

Wind Energy Policy Working Group  
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To Whom It May Concern,

**Re: Integrating Wind Farms into the National Electricity Market.**

The development of an equitable, well informed and flexible regulatory and market framework is crucial to the ongoing success of the Australian wind energy industry. Pacific Hydro Limited welcomes the opportunity to comment on the Wind Energy Policy Working Group (WEPWG) paper and support the WEPWG in its efforts to seek further feedback from industry.

Wind energy is a relatively new technology to the Australian energy market and exhibits some characteristics that are different to most of the existing generation plant in the national electricity market. However, it must be recognised that wind energy is a mature technology that has been successfully integrated in energy systems around the world for over thirty years.

In Australia issues have recently been raised concerning integrating wind power into the grid. While Pacific Hydro agrees that material issues need to be addressed before they become major problems we are deeply concerned by the level of misunderstanding and exaggeration concerning the severity of these issues and the materiality of the consequences of not taking immediate action.

There are challenges that both industry and regulators must meet but we firmly believe they are not yet material problems and that technical and market design solutions can be implemented. In many cases the concerns have not yet been quantified and generally one solution often resolves a number of issues. These solutions are straightforward and manageable and in many cases have been used to deal with similar issues already experienced in the electricity industry.

As an Australian company dedicated to a sustainable future through renewable energy and with operating wind farms, Pacific Hydro encourages the WEPWG to consider practical low cost solutions to the issues raised in the paper

Pacific Hydro notes that the discussions on technical issues for power system control have not included input from wind turbine manufacturers or specialists on the control systems that are available for modern wind turbines. This is a critical element in addressing the first principles for the integration of wind energy and ensuring that control systems are adequate. Bringing the manufacturers into the discussion would ensure they have an opportunity to respond with what is available to solve the issue or with what can be done to resolve it. Without this interaction, efficient and low cost methods of wind farm performance may not be identified.

The existing synchronous machines have had the benefit of many decades of careful power system and control engineering and have developed stable and reliable performance as a direct result. This does not guarantee they always perform well as there have been a number of serious events recently on the power system with the failure of large machines.

Power system engineers are only now concentrating on wind energy as a serious part of the power system. It is critical that the engineering requirements to improve integration be co-operatively managed between NEMMCO, NSPs and the project proponents. The first principles of wind generators, their performance and operation must be fully understood just as it is for synchronous machines. This must be set as a priority in order to achieve a satisfactory level for minimum or automatic performance standards of wind generators. Once this has been completed, any identifiable gap in system operation requirements could then be provided through market mechanisms by other generating units in the system.

As a wind farm developer, Pacific Hydro welcomes the challenge of integrating wind energy into the power system in a responsible manner so that renewable energy can be delivered to the end users for their long term benefit. It is evident from the developments and reports coming out of the mature wind energy markets of Europe that focus is turning towards wind power plants. It is also evident that the power system reports from Europe are showing the result of 20 years of wind development, where the grid operator has little or no control over large amounts of wind power, creating network management issues.

However Australia is not in that position, the current projects benefit from the latest technologies and control systems that the manufacturers have had to develop to address these grid operators concerns.

This submission will focus on the following areas, providing a brief comment on the key issues and suggest a future action that could be pursued:

- Centralised Forecasting – its relationship to resolving issues
- Dynamic Modelling
- Network Management, variability and interconnector flow
- Semi-dispatch, and network management.
- FCAS cost recovery
- Materiality

### **Centralised Forecasting System**

Pacific Hydro strongly supports the development of a centralised wind forecasting system. This is critical to providing all participants with forward warning of a change in the prevailing wind resources. Forward wind forecasting data will enable all generators to reposition themselves in the market and ensure that adequate generation is available to meet demand.

The NEM is designed to provide a flexible energy market, one that enables self dispatch and reoffering of generation to changed circumstances. The NEM is therefore in a unique position to respond to the integration of wind energy as part of our sustainable future.

Arguments that arise for a decentralised forecasting system as an obligation on wind farms to be accurate can be compared to the debate that raged in the early nineties over whether distribution companies should provide a daily forecast to the market operator. The concept was rejected as it would not be accurate and would contain too many discrepancies.

There is no convincing evidence to suggest that reliability will be threatened, on the contrary it should improve. The addition of multiple small generating units into the power system will vastly improve system reliability and maintain low reserve levels. In comparison installing single large generating units will detract from system reliability and require an increase to the regional reserve requirement.

### **Dynamic Modelling**

Pacific Hydro acknowledges that dynamic models are critical for the management of the power system. Adequate public domain models for power system studies are currently being developed. Wind generation is a developing technology and all emerging technologies try to retain their competitive edge through their Intellectual Property. When adequate public domain dynamic models are available for the various wind farm technologies, the concerns surrounding stability and oscillatory behaviour will be resolved through system studies. This will also enable the power system planners to develop adequate limit equations. Until such studies can be undertaken, there is no definitive position that can be adopted concerning the performance of large scale wind farms in the power system.

To consider the circumstance where all synchronous machines have been displaced by wind during low load is unlikely to be viable due to the inertial contributions that are necessary for transient stability. However this debate cannot be resolved until adequate dynamic models exist and the appropriate stability limits have been revisited. The transient stability equations have to be reconsidered with the wind farm performance and inertial contribution included. Without this assessment on wind farm inertial contribution and damping, all discussion on stability is speculative.

Most of the integration issues that WETAG has discussed will be resolved through a centralised forecasting system and power system studies using dynamic models.

