Short-Term Wind Integration

RECOMMENDATION PAPER

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1. Executive Summary

It is expected that up to 1100 MW of wind generation will be online in Alberta in 2011, which is nearly double the current level of wind installed on the Alberta Interconnected Electric System. AESO studies have determined that the reliable operation of the system requires tools and practices to be in place prior to connecting this level of wind capacity. These must be in place by early 2011 and the options that can be implemented in this timeframe are limited.

In addition to the tools and practices being developed for implementation by 2011, the AESO is proceeding with a second phase of the wind integration plan that includes tools and market features that will take longer to have in place. The tools developed in the short term plan will be beneficial in the second phase as they expand the range of tools available to integrate wind on the system. A Discussion Paper examining these options will be released in Q4 2010.

The AESO recommends the following approach to integrating wind given the requirement to have the tools in place for 2011:

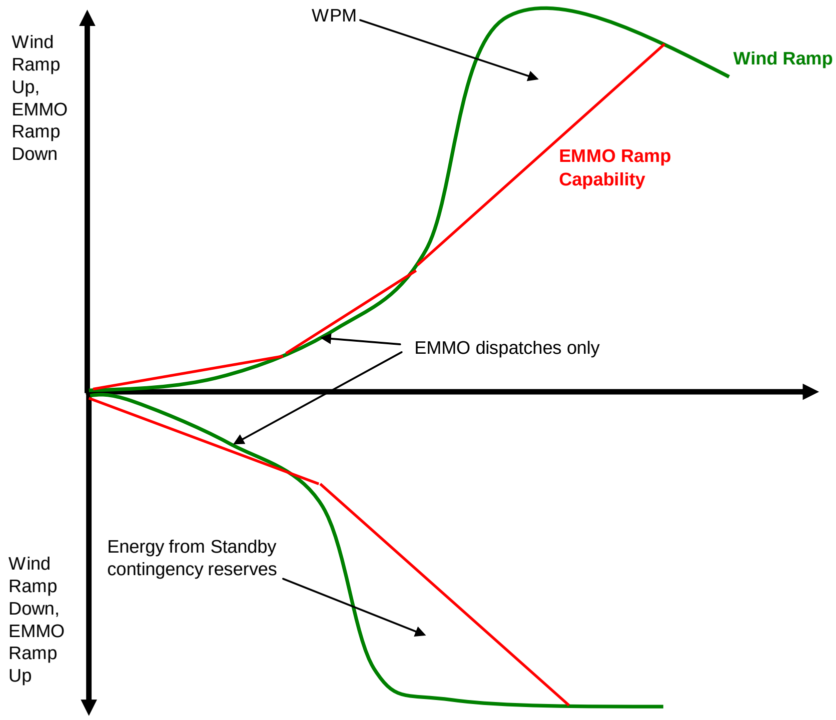
1. Dispatch the Energy Market Merit Order (EMMO) to balance supply and demand on the basis that the dispatches are expected to be required to balance energy needs rather than ramp rate requirements.
2. When wind power ramps down more rapidly than can be handled via EMMO per point 1, dispatch available contingency reserves to produce energy in order to replace the lost wind power. This will allow the system to manage wind ramp down events in a manner that is consistent with how sudden reductions in generation from other resources are currently treated.
3. When wind power ramps up more rapidly than can be handled via EMMO per point 1, utilize Wind Power Management (WPM) to control wind ramp up events.

Figure 1 on the following page illustrates the three recommendations. Wind ramp events that do not exceed the capability of EMMO will be managed solely through EMMO dispatches. Wind power ramp up events (top portion of the figure) in excess of EMMO capability will be managed through WPM. Wind power ramp down events (bottom portion of the figure) in excess of EMMO capability will be managed through the use of contingency reserves.

In order to implement the recommended approach, the AESO recommends that two new tools be made available to the system controller.

1. A near term wind power forecast, which is currently in the implementation phase.
2. A tool that calculates the current ramp rate capability of the system based on system conditions and distributes power limits to individual wind aggregated generating facilities, which is currently in the implementation phase.

