



Transmission Services

Customer Requirements for Operational Controls for Variable Generators - Phase II

August 17, 2009

I. PURPOSE

On October 1, 2009, BPA will begin implementation of Phase II of Dispatch Standing Order (DSO) 216. On this date, all wind resource generating facilities (wind plants) are expected to have in place any equipment necessary (GenICCP, SCADA ICCP, or SCADA RTU) to allow communication capability to receive data from BPA on the status of balancing reserves and actions required. All wind plants are required to take action if necessary to either limit wind generation to their schedules when balancing reserves are nearing or have been depleted to offset the over-generation of wind; or wind plants will have their e-Tags (schedules) curtailed when balancing reserves to offset under-generation of wind are nearing or have been depleted. The following information is provided to assist wind plant operators in better understanding what actions will be needed and when.

II. PROJECT DESCRIPTION

- A. This overall project implements automation tools and communication protocols to limit wind generation to schedule or curtail e-Tags to actual generation. These tools and protocols have been developed in response to the amount of balancing reserves needed and identified for wind plants in the 2010/2011 wind integration rate case. This project is an attempt to resolve problems caused by the over- or under-generation of wind plants, which can cause balancing reserves to be depleted.
- B. There are two kinds of balancing reserves needed for wind plants:
 - 1. DEC balancing reserves - BPA will provide decrease (DEC) balancing reserves to wind plants when the wind plant's actual generation is over-generating above what they scheduled. The idea is that BPA has to be able to offset the over-generation with a decrease in generation elsewhere in BPA's Federal Columbia River Power System. BPA sets aside a fixed amount of capacity each hour to provide DEC balancing reserves for both wind and load.
 - 2. INC balancing reserves - BPA needs to maintain increase (INC) balancing reserves when the wind plants are not generating or under-generating below what they have scheduled. The idea is that BPA has to be able to increase generation elsewhere in BPA's Federal Columbia River Power System to make up for the under-delivered generation from the wind farms. BPA sets aside a fixed amount of capacity each hour to provide INC balancing reserves for both wind and load.
- C. There are two phases to the DSO 216 project, so far.
 - 1. Phase I Limit Wind to Schedule protocol went into effect on April 3, 2009. At that time, BPA completed modifications to its Automatic Generation Control (AGC) system that sends a message to each wind plant to limit actual generation to its schedule if DEC balancing reserves have been exhausted. In Phase I, the warning message and limit message could only be initiated *manually* by the Power Services Hydro Duty Scheduler or Transmission Services Dispatcher, respectively.
 - 2. Phase II is a follow-up to the Phase I Limit Wind to Schedule project. This project builds on Phase I by continuously calculating the available balancing reserves and *automatically* sending out messages to wind plants to either warn them when INC balancing reserves are

becoming depleted or request them to take action when DEC balancing reserves become either low or are exhausted.

- D. On October 1, 2009, BPA will implement Phase II DSO 216 in full and rates associated with this protocol will be in effect. There are two types of actions that may be taken under DSO 216:
1. If wind plants are over-generating and BPA is supplying DEC balancing reserves, BPA will have the ability to put generation output limits on each wind plant, relative to its schedule. If a limit is ordered, this will require wind plants to adjust generation output to, or below, the limit within 10 minutes of receiving electronic directives from BPA. The limitation will remain in effect for the remainder of the hour, at which time each wind plant should have its e-Tags and schedule modified to match its actual generation.
 2. If wind plants are under-generating and BPA is supplying INC balancing reserves, BPA will have the ability to curtail transmission schedules for each plant, relative to its actual generation. If a curtailment is needed, the wind plants or their agents will be electronically notified of the curtailment through the existing NERC e-Tagging system. No other notification will be provided. Approval of the e-Tagging action must be consistent with the current e-Tagging timelines and requirements. The wind plant will not be required to modify output, as the curtailing of the schedule will decrease the amount of INC balancing reserve for that plant. The curtailment will remain in effect for the remainder of the hour, at which time each wind plant should have its e-Tags and schedule modified to match its actual generation.
- E The following communication methods will be used by BPA to provide information to the various wind plants:
1. Use SCADA ICCP to exchange data with each utility Wind Generation owner that is using this method for Phase I
 2. Use GenICCP to exchange data with each Wind Generation owner that is using this method for Phase I.
 3. Use SCADA RTUs (GE D20) to exchange data with each Wind Generation owner that has installed the new type of RTU, either as original installation or an upgrade from the BETAC type used for Phase I.
 4. Use SCADA RTUs (BETAC) to exchange data with each Wind Generation owner that is currently using this method for Phase I that has not upgraded to the new GE D20 or cannot use SCADA ICCP or GenICCP. (The information will be limited to the points available in Phase I.)
 5. An external BPA Web Application will be made available with additional information and graphical presentation to supplement the signals sent directly to the plants.

