Market and Operational Framework for Wind Integration in Alberta
Comment-Response Matrix

Overall/General Framework

Stakeholder	Stakeholder Response	AESO Response
Canadian Hydro	"a tremendous start in this regard, and will form the basis for detailed policies and procedures to be developed" An implementation schedule should be added to the Framework	A work plan is being developed and will be provided to stakeholders.
CanWEA	We would like to begin by congratulating the AESO on the development of this document. It provides a framework within which multiple tools could be utilized to facilitate the integration of wind energy into the Alberta grid and a positive proposal for allocating the costs associated with such tools.	
ENMAX	We are encouraged by the AESO's commitment to removal of the 900 MW threshold and examination of potential mitigation measures.	
EPCOR	EPCOR supports the AESO initiative to develop solutions that allow the 900 MW wind generation threshold to be removed. EPCOR also supports the development of renewable energy sources, like wind, in Alberta consistent with the fair, efficient and openly competitive (FEOC) operation of the market and the reliable operation of Alberta's electricity system. EPCOR believes there are several issues which need more detailed discussion and stakeholder consultation before the Wind Framework can be properly assessed. • Ensuring the optimum balance between the use of each of the mitigation tools … • The issue of cost allocation …. • The forecasting accuracy obligations … when considered in the context of obligations on other forms of generation ... • The AESOs's approach to transmission development ….	We agree that more work is required to develop the details of the Market & Operational Framework and to fully understand all implications. We believe that the Market and Operational Framework establishes the necessary direction for large scale integration of wind in Alberta and provide the foundation to instruct the development of rules, OPP's, tools in consultation with stakeholders.
IPCAA	[IPCAA] is generally supportive of the proposed AESO approach, in that the framework fairly balances the interests and cost burden of load and generation customers. IPCAA believes all generation should be treated in a similar fashion by the AESO and the AESO has achieved that in this case, while recognizing the additional costs being imposed on load customers. The framework is also consistent with the overall market framework and operative legislative and regulatory environment in Alberta.	

Stakeholder	Stakeholder Response	AESO Response
IPCAA	The Transmission Development Policy passed by the government of Alberta a couple of years ago puts the AESO into a difficult position of balancing the economic interests of generators and load. In separating the interests of generation and load, by requiring load pay all AESO costs and generators none, there is little economic incentive for generators to ensure costs are minimized. Accordingly, the AESO must provide its judgment regarding such costs. Load is also put into a difficult position as it tries also to find a fair position for all, where economic and financial signals regarding AESO costs have been eliminated. We believe the AESO has reached a fair balance.	
Joe Green	If you believe in "free markets", then you cannot impose the kind of limits that are inherent in the report. The fundamental flaw with the entire approach to wind power in Alberta has been the basic way in which people are trying to utilize it, i.e. direct grid interconnection	There are and will always be practical limits to the amount of generation and transmission on a power system. Notwithstanding these practical limits, the AESO is committed to integrating as much wind energy as is feasible without compromising system reliability or the fair, efficient and openly competitive operation of the market. Ramp rate limiting is one of several tools designed to incorporate wind resources and is expected to be used when others are exhausted.
NATURENER	The report shows balance in the approach to mitigating impacts of wind integration to grid stability and clearing a path for further development of this valuable renewable generation resource.	
Shell Canada	Shell Canada Ltd. is please that the Alberta Electric System Operator has advanced its proposal on the integration of wind power into the Alberta electrical grid.	
SUNCOR	We would like to congratulate the Alberta Electric System Operator (AESO) for its initiative taken towards integrating more wind power in Alberta, and on the development of this discussion paper. The document provides an excellent framework to allow for the continuing growth of wind power within the province respecting system reliability, effective distribution of costs, and market competition. However, the AESO has not indicated the order in which, or extent that, these tools will be deployed. This should be clarified since these measures have different cost responsibilities and, as the AESO has indicated, these tools and measures can, to varying degrees, be substituted for each other.	The order of use of the tools is intended to follow the order they were presented in the basic premise of the framework. • Forecasting • Energy Market Merit Order • Regulating Reserves • Load/Supply Following Services • Power Management Further details regarding the use of these tools will be developed as we learn more through the forecasting pilot and other work activities.
TransCanada	The MOF fully and thoroughly details the range of actions and measures (mitigating tools) that the AESO has at their disposal to manage the variability of Wind Power Facilities (WPFs) TransCanada has no issues with the ordering of the mitigation tools or the allocation of costs of those measures.	We believe that the ordering of the tools is aligned with the policies and ensures non-discriminatory access while recognizing the need to manage wind variability to ensure system reliability.

FORECASTING

Stakeholder	Stakeholder Response	AESO Response
Canadian Hydro	Canadian Hydro agrees with the proposed allocation. Costs allocated to wind generators. On what basis? Are existing plants treated differently than new facilities? Once the pilot is completed, will AESO contract the forecasting service and charge wind generators based on installed capacity? The costs to forecast, monitor and update the AESO are of concern. The wind farms would have to be monitored 24 hours per day, 7 days per week. If the forecast is not accurate will penalties be applied?	Forecasting method(s) and the basis for allocating these costs to wind generators will be determined through future work and stakeholder input. Provided forecasts meet established accuracy standards there would be no penalties. Non-compliance of forecasting accuracy would be consistent with non-compliance with other ISO rules/standards and would be dealt with similarly.
CanWEA	Determining the accuracy of wind energy forecasting models is not a simple task and further work may be required to determine the appropriate basket of metrics used to determine the "best" forecasting methods. We understand the Wind Power Forecasting Working Group has tabled this issue at this time, but we encourage the Working Group to consider revisiting this issue.	The issue of wind power forecasting accuracy is outside the scope of the policy issues contemplated in the Market and Operational Framework. However, this issue is being considered by the Wind Power Forecasting Working Group and the Wind Forecasting Pilot project where Ortech has been contracted to evaluate accuracy of the forecasts using the following metrics: • Root Mean Square Error (RSME) • Mean Absolute Error (MAE) • Normalized prediction error - per unit of capacity or energy (RSME or MAE) • Improvement over persistence in the short term (RSME or MAE) • Reliability diagrams to illustrate the relationship between probability forecasts and observations • Linear Error in Probability Space Score • Ensemble of regions (examining the smoothing effects of more wind power facilities spread out on forecast error) • Principle component analysis • Cluster analysis • Probability of Detection and False alarm ratios to analyze extreme event or non-systematic errors Accuracy metrics will be revisited as the project progresses and the results will inform the decision on how to prioritize and narrow the metrics or timeframes.