Figure 1 - Illustration of Phase 1 Wind Integration Recommendations



Following this Recommendation Paper, the next steps in the wind integration program include:

- Receive stakeholder feedback on the phase one implementation plan.
- Continue to integrate the wind power forecast into AESO systems.
- Continue development of the tool to calculate and disseminate the system wind power limit.
- Implement practices and any necessary new ISO rules or rules changes to use WPM and incremental ancillary services in a transparent manner.
- Release of Phase 2 discussion paper that examines incremental tools and market features for integrating wind on the system.
- Monitor and analyze the frequency of use and effectiveness of phase 1 tools.

The intent of these changes is to bridge the period required to develop the overall wind integration plan that will include new market rules and tools such as a ramping service.

2. Purpose

This recommendation paper presents the phase one implementation plan for wind integration using operating reserve, wind power management (WPM) and energy market merit order (EMMO) dispatches for ramp rate. The wind power forecast is an important tool within the integration plan to manage the use of the other tools. The blend of options utilized will mitigate the operational challenges associated with wind power variability and ensure the integration of wind generation in a manner consistent with FEOC principles.

3. Introduction and Stakeholder Feedback

As of September 2010, there are 629 MW of transmission connected wind generation installed in Alberta, and this is expected to increase to approximately 1100 MW by the fourth quarter of 2011. Previous AESO studies have indicated that this amount of wind capacity cannot be reliably operated without a specific wind integration strategy. Given the short timeframe available for the implementation of short-term integration tools, pragmatically the options are limited mainly to using existing tools available to the AESO.

The AESO recently published a Discussion Paper that detailed the following potential options for meeting the operational challenge expected in 2011.[1]

1. The Energy Market Merit Order (EMMO)
2. Operating Reserve
3. Wind Power Management (WPM)
4. Wind Power Forecast

This Recommendation Paper incorporates stakeholder feedback from the Discussion Paper and presents an implementation plan consistent with the Alberta market framework and the wind integration principles identified in the Discussion Paper. Several key issues were raised by stakeholders in the Discussion Paper comment matrix, and detailed AESO responses are contained in the AESO Comment Response Matrix released with this paper.

The AESO is concurrently developing the next phase of wind power integration measures that include the development of additional tools and market practices that will not be available in 2011. A Discussion Paper on these options will be released in Q4 2010. The implementation plan in this paper represents the first phase of work in a larger project, and the actions taken in this phase will create immediate as well as long term benefit for the wind integration program.

4. Policy Coherence and Principles

The Discussion Paper outlined the policy background and developed wind integration principles from an interpretation of the relevant policy. The duties to promote a FEOC electricity market and provide market participants a reasonable opportunity to exchange electric energy within the backdrop of a reliable electrical system are key elements of the policy and legislative framework that guide acceptable wind integration strategies. There are tradeoffs between using more or less of a given integration tool, as the overall solution can impact elements of the market such as ancillary services costs, the real-time energy price and the amount of wind power curtailed.

4.1 Stakeholder Feedback

The AESO has clarified several of the principles drafted in the Discussion Paper as a result of stakeholder feedback. It should also be noted that the principles are not presented in terms of precedence.

[1] Short-Term Wind Integration Discussion Paper. AESO, May 7, 2010.

1. **Any potential suite of wind integration tools must ensure the safe and reliable operation of the system.**

Unreliable operation is not an option and the AESO will use measures as required to maintain grid reliability. As wind generation increases, increased control measures may be required to maintain performance and compliance to reliability standards. This principle is based on the AESO's legislated mandate to ensure reliability.

2. **Market solutions are preferable to administrative solutions.**

The AESO will seek to develop market solutions to the full suite of challenges presented by increased wind generation on the system, including the need to maintain the reliable operation of the system. This principle is based on the AESO's interpretation of its mandate to promote a FEOC market.

3. **The energy market merit order is primarily a tool for balancing energy requirements on the system.**

The EMMO inherently supplies ramp rate to the market, but persistently dispatching multiple units for short periods to achieve a higher system ramp rate[2] results in impacts to generating unit operators, price responsive load and other market participants. With respect to wind power, while EMMO may be dispatched in this manner on an as needed basis to maintain reliability, it is not a practice that should be used on a 'planned' basis. This principle is based on the AESO's interpretation of its mandate to promote a FEOC market.

