimised dispatch of non-scheduled generation

NEMMCO must be able to automatically optimise non-scheduled generators (as is currently done for scheduled generators) to ensure that the market continues to operate efficiently and securely.

Recommendation 4: Proper cost allocation and market design measures

Market changes should be made to require non-scheduled generators to participate in ancillary service markets, both to pay for effects they cause and earn revenue for services they provide. This will drive appropriate investment and operational decisions.

2.6. Stakeholder views on the ESIPC report

In order to satisfy itself as to the credibility and robustness of the ESIPC recommendations, in April 2005 the Commission sought comments on the ESIPC report through a notice placed on its website.¹⁵ It also discussed the findings of the report with

¹⁵ Refer the *What's New* Electricity Archive page for 15 April 2005 (www.escosa.sa.gov.au/site/page:cfm?u=121&c=747).

various parties, including NEMMCO and several wind generator developers. Several written submissions were received in response to this consultative process.

In general, there was broad support at that time for both the method used by ESIPC in conducting its analysis of the impact of additional wind generation in South Australia, and for the findings contained in the ESIPC report.

NEMMCO noted the consistency between the findings of the ESIPC and WETAG reports, and provided the Commission with a detailed statement of the work it is doing to progress the WETAG recommendations.

Amongst wind generator proponents:

- ▲ AGL Power Generation (Brown Hill) Pty Ltd indicated its agreement with the recommendations of the ESIPC report, and expressed particular support for the conclusion that market forces should determine an appropriate level of wind generation in South Australia.
- ▲ TrustPower Ltd expressed its desire to work closely with the Commission, ESIPC and other relevant parties to progress the development of solutions to the issues raised in the ESIPC report.
- ▲ International Power plc welcomed the study undertaken by ESIPC, and indicated in-principle support for market based mechanisms rather than additional regulation as the way forward.
- ▲ Wind Prospect Pty Ltd welcomed the opportunity it had been afforded to participate in discussions with ESIPC during the development of the report.
- ▲ Stanwell Corporation Ltd indicated its support for the conclusions and recommendations of the ESIPC report.
- ▲ Babcock & Brown and National Power commented that the ESIPC report can be relied on as a basis for developing recommendations that will enhance competition in the NEM, ensure a level playing field for market participants, and ensure system security.

In commenting on the nature of the modelling undertaken by ESIPC, TrustPower noted that marginal loss factors recently released by NEMMCO for the year ending March 2006 have resulted in a significant reduction in these factors for connection points on the Yorke and Eyre Peninsulas, where several large wind generators are located. After allowing for local line losses and turbine maintenance outages, the net wind output available to supply load in South Australia is well below the name-plate capacity of the wind generators. In addition, TrustPower suggested that inclusion of significant geographical concentrations of wind generation from the mid North and South East of the State in the 800 MW and 1,000 MW cases considered by ESIPC had reduced the diversity benefits of various projects across the State. As a consequence, TrustPower suggested that any short-term limit to the level of wind generation capacity in South Australia could be comfortably higher than the 500 MW amount suggested by ESIPC.



International Power Australia commented that

...we recognise the inherent challenges of modelling wind farm impacts on the South Australian electricity market and as such we would urge caution on an over reliance on the modelling outcomes. We are happy to work with ESCOSA to refine these models in the future so wind's impact on the South Australian electricity market can be better understood.

In all cases, the wind generator proponents provided detailed comments on the means by which the concerns raised in the ESIPC report could be addressed in the short term, given their concern at the delay which might otherwise occur if the Commission was to await the ultimate national resolution of those concerns. Addressing the concerns of the ESIPC Report would allow the Commission to issue at least some generation licences to wind generators in the short term.

Operators of conventional generation plant (with no interests in wind generators) also supported the findings of the ESIPC report and suggested that the Commission should issue no further electricity generation licences for wind generators until the matters raised in the report has been addressed fully. In particular:

- ▲ NRG Flinders suggested that, while a cap on the permissible wind generation in South Australia is not necessarily required, a range of market improvements are needed urgently to ensure that wind generation operates in an efficient manner within the current framework, and faces the correct cost drivers and incentives.
- ▲ TRUenergy suggested that the ESIPC report has raised significant concerns that warrant action from the Commission to limit wind generation investment in South Australia to 500 MW until the ESIPC recommendations are implemented.

The Commission also received submissions from a small number of consumers urging the Commission to impose a moratorium on further electricity generation licences for wind generators until the matters raised in the ESIPC report had been addressed.

For example, a submission from the True Friends of the Southern Mt Lofty Ranges argued that the current level of licensed wind generation in South Australia is an already high proportion in the grid and that, based on the ESIPC report, the issuing of further licences is not warranted. It suggested that further licences would make the State's power system vulnerable to significant cost increases, instability and unreliability consequences.

ElectraNet provided comments on the nature of the analysis being undertaken by ESIPC prior to completion of the ESIPC report.¹⁶ It noted that the statistical approach used to assess the impact of short-term (< 30 minute) variability was based on wind generation data from Starfish Hill, which uses what might now be regarded as "old technology", and urged caution in drawing conclusions based on one site that may not be representative of wind generation as a whole. The Commission acknowledges such shortcomings, and notes that additional modelling and other work needs to be undertaken as more

¹⁶ Refer http://www.esipc.sa.gov.au/downloads/Comments_from_ElectraNet_re_Wind_Energy_work_Mar_05.pdf

operational wind generation data become available. NEMMCO in particular is now embarking on a broader and more detailed analysis, using the ESIPC work as a starting point.

Stakeholders commented again on the ESIPC report when responding to the Commission's Draft Statement of Principles. Those comments, unlike the submissions received during the April/May consultation period, tended to be more critical of the report. In general, most criticisms commented on the assumptions made by ESIPC in its analysis and the sources of information used.

Having considered those matters, and having regard to the more detailed submissions made on the ESIPC report during the April/May consultations (including the separate consultation run by ESIPC itself), the Commission does not consider that they impact on the credibility of the ESIPC report: indeed, the Commission is of the view that the work done by ESIPC is the most robust work in this area undertaken to date. This is particularly so given that the ESIPC work was based on the geographically diverse wind generators' output information for the wind generation projects which have actually been proposed for South Australia, as opposed to more generic information sources.

The Commission therefore relies on the ESIPC report in developing this Statement of Principles.

COMMISSION'S CONCLUSIONS IN RELATION TO THE ESIPC REPORT

It is the view of the Commission that:

- ▲ the ESIPC Report raises matters of significant risk for the ongoing security and reliability of the South Australian power system if the level of wind generation capacity were to increase beyond the current level.
- ▲ the fundamental conclusions of the ESIPC Report are appropriately conservative;
- ▲ the ESIPC findings are consistent with and complement those of the WETAG report.
- ▲ the ESIPC findings have received broad support from a range of stakeholders.

The Commission's conclusions are that:

- ▲ *the ESIPC Report proposes means of managing the risks it identified associated with an increase in the level of wind generation capacity, by the establishment of a regulatory environment in which the further expansion of wind generation in this State can safely occur;*
- ▲ *the ESIPC Report provides a sound basis for use in consideration of the current wind generator licence applications.*



2.7. Wind Energy Technical Advisory Group

In mid 2004, the Commonwealth and State and Territory Governments, through the Ministerial Council on Energy (MCE) established an inter-jurisdictional working group to review the range of policy level issues associated with large amounts of wind generation in the NEM. The Working Group in turn requested NEMMCO to establish a Wind Energy Technical Advisory Group (WETAG) to report on the technical matters associated with the policy review. A report from WETAG was released by the Working Group for comment in April 2005.¹⁷

Among the measures recommended by the WETAG report were the following:

- ▲ The application to wind generators of the technical standards contained in the NER should be reviewed in accordance with a set of guiding principles as outlined in the WETAG report. In addition, future reviews should be undertaken at intervals of 3 to 5 years.
- ▲ Large amounts of non-scheduled generation are incompatible with the optimised central dispatch process in the NEM, in part because the operational security limits of the network may be infringed. Some form of dispatch control should therefore be applied to wind generators (e.g. a “semi dispatch” model as described in the WETAG report).
- ▲ Evaluation of the power system security implications of increasing amounts of wind generation is urgently required. In addition, the NER should be amended to require the provision of appropriate dynamic generating plant models for all significant generators.
- ▲ Information regarding wind generation forecasts should be made available to market participants to facilitate transparency and efficient plant commitment. The NER could be amended to require appropriate information disclosure.
- ▲ The NER should be amended to require that all market generators participate in “causer pays” arrangements for regulation FCAS services.

The Commission notes that ESIPC was closely involved in the WETAG discussions and that there is broad consistency between the ESIPC and WETAG reports. While consultation on the WETAG report is still underway, some of the recommended measures are being progressed. For example, NEMMCO has already commenced the immediate review of the technical standards of the NER as applied to wind generators. Furthermore, the Australian Energy Market Commission (AEMC) is presently considering a series of proposed amendments to the NER to provide for appropriate information disclosure arrangements for non-scheduled generation in the NEM.¹⁸ The Commission will closely monitor the outcomes of these developments.

¹⁷ Refer <http://www.mce.gov.au/assets/documents/mceinternet/WEPWGDDiscussionPaperMarch0520050322094836.pdf>

¹⁸ Refer <http://www.aemc.gov.au/electricity.htm>

3. ESIPC RECOMMENDATIONS AND THE LEGISLATIVE FRAMEWORK

Having concluded that the ESIPC report of April 2005 provides a sound basis for the Commission to consider the current wind generator licence applications, it is necessary for the Commission to review the legislative framework within which it is required to make licensing decisions.

3.1. Electricity Act

The obligations on operators of electricity generation plant to be licensed, as well as the Commission's licensing powers in relation to the electricity supply industry, are established under the Electricity Act.

A person carrying on the generation of electricity is required to hold a licence under the Electricity Act if the generating plant has a rated nameplate output of > 100 kVA (or about 0.1 MW). The Electricity Act makes no distinction between generating plant using renewable or non-renewable energy sources: all are subject to the same licensing requirements.¹⁹

The Commission is required to determine the outcome of a licence application in accordance with specified criteria.²⁰ It is those criteria that must be used in determining the outcome of the current wind generation licence applications.

The Electricity Act specifies that the Commission may only issue a generation licence if satisfied that:

- ▲ the applicant is a "suitable person" to hold the licence (section 17(2)(a));
- ▲ the proposed generating plant will generate electricity of the appropriate quality for the relevant transmission or distribution network (section 17(2)(b)).

In deciding whether the applicant is a suitable person, the Commission may consider the previous commercial dealings of the applicant (and of the officers and major shareholders of the applicant) and the standard of honesty and integrity shown in those dealings; and the financial, technical and human resources available to the applicant (section 17(3)). These matters are not dealt with, however, in this Statement of Principles.

In terms of the appropriate quality requirement, that matter is dealt with more fully below.