Stakeholder	Stakeholder Response	AESO Response
CanWEA	the Market and Operational Framework seems to have created some confusion by implying prematurely that Alberta will move to a decentralized wind forecasting system (i.e., "it is envisioned that all wind power facilities will forecast their power output …") when the Wind Forecasting Pilot Project is examining a centralized wind forecasting system where wind power facilities provide wind data to a centralized forecasting service. We request clarification from the AESO on this point.	No conclusions have been reached regarding whether centralized or decentralized forecasting will be used in the future. The forecasting pilot project is using a centralized approach to learn about the selected forecasting approaches for regions of Alberta and Alberta as a whole. This information should provide insight about forecasting methodologies as well as centralized versus decentralized approaches. The intent of the language within the framework is to establish that, at a minimum, some form of forecasting input will be required by wind generators and to establish that the costs associated with forecasting will be borne by wind generators (either directly in the case of decentralized forecasting or allocated back to them in the case of centralized forecasting)
ENMAX	ENMAX is supportive of efforts to study the efficacy of wind forecasting. If wind forecasting appears promising, ENMAX believes that the logical starting point for the industry would be to centralize the wind forecasting through the AESO. Centralizing wind forecasting will help to ensure that the forecasting methodologies that are developed meet the needs of the system controller in balancing the integrated electric system. Centralized forecasting would also ensure the development of standardization and consistency. As the industry gains experience with wind forecasting methodologies, the centralized forecasting model could then be reviewed to determine if another approach would better suit both the AESO and participant needs. Whether centralized or not, ENMAX believes that the AESO and the industry must be realistic in their views of forecasting. Weather forecasting contains a great degree of uncertainty. Therefore forecasting standards or requirements must be considered on a 'best efforts' basis as the details of accuracy, error tolerance and time windows of forecasting will undoubtedly provide challenges.	No conclusions have been reached regarding whether centralized or decentralized forecasting will be used in the future. The forecasting pilot project is using a centralized approach to learn about the selected forecasting approaches for regions of Alberta and Alberta as a whole. This information should provide insight about forecasting methodologies as well as centralized versus decentralized approaches.
IPCAA	We also support the AESO position that the wind generators should pay for the additional forecasting costs, power management costs and wind power diversity costs, as these are very specific to wind generation. This is, in our view, not discriminatory to wind generation.	

Stakeholder	Stakeholder Response	AESO Response
IPCAA	The AESO framework is supportable because wind cannot meet the "must comply" requirements of the AESO, and as such, additional forecasting costs are incurred by the AESO. Such additional costs should be borne by the generator causing these costs.	
Joe Green	The cornerstone of a functioning market is the "contract" which is a solemn legal obligation to provide a service at an agreed upon fee. It is fundamentally unfair that wind generators face no penalty for not delivering power when that power is contracted for delivery, in my opinion. If windmill operators contracted to deliver wind power, they should be obliged to do so, under penalty terms if necessary. To do otherwise, is to unfairly punish the other market participants.	There are a number of different physical and financial contracts. Each will stipulate the deliver obligations and associated defaults. These contracts are strictly between market participants. The AESO is not party to contractual agreements between suppliers and buyers unless submitted as a "net settlement instruction" and even then only as a means to fulfill the settlement of the agreed to contract terms.
NATURENER	We agree and fully support this fundamental requirement. …We fully support the requirement for generators to implement such a system that will achieve a standard of timely and accurate forecasts, set by AESO. And, no one forecasting system is best for all locations or circumstances. … Statistically, AESO will collect a much more accurate forecast by requiring wind generators to implement separate independent systems …. We believe an independent wind resource analysis group like Phoenix Engineering or Garrad Hassan can develop the standards for timing, accuracy and protocols that AESO would need to properly set these standards. To this point, we believe it is a mistake not to included forecasting accuracy in the recently commissioned study by Phoenix Engineering Inc. Understanding the accuracy that can be achieved will help AESO …	The issue of wind power forecasting accuracy is outside the scope of the policy issues contemplated in the Market and Operational Framework. However, this issue is being considered by the Wind Power Forecasting Working Group and the Wind Forecasting Pilot project where Ortech has been contracted to evaluate accuracy of the forecasts using the following metrics: • Root Mean Square Error (RSME) • Mean Absolute Error (MAE) • Normalized prediction error - per unit of capacity or energy (RSME or MAE) • Improvement over persistence in the short term (RSME or MAE) • Reliability diagrams to illustrate the relationship between probability forecasts and observations • Linear Error in Probability Space Score • Ensemble of regions (examining the smoothing effects of more wind power facilities spread out on forecast error) • Principle component analysis • Cluster analysis • Probability of Detection and False alarm ratios to analyze extreme event or non-systematic errors Accuracy metrics will be revisited as the project progresses and the results will inform the decision on how to prioritize and narrow the metrics or timeframes.