### **Network Management**

Pacific Hydro acknowledges that all generators can contribute to line overloads or be part of a transient stability limit. As such, to enable the power system operator to manage power flows from both scheduled and non-scheduled generation, a form of maximum generation limit may be required on a non-scheduled generator. When a generator contributes to the power flow on a line that is reaching its rating, then it is reasonable to expect to be kept at an output that will avoid damage to the line. However, Pacific Hydro notes that the implementation of a generation limit is not the same as requiring wind farms to be scheduled and should not be confused with requiring wind farms to be fully scheduled.

The inclusion of control systems to manage generation levels is already being implemented in South Australian connection agreements. In most cases this will be adequate to manage emergency line over loading.

### **Variability and interconnector flows**

It is our opinion that public comments on interconnector flow issues are being exaggerated, taken out of context and blatantly misunderstood. Low probability events also seem to be given out of proportion attention. The low probability events can be managed with the implementation of proper forecasting methods and the "semi dispatch" method already discussed in this paper. Concerns over interconnector variability can be technically overcome through improved wind farm connection point technology and various low cost system control methods.

An example of such a system control method would be a control system on Murraylink to provide variability offset on the Vic to SA (AC) interconnector. This is an example of the type of power system engineering solutions that would resolve concerns over lack of frequency control ancillary service raise capability in South Australia under certain operating conditions.

There is a current level of variability on the system already and wind farms will generally add to this. However, the comments that have been presented in the South Australian planning council paper do not logically create as big an issue as their paper has indicated. We strongly encourage more work to be done on understanding the “portfolio effect” of several wind farms spread across a geographic area that make use of variable meteorological conditions. Only then can we fully appreciate the true quantum of variability likely to be experienced.

An increase in wind generation will drive SA into an export condition more often, although there may be occasions where SA is importing. Whenever SA is exporting then the interconnector will have ample provision to provide raise capability to South Australia. Concerns over hitting import limits due to a wide spread ‘roll off’ of wind energy are highlighting a low probability operating condition. Again, further detailed study should be conducted in this area and future regulation drafted so as to maintain a level of flexibility as our understanding of the issue will improve over time.

### **Semi-dispatch**

If non-scheduled generation is to be included in the market constraint formulations using a “semi-dispatch” method, Pacific Hydro requests this be implemented only when and where there is adequate evidence of network control issues to warrant the use of a dispatch limit. In other words, all non-scheduled generators include the technology for dispatch control, but only those non-scheduled generators that are proven to have an affect in network constraints actually be included in equations.

Forcing a wind farm to be scheduled is not necessarily a practical solution, and in fact is likely to cause more disruption to the NEM systems than provide a net market benefit.

### **Frequency Control Ancillary Service Regulation Cost Recovery**

If application of FCAS regulation cost recovery is applied to market generators, Pacific Hydro questions the validity of the current causer pays methodology in its application to wind farms and requests that a consultation process be done prior to NEMMCO including the non-scheduled generators in the calculation.

### **Materiality**

The WETAG notes that the WETAG paper is qualitative, there were no studies performed to provide a quantitative analysis on the issues for the whole NEM.

Pacific Hydro notes that the only system study performed to date is the SA Planning Council’s report to ESCOSA. This report focussed on rare and obscure events for a single region and on the market results for South Australia, not the NEM as a whole. Studies are required for the whole NEM in order to identify power system management issues on the national perspective combining this with market studies to identify reform issues.

PHL requests that studies be performed with a national perspective, to assess the overall response of the market to the inclusion of wind energy. A NEM wide study is

the only basis on which market policy decisions should progress. Individual jurisdictional solutions should be avoided where practical low cost solutions can be found to the benefit of the national market.

Independent national studies should be undertaken to quantify the variability issues raised in the WETAG paper. The studies should be aimed at identifying the statistical probability of:

- wind roll off across all regions and the impact on the interconnector flows; and
- aggregated regional variations against periods of high import or high export.

## **Summary of Recommendations**

Following is a brief summary and collation of the main recommendations put forward in this submission:

- § Include wind turbine manufactures or specialists in discussions that relate to technical issues for power system control.
- § Learn from the experiences of European network operators.
- § Develop a centralised wind forecasting system that considers the NEM as a whole, not individual jurisdictions.
- § Develop adequate public domain dynamic models with the manufacturers to resolve key system stability issues.
- § If required by power system operators to manage power flows for both scheduled and non scheduled generation, a form of maximum generation limit could be required for non scheduled generation.
- § Undertake a NEM wide study to better understand issues such as the “portfolio effect” of several wind farms spread across a geographic area that make use of variable meteorological conditions.
- § Only implement a “semi-dispatch” method when and where there is adequate evidence of network control issues.
- § If FCAS is to be applied to wind farms registered as market participants, Pacific Hydro requests that a extensive consultation process with industry participants be undertaken.
- § All future studies should be performed from a national perspective to assess the overall response of the market to the inclusion of wind energy.

## **Conclusion**

Pacific Hydro is actively participating in the reform processes for the technical standards review and has already supported NEMMCO's initiative on disclosure of appropriate information.

As a company with a number of large projects in progress Pacific Hydro is keen to see these issues resolved relatively quickly. We recognise that Code or Rule changes are likely to take at least a year. Addressing the fundamental issues such as forecasting, dynamic modelling and eventually constraint management will reduce the likelihood of an arbitrary saturation limit for wind power as it increases.

Pacific Hydro looks forward to continuing its delivery of renewable energy power plants for the reduction of green house gases and a sustainable future. As our vision is to see Australians using a majority of renewable energy wherever possible, it is for the long term benefit of all consumers that wind power finds a way to work in synergy with the power grid and the market.

To achieve this Pacific Hydro is actively encouraging the Australian Wind Energy Association to take a leadership role with its members to look at ways that they can help to progress the matters raised in the WEPWG paper.

We look forward to participating in future consultation in this area.



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