In addition, the Electricity Act requires that, in considering a licence application, the Commission must have regard to the general factors specified in Part 2 of the ESC Act

¹⁹ It is noted that many domestic (roof-top) photovoltaic electricity generation systems have capacity < 100 kVA and hence are not required to be licensed.

²⁰ A detailed description of the Commission's licensing powers and the process followed in considering a licence application is available from Advisory Bulletin No. 4, *Licensing Arrangements for the Electricity and Gas Supply Industries*, available from the Commission website, refer www.escosa.sa.gov.au/webdata/resources/files/050414-D-AdvBull4Licensing.pdf



(section 17(2)). A consideration of the requirements of Part 2 of the ESC Act is set out below.

3.2. ESC Act

These general factors are specified at section 6(1) of the ESC Act, which provides that the Commission, in performing its functions, must:

- (a) *have as its primary objective protection of the long term interests of South Australian consumers with respect to the price, quality and reliability of electricity services; and*
- (b) *at the same time, have regard to the need to –*
 - (i) *promote competitive and fair market conduct; and*
 - (ii) *prevent misuse of monopoly or market power; and*
 - (iii) *facilitate entry into relevant markets; and*
 - (iv) *promote economic efficiency; and*
 - (v) *ensure consumers benefit from competition and efficiency; and*
 - (vi) *facilitate maintenance of the financial viability of regulated industries and the incentive for long term investment; and*
 - (vii) *promote consistency in regulation with other jurisdictions.*

The Commission must thus consider whether or not the proposed electricity operations might compromise the achievement of these objectives. It is noted that the objectives may, in some situations, conflict, so that the Commission would need to consider whether a negative impact on the achievement of one objective was being offset by a positive impact on the achievement of another objective. The fact that one objective is expressed as being the primary objective, provides clear direction that stronger weight should be given to that objective in the Commission's deliberations than to the subsidiary objectives.

Ultimately, the Commission might form the view that the achievement of the set of objectives was being sufficiently compromised by the proposed operations as to require that it not approve the issue of the licence. This would be particularly the case if the primary objective were being seriously compromised.

Several other general comments can be made about these criteria in the context of the current wind generator licence applications.

The criteria specified at section 17(2)(a) and (b) of the Electricity Act are matters about which the Commission *must* be satisfied before it may issue a licence, whereas the criteria specified at section 6(1) of the ESC Act are general factors to which the Commission *must have regard* (i.e. to which it must give real and serious consideration) in making its decision.

Nevertheless, the identification of significant risks to the achievement of the principal objective as specified at section 6(1) of the ESC Act might provide grounds for the Commission to reject such a licence application.

3.3. Other considerations

None of the criteria in either the Electricity Act or the ESC Act suggest that the Commission can give weight to the renewable energy aspect of wind generators (e.g. in terms of reducing greenhouse gas emissions in comparison with non-renewable generation sources) in reaching its decision on the wind generator licence applications currently before it. As a consequence, the Commission has not done so.

Equally, the criteria do not provide for the Commission to consider planning issues (e.g. landscape impacts of wind generators) in arriving at a decision on whether or not to issue a licence. Such matters are dealt with through the development approval process under the Development Act 1993, which operates independently of the licensing process established under the Electricity Act. Clearly a proposed wind generator will require approval under both processes before the electricity generation operations can be commenced.

3.4. Attainment of the Commission's Objectives

This subsection reviews the current set of proposed wind generator developments (for which the Commission has received electricity generation licence applications) against the primary and general objectives specified in section 6(1) of the ESC Act. The review takes into account the findings outlined in the ESIPC and WETAG reports, submissions received on those reports, and submissions received on the Draft Statement of Principles.

3.4.1 Primary Objective

The matter addressed by the Commission in considering the issuing of electricity generation licences to wind generators in light of the recommendations of the ESIPC report is how will the proposed wind generator developments impact on the long-term interests of consumers with respect to price, quality and reliability of electricity supply?

(i) The price of electricity supply

The ESIPC report drew some general conclusions about market and associated price impacts of wind generator developments for 400 MW, 500 MW, 800 MW and 1,000 MW cases (refer section 2.4 of this paper). Its modelling showed that under simple bidding strategies, wholesale prices fall due to the competitive pressures associated with new sources of generation. More complex bidding strategies lead to more volatile wholesale prices, and such volatility could be reflected in higher contract prices in the retail market. In addition, high variability of wind can impose additional costs on conventional generators. Thus, under certain circumstances, prices experienced by customers could increase.



In its submission on the ESIPC report, TRUenergy indicated its broad agreement with the ESIPC assessment of significant wind generation on wholesale prices, and:

...in particular, that this is likely to result in lower base-load energy prices, and that scheduled plants will become even more reliant on short-term spikes to recover their costs.

However, in commenting on the ESIPC suggestion that plants may alter their bidding strategies to increase market volatility following large scale wind penetration, TRUenergy noted that:

...while we concur that bidding strategies may change as a result of changes in competitive dynamics, we are sceptical that sufficient supply scarcity will occur to substantially increase the incidence of price spikes.

TRUenergy suggested that if the incidence of price spikes does increase, this would be more likely due to increased occurrences of ramp rate constrained dispatch intervals.

The ESIPC report noted that increasing wind generation changes the utilization of the Heywood interconnector, reducing imports and increasing exports, thereby bringing prices in South Australia and Victoria closer together. Stanwell commented that reduction of this price differential:

...has NEM wide benefits that should not be underestimated and is limited only by the current interconnector transfer capacity. While there is also an increase in the volatility in the NEM as a result of increased wind penetration, this should be seen as an opportunity for market innovations to emerge from participants in terms of contracting, demand management and integration of various generation technologies.

In summary, the conclusions of the ESIPC report on price impacts are equivocal:

There is no clear outcome on the impact of wind on price. Instead the Planning Council observed a number of balancing pressures on price. (ESIPC report, p iv).

Submissions to the Draft Statement of Principles also commented on the potential long term price impacts of a greater amount of wind electricity generation in South Australia.

The Australian Wind Energy Association submitted that:

NEMMCO stated that 1200MW of wind power will improve the transient stability limit (export limit) from South Australia to Victoria. NEMMCO showed that the export limit can be lifted from 750MW under high wind conditions and that this would not create problems with transient stability. This supports the finding from ESIPC that South Australia will be more often exporting power, which will undoubtedly lead to low market prices in the region.

Babcock & Brown, HydroTasmania and Pacific Hydro Ltd also made submissions to the effect that the potential price reductions demonstrated by the ESIPC work will benefit South Australian consumers.

On the other hand, the True Friends of the Mount Lofty Ranges put forward the view that more modelling is required to assess the long-term price impacts on consumers, particularly in respect of the ancillary services. It also submitted its view that UK, European and US experience shows that prices increase once penetration exceeds 20 – 30 percent.

The Commission notes the complexity associated with any forward looking analysis of prices and that the ESIPC report in fact made no specific predictions as to actual outcomes. Nevertheless, the ESIPC report indicated that it is likely to be the balance between any price volatility arising from the rapid output changes of wind generators and the competitive pressures that wind generators will place on conventional generation that will dictate those actual outcomes.

In addition, the Commission notes that any long-term upward pressures on price are likely to be ameliorated through the market-based measures recommended by ESIPC to address the reliability and system security, efficient market operation and cost allocation impacts associated with wind generation.

Having considered all of these matters, the Commission does not believe that there is clear evidence that the long-term interests of consumers would be adversely affected by price impacts associated with significant amounts of additional wind generation.

(ii) The quality of electricity supply

In contrast, the conclusions of the ESIPC report on quality impacts are unequivocal. ESIPC concluded that the combination of improving wind turbines and the high standard of connection agreements provides adequate assurance that power quality levels will not be adversely impacted by wind generation. The Commission is therefore satisfied that the long-term interests of consumers would not be adversely affected by the power quality impacts associated with significant amounts of additional wind generation.

(iii) The reliability of electricity supply

The Commission interprets the term “reliability” as contained in section 6(1) of the ESC Act as incorporating the reliability and system security impacts examined in the ESIPC report (refer section 2.3 of this paper).

In brief, ESIPC found that, in the absence of upgraded technical standards for network connections, high quality wind energy forecasting, and market arrangements that would integrate wind generators more fully into the NEM, wind developments in SA at the 800 MW and 1,000 MW cases posed significant risks to reliability and security of the South Australian power system. Such risks arise chiefly from the inherent variability associated with the output of wind generators, and include:



- ▲ reduced ability of the system to remain operational through low voltage events or through disturbances to system frequency;
- ▲ insufficient capacity of the system to generate and absorb reactive power;
- ▲ greater variability and uncertainty in market operations;
- ▲ ineffective management of ramp rates, requiring the commitment of additional generation; and
- ▲ system instability arising from a credible contingency (particularly at times when high level of wind generation coincide with low State demand).

The WETAG report has noted the urgent need to progress the development of measures to manage these risks. NEMMCO, in its comments to the Commission, has reinforced the need for such action, noting in particular that it:

sees management of network flows (where flows are close to network limits) as an area for urgent investigation.

The Commission therefore believes that a further significant increase in the level of wind generation in the State, in the absence of measures to ameliorate the risks identified in the ESIPC report, could significantly impact on the long term interests of South Australian consumers with respect to the reliability of the power system.

3.4.2 Subsidiary Objectives

The subsidiary objectives of section 6(1) of the ESC Act relate to matters associated with competition and efficiency, and the financial viability of, and long term investment in, the electricity supply industry in South Australia.

The influx of a significant amount of additional generation (whether powered by wind or other sources) enhances competition in the generation sector of the NEM. As noted previously, the ESIPC modelling suggests that, under certain circumstances, this competitive pressure will act to drive wholesale market prices lower. However, since wind generators do not at present participate fully in the market in the manner of conventional generators (in particular because they are not currently part of the scheduled dispatch processes of NEMMCO), the notion of competition being enhanced in this manner has a degree of artificiality about it. Furthermore, the extent to which customers benefit from such competitive pressures is questionable if it is accompanied by reduced power system security and reliability.

TRUenergy, in its submission on the ESIPC report, commented on the impact of wind generation on the financial position of conventional generators. It noted the possible increased incidence of wholesale price spikes, which it suggested are difficult for gas-fired scheduled generation plant to manage, and may not be fully recoverable through the NEM pool.

These factors could impact on the financial sustainability of scheduled plant in SA in the face of the subsidised entry of wind farms, which are generally not reliant on market price outcomes for their revenue. Needless to say the ongoing viability of scheduled plant will be essential to support energy supply security in SA.

The ESIPC report also noted that the advent of large amounts of wind generation capacity, even at the 400 MW level, would have a significant impact on future investment from conventional generation. Nevertheless, the Commission notes that the overall level of generation investment would not diminish as a result of significant levels of wind generation investment.

3.5. Other Issues

The Commission sought further advice from ESIPC on whether it was possible, based upon the ESIPC analysis of the aggregated impact of proposed wind generator developments, to draw any conclusions about the impact of individual developments on the achievement of the ESC Act objectives?