Stakeholder	Stakeholder Response	AESO Response
RHO*VCUBED**	The entire Framework document is based on the assumption that the current forecast program will produce constructively useful results. Such is by no means assured. My personal work experience indicates that a primarily statistical model with physical process model support will be the most successful. I can only encourage AESO to clearly state its accuracy requirements/expectations to the contractors. Such will focus contractors' efforts under the contract and enhance results. Secondarily, it will provide transparency to all in evaluation of the Forecasting Working Group progress and final reports.	The issue of wind power forecasting accuracy is outside the scope of the policy issues contemplated in the Market and Operational Framework. However, this issue is being considered by the Wind Power Forecasting Working Group and the Wind Forecasting Pilot project where Ortech has been contracted to evaluate accuracy of the forecasts using the following metrics: • Root Mean Square Error (RSME) • Mean Absolute Error (MAE) • Normalized prediction error - per unit of capacity or energy (RSME or MAE) • Improvement over persistence in the short term (RSME or MAE) • Reliability diagrams to illustrate the relationship between probability forecasts and observations • Linear Error in Probability Space Score • Ensemble of regions (examining the smoothing effects of more wind power facilities spread out on forecast error) • Principle component analysis • Cluster analysis • Probability of Detection and False alarm ratios to analyze extreme event or non-systematic errors Accuracy metrics will be revisited as the project progresses and the results will inform the decision on how to prioritize and narrow the metrics or timeframes.
Shell Canada	It is our understanding that forecasting is the primary method for reducing the cost of mitigating measures. … Therefore, the approach we take on forecasting is very important in terms of reducing these costs as well as reducing the potential impact to wind generators by minimizing power management requirements.	Forecasting is seen as a critical first step or first line of defense in managing wind variability. It is too early to conclude what proportion of mitigation forecasting will represent or the degree forecasting will reduce the use and costs of other mitigation measures. As the AESO understands wind forecasting in Alberta better, we will be better equipped to determine what level of accuracies are achievable and how costs compare to other mitigation measures.

Stakeholder	Stakeholder Response	AESO Response
Shell Canada	We have suggested to the AESO wind forecasting group that determining accuracy of forecasting models is not a relatively simple task. We suggest further work needs to be completed to determine the appropriate basket of metrics used to determine the 'best' forecasting methods.	The issue of wind power forecasting accuracy is outside the scope of the policy issues contemplated in the Market and Operational Framework. However, this issue is being considered by the Wind Power Forecasting Working Group and the Wind Forecasting Pilot project where Ortech has been contracted to evaluate accuracy of the forecasts using the following metrics: • Root Mean Square Error (RSME) • Mean Absolute Error (MAE) • Normalized prediction error - per unit of capacity or energy (RSME or MAE) • Improvement over persistence in the short term (RSME or MAE) • Reliability diagrams to illustrate the relationship between probability forecasts and observations • Linear Error in Probability Space Score • Ensemble of regions (examining the smoothing effects of more wind power facilities spread out on forecast error) • Principle component analysis • Cluster analysis • Probability of Detection and False alarm ratios to analyze extreme event or non-systematic errors Accuracy metrics will be revisited as the project progresses and the results will inform the decision on how to prioritize and narrow the metrics or timeframes.
Shell Canada	The current wind forecasting pilot is based on a centralized forecasting model, rather than a decentralized model. Research indicates that centralized forecasting has the capability and economies of scale to provide more accurate forecasts at a cheaper cost compared to decentralized forecasts. Is the AESO contemplating a forecasting study on a decentralized basis, to compare decentralized with centralized?	No conclusions have been reached regarding whether centralized or decentralized forecasting will be used in the future. The forecasting pilot project is using a centralized approach to learn about the selected forecasting approaches for regions of Alberta and Alberta as a whole. This information should provide insight about forecasting methodologies as well as centralized versus decentralized approaches.

Stakeholder	Stakeholder Response	AESO Response
SUNCOR	Suncor supports a centralized forecasting system that is cost effective to all parties involved. We appreciate that many of the details may not be known. However, Suncor asks the AESO to indicate: • An estimate or bounds on the costs wind power generators will pay and how these costs will be allocated to wind generators (for example will it be on a energy basis, a capacity basis, or other basis) • When the AESO anticipates the recovery of these costs will begin, • How the development or startup costs will be recovered.	No conclusions have been reached regarding whether centralized or decentralized forecasting will be used in the future. The forecasting pilot project is using a centralized approach to learn about the selected forecasting approaches for regions of Alberta and Alberta as a whole. This information should provide insight about forecasting methodologies as well as centralized versus decentralized approaches. The AESO will communicate further information to stakeholders as it becomes available.
TransCanada	ISO rules will soon require that all generators Must Offer and Must Comply. TransCanada understands the linkage that the AESO makes in stating that for WPFs [wind power facilities] "Must Forecast" is equivalent to "must Offer". However, all generators also "Must Comply and this requirement does not seem to carry forward to WPFs. This leaves WPFs with a level of responsibility that is not equivalent to that of other generators. Other generators expend considerable energy and resources to schedule generation and maintain real-time dispatch. It is TransCanada's view that it is feasible to schedule wind power. Should the AESO not require WPFs to schedule and comply, it will result in an advantage for WPFs over other generators. Requiring WPFs to schedule would place the onus on WPFs to manage output in a manner consistent with all generators.	Wind power generators, like all other generators, must comply with dispatch instructions and directives from the System Controller. Wind power management, in the form of power limiting or ramp rate limiting, will be exercised when the AIES is not able to absorb all of the forecasted or actual wind generation.