4. **All generation should be treated fairly while recognizing their unique characteristics.**

The use of WPM and the deployment through "must forecast must comply" principles to wind aggregated generating facilities must recognize the particular characteristics of wind, yet not create unfair costs or a materially unleveled playing field for other market participants. This principle is drawn from the 2005 Alberta Policy Framework.

5. **Ancillary services are a tool to protect the system from events that cannot be reasonably controlled.**

The use of ancillary services in the wind integration plan must be considered with respect to both wind ramping up and down. In the context of wind power, ramp up events can be reasonably controlled provided the facility has the technical capability, while wind ramp down events cannot be reasonably controlled given current technology. This principle is based on the AESO's interpretation of its mandate to promote a FEOC market and the AESO's duty to manage ancillary services costs in a prudent manner.

These principles are intended to guide the overall wind integration program in order to ensure a fair, efficient and openly competitive outcome.

[2] See section 6.1 for a description of over dispatching for ramp rate.

5. Analysis

In response to stakeholder feedback to the analysis presented in the Discussion Paper, section 5 presents additional analysis.

5.1 Source of ACE Events

Table 1 in the Discussion Paper, reproduced below, created the impression that wind was a factor in about 38% of the Big ACE events (12/32), as noted by several stakeholders.

Table 1 - Original ACE Contribution Table

ACE & Big-ACE Events from Base-Case Results	Big ACE Events											ACE Events										
	Wind		Load		Tie		Other		Total			Wind		Load		Tie		Other		Total		
Scenario Name	Up	Dn	Up	Dn	Up	Dn	Up	Dn	Up	Dn	All	Up	Dn	Up	Dn	Up	Dn	Up	Dn	Up	Dn	All
2008 Backcast (497 MW)	0	0	0	0	0	0	0	0	0	0	**0**	0	3	9	4	5	8	28	3	42	18	**60**
Base Case (1100 MW)	10	2	3	0	3	6	6	2	22	10	**32**	27	40	25	21	4	14	113	14	169	89	**258**
Perfect Forecast (1100 MW)	1	0	0	0	1	4	0	1	2	5	**7**	2	1	10	9	3	9	39	3	54	22	**76**

Table 2 presents the same information for the Base Case but groups all events where wind was a contributing factor to the ACE event. The distinction is that wind was the primary contributor in 12 of 32 Big ACE events, but was a contributing factor in 29 of 32 Big ACE events, as per Table 2. Wind was defined as a contributing factor to an ACE event when it ramped in the same direction as the ACE event, i.e. if wind ramped up during an over generation event, it was categorized as a contributor.

Table 2 - Contribution of Wind Variability to ACE Events

Detailed sources of ACE and Big-ACE events **W** = Wind, **L** = Load, **T** = Intertie									
Contributors to ACE event		W	WL	WT	WLT	Other with W	Other w/o W	Total	% of total events where wind was a factor
Base case	BIG ACE	4	10	2	5	8	3	**32**	**91%**
	ACE	6	82	17	13	108	32	**258**	**88%**

A key finding from Table 1 and Table 2 is that wind contributes to about 90% of the ACE events seen in the study. It is not, however, the only contributor and therefore cannot be expected to bear all the costs.

5.2 WPM and Regulating Reserve Comparison

WPM and the amount of incremental regulating reserves required to manage wind ramp up events were identified by stakeholders as a key concern in feedback to the discussion paper. The AESO developed incremental analysis that examined the tradeoff between WPM and incremental regulating reserves under the assumption that either could be utilized efficiently, i.e. either would be used only when actually required to meet ACE standards. The analysis is based on the net ramping capability of the system, which is defined as the capability of the EMMO less the ramping requirement to serve load changes.

The analysis was done on 15 minute increments. For example if the hourly ramp down capability is assumed to be 600 MW then in the 15 minute timeframe a wind ramp up of 150 MW could be accommodated without using WPM or incremental regulating reserve. Anything in excess of this would require additional regulating reserves or the use of WPM. Should load be ramping up at the same time as wind then there should be additional net ramping capability on the system, and when load is ramping down there would be less net ramping capability.

Additional regulating reserves are procured for the entire hour where additional wind ramp accommodation is required. It is assumed that 1 MW of regulating reserve can supply 0.5 MW of ramping service because regulating reserve is targeted at the midpoint of its range.