Key additional issues are as follows:

3.5.1 Distribution vs transmission connected wind generators

As noted in Table 1, two of the wind generators that are currently the subject of electricity generation licence applications before the Commission are proposed to be connected to the distribution network, with the remainder to be connected to the transmission network. The distribution-connected (embedded) wind generators are smaller (< 50 MW) than transmission-connected developments, and hence, perhaps, less likely to contribute significantly to the reliability and system security risks identified in the ESIPC report as arising from the output variability of wind generators.

The ESIPC report suggests that distribution-connected wind generators are more likely to give rise to power quality issues, being electrically closer to customers, and, as a consequence, higher power quality standards might be expected of such wind generators. In addition, they may introduce issues of network loading and control that are beyond NEMMCO's capacity to influence. Nevertheless, ESIPC concluded that local power quality and network control issues were being managed satisfactorily by ETSA Utilities through the connection agreement process for distribution-connected wind generators.

3.5.2 Geographical Location

Some wind generator locations may be more suited to the management of risks identified in the ESIPC report than other locations. Geographical location is, of course, a critical determinant in the success of a wind generator's proposal, as it



influences the amount of the wind resource, the costs of connection, the extent of line losses, and local network management issues.

With the exception of the two embedded wind generator proposals and the Lake Bonney proposal, the wind generators that are currently the subject of electricity generation licence applications are all grouped in the mid-north area of the State. This location is favourable from a connection cost perspective. However, such a large amount of wind generation in a relatively small area (up to 1,000 MW based upon the plant capacities of Table 1) may exacerbate the reliability and system security issues associated with variability of wind generation output.

A similar problem could arise in relation to the wind generators located in the south east area of the State. This could suggest the need to limit the amount of generation located in such areas.

3.6. Impacts of the ESIPC report on the Commission's objectives

The Commission has analysed the likely attainment, or otherwise, of its primary objective of protecting the long term interests of South Australian consumers with respect to the price, quality and reliability of electricity services if it were to issue electricity generation licences to wind generation licence applicants. In doing so it has had regard at the same time to the subsidiary objectives set out in section 6(1)(b) of the ESC Act.

The Commission's conclusions are that while the issuing of such licences would not have a negative impact on South Australian consumers' long term interests with respect to the price and quality of electricity services, the same cannot be said with respect to the reliability of electricity supply.

Based on the findings of the ESIPC report, the Commission has identified an adverse impact on the achievement of the primary objective of section 6(1) of the ESC Act, with respect to the reliability of electricity services to South Australian consumers, as a result of further increases in the level of wind generation in South Australia. There are also some positive impacts on the secondary objectives, in particular through enhancement of competition in the generation sector. However, it would be difficult to conclude that those benefits were sufficient to offset the adverse impacts on the achievement of the primary objective

The Commission is therefore of the view that unless it takes steps to implement the recommendations of the ESIPC report, the combined effects of section 6(1) of the ESC Act and section 17(2) of the Electricity Act might require the Commission to reject wind generator proponents' electricity generation licence applications.

In forming this view the Commission would observe that the consideration of the ESC Act objectives must ultimately focus on each individual wind generator that is the subject of an electricity generation licence application.

The Commission has also concluded that the findings of the ESIPC Report must be considered to apply to each individual wind generator that is currently the subject of an electricity generation licence application.

**THE COMMISSION'S ASSESSMENT OF THE IMPACT OF THE ESIPC
REPORT ON LICENSING CRITERIA**

The view of the Commission, based on consideration of the impact of additional wind generation in South Australia on the achievement of the objectives specified at section 6(1) of the ESC Act and the findings of the ESIPC report, is that:

- ▲ the long-term interests of South Australian consumers would be adversely affected in relation to reliability of electricity services by such a development, and that any offsetting benefits (e.g. those associated with enhanced competition in the generation sector) are minor; and
- ▲ accordingly there are grounds for the Commission to reject each of the wind generation licence applications;

unless

- ▲ the main findings of the ESIPC Report are given effect in such a way as to bind the proponents of additional wind generation capacity in South Australia.

4. IMPLEMENTATION OF ESIPC RECOMMENDATIONS

As the Commission has determined that electricity generation licences can only be issued in respect of wind generators provided that the risks identified by ESIPC can be appropriately addressed, it is necessary for the Commission to consider the options for so addressing those risks.

4.1. Implementation Options

The Commission has determined there are three options for implementing the regulatory framework recommended by ESIPC Report to facilitate the introduction of wind generators in South Australia:

- ▲ Option 1: The Commission could issue electricity generation licences to current wind generator applicants in the same form as current generation licences in the expectation that the necessary work at the national level will be completed and that the licensees would then be bound by the outcomes of that work (e.g. NER changes); or
- ▲ Option 2: The Commission could await the completion of work at the national level before licensing any further wind generation developments, noting that the best evidence available to the Commission indicates that, should it adopt this approach, a period of at least two years might elapse before such licences were issued; or
- ▲ Option 3: The Commission could issue licences subject to a set of conditions and specified pre-conditions that seek to ensure that, for the transitional period between the commencement of the generation operations and the implementation of appropriate measures at the national level, the risks identified in the ESIPC report can be managed effectively.

4.2. Assessing the Options

The Commission has analysed the appropriateness of each of the options proposed in turn.

4.2.1 Option 1

In terms of Option 1, the Commission has determined that issuing licences without any protections, in anticipation of future amendments to NEM arrangements, would in no manner address the risks identified by ESIPC. To do so would provide a perverse outcome, given the earlier conclusion by the Commission that those risks are real in the South Australian context. This would lead to circumstances where the Commission, on its own analysis, would be placed in a position of not



protecting the long-term interests of South Australian consumers with respect to the reliability of electricity supply.

The Commission therefore rejects Option 1 as a viable mechanism for dealing with wind generator licence applications.

4.2.2 Option 2

In terms of the second option, the Commission would again confirm its view that, ultimately, changes to the NER are the preferred method for establishing the technical and market operation rules under which an expansion of wind generation in South Australia can safely occur.

However, the Commission is aware that such changes, while being actively considered, are still some way (perhaps eighteen months to two years) from being implemented. The Commission does not, therefore, consider that this is an appropriate option for the South Australian market at present.

In rejecting this approach, the Commission notes that it is open to wind generator proponents with licence applications before the Commission, or who are considering lodging applications with the Commission, to place those applications on hold themselves and await the outcome of NEM reforms before proceeding further.

4.2.3 Option 3

Finally, considering the third option, while it should be acknowledged that it is open to the Commission, based on the ESIPC report, to decline to issue further wind generation licences until the NER amendments have been made, the Commission considers it is appropriate for it to develop a range of licence conditions which would allow for the expansion of wind generation capacity in South Australia in the interim period. This is particularly so given the Commission's ability to craft licence conditions, which will be binding on licensees, such that the risks identified by ESIPC can be addressed.

The Commission's decision is therefore that it will implement the recommendations of the ESIPC report by issuing licences subject to a set of conditions and pre-conditions that seek to ensure that, for the transitional period between the commencement of the generation operations and the implementation of appropriate measures at the national level, the risks identified in the ESIPC report are managed effectively.

4.3. The Commission's power to impose licence conditions

The Commission's decision to implement Option 3 hinges on its ability to include suitable conditions within electricity generation licences. For reasons set out below, there are no legal impediments to the Commission imposing such conditions.

Section 21 of the Electricity Act sets out a number of mandatory licence conditions which the Commission must include within any licence it grants, regardless of the operations which that licence might authorize. Those mandatory conditions include such matters as requiring compliance with industry codes made by the Commission under the ESC Act; requirements as to auditing of the operations authorized by the licence; and participation in schemes for delivery of customer concessions and community service obligations.

In addition to those mandatory licence conditions, section 21 also confers a discretionary power on the Commission to impose other licence conditions.

The Commission may make a licence subject to further conditions considered appropriate by the Commission.

Section 22 of the Electricity Act set out additional mandatory licence conditions which the Commission must include within electricity generation licences. These include such matters as requiring compliance with directions from the system controller; requiring the licensee not to do anything affecting the compatibility of its electricity generating plant with any network so as to prejudice public safety or power system security; and requiring the provision of information to ESIPC.

Again, in addition to the mandatory licence conditions, section 22(2) confers a discretion on the Commission to impose additional conditions.

This section does not limit the matters that may be dealt with by terms or conditions of a licence authorising the generation of electricity.

The combination of these two sections provides the Commission with sufficient power to impose on electricity generation licensees such additional binding licence conditions as it considers necessary, having regard to its section 6(1) objectives.

THE COMMISSION'S APPROACH TO IMPLEMENTATION OF ESIPC REPORT

Having considered and accepted the ESIPC Report, the Commission will:

- ▲ establish pre-conditions which provide certainty as to how it might be satisfied that an application for a wind generation licence will not, if granted, have adverse impacts on the long-term interests of South Australian consumers with respect to the reliability of electricity supply; and
- ▲ pursuant to sections 21(3) and 22(2) of the Electricity Act 1996, impose licence conditions that it considers will address the risks identified in that report in order that new wind generation licences can be issued in the transitional period prior to amendments to the NER and other NEM arrangements.

5. CONDITIONS

As outlined in section 2.5, the ESIPC report included four key recommendations with respect to the following matters:

- ▲ Technical standards: new wind generators should be required to conform to higher technical standards. In the short term, those standards should be based on the automatic access standards specified in the NER. In the medium term the technical standards should be aligned with emerging world's best practice. Most modern wind turbines are already capable of meeting these standards.
- ▲ Optimised dispatch of non-scheduled generation: NEMMCO must be able to automatically optimise non-scheduled generators (as is currently done for scheduled generators) to ensure that the market continues to operate efficiently and securely.
- ▲ State of the art wind energy forecasting: the market needs to be informed to allow participants to make efficient decisions on the commitment of plant and scheduling of fuel. Otherwise, costs could rise and security be put at risk.
- ▲ Proper cost allocation and market design measures: market changes should be made to require non-scheduled generators to participate in ancillary service markets, both to pay for effects they cause and earn revenue for services they provide. This will drive appropriate investment and operational decisions.

ESIPC suggested that, if implemented, these recommendations would impose additional economic constraints on wind generator developments so as to ensure that the Commission's statutory objectives are met. Further, if the conditions were met, they would allow market forces to determine an appropriate level of wind generation in South Australia.

In the Draft Statement of Principles, the Commission developed the four key recommendations into a set of draft licensing principles. The Commission then consulted on those draft licensing principles through the release of the Draft Statement of Principles on 17 June 2005.

With the benefit of submissions on those draft licensing principles, the Commission is now in a position to make final licensing principles. Those principles, and their reasons for adoption, are set out below in detail.

5.1. Preconditions

In order to issue a generation licence, the Commission must be satisfied that the proposed generating plant will generate electricity of the appropriate quality for the relevant transmission or distribution network (Electricity Act) and the Commission must also consider the quality and reliability of electricity services (ESC Act). A consideration of these matters requires a consideration of the technical standards to be applied to wind generators.