ADDITIONAL ANCIALLARY SERVICES - REGULATING RESERVES & LOAD SUPPLY FOLLOWING

ADC	The ADC is a supporter of the development of wind power and other means of green generation; however, the ADC is concerned about the additional costs to the system that consumers will face as a result of the increased wind generation. Although the ADC realizes that wind generation growth in the province will be gradual we are concerned about the additional operating reserves costs that load will be expected to pay given the existing policy of load paying for all regulating reserve costs.	As described in detail in section 4.3 of the paper, the Transmission Development Policy clearly states that the responsibility for transmission costs, and therefore the costs associated with the procurement of additional regulating reserves will be allocated to load.

Stakeholder	Stakeholder Response	AESO Response
ADC	The paper's forecast estimates the annual cost of regulating reserves could increase by as much as $60 million. This equates to …roughly $1/MWh, … approximately $5.2 million in [added] annual operating costs to our Association's respective companies. Our expectations are that the pool prices over the next 5 or more years have the potential to be significantly higher than the past 5 years which could increase the ancillary services costs well beyond $30/MWh. The ADC feels the existing policy of load paying all regulating reserve costs was based on the premise that ancillary services were in support of grid reliability for the benefit of load. Additional ancillary services costs which support the development of a specific generation type seems to be a departure from the policy's original intent. We feel now is the time to revisit the policy behind the cost allocation of regulating reserves. "shifting wind generation related regulating reserve costs back to wind generators it places the appropriate economic signals"	It is possible that assumptions in the estimate provided in the Market and Operational Framework paper may not reflect actualities in the future and that the actual cost could be either higher or lower than estimated. The AESO is comfortable that the estimate provided in the framework paper is a reasonable order of magnitude indication of anticipated costs. The AESO does not see the distinction of reliability benefit between ancillary services procured to reliably manage the variability of load or other generation sources from those for wind generation. The policy is clear that loads benefit from open access and competitive electricity market. The framework establishes economic signals to wind developers through establishing forecasting accuracy standards for procurement reasonable levels of ancillary services and through resulting power management levels.
ENMAX	While ENMAX acknowledges that some incremental regulating reserves may be necessary to accommodate wind facility variations, ENMAX would encourage the AESO to study the impact of increased regulating reserves on the wholesale energy market, particularly on the price signals and volatility prior to committing to increasing volumes of regulating reserves. Until completion of both the wind forecasting study and geographic diversity study, it is difficult to ascertain the extent to which the Alberta system may need a supply-load following (SLF) service to counterbalance wind variability or ramping. ENMAX does note, however that the same concerns relating to the impact on pool price and volatility arise from employing SLF service as would arise from increasing the volume of regulating reserves.	The intended use of regulating reserves would be similar to the current use of regulating reserves – to balance the system as either demand or supply vary and ensure system reliability. Additional regulating reserves are anticipated with additional variability. We are mindful of the potential impact to both the energy and ancillary services markets and will monitor and evaluate as wind penetration increases.
IPCAA	While IPCAA recognizes load customers must pay for additional ancillary services costs, pursuant to the Transmission Development Policy, it is important that the AESO, and others, recognize the magnitude costs as new wind generation is added to the system. The AESO's estimate is that an additional $60 million per year … is required, if wind generation reaches the 2000 MW level. This is a significant cost increase for load customers. We submit that additional costs in this area should not be left open-ended, and the AESO should formulate some recommendations or policies in the event wind generation exceeds 2000 MW.	It is possible that assumptions in the estimate provided in the Market and Operational Framework paper may not reflect actualities in the future and that the actual cost could be either higher or lower than estimated. Time and experience only will clarify actual costs. We expect that through experience and other improvements these costs will be managed but recognize that additional policies and rules for wind generation may be necessary depending on the effectiveness of the proposed tools and the systems' ability to absorb higher levels of wind penetration.

Stakeholder	Stakeholder Response	AESO Response
NATURENER	We would also wish to see more clarity on the limitation of ramp rates for the purpose of curtailment and the supply of Ancillary Services.	Further details will be developed in subsequent work planned to further define the Framework.
RHO*VCUBED**	No one doubts the AESO requirement of enhanced regulating reserves and load/supply following services. However, one might seriously question the position that all of these accrue to wind generation	The costs associated with increased regulating reserves and load/supply following services will be allocated to load.
Shell Canada	In the cost analysis presented in Appendix I, an estimate of the additional cost for ancillary services at 2,000 MW of wind is $60 million/year. This is about a 30% increase in current cost of ancillary services, which is not insignificant. … Can you confirm that this estimate assumes no ramp rate limiting or power limiting? What are the estimated ancillary service costs for integrating wind projects beyond the 2000 MW … for example all currently proposed wind projects in Alberta? If wind power projects significantly beyond these levels are contemplated, how will the AESO weigh the benefits of additional wind power generation against increasing ancillary services costs?	The estimate provided and referenced assumes no ramp rate limiting or power limiting. We have not gathered data or conducted analysis to estimate beyond 2000 MW of wind generation. This may be an appropriate area for further study in future.
SUNCOR	Suncor supports the use of load/supply following to reduce the need for more expensive regulating reserves but would be concerned if load/supply ramping services were to be used in preference to energy market dispatches as this could lead to prolonged periods where energy prices remain unchanged even as supply/demand is increasing or decreasing significantly. The AESO's analysis greatly overstates the likely cost of the additional annual ancillary services required. This is because the AESO has double the Phase II estimate of additional ancillary services required and assumed that all the additional services will be regulating reserves rather than load/supply following services. It is anticipated that the cost of a load/supply following service would be less than the cost of procuring regulating reserves. This is because there are fewer requirements ….	We agree that the primary tool of the system operator is to dispatch the Energy Market Merit Order. The order of use of the tools described in the framework is intended to follow the order they were presented in the basic premise of the framework: • Forecasting • Energy Market Merit Order • Regulating Reserves • Load/Supply Following Services • Power Management It is possible that assumptions in the estimate provided in the Market and Operational Framework paper may not reflect actualities in the future and that the actual cost could be either higher or lower than estimated. We are comfortable that the estimate provided in the framework paper is a reasonable order of magnitude indication of anticipated costs.