III. BALANCING RESERVE WIND STATES

A. State Changes

AGC will monitor balancing reserves and respond as INC or DEC balancing reserves are deployed. There are seven different states within BPA's AGC that will be conveyed to wind plants to be monitored and acted upon as balancing reserve levels change. The state changes are relative to the percent of balancing reserves deployed. The percent is the ratio of the balancing reserves deployed at any time to the fixed amount of balancing reserves set aside for that hour.

1. Normal - Indicates that less than 85% INC or DEC balancing reserves have been deployed and no new action is required by the wind plant. This is indicated as a Wind State of 0 on SCADA ICCP and GenICCP, Displayed as Normal on the BPA Web Application There is no indication via SCADA RTU (GE D20 or BETAC).

2. Limit Warning - The Limit Warning indicates that the DEC balancing reserves deployed have exceeded 85% and generation limits may be required. This is indicated as a Wind State of -1 on SCADA ICCP and GenICCP. It is a control point on GE D20 SCADA RTU, but the point does not indicate a Limit or Curtail warning. There is no indication via BETAC SCADA RTU. No acknowledgement (ACK) is required from the wind plant. This is displayed as Wind Limit Warning on the BPA Web Application.
3. Limit Level 1 - The Limit Level 1 indicates that the DEC balancing reserves deployed have exceeded 90% and that each wind plant must reduce its actual generation output to its DEC Target, which is its schedule plus its allocated portion of DEC wind balancing reserves that has been established through the 2010/2011 Wind Rate Case process. This is indicated as a Wind State of -2 on SCADA ICCP and GenICCP and as a control point on GE D20 SCADA RTU. This is also a control point on BETAC SCADA RTU, but the point is set for both a Level 1 or Level 2 limit. ACK is required for each individual wind plant. This is displayed as Level 1 Limit on the BPA Web Application.
4. Limit Level 2 - The Limit Level 2 indicates that the DEC balancing reserves deployed exceeded 100% and that each wind plant must reduce its actual generation output to its schedule. This is indicated as a Wind State of -3 on SCADA ICCP and GenICCP and as a control point on GE D20 SCADA RTU. This is also a control point on BETAC SCADA RTU, but the point is set for both a Level 1 or Level 2 limit. ACK is required for each individual wind plant. This is displayed as Level 2 Limit on the BPA Web Application.
5. Curtail Warning -The Curtail Warning indicates that the INC balancing reserves deployed have exceeded 85% and e-Tag (schedule) curtailments may be required. This is indicated as a Wind State of 1 on SCADA ICCP and GenICCP and as a control point on GE D20 SCADA RTU (the same control point as the Limit Warning). There is no indication via BETAC SCADA RTU. No ACK is required from the wind plant. This is displayed as Wind Curtail Warning on the BPA Web Application.
6. Curtail Level 1 -The Curtail Level 1 indicates that the INC balancing reserves deployed have exceeded 90% and that each wind plant's schedule (sum of its e-Tags) will be curtailed (via individual e-Tag curtailments) by the amount exceeding its INC Target, which is its actual generation plus its allocated portion of INC wind balancing reserves that has been established through the 2010/2011 Wind Rate Case process. This is indicated as a Wind State of 2 on SCADA ICCP and GenICCP. There is no indication via SCADA RTU (GE D20 or BETAC). No ACK is required from the wind plant. This is displayed as Wind Curtail Level 1 on the BPA Web Application.
7. Curtail Level 2 -The Curtail Level 2 indicates that the INC balancing reserves deployed have exceeded 100% and that each wind plant's schedule (sum of its e-Tags) will be curtailed (via individual e-Tag curtailments) by the amount exceeding its actual generation. This is indicated as a Wind State of 3 on SCADA ICCP and GenICCP. There is no indication via SCADA RTU (GE D20 or BETAC). No ACK is required from the wind plant. This is displayed as Wind Curtail Level 2 on the BPA Web Application.

B. State Change Rules

The following rules apply to the wind states:

1. The balancing reserves deployed (whether INC or DEC) must remain in a band for 30 continuous seconds before it is considered to be in that state. For example: balancing reserves deployed must be over 85% for more than 30 seconds to be in a Warning state.
2. Once a new action state has been reached (Level 1 or Level 2), the wind state will remain in that state for a minimum of 10 minutes before considering changing states. The warning state could last a much shorter length of time.
3. A Level 1 state must always take place before a Level 2 state occurs, even if balancing reserves are fully (100%) deployed. Going into a Level 1 state before moving immediately

to a Level 2 state first will give the wind plant 10 minutes to take actions that may prevent the transition to a Level 2 state.