The Commission's draft position was that it would be satisfied that the "appropriate quality" requirement (section 17(2)(b) of the Electricity Act) and the quality requirement (section 6(1)(a) of the ESC Act) have been met in relation to any wind generator licence applicant if:

- ▲ a connection agreement between the proposed wind generator and the relevant network service provider has been signed. Since this legislative requirement is one about which the Commission must be satisfied before it can issue a generation licence, the requirement to have signed a connection agreement thus becomes a condition precedent to the issue of such a licence; and
- ▲ the proposed wind generator could demonstrate that its proposed generating plant and associated equipment has the technical capacity to meet the further technical standards set out in draft licensing principle 2.

The Commission has further considered that position in light of submissions received.

5.1.1 Requirement for connection agreement

The Commission's interpretation of the "appropriate quality" requirement is that it encompasses quality of supply (i.e. voltage levels and fluctuations) as well as other matters required to ensure that the generation plant is appropriately connected to the relevant network so as to meet relevant technical requirements (e.g. those imposed by the NER).

The Commission has historically taken this requirement to be satisfied in full if a connection agreement has been negotiated between the proposed generator and the relevant network service provider,²¹ and there are no remaining impediments to the signing of such an agreement.

The Commission determined in October 2004 that it would not issue an electricity generation licence for the Clements Gap wind generator until the transmission connection agreement between the proposed wind generator and ElectraNet had been signed. This is the position that the Commission proposes to adopt in relation to other wind generator licence applicants.²²

In adopting this position, the Commission notes the conclusions of the ESIPC report that the connection agreements being negotiated between wind generator proponents and ElectraNet or ETSA Utilities are of a "commendably high" standard.

²¹ Network service providers are required to assess connection applications in accordance with the provisions of Chapter 5 of the NER. Clause 5.1.3 of the NER requires that technical standards of performance be established at levels at or above the minimum access standards set out in schedules 5.1, 5.2, 5.3 and 5.3a, with the objective of ensuring that the power system operates securely and reliably and in accordance with the system standards set out in schedule 5.1a.

²² It is noted that connection agreements are typically made conditional on the receipt of final approvals, including securing an electricity generation licence. The Commission would be satisfied with the signing of such a conditional connection agreement for the purposes of satisfying the "appropriate quality" requirement.

Most stakeholders who submitted responses to this issue when raised in the Draft Statement of Licensing Principles expressed no concerns over the adoption of a principle requiring a fully negotiated connection agreement as a condition precedent to consideration of a licence application.

For instance, the Australian Wind Energy Association noted that:

A signed connection agreement should be in place prior to the issue of a licence. This requirement is proper and reasonable.

Pacific Hydro also supported this element of the Commission's proposals:

Pacific Hydro agrees that a pre-condition of a signed connection agreement is a reasonable expectation for ESCOSA.

ESIPC, in its further advice to the Commission, put the view that it continued to support this proposal, as the presence of a connection agreement not only indicates that the project is at an advanced stage, but also the fact that the connection arrangements and proposed plant will have been specified, with attendant supporting analysis to demonstrate the generator's technical performance.

While confirming that it will not issue an electricity generation licence for a wind generator until a connection agreement between the proposed wind generator and the relevant network operator has been fully negotiated, the Commission notes that meeting the connection agreement requirement is not in itself sufficient to ensure the issue of an electricity generation licence for a wind generator. These requirements are necessary in order to satisfy the Commission that the legislative criterion in relation to quality of supply, set out in section 17(2)(b) of the Electricity Act and section 6(1)(a) of the ESC Act, have been met.

5.1.2 Demonstrated capacity to meet technical standards

The Commission's proposed other element of its draft licensing principle 1 was that an applicant would be required to demonstrate, as a condition precedent, that its proposed generating plant and associated equipment has the technical capacity to meet the further technical standards set out in draft licensing principle 2.

Unlike responses to the first element, stakeholders overwhelmingly rejected this aspect of draft licensing principle 1. However, on analysis that rejection was linked to the standards proposed by draft licensing principle 2 (technical standards) rather than a rejection of the need for the Commission to satisfy itself that the licensing principles would be met. On this basis, the Commission sought further advice from ESIPC, which advised that the negotiation of a connection agreement and the analysis performed by network service providers as a part of that process would necessarily be based on the actual plant and equipment required to be installed at the connection point.



The Commission notes that the relevant requirements will be those of the generator, in terms of what it may want and/or be obliged by regulatory regimes such as the Commission's licensing requirement to install at the connection point in order to generate electricity.

On this basis, the Commission has formed the view that the plant and equipment will meet the requisite standards if a connection agreement reflecting the plant and equipment required (noting that required plant and equipment includes that required to meet the Commission's licence conditions) at the connection point has been signed or fully negotiated.

This means that the second element of the proposed licence pre-condition is not necessary in practice, and the Commission will not pursue this matter as a final licensing principle.

Nevertheless, should a wind generation proponent wish to proceed in accordance with the Commission's licensing principles, it will be necessary for it to certify in writing to the Commission that the generation plant and associated equipment that is the subject of the licence application will be operated to comply in all respects with applicable new licence conditions as enunciated this Statement of Principles. Necessary detail should be provided where relevant as to the reasons why the wind generation proponent believes that the plant will be able to do this. Where modification to the plant or the manner of its operation, as previously proposed, is required to enable any of the new licence conditions to be met, the nature of those modifications should be specified.

In making this decision, however, the Commission would note several matters which must be addressed by a wind generation proponent.

As a matter of practical application, this licensing principles will require a fully negotiated or signed connection agreement with the relevant network service provider to be evidenced to the Commission. For a wind generation proponent that wishes to be licensed in accordance with the Commission's licensing principles, there are two possible scenarios:

- ▲ Where a connection agreement with the network service provider has not yet been executed or fully negotiated, the wind generation proponent will need to ensure that the plant and equipment it proposes to install at the connection point will deliver the technical standards specified by the Statement of Principles and, in accordance with the requirements of the National Electricity Rules, that plant and equipment (and operating specifications of that plant and equipment) must be specified and agreed in the final connection agreement.
- ▲ Where the wind generation proponent has already executed or fully negotiated a connection agreement with the network service provider, then, to the extent that the plant and equipment (and operating specifications of that plant and equipment) cannot meet the technical standards specified by this Statement of

Principles, it will need to take steps to ensure that those technical standards can be met before a licence can be issued. This will require modification to the plant, equipment or operating specifications at the connection point and therefore the applicant will need to reach agreement with the network service provider as to an appropriate amendment of, or addendum to, the connection agreement, as required by the National Electricity Rules.

5.1.3 Other conditions precedent

It was suggested to the Commission that the requirement for a wind generator to register with NEMMCO under the NER should also be made a condition precedent to the issue of an electricity generation licence, or indeed that such a requirement might replace the requirement to have entered into a connection agreement. For example, in its submission on the ESIPC report, NRG Flinders commented that:

...it would also appear prudent to require licence applicants to provide evidence of registration with NEMMCO under the Code prior to the issue of any further generation licences, noting that this is a standard generation licence requirement in any event.

In response, the Commission notes that it has only limited powers to set conditions precedent to the issue of a licence. Such conditions must relate to the legislative criteria in the Electricity Act or ESC Act. It is not clear that a requirement to have registered with NEMMCO prior to the issue of an electricity generation licence can be related to these criteria. The connection agreement requirement, however, is directly related to the criterion at section 17(2)(b) of the Electricity Act.

In any event, NEMMCO must be involved in the negotiation of technical standards in a connection agreement, particularly in areas which may impact on system security.

As noted by NRG Flinders, the requirement to hold appropriate NEMMCO registration is a standard condition of an electricity generation licence issued by the Commission. Thus, once the generation operations commence, the generator is required to hold such registration. Operating the generation plant without NEMMCO registration gives rise to a breach of both the NER and the electricity generation licence. The licence breach is a compliance matter for the Commission²³.

Wind Prospect, in its submission on the ESIPC report, suggested that conditions precedent to the issue of an electricity generation licence should include receipt from the relevant authority of the appropriate development approval for the wind generator and associated power line; and that long-term power purchase agreement(s) or options are in place for the output of the wind generator. Again,

²³ Division 4, Part 3 and Divisions A1 and A2, Part 7 of the Electricity Act provide the Commission with certain powers in respect of the breach of licence conditions, including the suspension or cancellation of a licence (s.37), issue of warning notices (s.63A) and injunctions (s.63C).



the Commission stresses that it does not have the legislative power to arbitrarily select conditions precedent to the issue of an electricity generation licence. While it is acknowledged that the two conditions suggested by Wind Prospect are appropriate barometers of a viable and advanced project, the connection agreement requirement performs the same function and has a stronger legislative basis.

5.1.4 Conclusion on preconditions

The Commission will continue to require a fully negotiated connection agreement to be in place prior to the issue of a licence for wind generation.

5.1.5 Licensing Principle 1

Licensing Principle 1.

The Commission will be satisfied that the “appropriate quality” requirement of section 17(2)(b) of the Electricity Act and the quality requirement of section 6(1) of the ESC Act have been met in relation to any wind generator licence applicant if a connection agreement between the proposed wind generator and the relevant network service provider has been executed or fully negotiated.

As this legislative requirement is one about which the Commission must be satisfied before it can issue an electricity generation licence, the requirement to have signed a connection agreement thus becomes a condition precedent to the issue of such a licence.

5.2. Licence conditions

The balance of the matters identified by ESIPC cannot be appropriately addressed by precondition, for reasons set out above. The following section therefore discusses each of the licence conditions which the Commission will impose to address those risks. In finalising the conditions, the Commission has sought further advice from ESIPC.²⁴

5.2.1 Technical standards

The ESIPC report concluded that higher technical standards would need to be imposed on future wind generators, and in particular that they have the ability to:

- ▲ ride through a prescriptive and more severe low voltage event than is usually negotiated in connection agreements;
- ▲ generate and absorb reactive power and to control voltage;
- ▲ smooth short term fluctuations in output; and

²⁴ The further report from ESIPC is available from the Commission's website and is being released concurrently with this Statement of Principles.

- ▲ be remotely controlled and to curtail output where necessary.

It suggested that new standards consistent with these requirements should be developed, but that the NER automatic access standards combined with NEMMCO's remote data and control requirements provided a reasonable interim step.

The Commission developed draft licensing principle 2 to reflect these concerns. In summary, the Commission considered that proposed wind generator developments in South Australia should be capable of meeting emerging technical standards as proposed by the ESIPC report (noting that amendments to the NER to give effect to such standards are likely to be in place within two years).

In advance of such standards being in place, the Commission concluded that a licence condition should be established that specifies interim technical standards to be met by future wind generators, and that explicitly obliges the licensee to comply with ongoing technical standards established under the NER.

The Commission was of the view that wind generators should be required to comply with the automatic access standards which apply to conventional synchronous generators, and that specific licence conditions should be established requiring wind generators to contribute to reactive power support and voltage control to the extent required by either ETSA Utilities or ElectraNet or both.