Stakeholder	Stakeholder Response	AESO Response
SUNCOR	Strangely, the AESO's analysis shows that if the system wide wind ramp rate limit is 4 MW/minute, the annual additional ancillary services (MWh) with 1995 MW of wind power is 6.4% less than the annual additional ancillary services required with 1445 MW of wind power. However, this reduction in ancillary services required is accompanied by a tripling of the annual wind power curtailments.	The AESO is unclear on the comment and can not respond with the given information.

POWER MANAGEMENT

Canadian Hydro	"MUST ensure existing facilities are grandfathered and exempt from any form of ramp-rate limiting and/or curtailment" Most existing facilities have not been equipped with the hardware required to manage output (short of tripping the plant" and often retrofitting is expensive or not feasible. Some of the older facilities have fixed-price long term contracts which can not afford the added costs/losses associated with ramp-rate limiting or curtailment. "If the system can not take all the power being generated from the wind farms and the AESO calls for wind generation to be dispatched down or off, how is this going to be achieved to ensure it is fair to all the Companies involved?"	The details regarding power management standards and rules are among the work still to be completed. We intend to work with industry experts in the development of power management standards and rules and will conduct stakeholder consultation on these standards and rules. It is critical, however, that all generation meet system required standards in some format to ensure there is no undue bias between generators.
CanWEA	While we agree that this integration tool, if it is to be used, should only be used after all other tools have been implemented, we feel there is a need to better understand the potential contribution this tool can make to the facilitation of wind integration in Alberta. CanWEA would like to see the AESO/CanWEA Steering Committee establish a multistakeholder working group to examine this issue in more detail and CanWEA would be an active participant in such a group.	We agree that further work is required to understand and define how power management will be used and the associated impacts However all generators are required to comply with reliability directives issued by the System Controller. A fundamental component of the Framework is that wind generators are able to comply with instructions from the System Controller to limit their output when AIES is not able to absorb all of the forecasted or actual wind generation.

Stakeholder	Stakeholder Response	AESO Response
ENMAX	Power Management and ramp-rate limiting are of concern to ENMAX. Wind facilities generally have low capacity factors. As such, the economics of these investments require capturing generation opportunities when the wind is blowing. Curtailment or otherwise limiting the ability of a facility to ramp up could have a significant impact on wind project economics. ENMAX is of the view that power management or ramp-rate limiting should only be employed as an absolute last-resort measure and would view it as unacceptable if transmission outages or abnormal operating conditions did not exist at the time of the curtailment.	See response to CanWEA above. The details regarding power management standards and rules are among the work still to be completed. However, it is envisioned that power management or ramp rate limiting will be employed to the extent that the AIES is not able to absorb all of the forecasted or actual wind generation.
IPCAA	We also support the AESO position that the wind generators should pay for the additional forecasting costs, power management costs and wind power diversity costs, as these are very specific to wind generation. This is, in our view, not discriminatory to wind generation.	
Joe Green	It's a basic mistake not to harvest as much energy as you can because of limiting the harvesting of wind energy on account of control system problems is really not much of a solution to our looming energy shortages and green house gas emission problems. We simply need as much clean energy as we can get and utilize.	The AESO is committed to integrating as much wind energy as is feasible without compromising system reliability or the fair, efficient and openly competitive operation of the market.
NATURENER	We do not agree with the assessment presented by AESO that distributed generation resources do not reduce the ramp rate impact to the electrical system. While we believe ramp rate will be less than shown in previous AESO presentations, it does have an impact when the entire system load is ramping in the opposite direction of wind speeds. We would also wish to see more clarity on the limitation of ramp rates for the purpose of curtailment and the supply of Ancillary Services.	The details regarding power management and ancillary services standards are among the work still to be completed. We intend to work with industry experts and stakeholders in the development of power management and ancillary services standards and rules.
RHO*VCUBED**	In the discussion of 'Wind Generator Power Management' the statement was made that generators dispatch down or off applies to all generators in the system. In the interests of clarify, it would be useful for AESO to table a list of all such dispatches, and the settings of these, within the past five years. AESO specifically acknowledges that 'investors will allocate capital to specific wind generation facilities'. Globally, there is a cadre of investors who have become familiar and comfortable with wind variability. Care must be taken that the addition of 'power management' does not kill the goose that laid the golden egg by effectively precluding investment in Alberta wind facilities.	See response to Naturener above.