WPM affects the 15 minute intervals in which wind ramps cannot be accommodated. The remaining wind that was managed in the previous interval is added to the ramp capability of the next interval until such point as the wind is fully accommodated.

Using the actual wind and load values from February through May 2010, the impacts on additional regulating reserves (448 GWh procured in the time period) or the impact on wind power production (524 GWh produced in the time period) is illustrated in Table 3.

Table 3 - WPM and Regulating Reserve Impacts

	Assumed EMMO Ramp Rate (MW/hour)	300	400	500	600	700	800	900	1000
Current Wind Capacity	WPM (% of total energy)	0.8%	0.3%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
	Additional RR (% of total RR)	2.8%	1.4%	0.6%	0.2%	0.1%	0.0%	0.0%	0.0%
Double Existing Capacity	WPM (% of total energy)	1.5%	0.7%	0.3%	0.1%	0.1%	0.0%	0.0%	0.0%
	Additional RR (% of total RR)	8.3%	5.0%	2.7%	1.4%	0.6%	0.3%	0.2%	0.1%

The EMMO generally has around 600 MW/hr of ramping capability, although in off peak hours the capability may be less, assuming there is no over dispatching for ramp rate. Nonetheless, the results show that given an average system ramp rate of 600 MW/hr, an efficient WPM would result in about 0.1% of wind energy being curtailed for double the existing wind capacity base.

The tradeoff between WPM and regulating reserve illustrates that WPM is about 5 to 10 times more efficient in resolving over generation situations. In other words, if both WPM and regulating reserves could be used efficiently, 6 times as many MWh of regulating reserves must be used to manage the same challenge in hours when the EMMO ramp rate is 600 MW/hr (as derived from Table 3). In addition, given that regulating reserves must be put in place prior to real-time and WPM can be utilized in real-time, the efficiency advantage for WPM is more pronounced than indicated by this analysis.

6. Recommendations

There are three tools to manage the integration of additional wind energy in the short-term: the EMMO, expanded use of existing ancillary services and WPM. A robust wind power forecast capability will also be available to improve the effectiveness and efficiency of each mitigation measure.

The AESO recommends the following approach to this first phase of wind integration:

1. Dispatch the EMMO to balance supply and demand on the basis that the dispatches are expected to be required for energy rather than ramp rate, or in other words, do not plan to over dispatch the merit order as the first step. This includes dispatches in response to changes in wind power. This ramp rate applies for step 2 and 3.

2. Activate standby contingency reserves to manage risk of wind ramp down events when indicated by the wind forecast and/or system conditions.
3. Direct available contingency reserves to produce energy in order to manage ramp rate requirements that are in excess of the EMMO capability. This will provide ramp rate to the system to manage wind ramp down events. Currently, this requires that incremental contingency reserves beyond the minimum levels specified by the NWPP would need to be made available during periods when there is a risk.
4. Utilize WPM to control wind ramp up events when the ramp requirement exceeds the ramp down capability of the EMMO.
5. Dispatch the EMMO for ramp rate on an as needed basis when required to maintain the system balance when other options are exhausted.

In order to implement the recommended approach, the AESO recommends that two additional tools be made available to the system controller.

1. A near term wind power forecast.
2. A tool that calculates the current ramp rate capability of the system based on system conditions and distributes power limits to individual wind facilities when required.

The following sections present greater detail on each of the steps and tools in the wind integration framework. The Appendix of this paper provides more detail concerning WPM and the pro rata allocation of wind power limits to individual wind power facilities.

6.1 Energy Market Merit Order

The Energy Market Merit Order is the primary tool used to balance supply and demand in Alberta, and through this function the EMMO also sets the system marginal price. Wind generation is not currently represented in the EMMO as currently the owners of wind aggregated generating facilities do not submit offers. EMMO is dispatched up or down as required to balance the system and the frequency of dispatches depends on load changes, contingency events, wind generation output or other factors that alter the supply demand balance. Increased wind capacity will increase the number of dispatches as one more variable factor is added to the system.

6.1.1 Recommendation

The AESO recommends that the EMMO continue to be used as the primary tool to balance supply and demand in the market, and that the EMMO will be the first tool used to balance changes in wind production on the system.