The Commission considered that the issue of voltage control on the 275kV system may arise with a distributor connected wind generator, and therefore its proposed licence condition had the effect of requiring such generators to contribute to voltage control or the cost of voltage control equipment on the transmission system if required to do so by ElectraNet.

Stakeholder responses to these technical standards draft licensing principles were generally critical of the Commission's proposals, with many describing the overall proposals as being inappropriate and discriminatory (against wind as compared with "conventional" generators).

Some stakeholders, mostly those operating "conventional" generators, were supportive of the Commission's proposals however.

A common theme recurring throughout the submissions was that mandating the automatic access standard was excessive, and that both NEMMCO and relevant network services providers (which both have a role in the negotiation of connection agreements) are better placed to specify requirements.

The Commission acknowledges that these parties do have a role to play as described, but emphasises that the motivations of those parties are different to that of the Commission. NEMMCO, which is not ultimately a signatory to a connection agreement, has overall responsibility for power system security (NEM wide) but



has no responsibility for pricing or efficiency; while network service providers' primary concerns are protection of the network and provision of access to the network.

In terms of the Commission's objectives, both of these motivations have differences in emphasis as compared with protection of the long term interests of South Australian consumers. This indicates to the Commission that for wind generation, which is widely acknowledged not to be adequately dealt with in the general provisions of the NER (for instance, the MCE has specifically requested NEMMCO to review the NER in terms of appropriate standards for wind generators) there is a role for it to set standards for an interim period to ensure that its primary statutory objective under section 6(1)(a) of the ESC Act is met.

5.2.1.1 Fault ride through

In draft licensing principle 2 the Commission had proposed applying the automatic access standard of S5.2.5.3 of the NER.

A number of respondents argued against this proposal, on the grounds that such high standards would be onerous and unnecessary. Other respondents put the view that the existence of a connection agreement, with the inputs of the network service provider and NEMMCO, would be sufficient to ensure that fault ride through capabilities of a wind generator were sufficient.

The further advice of ESIPC on this matter is that, having had regard to the submissions made, it remains convinced that standards higher than those which would otherwise be negotiated are required to ensure appropriate quality of electricity supply.

Nevertheless, ESIPC has acknowledged that, on further consideration, a simple application of the automatic access standard for fault ride through might be difficult to implement and, moreover, to interpret. ESIPC has therefore recommended that a modified position be adopted by the Commission.

The position favoured by ESIPC is the adoption of a standard similar to that set by the National Electricity Tribunal recently in the matter of *National Electricity Code Administrator Ltd and NRG Flinders Operating Services Pty Ltd*.²⁵

Considering that advice, the Commission is of the view that the following condition would achieve the required outcome:

- ▲ Each generating unit must be capable of continuous uninterrupted operation during the occurrence of a normal voltage fluctuation caused by a

²⁵ *National Electricity Code Administrator Ltd (A.C.N. 073 942 775) and NRG Flinders Operating Services Pty Ltd (A.C.N. 094 130 837)* National Electricity Tribunal, Number 1 of 2005, 15 August 2005 (refer <http://www.netribunal.net.au/1-2005-DirectionsOrders.pdf>)

transmission system fault involving a single phase or two phase to ground condition with a loading level after the fault is cleared that is at, or reasonably about, the loading level immediately prior to the fault.

For the purposes of this condition, normal voltage fluctuation would be defined to mean voltage remaining within a band for 3 minutes, 10 seconds and 175 milliseconds following a fault, with the band having:

- ▲ an upper boundary of 100% of nominal voltage at all times; and
- ▲ a lower boundary of 0% of nominal voltage for the first 175 milliseconds during the fault, 80% of nominal voltage for the first 10 seconds after the fault is cleared and 90% of nominal voltage for the next 3 minutes.

Adoption of a condition such as this maintains a robust approach to fault ride through capability in light of the proposed high levels of wind generation in South Australia. At the same time, however, it clarifies the nature of the requirements in respect of this technical capability and removes the need to ride through a three phase fault.

5.2.1.2 Reactive power

In draft licensing principle 2, the Commission proposed that wind generators would be required to meet the reactive power capability required under the automatic access standard applicable to synchronous generators and, where that capability was not required locally, to deliver voltage support to the 275kV transmission network.

As was the case with respect to fault ride through, stakeholders generally commented that this proposal was costly, onerous and unwarranted. Stakeholders did not, however, provide any empirical support for this argument. It is therefore difficult for the Commission to directly address stakeholder's concerns.

Nevertheless, the Commission also sought further advice from ESIPC on this matter, with a view to accommodating stakeholder concerns without compromising the attainment of the Commission's primary objective.

ESIPC advised that it was aware of work being done by DlgSILENT which has demonstrated that the addition of considerably more capacity to the system which has minimum, or no, reactive power capability will lead to serious voltage control problems.

However, ESIPC also recognised that this risk is not unique to the introduction of wind generators: the broader problems are generic and are not technology specific. ESIPC therefore recommended that the Commission remove any requirement to provide voltage control support to the 275kV transmission system.



Nevertheless, ESIPC advised that it remained of the view that wind generators should be required to have reactive power capabilities greater than the current minimum standard, so that:

- ▲ contribution could be made to local voltage control during and immediately after a fault; and
- ▲ the impact of further wind generators on the power system would be minimised, thereby deferring the time at which voltage control might become an issue.

Having further considered the practicalities of applying the automatic access standard, ESIPC have advised the Commission that a more flexible alternative approach ought to be adopted with respect to reactive power capabilities. ESIPC therefore proposed that:

- ▲ At full rated power output the generation plant operated by a wind generator must be capable of delivering or absorbing reactive power of 0.395 times its power output.
- ▲ At generation levels below full rated output, the generation plant operated by a wind generator must be capable of delivering or absorbing reactive power at a level at least pro-rata to that of full output.
- ▲ At least 50% of the reactive power capability of the generation plant operated by the wind generator must be dynamically variable, with the balance able to be provided by non-dynamic plant.
- ▲ The reactive power capability of the generation plant operated by the wind generator must be controlled by a fast-acting, continuously variable, voltage control system which is able to receive a voltage set point.
- ▲ The wind generator must be able to operate its generation plant to a set power factor if that is the preferred mode of control at any time.

Having considered the submissions made by respondents, and noting as valid and relevant the concerns expressed by ESIPC, the Commission is of the view that the modified proposals of ESIPC, which are less onerous than the automatic access standard under the NER, are an appropriate condition to adopt in licences.

5.2.1.3 Data to NEMMCO

In draft licensing principle 2, the Commission proposed that the licensee must ensure that generating plant could meet NEMMCO's requirements for the supply of data on active and reactive power, wind speed and wind direction, as well as being capable of remote control by NEMMCO.

The Commission maintains that this requirement is appropriate and will adopt it as a final licensing principle.

5.2.1.4 Control equipment operation

In draft licensing principle 2, the Commission proposed that the licensee must ensure that its control equipment could operate for three hours following a total loss of supply at the connection point.

Some respondents expressed concern over the requirements of this proposal. The Commission would observe that it is intended to ensure that a wind generator can receive and act on dispatch instructions and provide data to NEMMCO in the event of a prolonged system failure. As such, the Commission also maintains that this requirement is appropriate and will adopt it as a final licensing principle.

5.2.1.5 Application of technical standards to small generators

Some respondents raised for the Commission's consideration the issue of whether these technical standards should apply to small wind generators.

Noting that the NER standards only apply to registered generators, and that NEMMCO has issued a standing exemption from the requirement to be registered in favour of generators with a nameplate rating of less than 5MW, the Commission agrees that it is not appropriate for generators with a nameplate rating of less than 5MW to be bound by the above technical standards.

5.2.1.6 Licensing Principle 2

The principles set out below represent the technical standard requirements which the Commission believes are appropriate to reflect in wind generators' licence conditions to address the risks identified in the ESIPC report.

The Commission notes that these technical standard requirements are consistent with, although in some instances less strenuous than, emerging international standards.

The Commission also notes that the technical standards licence conditions are in addition to, and do not displace or amend, the technical standards requirements as set out in Chapter 5 of the NER.



Licensing Principle 2.

The Commission will insert the following technical standards licence conditions in future electricity generation licences issued for wind generators in South Australia in respect of generators with a nameplate rating of greater than 5MW.

Fault Ride Through Capability

1. *Each generating unit of the generating plant operated by the licensee must be capable of continuous uninterrupted operation during the occurrence of a normal voltage fluctuation caused by a transmission or distribution (as the case may be) system fault involving a single phase or two phase to ground condition with a loading level after the fault is cleared that is at, or reasonably about, the loading level immediately prior to the fault.*
2. *For the purposes of clause 1, normal voltage fluctuation means voltage remaining within a band for 3 minutes, 10 seconds and 175 milliseconds following a fault, with the band having:*
 - (a) *an upper boundary of 100% of nominal voltage at all times; and*
 - (b) *a lower boundary of 0% of nominal voltage for the first 175 milliseconds during the fault, 80% of nominal voltage for the first 10 seconds after the fault is cleared and 90% of nominal voltage for the next 3 minutes.*

Reactive Power Capability

1. *At full rated power output the generation plant operated by the licensee must be capable of delivering or absorbing reactive power of 0.395 times that power output.*
2. *At generation levels below full rated output, the generation plant operated by the licensee must be capable of delivering or absorbing reactive power at a level at least pro-rata to that of full output.*
3. *At least 50% of the reactive power capability of the generation plant operated by the licensee must be dynamically variable, with the balance able to be provided by non-dynamic plant.*
4. *The reactive power capability of the generation plant operated by the licensee must be controlled by a fast-acting, continuously variable, voltage control system which is able to receive a voltage set point.*
5. *The licensee must be able to operate its generating plant to a set power factor if that is the preferred mode of control at any time.*

Data to NEMMCO

1. *The licensee must ensure that the generating plant it operates is able to meet the requirements specified by NEMMCO from time to time for the real time supply of data on active and reactive power, wind speed and wind direction, and be capable of remote control by NEMMCO.*
2. *The licensee must ensure that the generating plant it operates can meet the requirements specified in clause 1 for at least 3 hours following total loss of supply at the connection point.*

5.2.2 Optimised Dispatch

The ESIPC report highlighted the difficulties caused by the classification of wind generators as non-scheduled under the NER. Wind generation is treated as a negative demand rather than a source of supply, and, as a consequence, neither the forecast nor the actual quantity of wind energy is visible to the market. In particular, wind generators do not participate in the normal market bidding and dispatch process to determine which generators operate to satisfy market demand.

NEMMCO is therefore unable to manage market stability and security through its normal market optimization techniques, leading to unacceptable market risks at higher levels of wind generation. ESIPC concluded that wind generators must be integrated into the security constrained, optimised dispatch system operated by NEMMCO.

Based on that advice, the Commission proposed that wind generators should be required, as a licence condition, to register as scheduled under the NER.

This matter was of perhaps most significant concern to respondents to the Draft Statement of Principles. The Commission has therefore carefully set out its reasoning in respect of this matter below.