Stakeholder	Stakeholder Response	AESO Response
Shell Canada	Shell Canada Ltd. is please that the Alberta Electric System Operator has advanced its proposal on the integration of wind power into the Alberta electrical grid. The AESO indicates that the Market and Operational Framework balances wind facility power management and ancillary services. Although not fully defined in the framework document, it would appear that a balance between Power Management requirements and additional ancillary services could provide appropriate economic signals for wind developers while helping to reduce cost of additional ancillary services. • Is it the AESO's intention to find such a balance between Power Management requirements and additional ancillary services, and if so, how will the AESO evaluate the economic impact to wind developers versus the cost of additional ancillary services? Is the AESO leaving this out for broader consultation?	The primary objective in the use of power management and ancillary services is to manage wind variability and uncertainty and ensure the reliability of the system We recognize that the balance of use of the two tools will provide economic signals to both wind developers as well as Ancillary Service providers. As such, these will be important considerations as the terms of these tools and services are developed. There will be further stakeholder consultation on these details.
Shell Canada	Any impact on the wind-farm production rate will obviously impact wind-farm economics. The following areas would need to be defined with respect to the envisioned frequency and magnitude of production losses for the wind farm developer. • What ramp rates is the AESO envisioning for the wind industry and at what expected frequency of occurance? • Would ramp rate limiting be required in addition to power limiting? • Can you provide more detail on power limiting? • Shell encourages the AESO to work with industry to determine a transparent protocol for power limiting. • Will power limiting be across all wind farms in Alberta? • Will each wind farm be power limited at the same rates? As a wind developer, we have concerns about quantifying how much output could be lost through the AESO's proposed Power Management. This would add a significant element of complexity for any wind developer's financing arrangements. How does the AESO expect Power Management requirements to affect existing projects, now and in the future, when wind penetration increases? How will Power Management change as wind penetration increases?	The details regarding power management and ancillary services standards are among the work still to be completed. We intend to work with industry experts and stakeholders in the development of power management and ancillary services standards and rules.

Stakeholder	Stakeholder Response	AESO Response
SUNCOR	It is expected that the System Controller would only issue a directive to curtail in-merit generation for security or reliability reasons and that these instances would be infrequent and of short duration. Limits on wind power output should only be used in extreme circumstances to avoid constraining in-merit generation under normal operating conditions (i.e. all transmission facilities in service) and to enable the competitive market to deliver the lowest energy price to consumers. Generators should not be constrained due to congestion that is not due to planned maintenance, forced outages of transmission facilities and/or some critical generation facilities and which can be relieved by procuring sufficient ancillary services. The AESO should provide more clarity around the anticipated frequency and duration of power curtailments to wind generators. Suncor asks that the AESO clarify the responsibilities and costs for uncertain output reduction that wind generators are to assume.	The details regarding power management and ancillary services standards are among the work still to be completed. We intend to work with industry experts in the development of power management and ancillary services standards and rules. Generators, including wind facilities, bear the risk of curtailment and do not receive compensation when curtailed.

DIVERSITY

Canadian Hydro	Need signals to encourage wind generators to locate appropriately. Could divide the province and "cap" certain areas? Could also provide some guidance regarding the possibility of Power Management in certain geographic areas?	The ISO expressly does not have a role in centralized planning of generation investments. The decisions regarding the timing, location, siting and type of generation investments must be driven by competitive market forces. However, we do intend to conduct further studies to explore the degree and value of diversity as it pertains to managing wind variability costs and the development and implementation of policy, rules and business practices. We do not expect to divide the province, cap certain areas or create any other type of regional incentive.

Stakeholder	Stakeholder Response	AESO Response
CanWEA	'more work needs to be done to better understand and quantify the potential benefits to wind integration from geographic diversity in wind farm siting to inform the development of policy both within the AESO (e.g., queuing) and within the Alberta Government (e.g., siting). While CanWEA understands that Ortech will be completing co-variance studies on a site-to-site basis with real time data, we feel that an additional study utilizing readily available historical data is also required. Some of the additional information to be derived from this study would include the combined effects on ramp rate, maximum and minimum production levels, and the identification of the impact of different geographic areas in minimizing variability.	The ISO expressly does not have a role in centralized planning of generation investments. The decisions regarding the timing, location, siting and type of generation investments must be driven by competitive market forces. However, we do intend to conduct further studies to explore the degree and value of diversity as it pertains to the managing wind variability costs and the development and implementation of policy, rules ad business practices.
ENMAX	ENMAX would strongly encourage the AESO to thoroughly study the benefits of geographic diversity in parallel to the wind forecasting study. A more fulsome understanding of the impact and benefits of geographic diversity may enable the development of policies designed to maximize these benefits. Appropriately designed policies that, to the extent possible, promote geographic diversity, may act as a full or partial substitute for relying on other mitigating measures that may have secondary impacts on the energy and AS markets and which may impose considerable risk or costs on existing facilities and load customers. Determination of the impact of geographic diversity is a necessary precursor before any conclusions can be drawn regarding the requirement of mitigation measures such as regulating reserves or load/supply following.	See response to CanWEA above.

Stakeholder	Stakeholder Response	AESO Response
ENMAX	Such a study would not be difficult to complete as developers have already shared wind measurement and facility out put data for the forecasting study; similarly, a consultant could be engaged to determine geographic diversity statistics for those facilities that are existing, under construction and also in late stages of development. ENMAX supports efforts to allow investors and the market to make decisions about the type, location and timing of investment. ENMAX would add, however, that appropriate information and signals need to be accessible by potential investors in order that they make rational investment decisions and valued geographic diversity from both a system and investor perspective. ENMAX believes that it is important for both industry participants and the AESO to rationally examine potential geographic diversity benefits in order to maximize wind interconnection while minimizing the impact of mitigation measures. Geographic diversity information would greatly aid both the wind developer and the AESO, who with different goals, are working to solve this shared issue.	The forecasting study only makes use of 12 sites that may not represent actual or potential diversity. As such, the AESO is planning study of diversity.
SUNCOR	Currently there are no market mechanisms to signal to investors the value of diversity. Without appropriate market structure it is unlikely that this value will be fully realized. To realize the value of diversity, a regional queuing system should be established for wind projects. Any capacity above the current 900 MW threshold should be allocated to regional queues so as to maximize diversity. In this way projects that reduce aggregate wind power variability and ramping impacts on the system can be expedited. This would benefit generators by expanding the amount of wind power that can be integrated in the Alberta system. It would also benefit load customers by reducing the volume and cost of regulating reserves and/or load/supply following services and increase the supply of in-merit generation. The AESO should also undertake a study to better quantify the benefits that could be realized from diversity and to further explore ways that this value can best be realized. Data for such a study can easily be extracted from data used in the pilot program on wind forecasting that is currently underway.	The ISO expressly does not have a role in centralized planning of generation investments. The decisions regarding the timing, location, siting and type of generation investments must be driven by competitive market forces. However, we do intend to conduct further studies to explore the degree and value of diversity as it pertains to managing wind variability costs and the development and implementation of policy, rules ad business practices. We do not expect to divide the province, cap certain areas or create any other type of regional incentive.