The AESO recommends that EMMO dispatches to accommodate wind power should not include dispatches solely intended to achieve a higher system ramp rate. EMMO dispatches should be made to balance the anticipated supply demand balance, given the information available at the time as this best represents a FEOC market. Over dispatching may occur from time to time in order to maintain system balance due to large intertie schedule changes and large load changes or rapid declines in wind generation that cannot be managed in advance (see recommendation 6.2.1 for wind), but these instances have been manageable to date.

The AESO recommends that a tool be developed that calculates the real-time ramping capability of the system under the assumption that dispatches are made for energy requirements. This tool would allow the system to accommodate the maximum amount of wind power, given real-time conditions without the use of secondary wind integration tools such as ancillary services and WPM. The available system ramp rate will be published by the AESO to ensure transparency.

6.2 Operating Reserve

In the near-term, the AESO has access to two main types of reserve: regulating reserve and contingency reserve. Contingency reserve is made up of spinning reserve and supplemental reserve. This reserve is used to replace energy when a contingency event occurs that results in a loss of generation, but according the Northwest Power Pool Reserve Sharing Operating Procedure, contingency reserve cannot be used for general system balancing needs absent a contingency event.

Each type of reserve has two sub-types: active and standby. Active reserve is procured day ahead, and all of the volumes purchased are dispatched in the real-time market. Standby reserve is a secondary product that is used near real-time on an as needed basis. In essence, standby reserve must be in position to supply service within 15 minutes when activated by the AESO, but unless the service is activated the provider is free to participate in the energy market.

6.2.1 Regulating Reserve Recommendation

The AESO recommends that regulating reserves should not be purchased or activated from standby to accommodate wind ramping up. Wind ramping up is a controllable event, which suggests that it should not be managed with ancillary services paid for by load based on principle number 5 (see page 4). Analysis presented in Table 3 also indicated that regulating reserve was not as efficient at mitigating wind ramp up events relative to WPM. As such, the use of incremental regulating reserve to accommodate potential wind ramp up events raises both fairness and efficiency concerns.

6.2.2 Contingency Reserve Recommendation

The AESO recommends that the loss of wind energy due to a decrease in wind speed should be treated as a generation contingency. As such, contingency reserves should be used to replace this energy. This establishes fair treatment across generation types based on the premise that uncontrollable decreases in production are managed by system services paid for by load.

The AESO recommends that contingency reserves be used to replace lost wind energy when the rate of wind energy decline exceeds the ability of the EMMO to replace it. The ramp rate calculated in Recommendation 6.1.1 is the ramp rate that will be used to determine when to direct contingency reserves for energy.

The AESO recommends that existing standby reserves (spinning and supplemental) be activated when there is a risk required ramp rate will exceed the available ramp due to a wind ramp down event. These standby activations will result in Alberta carrying more than the minimum level of contingency reserves in some hours. Given the uncertainty of wind ramp down events in the day ahead timeframe, standby reserve is the most efficient tool currently available to manage wind ramp down events on an as needed basis.

The AESO recommends that if the North West Power Pool allows contingency reserve to replace the unexpected loss of wind generation due to a reduction in wind speed, this practice should be followed in Alberta. Until this is allowed, the AESO recommends incremental contingency reserves (volumes beyond the minimum specified by NWPP) be activated from the standby market to manage wind ramp down events. The AESO does not recommend procuring additional standby reserves at this time because it is expected that the existing standby volumes will be sufficient.

6.3 Wind Power Management

WPM involves temporarily limiting production from wind generation facilities when system conditions are such that the total amount of available wind energy cannot be accommodated. WPM is primarily a tool to control wind events where wind rapidly ramps up.

6.3.1 Recommendation

The AESO recommends that wind generation ramping up be treated as a controllable event. WPM is the most efficient means currently available to manage wind ramp up events, and wind generators should bear the cost of managing the controllable elements of their operations, just as all other generation types must.

The AESO recommends that WPM be used to control the increase in wind energy only when the rate of wind energy increase exceeds the ability of the EMMO to accommodate it and the system is at risk for an over generation condition. The ramp rate calculated in Recommendation 6.1.1 is the ramp rate that will be used to determine when to utilize WPM. This allows wind generators to benefit from the flexibility of the current market design to avoid WPM in most instances. WPM will not be used when wind generation has not contributed to an over generation condition, nor will it be used when wind generation is ramping more rapidly than the calculated limit but there is no risk of an over generation condition.