5.2.2.1 Background

The WETAG report put the same view as that put by ESIPC: some form of dispatch control should be applied to wind generators. The WETAG report suggested that it is:

...inevitable that significant non-scheduled generation plant will need to be controlled to reduced outputs in cases where network loading constraints become binding. There is merit in determining the acceptable loading level limits of non-scheduled generating plant using the central dispatch engine, particularly for any plant that is greater than 30 MW in size (WETAG report, p 15)

WETAG suggested that one option to meet this requirement for wind generators would be through a form of what it termed “semi-dispatch”: the maximum output of the relevant non-scheduled generation would be determined for the next dispatch interval through the central dispatch process, using constraint equations to keep network flows within limits. Dispatch targets of maximum generation would be sent to wind generators where network constraints are binding. Communication and control facilities would need to be installed and operated to ensure that the dispatch instructions could be implemented.

NEMMCO has indicated to the Working Group overseeing consideration of the WETAG report that it is willing to take a lead role in the further development of the semi-dispatch or similar mechanism for application to non-scheduled generators. The Commission understands that NEMMCO may be requested to



provide further advice on this matter shortly, and that the provision of such advice could take up to 6 months. The subsequent process of amending the NER to accommodate the appropriate dispatch mechanism and implementing required system changes in the NEM could take a further two years. Thus, on the assumption that there is policy level commitment to implement such a mechanism (and the Commission believes there are grounds for optimism on this matter), it could be mid-2007 before the mechanism is in place.

In general, wind generator developers supported the incorporation of non-scheduled generators into the NEMMCO optimised dispatch process (e.g. through semi-dispatch rules), together with the installation of the associated control equipment.

However, Stanwell has suggested that, from a trading perspective, it did not consider that the WETAG semi-dispatch model was the most appropriate and cost effective method to apply to wind generators.

Given the financial arrangements associated with wind farm developments (e.g. metered-volume power purchase agreements), the owner/operator has an incentive to maximise output at all times. As a result, under the proposed semi-dispatch arrangements, all wind farm participants are expected to bid at the price floor. In the event of network constraints, bids submitted by wind farm participants are of second order importance and dispatch will need to be prorated based on system requirements. Accordingly, the costs (e.g. IT start-up and monitoring) incurred by wind farm participants under the proposed semi-dispatch model will exceed the potential market benefits and these costs may be passed onto end users. Consequently, Stanwell considers there is merit in developing an alternative methodology to apply to the dispatch arrangements for wind farms in the event of network constraints.

International Power Australia indicated its agreement with the need to automatically optimise non-scheduled plant operation within the electrical system security envelope.

This in turn requires the wind generator to have the necessary facilities installed to achieve ramp rate limiting, remote offloading and to allow for communication with NEMMCO. The offloading requirements may be met by using either proportional control or by a unit trip. However, it should be possible for wind generators to enter into commercial arrangements with existing generators to either firm up the wind output for system security purposes, or to provide offloading services (runback) where it is not a local network issue. To manage system security, non-scheduled generators can be dispatched according to a standing off-loading offer without the need to offer the plant into the NEM market on daily basis (i.e. "semi-dispatch"). The dispatch engine would use the offloading price to optimally reduce output of a wind generator where necessary to manage system constraints. This would be done consistently between different plant technologies whilst maintaining the overall efficiency of economic dispatch.

ElectraNet requires that a wind generator connecting to its network have the capability to limit its output in order to manage local network flows. Such a capability would be used by ElectraNet to manage system security issues in

instances where network constraints became binding. As noted in the WETAG report:

...such arrangements are not required by the Code, nor co-ordinated with the central dispatch process and will therefore not be reflected in market forecast processes managed by NEMMCO. ... These arrangements deliver an ability to manage network flows for the NSPs but introduce complexity for wind developers through potentially different approaches being adopted by each NSP. ... It is desirable to have NEM wide common arrangements for the dispatch of plant rather than different arrangements being possible at different locations in the NEM. (WETAG report p 14)

The Commission concurs with the sentiments of the WETAG report on this matter. However, it notes that, due to the ElectraNet requirements, wind generators in South Australia appear to already have the necessary control equipment to support a centralised dispatch process operated by NEMMCO. Furthermore, the emerging technical standards to be applied to future wind generation plant, as discussed above, will also impose such requirements. In addition, the proposed licence condition for technical standards addresses this requirement.

As noted in section 1.1 of this paper, any generator over 30 MW in size will be classified as a scheduled generator unless it seeks NEMMCO's approval to be non-scheduled. It is thus an option, albeit one that would introduce operational complexities, and hence presumably additional costs, for a wind generator to operate as a scheduled generator in the market. ESIPC has advised that a scheduled wind generator:

- ▲ would be required to submit Projected Assessment of System Adequacy (PASA) and pre-dispatch data, hence providing an avenue for the wind generator to supply forecast information;
- ▲ would be expected to automatically rebid its availability every five minutes with a statistical five minute forecast that would aid market operation and would result in the generator being charged for ancillary services on a causer pays basis relative to its forecast;
- ▲ is by definition part of the NEMMCO optimised dispatch process.

It is therefore a possible interim step, i.e. prior to finalization of a semi-dispatch or other appropriate form of dispatch for non-scheduled wind generators, to require new wind generators as a condition of licence to operate as a scheduled generator. As an alternative, NEMMCO might be able to use its powers under clause 2.2.3(c) of the NER (in approving a non-scheduled classification) to specify certain interim conditions that would have the same effect.

There appears to be commitment to the development of appropriate changes to the NER to support the imposition of some form of optimised dispatch (e.g. semi-



dispatch) requirements on future wind generation operators, such measures will not be in place for about two years.

As an interim position, the Commission therefore concluded that a licence condition should be established that requires the wind generator to operate as a scheduled generator during the transitional period. The condition would allow a change in classification when new national arrangements are in place and then bind the licensee to comply with the optimised dispatch measures for non-scheduled generators once established under the NER.

5.2.2.2 Submissions

The Commission's review of all the submissions received indicates that the majority of wind generator proponents were not in favour of a requirement that they be classified as scheduled. The key reasons presented for this were:

- ▲ concerns over the costs of systems to provide offers to NEMMCO;
- ▲ the risk of penalties for not delivering the output accepted in a dispatch offer and therefore being regarded as non-conforming; and
- ▲ difficulty in providing meaningful inputs to PASA and pre-dispatch processes as to future generation outputs.

Aside from these reasons, other respondents also put forward the view that wind generators should be registered with NEMMCO as "semi-scheduled" or "semi-dispatched" rather than as scheduled.

Dealing with that last point first, the Commission would note that while it understands the intent of the semi-dispatched proposal, the concept is only under investigation at present as it does not form part of the NER. It is therefore not open to the Commission to seek to require wind generators to register with NEMMCO as semi-dispatched generators.

Turning then to the three key objections of stakeholders, the Commission would respond as follows.

First, in terms of system costs and penalties, the Commission notes that the NER's requirement for scheduled generators to offer bids contains flexibility for the bidding and rebidding of available outputs and for the movement of capacity within pricing bands. Further, automated bidding systems can be used for these purposes. Advice received from ESIPC indicates that it is of the view that any generator with an automated reoffer system, providing NEMMCO with a soundly based indication of likely capacity and generation over the coming dispatch interval, is unlikely to be judged as not offering "in good faith". The Commission is of the view that the costs to wind generators of being classified as scheduled under the NER would be no greater than the likely costs of being "semi-dispatched".

Secondly, in terms of “non-conformance” risks, ESIPC has again provided detailed analysis and advice which indicates that the provisions of the NER, and guidelines published by NEMMCO, provide clear scope for generators to routinely diverge from targets by modest amounts, and by larger amounts for a more limited number of dispatch intervals (particularly where the divergence is not driving security risks).

Given ESIPC’s advice in the April 2005 report that its statistical analysis demonstrates that the majority of five minute variations in wind persistence (and therefore wind generator output) were zero or very small, in combination with the ESIPC analysis of the NER non-conformance procedures, the Commission does not consider non-conformance to present a credible risk to wind generators.

Finally, while it might be superficially regarded as problematic for wind generators to provide meaningful input into short term (ST) and medium term (MT) PASA processes, the NER only requires these inputs to represent a best indicator of future performance. Clearly in the case of wind generators, any inputs will only ever be indicative. Given that weather forecasting is not precise over long time horizons, it would be sensible to provide typical seasonal or monthly weather patterns for those timeframes. Shorter timeframes may be dealt with through Bureau of Meteorology or site specific analysis data.

5.2.2.3 Conclusions on scheduled requirement

In light of the further advice provided by ESIPC in response to issues raised in consultations, the Commission has confirmed its position that until appropriate arrangements (such as formalized semi-dispatch rules) are made in the NEM, it is appropriate to require wind generators to operate as scheduled generators under the NER.

This requirement will apply to all wind generators with a nameplate generation capacity of greater than 30MW.

5.2.2.4 Licensing Principle 3

Licensing Principle 3.

The Commission considers it appropriate for conditions in the following form to be included in future a electricity generation licences issued for wind generators in South Australia in respect of generators with a nameplate rating of greater than 30MW.

OPTIMISED DISPATCH

- 1. The Licensee must be classified as a scheduled generator under the National Electricity Rules.*
- 2. The Licensee, as a scheduled generator, must provide forecasts of expected generation output for incorporation into pre-dispatch, medium term and long term PASA data.*



5.2.3 Wind Energy Forecasting

The ESIPC report noted that a fundamental strategy to deal with the variability of wind energy available to the market was to have techniques to ensure accurate wind forecasting. The need to have such forecasting techniques arises because the output of wind generators varies significantly over time and affects the efficiency of the market and the security of the power system.

For reasons set out below, the Commission formed a view that it would be appropriate to require wind generators to provide forecasting data as required, to participate in the development of a centralised wind forecasting system, and to provide other data required for incorporation into pre-dispatch, medium term and long term PASA data.

Submissions on this matter indicated that there was a degree of confusion as to the outcomes being sought by the Commission.

5.2.3.1 Background

Significant work is now underway to develop wind forecasting techniques. For example, the Australian Greenhouse Office (AGO) has received funding from the Federal Government to develop a comprehensive forecasting tool.

NEMMCO has advised that it currently has a rudimentary model to forecast output from wind generators for pre-dispatch timeframes in South Australia, developed with assistance from ESIPC. It is seeking additional SCADA data from wind generators to improve the model and is seeking to establish the availability of forecast information from the Bureau of Meteorology about major changes in wind speed. NEMMCO suggests that, in the longer term, the AGO project will deliver a forecasting system for the NEM that covers all relevant timeframes from dispatch to medium term PASA (2 years). However, it is understood that initial deliverables from the AGO project will not be available until late 2006.

In its submission to the Commission on the ESIPC report, TRUenergy suggested that the approval of wind generation above 500 MW in advance of appropriate forecasting systems being available was likely to artificially force additional unit commitment through the use either of additional dispatch constraints, or through direction or instructions issued by NEMMCO, resulting in market uncertainty and disputes between participants. It proposed an alternative approach to managing unit commitment risk.