Grandfathering

Stakeholder	Stakeholder Response	AESO Response
CanWEA	In the Market and Operational Framework, the AESO specifically seeks input on the question of whether or not "power management" requirements should be applied to existing wind energy facilities in Alberta and CanWEA will consider this issue and report back to the AESO in the near future.	
ENMAX	While potential investors may take this mitigation measure into account quantitatively when making an investment decision, existing facilities have already made irreversible investment decisions and committed capital under a framework that contemplated power limiting only during abnormal operating conditions rather than under normal operating conditions. The AESO's Wind Power Facilities Technical Requirements notes that: "Most of the time the AEIS operates normally and with no constraints on wind power facilities. On occasions, transmission outage(s) or abnormal operating conditions can occur that require electrical disconnection or partial curtailment of a wind power facility"	All generators need to make arrangements to meet changing system standards as they develop. Further consideration is needed to determine if there are legitimate reasons for modifications or deviations from the standards.
NATURENER	Existing plants without such systems in place should be given a grace period to achieve compliance.	
SUNCOR	It is fair that wind farms should be held to the standards and requirements that were in place when they were constructed and that any new requirements apply on a going forward basis to new generators. If new requirements are applied to existing generators the costs associated with implementing these requirements should not accrue to these generators.	All generators need to make arrangements to meet changing system standards as they develop. Further consideration is needed to determine if there are legitimate reasons for modifications or deviations from the standards.

Next Steps

Canadian Hydro	Appendix III provides a path forward to removing the 900 MW threshold, including a list of critical issues to be resolved. We agree with items 1 & 2. However, tasks 3 and 4 indicate power management to be implemented. We have always understood that power management would be a "last resort" in the tool box, and suggest the words be deleted from both sentences. "a statement regarding tools to be developed to encourage diversity; and a position developed for timing and acquisition of necessary reserves and load following services should be included [in Appendix III]	All generators are required to comply with reliability directives issued by the System Controller. A fundamental component of the Framework is that wind generators are able to comply with instructions from the System Controller to limit their output when AIES is not able to absorb all of the forecasted or actual wind generation.

Stakeholder	Stakeholder Response	AESO Response
CanWEA	We believe that investor confidence will be further supported when the AESO provides a firm timetable for the removal of the threshold. We believe that the structure provided by the Market and Operational Framework, coupled with the new policy directions being implemented by the Alberta Government with respect to greenhouse gas emissions and the development of an Alberta renewable energy strategy, provide a basis for the AESO to immediately make a clear and definitive statement that the 900 MW threshold is no longer in place. "it will be important to ensure that the removal of the 900 MW threshold results in more proactive transmission planning and investment … We believe that the final outcome must respect the directive of the Department of Energy that any market refinements should not "…create an uneven playing field or be detrimental to the development of renewable resources". CanWEA requests that the AESO/CanWEA Steering Committee develop a comprehensive strategy to complete this work, with clear timelines and deliverables.	
ENMAX	Removal of the 900 MW threshold on wind facility interconnection requires the consideration of many significant and highly uncertain variables. Given these significant uncertainties, ENMAX remains unclear as to the 'order of magnitude' or potential cost of the wind facility ramping and power management issues and to what extent the various mitigation measures will need to be employed. It is our view that wind forecasting work that has been commissioned will help in understanding the potential magnitude of the wind issues faced, and to what degree potential mitigation measures will impact existing wind facilities, the energy and ancillary services (AS) markets, load and potential wind investments. There remains a great deal of uncertainty relating to the magnitude of the need for and impact of the mitigation measures proposed … ENMAX suggests a cautious approach until the wind forecasting study and geographic diversity study are completed. ENMAX also believes that it is paramount that the operational framework balances the interests of existing wind investments, potential wind investments, load customers, the energy market and the AS market, in order to optimize interconnection of wind facilities while minimizing	We agree that more work is required to develop the details of the Market & Operational Framework and to fully understand all implications. We expect the details that unfold from the work ahead will inform the AESO and market participants. However, we believe that the principles behind this framework can be assessed and evaluated in absence of the details and impact assessment.

	mitigation costs.	
Stakeholder	**Stakeholder Response**	**AESO Response**
NATURENER	To enable AESO to remove the present 900 MW limit for wind generation, a temporary regulation can be established for forecasting at least as accurate as persistence modeling.	
SUNCOR	Suncor would like the AESO remove the 900 MW cap and implement a revised queuing structure by Q4 2007 and to provide stakeholders with a work plan and timelines with target dates to achieve this. To keep the process moving forward the AESO should develop and table to stakeholders a work plan and schedule and task resources to resolve these issues. As far as possible, work should be carried out in parallel. Where possible the AESO should allow for interim increases to the 900 MW cap prior to all work being completed.	The ISO expressly does not have a role in centralized planning of generation investments. The decisions regarding the timing, location, siting and type of generation investments must be driven by competitive market forces. We do intend to conduct further studies to explore the degree and value of diversity as it pertains to managing wind variability costs and the development and implementation of policy, rules and business practices. We do not expect to divide the province, cap certain areas or create any other type of regional incentive.
TransCanada	TransCanada requests that the AESO ensure all of the operational details of these measures are worked out before the threshold/cap is lifted. There can be significant differences in the system controllers' actions based on the information available, its interpretation and the standards put in place. This in turn can result in dramatic impacts on the energy market and its participants.	More work is required to develop the details of the Market & Operational Framework and to fully understand all implications. We expect the details that unfold from the work ahead will inform the AESO and market participants. However, we believe that the principles behind this framework can be assessed and evaluated in absence of the details and impact assessment.