The AESO recommends that WPM be implemented on a pro rata basis across wind facilities that are ramping up and thus contributing the over generation condition. WPM should not impact wind aggregated generating facilities that have stable or decreasing production at the time of the over generation event.

The detailed recommendation for WPM is contained as an appendix to this paper.

6.4 Wind Power Forecast

The AESO entered a two-year contract with WEPROG to provide centralized wind power forecasts for Alberta in early 2010. WEPROG's service will provide wind power forecasts that will range from 10 minutes to 144 hours ahead. This forecast is currently being integrated into a variety of AESO systems and tools.

6.4.1 Recommendation

The AESO recommends that the wind power forecast be integrated into the wind integration portfolio in order to increase the effectiveness of all tools. An accurate wind power forecast is expected to provide benefit in several ways including:

- Reduce the amount of WPM because the system controller will be better prepared to dispatch the EMMO for an expected event versus for an unexpected event
- Reduce the requirement to activate Standby reserves to manage potential ramp down events. An accurate forecast will allow the system controller to activate reserves in a smaller number of hours.

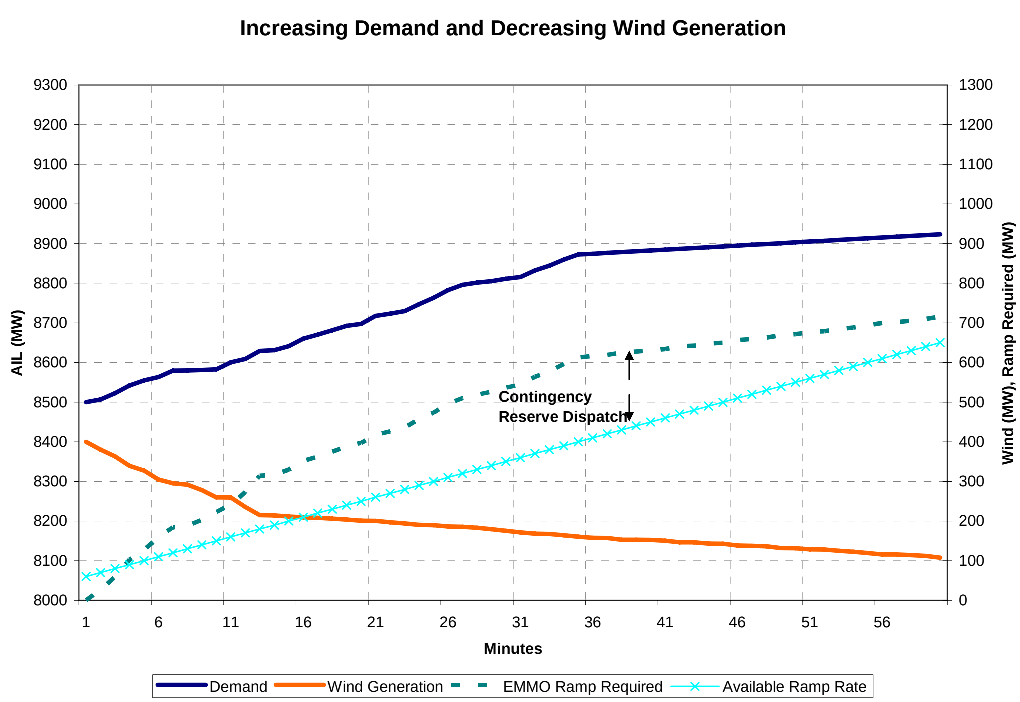
The requirement for wind generators to provide forecast data is expected to provide the same benefits to system reliability and adequacy as does the "must offer" requirement for dispatchable generators. Since wind generators currently do not offer firm energy offers due to the intermittent nature of their 'fuel', a wind power forecast requirement has been identified as a reasonable alternative that provides information to both the system controller and the market on the expected operation and participation of wind aggregated generating facilities.

6.5 Summary of Recommendations

The previous sections outlined the recommendations for each of the wind integration tools proposed. This section outlines two high level examples based on representative data (not actual events) that illustrate the overall set of tools in Figure 2 and Figure 3.