Specifically, we suggest that a "unit commitment" ancillary service payment be made to units in SA which may be required to commit at short notice in the event of large wind variations. This would compensate generators for the costs of maintaining their units in a state of rapid availability, and ensure that sufficient scheduled plant is available for rapid commitment in the event of significant wind variations. Such a service could be contracted with NEMMCO over

several years, thereby providing a stable low-cost transition to a time when wind-forecasting technology has reached standards that will allow the NEM decentralised commitment process to appropriately manage system security.

The approach outlined above is one which would be difficult to implement from the Commission's viewpoint, but may be a valuable suggestion in the context of NEM changes, particularly if wind generator construction outstrips forecasting system development.

Wind generator developers were in general agreement about the need to provide both forecast and real time wind generator output data to relevant parties (e.g. NEMMCO, ESIPC, and network service providers) as required.

- ▲ International Power Australia commented that to assist market participants in managing their risks and opportunities in the market, wind forecasts must be provided to all market participants in a manner analogous to demand forecasts. The forecasting process should be facilitated by NEMMCO, either in-house or outsourced to an external service provider on a competitive basis.
- ▲ Stanwell indicated that it is imperative that all (existing licensed and future licensed) wind generation participants provide comprehensive forecasting information and are involved in the development of NEM forecasting systems. The ability to manage system stability and concurrently maximise the amount of wind generation will be enhanced by all participants being required to provide forecasting information. The submission from Babcock & Brown and National Power Partners also emphasised the need for forecasting requirements to be imposed equitably on both current and future wind generators.

As noted previously, NER changes have recently been proposed by NEMMCO providing for appropriate information disclosure arrangements for non-scheduled generators. These changes would enable NEMMCO to publish details of allowances made for non-scheduled generation in forecasts of short and medium term PASA and in pre-dispatch forecasts, and have been developed as a result of a recommendation of the WETAG report. This is a necessary step in making wind generation load forecasts available to the market, but nevertheless is ineffective without adequate forecasts being developed.

5.2.3.2 Submissions

As noted above, submissions tended to indicate that the Commission had not clearly expressed its desired forecasting outcomes.

To clarify, the Commission notes the following matters.



First, the overall intent was to ensure that all licensees provide information to facilitate the successful development of a centralized wind forecasting system. It was not aimed at having each licensee develop individual wind forecasting software.

Secondly, in terms of requirements as to the provision of models, the intent of the Commission was to ensure that any models provided by a wind generator are appropriate representations of the conversion of wind at the wind generator into power output.

5.2.3.3 Conclusions on forecasting

In light of the foregoing clarification of its position (which is reflected in the revised final licensing principle below) it is the Commission's position that wind generators can and should provide forecasting data input into development processes and NEM systems.

The Commission considers, on advice from ESIPC, that this requirement should apply to all wind generators with a nameplate generation capacity of greater than 5MW.

5.2.3.4 Licensing Principle 4

Licensing Principle 4.

The Commission considers it appropriate for a condition in the following form to be included in future electricity generation licences issued for wind generators in South Australia in respect of wind generators with a nameplate rating of greater than 5MW.

WIND FORECASTING

- 1. The Licensee must, on request, provide to the Planning Council, the Commission and NEMMCO accurate and verifiable wind energy forecasting data and temperature data, appropriately constructed models, documents and other information concerning the operation of the generating plant the licensee is authorised by this licence to operate.*
- 2. Any data, models, documents and information requested under this clause must be provided in the manner and form and within the time frame specified by the Planning Council, the Commission or NEMMCO.*
- 3. The Licensee must cooperate with the development and implementation of wind energy forecasting systems for use in the National Electricity Market and must provide timely, accurate, and verifiable information for this purpose.*

5.2.4 Cost Allocation

The ESIPC report has highlighted the importance of the role played by the FCAS markets within the NEM. The regulatory markets in particular, operate on a causer pays basis and allow NEMMCO to maintain the power system frequency within secure limits. The ESIPC report recommended that market changes be introduced to require participation by wind generators in such markets; this would require that wind generators pay for the effects they cause and earn revenue for services they provide. This would drive appropriate investment and operational decisions on the part of wind generators.

As an interim measure, the Commission therefore concluded that a licence condition that wind generators must install metering suitable for the purposes of clause 3.15.6A(h) of the NER would be appropriate. In addition, the clause would require compliance with any future ancillary service arrangements established under the NER for wind generators.

5.2.4.1 Background

The WETAG report noted that NEMMCO procures *contingency* FCAS to ensure that power system frequency meets the operating standards set by the Reliability Panel. At present, the amount of contingency raise service procured by NEMMCO is mainly determined by the largest generating unit present on the power system; contingency lower service is determined by the largest load. WETAG suggests that wind generators would be unlikely to impact these requirements directly, and that hence no compelling reason has emerged as to the need for changes to the current arrangements for the procurement and funding of contingency FCAS.

The WETAG report further notes that variations in the output of generating units and loads disturb the supply/demand balance and routinely cause power system frequency to move away from the nominal 50 Hz. NEMMCO procures *regulation* FCAS through a spot market to ensure that power system frequency stays within the operating limits set by the Reliability Panel. WETAG notes that NEMMCO has made no special arrangements to purchase additional regulation FCAS due to an increase in wind generation, but that, if the issue increased in materiality, NEMMCO's current powers under the NER were considered sufficient for the purpose.

In relation to cost recovery of regulation FCAS, the WETAG report notes that the "causer pays" mechanism is defined at clause 3.15.6A of the NER for market generating units that have real time operational metering that records short-term variations in plant output.

The causer-pays mechanism identifies relevant generators that are causes of frequency variations and allocates a causer pays factor to each. The remaining cause of frequency



deviations is allocated to market customers, shared on a pro-rated basis. The causer pays factors are then used in market settlements to recover the procurement costs for regulation FCAS. (WETAG report, p 32)

Thus, wind generators that are registered as market generators under the NER will participate in the current causer pays arrangements for regulation FCAS only if appropriate operational metering is installed. If such metering is not installed, that generator's contribution to regulation FCAS will be picked up by customers. Non-market generators will not participate in such arrangements. In this case, the generator's contribution will default to market customers as a group. The WETAG report expresses particular concern about the cross subsidy caused by wind generators that are registered as market generators but do not have appropriate operational metering. It suggested that a preferred option for addressing this issue was to amend the NER to require that all significant market generating systems (> 30 MW) be included in the causer pays arrangements under the NER.²⁶

The Commission noted that, in the absence of such a change to the NER, the current causer pays arrangements would continue to operate, such that only wind generators registered as market generators and with appropriate operational metering would participate in those arrangements. The Commission is of the view that, in the interim, it would be appropriate to require, as a condition of an electricity generation licence issued to a wind generator, the installation of metering appropriate for participation in the causer pays arrangements as established under clause 3.15.6A of the NER.

5.2.4.2 Submissions

In general, wind generator developers supported the inclusion of wind generators in the markets for ancillary services within the NEM.

In responding to the ESIPC report, Stanwell sounded a note of caution, commenting that:

...the participation of wind generation as a full participant in the NEM with efficient allocation of costs should be seen as a long-term goal that will have issues of practicality in its implementation and will be reliant on achieving quality forecasting as a precursor, but Stanwell agrees with the need for clarification with regards to wind farms over 30 MW.

International Power Australia supported the extension of ancillary services market-based approaches to wind generators, and suggested that:

²⁶ WETAG noted that it did not consider the cross subsidies associated with the exclusion of non market generators from the causer pays arrangements to be material, and that, as a consequence, no compelling case existed to address this matter. It noted that, as wind generators become larger, many will be registered as market generators, either because the generator will not have a Power Purchase Agreement or because their Agreement will be with a retailer other than the first tier retailer (AGL SA in South Australia).

...the Code already provides for this without policy changes, although clarification in the Code would be helpful.

Other respondents supported a process of ensuring that modifications to the NER appropriately address this matter. On that point, the Commission would observe (for the reasons detailed at section 4.2.1) that it is not in a position to issue “ordinary” generation licences to wind generators pending future changes to the NER: the basic premise adopted by the Commission is that to do so would likely prevent the attainment of its primary objective.

As with all of the Commission’s proposals, once appropriate NER/NEM changes are in place, wind generator licences may be modified by removing these interim licence conditions.

5.2.4.3 Conclusion on cost allocation

In summary, the Commission supports the approach advocated by the WETAG report on cost allocation of ancillary services. Clarification of current NER requirements is necessary to ensure that wind generators registered as market generators participate fully in the causer pays arrangements for regulation FCAS.

In the interim, however, the Commission maintains the view that a licence condition dealing with the installation of metering appropriate for participation in the causer pays arrangements as established under clause 3.15.6A of the NER is necessary for wind generators with a nameplate rating of greater than 5MW.

Licensing Principle 5.

The Commission considers it appropriate for a condition in the following form to be included in future electricity generation licences issued for wind generators in South Australia in respect of generators with a nameplate rating of greater than 5MW:

COST ALLOCATION OF ANCILLARY SERVICES

- 1. The licensee must ensure that it has installed, and keeps operational, metering suitable for the purposes of clause 3.15.6A(h) of the National Electricity Rules to allow the individual contribution of the generating plant to the aggregate deviation in frequency of the power system to be assessed within each trading interval of the National Electricity Market.*
- 2. The Licensee must comply with requirements imposed under the National Electricity Rules from time to time in relation to ancillary services arrangements.*
- 3. The Licensee must be registered under the National Electricity Rules as a market generator.*



5.3. Existing Wind Generation Licensees

As noted in section 1 of this paper, the Commission has already licensed seven wind generators with a total capacity of about 450 MW. The question arises as to whether or not any of the licence conditions for application to *future* wind generators should also be made applicable to those that have already been licensed.

The Commission is empowered to vary existing licences by s. 27 of the Electricity Act. A licence variation may be made on application by the licensee or with the licensee's agreement. Alternatively, the Commission may vary a licence after giving the licensee reasonable notice of the proposed variation and allowing the licensee a reasonable opportunity to make representations about the proposed variation²⁷. It is thus open to the Commission to vary the existing electricity generation licences issued to wind generators to incorporate new conditions such as those discussed in section 5.2.

In deciding on such a matter, the Commission would need to consider carefully the costs and benefits of imposing such conditions on existing licensees. Significantly greater costs would potentially be imposed on the currently licensed wind generators (five of which have already commenced the generation operations) than on new licensees through such conditions. Furthermore, the impacts of additional wind generation as detailed in the ESIPC report have been assessed based on an assumption that none of the recommended measures are applied to the existing licensees. The ESIPC report concluded that the current level of wind generation in South Australia is manageable. It might therefore be concluded that the additional licence conditions developed for application to new wind generation developments should not be imposed on existing licensees.

Submissions to the Draft Statement of Principles were generally supportive of this position. Nevertheless some submissions commented that both current and future wind generators should be required to provide comprehensive forecasting information about wind energy output and to be involved in the development and implementation of NEM wind forecasting systems.