Other

Stakeholder	Stakeholder Response	AESO Response
IPCAA	as the AESO purchases additional energy for ancillary services, that energy is removed from the energy market. This will cause a commensurate increase in pool price as energy supply is reduced accordingly. This is not to suggest the framework should be different, but stakeholders should be aware of all cost impacts on load customers.	The associated change in the energy price, if any, is a function of the competitiveness of the energy market and the amount of generation available. While more ancillary services may be required, they will be used to facilitate more generation. The net impact is difficult to assess.
RHO*VCUBED**	FERC Order 661 - Why is it not mentioned in Alberta? Briefly stated FERC 661 calls for wind generator overproduction to be paid for at 90% of pool price and the makeup of undersupply to be purchased by generators at 110% of pool price. The framework makes no provision for the wind generator to self supply regulate by application of hydrogen, mini-hydro, biomass, or other means. The potential is there to achieve a 24/7/365 constant power supply. It seems to me that the application of these emerging innovative technologies is best left to the entrepreneur rather than placed in the hands of a large monopoly.	Alberta as a Canadian energy market is not FERC jurisdictional. To the extent FERC orders provide insight into applications that could be considered in Alberta, this consultation will occur in industry.
Joe Green	In my opinion, it makes a lot more sense to use the maximum available wind energy at a site to pump water for "energy storage" for use later in a "hydro generation" scheme, or even an air compressor scheme for later use in an air turbine for generation of electric power. Unlike damns that are large because they are storing energy for long periods of time, the time frame required here is relatively short, perhaps a few days to a week or so. That dramatically reduces the environmental impact of hydro generation systems that are still capable of very large power production, even over shorter intervals between periods of low wind conditions. But the industry has missed the boat in terms of optimizing wind mills as water pumps that are not always running, but are capable of very high power levels under strong wind conditions. In control systems theory, a "storage device" has the impact of "filtering" fluctuating signals, in this case power output caused by direct coupling into the wind. That "storage device" in my opinion, is a small but powerful hydro plant that produces power, and is capable of operating "off line" in a water pumping mode for maximum wind power conversion.	The market framework in Alberta allows investors and the market to make decisions about the type, location and timing of investment, including any synergies between fuels. The policies further provide open access to all generation and consumer choice to procure energy that meets their needs and environmental standards. Further, the Alberta market must be aligned with the environmental standards developed by governments.

Joe Green	There exists another fundamental flaw in the Alberta Power Model more generally and that of course is related to the "transmission" and "distribution" side of the "regulated" system. The current situation with power transmission between customers and suppliers is not "fair and reasonable" to use a regulatory term. If a windmill generator sells power to a distant customer, that customer should have to bear the carrying charges for that energy. To make a direct comparison, the current Alberta Power Policy is rather like having Air Canada fly freight anywhere in Canada at a fixed rate, whether that is across town or across the country. Let me go further and suggest that this ENTIRE POLICY FRAMEWORK may even be illegal. Its a sophisticated form of "cross subsidization" and the celebrated "Prince George Gas Case" has much to say in our regulatory laws about such practices. Its also a dysfunctional arrangement in practice. In those regions of the Province where infra-structure is limited, a local "distributed generator" can supply a very valuable service at a competitive price, but that price must be free to float up to its "free market levels" that are set in part by local conditions. Yet in Alberta, the entire regulatory framework of a "market" rests upon a false premise, that of a "commodity" whose value is independent of location. What that does is discourage local distributed generators from locating where they are most in demand, and it provides the "transmission operator" with an unfair advantage. In fact, it calls upon the "distributed generator" to pay the transmission operator a fee for not performing any service at all, particularly when a local distributed generator utilizes the power he produces in the immediate vicinity of his own location, as is often the case with co-generation plants. The Alberta market model ONLY works, in the fictional world where transmission lines have zero resistance losses and infinite transmission capacities, and where delivery of energy does not consume any energy. In my opinion, this policy at AESO is "anti-environment" as is the Alberta Department of Energy policy that does not support new green energy production technologies. Indeed, this policy is consistent with the "anti-environment" policies of the Alberta Department of Environment and its views related to the use of "open loop" geothermal heating and cooling systems in many Alberta communities closely located near rivers and lakes.	

Joe Green	Finally, this "policy" does not take into account the relationship between fuels, which do have differing environmental impacts. There have been times in the Alberta market where electrical energy cost less than the cost of fuel to produce it, at least in the context of natural gas. Let me go even further and suggest that Alberta's excessive dependence upon coal power technologies not only emit over twice as much CO_2 compared to competing hydrocarbon technologies such as natural gas, but that it also discourages the upgrading of coal deposits to the much more valuable form in "methane gas". If you are to have a free market in electrical energy in Alberta, than AESO should at least ensure that it is a well policed and well managed free marketplace where the rules are the same and fair to all participants. Windmill operators should not be relieved of their contractual obligations because of an "act of God" (i.e. no wind), and they should face the same penalties for failing to perform as does any other player. And coal generators should be faced with the consequences of emitting large quantities of green house gases and other pollutants in the course of their business operations. By any reasonable measure, this proposed policy framework is "anti-market", and "anti-environment".	