Figure 2 represents a wind ramp down event concurrent with a load ramp up period. As a result, the total requirement for ramp rate on the system exceeds the available ramp rate, which is shown as the light blue line. For simplicity, the figure shows a system ramp rate of about 10 MW per minute, which is typical for the system (without over dispatching for ramp rate).

Figure 2 - Positive Ramp Rate Required



The gap between the light blue line and the dashed green line is the ramp rate required to balance the system. In Figure 2, this requirement is met with a contingency reserve dispatch of about 200 MW for a period of nearly 1 hour. If the available reserves are insufficient to meet the total ramping requirement, dispatches intended to meet ramp rate would be necessary to maintain system balance. The intent of the wind integration tools is to minimize the likelihood of this requirement.

Figure 3 - Negative Ramp Rate Required

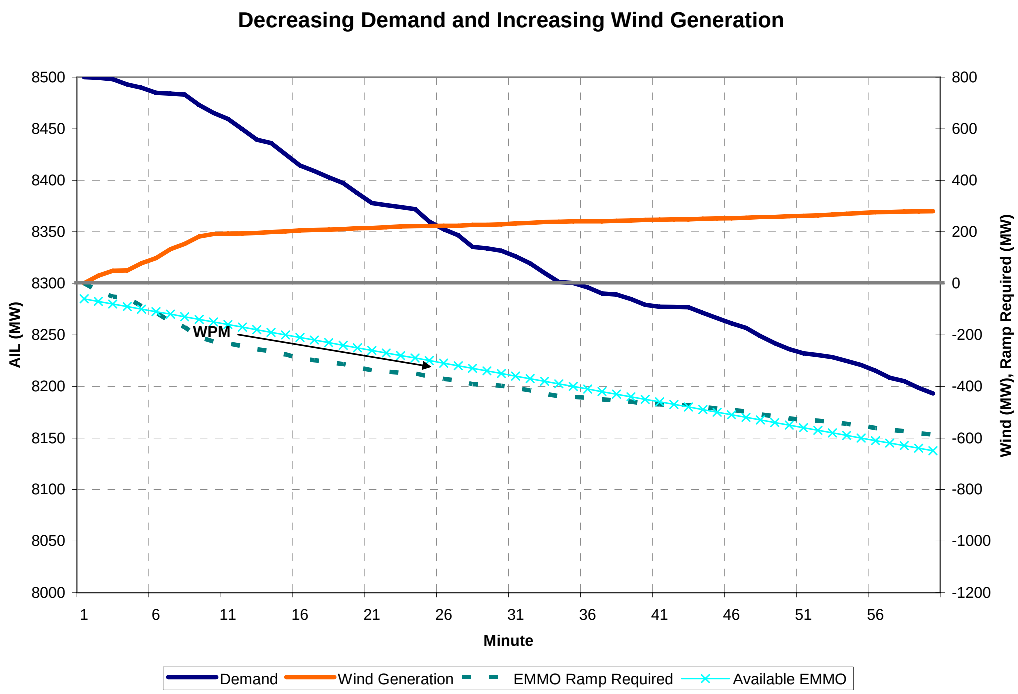


Figure 3 illustrates a theoretical wind ramp up event that required a maximum of about 50 MW of wind to be curtailed for about a 30 minute period, or 25 MWh. WPM would only be used to the extent that wind was ramping during the relevant timeframe, i.e. if wind was flat across the example hour WPM would not have been used. In this example, wind ramped up by about 300 MW in the hour, or an average of 5 MW per minute.

7. Next Steps

The next steps in the wind integration program include:

- Receive stakeholder feedback on the phase one implementation plan.
- Continue to integrate the wind power forecast into AESO systems.
- Continue development of the tool to calculate and disseminate the system wind power limit.
- Implement practices and any necessary new ISO rules or rules changes to use WPM and incremental ancillary services in a transparent manner.
- Release of Phase 2 discussion paper that examines incremental tools and market features for integrating wind on the system.

- Monitor and analyze the frequency of use and effectiveness of phase 1 tools.