As it did in the Draft Statement of Principles, the Commission endorses the view that there may be a particular need for existing as well as future wind generators to provide appropriate forecasting information to the market. It notes, however, that variation of existing wind generation licences to include such a condition would be subject of a separate consultation process in accordance with the requirements of section 27 of the Electricity Act.

Furthermore, as noted earlier, ElectraNet requires wind generators connecting to its network to install control equipment to enable output to be limited as necessary to manage local network flows. It is understood that this applies equally to the current set of

²⁷ S. 75 of the Electricity Act provides for a system of review by the Commission and appeal by the licensee to the District Court where the licensee is dissatisfied with a decision of the Commission to vary an existing licence.

wind generators that have already been licensed as well as to proposed new wind generators. This would facilitate the participation of the current wind generators in any future centralised dispatch process developed by NEMMCO.

It is noted, however, that this view does not apply to the proposed variation of the current generation licence held by Lake Bonney to accommodate an additional 160 MW of wind generation capacity (refer Table 1). It is the Commission's position that the licence conditions enunciated above would apply in relation to the additional capacity proposed for that wind generator.

Licensing Principle 6.

It is the Commission's view that:

- ▲ current electricity generation licences issued to wind generators should not be varied to impose the requirements described in Licensing Principles 2, 3 and 5.

but

- ▲ current licences issued to wind generators should nevertheless be varied to impose the requirements described in Licensing Principle 4 in relation to wind forecasting.

5.4. Other issues

One consideration put forward by the Commission in respect of the subsidiary objectives of the ESC Act is the potential for a wind generator proponent, once licensed, to fail to operationalise its wind generator. For example, it might be the case that, even after a connection agreement has been signed and a licence issued, a wind generator proponent might not gain development approval or might not finalise the necessary commercial arrangements that underpin the viability of the project. Hence the wind generation operations might never commence.

The Commission therefore proposed, as draft licensing principle 7, that to guard against the situation in which a licensee gains a licence but does not proceed with the project, it would include a condition in each new electricity generation licence issued for a wind generator to provide that the licence would expire if the operations authorised by the licence had not commenced within a specified time (e.g. 1-2 years) following issue of the licence.

While submissions to the Draft Statement of Principles were generally supportive of this position, the Commission, having further considered the matter, is no longer of the view that such a provision is required. More particularly, the imposition of the licence conditions set out in this Statement of Principles will have the effect of removing any absolute limits on the amount of wind generation capacity which can be installed in South Australia.

As a result, the Commission will not implement draft licensing principle 7 through this Statement of Principles.



5.5. Summary of Principles

This section briefly restates the licensing principles for future wind generators as established in this Statement of Principles.

▲ *Condition precedent for issue of an electricity generation licence*

The Commission will be satisfied that the “appropriate quality” requirement (section 17(2)(b) of the Electricity Act) and quality requirement (section 6(1) of the Essential Services Commission Act) have been met in relation to any wind generator licence applicant if a connection agreement between the proposed wind generator and the relevant network service provider has been executed or fully negotiated.

▲ *Additional Licence Conditions*

The Commission is aware that significant work is underway at the national level (e.g. through development of changes to the NER by NEMMCO) to provide long term solutions to the risks, as identified in the ESIPC and WETAG reports, attached to further significant wind generation in the NEM, and in particular in the South Australian region of the NEM.

To facilitate the issuing of electricity generation licences for wind generator in the short-term, the Commission has developed proposals for a set of additional licence conditions that seek to ensure that, for the transitional period between the commencement of the generation operations and the implementation of appropriate measures at the national level, the risks identified in the ESIPC report can be managed effectively.

The Commission notes that applicants will need to demonstrate to the Commission the capacity to comply with the licence conditions. Further, in the event that an applicant gaining a licence subsequently breaches the relevant licence conditions, the Commission would regard that breach as serious and as providing grounds for enforcement action (including suspension of the licence).

The conditions are as follows:

- ▲ The first licence condition relates to technical standards for wind generators with a nameplate rating of greater than 5MW.

Fault Ride Through Capability

1. *Each generating unit of the generating plant operated by the licensee must be capable of continuous uninterrupted operation during the occurrence of a normal voltage fluctuation caused by a transmission or distribution (as the case may be) system fault involving a single phase or two phase to ground condition with a loading level after the fault is cleared that is at, or reasonably about, the loading level immediately prior to the fault.*

2. For the purposes of clause 1, normal voltage fluctuation means voltage remaining within a band for 3 minutes, 10 seconds and 175 milliseconds following a fault, with the band having:
 - a. an upper boundary of 100% of nominal voltage at all times; and
 - b. a lower boundary of 0% of nominal voltage for the first 175 milliseconds during the fault, 80% of nominal voltage for the first 10 seconds after the fault is cleared and 90% of nominal voltage for the next 3 minutes.

Reactive Power Capability

1. At full rated power output the generation plant operated by the licensee must be capable of delivering or absorbing reactive power of 0.395 times that power output.
2. At generation levels below full rated output, the generation plant operated by the licensee must be capable of delivering or absorbing reactive power at a level at least pro-rata to that of full output.
3. At least 50% of the reactive power capability of the generation plant operated by the licensee must be dynamically variable, with the balance able to be provided by non-dynamic plant.
4. The reactive power capability of the generation plant operated by the licensee must be controlled by a fast-acting, continuously variable, voltage control system which is able to receive a voltage set point.
5. The licensee must be able to operate its generating plant to a set power factor if that is the preferred mode of control at any time.

Data to NEMMCO

1. The licensee must ensure that the generating plant it operates is able to meet the requirements specified by NEMMCO from time to time for the real time supply of data on active and reactive power, wind speed and wind direction, and be capable of remote control by NEMMCO.
2. The licensee must ensure that the generating plant it operates can meet the requirements specified in clause 1 for at least 3 hours following total loss of supply at the connection point.

- ▲ The second condition relates to optimised dispatch and applies to wind generators with a nameplate rating of greater than 30MW.

OPTIMISED DISPATCH

1. The Licensee must be classified as a scheduled generator under the National Electricity Rules.
2. The Licensee, as a scheduled generator, must provide forecasts of expected generation output for incorporation into pre-dispatch, medium term and long term PASA data.



- ▲ The third condition relates to wind forecasting and applies to wind generators with a nameplate rating of greater than 5MW.

WIND FORECASTING

1. *The Licensee must, on request, provide to the Planning Council, the Commission and NEMMCO accurate and verifiable wind energy forecasting data and temperature data, appropriately constructed models, documents and other information concerning the operation of the generating plant the licensee is authorised by this licence to operate.*
2. *Any data, models, documents and information requested under this clause must be provided in the manner and form and within the time frame specified by the Planning Council, the Commission or NEMMCO.*
3. *The Licensee must cooperate with the development and implementation of wind energy forecasting systems for use in the National Electricity Market and must provide timely, accurate, and verifiable information for this purpose.*

- ▲ The fourth condition relates to cost allocation and applies to wind generators with a nameplate rating of greater than 5MW.

COST ALLOCATION OF ANCILLARY SERVICES

1. *The licensee must ensure that it has installed, and keeps operational, metering suitable for the purposes of clause 3.15.6A(h) of the National Electricity Rules to allow the individual contribution of the generating plant to the aggregate deviation in frequency of the power system to be assessed within each trading interval of the National Electricity Market.*
2. *The Licensee must comply with requirements imposed under the National Electricity Rules from time to time in relation to ancillary services arrangements.*
3. *The Licensee must be registered under the National Electricity Rules as a market generator.*

- ▲ *Existing wind generation licensees*

It is the Commission's view that current electricity generation licences issued to wind generators should not be varied to impose the requirements described in licensing principles 2, 3 and 5 but should be varied to impose the requirements described in licensing principle 4 in relation to wind forecasting.

5.6. Transitional nature of licence conditions

As repeatedly noted by the Commission throughout the course of its considerations of wind generation licensing issues, the licence conditions set out in this Statement of Principles are intended to be of a transitional nature only. The Commission remains of the view that a national market-wide solution to the issues associated with the introduction of greater amounts of wind generation capacity is the best and most appropriate outcome.

Nevertheless, in the absence of such a solution, the licence conditions enabling the Commission to issue electricity generation licences to wind generators in the short term are an appropriate means by which the Commission can ensure that its primary objective under the ESC Act is met.

Recognising, as it does, that a national market-wide solution is expected to be finalised within two years, the Commission notes that it will take steps to make necessary amendments to generation licences once the nature and timing of those solutions has been crystallized. If necessary, the Commission will make staged amendments to licences.

6. NEXT STEPS

The Commission has now set out its licensing principles which will enable it to issue electricity generation licences to wind generators in the short term in South Australia, pending the introduction of amendments to the NEM/NER.

It is now a matter for each wind generator proponent to consider whether it wishes to proceed with its licence applications, on the basis of the Commission's principles, or to await the NEM/NER changes before proceeding.

Should a wind generation proponent wish to proceed immediately, it will be for that proponent to demonstrate to the Commission that its proposals will satisfy the principles set out herein.

The Commission would emphasise that should a wind generation proponent wish to proceed in accordance with the Commission's licensing principles, then it will be necessary for it to certify in writing to the Commission that the generation plant and associated equipment that is the subject of the licence application will be operated to comply in all respects with applicable new licence conditions as enunciated in this Statement of Principles. Necessary detail should be provided where relevant as to the reasons why the wind generation proponent believes that the plant will be able to do this. Where modification to the plant or the manner of its operation, as previously proposed, is required to enable any of the new licence conditions to be met, the nature of those modifications should be specified.

As a matter of practical application in relation to the technical standards licensing principles, a fully negotiated or signed connection agreement with the relevant network service provider will need to be evidenced to the Commission. For a wind generation proponent that wishes to be licensed in accordance with the Commission's licensing principles, there are two possible scenarios:

- ▲ Where a connection agreement with the network service provider has not yet been executed or fully negotiated, the wind generation proponent will need to ensure that the plant and equipment it proposes to install at the connection point will deliver the technical standards specified by the Statement of Principles and, in accordance with the requirements of the National Electricity Rules, that plant and equipment (and operating specifications of that plant and equipment) must be specified and agreed in the final connection agreement.
- ▲ Where the wind generation proponent has already executed or fully negotiated a connection agreement with the network service provider, then, to the extent that the plant and equipment (and operating specifications of that plant and equipment) cannot meet the technical standards specified by this Statement of Principles, it will need to take steps to ensure that those technical standards can be met before a licence can be issued. This will require modification to the plant, equipment or operating specifications at the connection point and therefore the applicant will need



to reach agreement with the network service provider as to an appropriate amendment of, or addendum to, the connection agreement, as required by the National Electricity Rules.

Once the Commission is satisfied as to these matter, it will be in a position to commence issuing licences in accordance with the provisions of Part 3 of the *Electricity Act 1996*, with appropriate licence conditions reflecting the licensing principles.