8. Appendix: Wind Power Management Details

8.1 Purpose

This appendix provides further detail regarding the application of wind power management (WPM) for those wind aggregated generating facilities built under the 2004 Wind Interconnection Standard and all subsequent standards, discusses the conditions that result in WPM being triggered, and describes the protocol that distributes the limits across wind generation facilities subject to WPM. The AESO expects that the specific values articulated in this appendix may change over time as the AESO gains experience with the proposed phase 1 wind integration tools.

8.2 Enacting WPM

WPM is used on a temporary basis when wind generation output increases faster than the system can absorb, which will be defined as the system wind power limit (SWPL). In calculating the SWPL, the AESO will calculate the available system ramp rate from the energy market merit order (EMMO) as well as expected changes in load and the net intertie schedule. WPM will be enacted when wind generation increases at a rate greater than the SWPL.

8.2.1 System Wind Power Limit

The system wind power limit is set as the amount of wind energy that can be accommodated on the system without the use of WPM over a given interval. The system wind power limit for the next interval is calculated as the greater of:

<u>A</u>

- Current wind production; plus
- 6.5 MW per minute increase

<u>Or B</u>

- Current wind production; plus
- Expected increase (decrease) in load in the next interval; plus
- EMMO ramp rate down capability; plus
- Interchange Net Schedule Change (more exports or lower imports are positive, more imports or lower exports are negative)

The minimum allowable increase in total wind production from these formulas amounts to 65 MW over a ten minute interval. This value corresponds to Alberta's transmission reliability margin (TRM) combined with the 10 minute response time allowed for each wind aggregated generating facility to respond to a WPM directive.

The expected change in load impacts the system wind power limit because it is met through dispatching the EMMO. If load is expected to increase over a given interval, the system wind power limit will increase by the change in load. If load is expected to decrease, the wind power limit will also decrease.

The ramp down capability of the EMMO ranges significantly based on the real time position of the market. If numerous fast ramping units are on or near the margin with small offer blocks, i.e. they will be the first units dispatched down, the ramp rate of the EMMO is much higher than if a single large block with a slow ramp rate is on the margin. The AESO will calculate the ramp down capability of the EMMO based on these factors.

The interchange schedule is similar to load in that the EMMO must be ramped to maintain the supply demand balance. The schedule is known and firm prior to real time. If the schedule reduces imports or increases exports, the system wind power limit will be higher relative to a flat schedule. If the schedule increases imports or reduces exports, the system wind power limit will be lower.

The current wind production impacts the system wind power limit because the system wind power limit is a function of ramping capability. The system wind power limit is in effect the allowable increase in wind energy in the next interval.

If total wind energy production is no longer at the system wind power limit, the limit will be removed. It may be necessary to release the system wind power limit in a staged manner if the system controller determines that there is an over generation risk in releasing the limit entirely. For example, if several wind generation facilities are operating at their respective limit, releasing the limit entirely could result in a large, near instantaneous increase in production that would create operational issues.

8.2.2 Pro Rata Distribution of the SWPL

Each wind aggregated generating facility subject to the WPM protocol will receive a pro rata share of the overall system wind power limit. Each facility’s pro rata limit will be recalculated on an interval basis, and on the revised system wind power limit, or the limit will be removed if all wind energy can be accommodated. The ‘potential MW’ data element required by the proposed ISO Rule 502.1 will be utilized in the pro rata calculation in lieu of actual production in situations where a facility has been limited and the data is available.

8.2.3 Impact of Transmission Constraints

A wind aggregated generating facility that has had its production limited by a Remedial Action Scheme (RAS) or the Transmission Constraints Management (TCM) protocol is not exempt from WPM due to system ramp rate considerations. However, it is unlikely that a facility that has had its output reduced or limited for RAS or TCM reasons would be further limited by the WPM protocol because the WPM protocol limits increases to wind generator’s output. Generators that are not increasing production (or have reduced production) would not face further reductions except under unusual circumstances where system stability is at risk.

8.2.4 Supply Surplus Considerations

Supply surplus rules will operate independently of WPM. A facility limited by the WPM protocol is not exempt from the supply surplus protocol. Similarly, a facility that has had its output limited via the supply surplus protocol is not exempt from WPM. However, it is unlikely that a facility that has had its output reduced or limited to manage a supply surplus situation would be further limited by the WPM protocol because the WPM protocol limits increases to wind generator’s output.