4. Transitions will not be made to a lower state within an hour; they will either hold or they may increase to the next higher level. In other words, states will not change from a Level 2 to a Level 1, unless the change is from a Limit to a Curtail or a Curtail to a Limit state.
5. Wind state will be set to Normal at the top of the hour.
6. A Level 1 or Level 2 Limit will not be initiated during the ramping period, from 10 minutes prior to the top of the hour to 10 minutes after the top of the hour. This will allow the ramp to new schedules to occur, which could possibly reduce DEC balancing reserve deployment without BPA taking action.
7. A Level 1 or Level 2 Curtailment will not be issued between 15 minutes prior to the top of the hour and 10 minutes after the top of the hour. This will allow the ramp to new schedules to occur, which could possibly reduce INC balancing reserve deployment without BPA taking action

IV. NOTIFYING THE WIND PLANT OPERATORS

Wind plants can be notified directly via SCADA ICCP, GenICCP, GE D20 SCADA RTU, or BETAC SCADA RTU. There is also a BPA Web Application that is available as a supplement to the telemetry. The following sections apply to the various methods that each wind plant will use to receive and send information.

A. Communication Received by Wind Plants from BPA

Data can be received by wind plants that have a telemetered communications link through SCADA ICCP, GenICCP, or SCADA RTU with BPA. It is expected that telemetered links will be set up with all wind plants as their primary source of communication by October 1, 2009. Plants that have RTU Communication Controls at this time, will use the existing communication from Phase I. As the new Plants and new GE D20 RTU's are Phased in, communications will be switched to these new installations.

However, as a secondary backup to these connections being completed, the wind plants are expected to use BPA's Web Application.

B. Communication Sent from Wind Plants to BPA

As in Phase I, the wind farms will need to keep the ACK they send back to BPA asserted during the time that the respective state is active. For example, once a Limit Level 1 request is sent to the plant by BPA, the plant should return an ACK immediately and keep the ACK asserted (true) until the Limit Level 1 state is no longer active. The Web Application is read-only and will NOT allow the wind plant to send an ACK back to BPA.

V. SPECIFIC DATA ELEMENTS ACCORDING TO COMMUNICATION TYPE

A For SCADA ICCP and GenICCP plants:

1. The following BPA Balancing Authority data will be provided:
 - 1.1 Wind State --3,-2,-1,0,1,2,3 (Normal, Warning, Level 1 or Level 2 trigger)
 - 1.2 Total Reserves Deployed
 - 1.3 Total Balancing Reserves Deployed
 - 1.4 Total Balancing Reserves % Deployed
 - 1.5 Total Balancing Reserves Deployed INC Max
 - 1.6 Total Balancing Reserves Deployed DEC Max
2. For each of their Wind Plants, the following data will be provided:

- 2.1 INC Reserve Allocation
- 2.2 DEC Reserve Allocation
- 2.3 INC Target (aka desired gen)
- 2.4 DEC Target (aka desired gen)
- 3. For each of their Wind Plants, the following will be received:
 - 3.1 INC Target that was sent (echo back)
 - 3.2 DEC Target that was sent (echo back)
 - 3.3 ACK of Limit Level 1 state change
 - 3.4 ACK of Limit Level 2 state change
- B. For GE D20 SCADA RTU plants:**
 - 1. Sent data:
 - 1.1 Warning Control point (for Limit or Curtail condition)
 - 1.2 Limit Level 1 Control point (trigger)
 - 1.3 Limit Level 2 Control point (trigger)
 - 1.4 DEC Target (aka desired gen)
 - 1.5 Total Balancing Reserves % Deployed
 - 2. Received data:
 - 2.1 DEC Target that was sent (echo back)
 - 2.2 ACK of Limit Level 1 state change
 - 2.3 ACK of Limit Level 2 state change
 - 3. Notes:
 - 3.1 GE D20 RTUs will be the required RTU for all new wind facility installations. The older BETAC RTUs must also be replaced with GE D20 RTUs.
- C. For BETAC SCADA RTU Plants:**
 - 1. Sent data:
 - 1.1 Control point for Limit-to-Schedule (level not indicated)
 - 2. Received data:
 - 2.1 ACK of Limit-to-Schedule (level not indicated)
 - 3. Rules:
 - 3.1 Newer GE D20 RTUs will not be installed until 2010, so until then BPA will only be using the Phase I data points to the older BETAC RTUs for Phase II.
 - 3.2 No Warning is sent.
 - 3.3 For Phase II, the control point will also be triggered for a Level 1 or Level 2 Limit. The Wind Plant Operator would need to check the Web Application to determine the level of the limit and the target generation.
- D. For Web Application Generation Advisor:**
 - 1. The following BPA Balancing Authority data will be posted globally:
 - 1.1 Wind State - Normal, Limit/Curtail Warning, Limit/Curtail Level 1 or Limit/Curtail Level 2

- 1.2 Total Reserves Deployed
- 1.3 Total Balancing Reserves Deployed
- 1.4 Total Balancing Reserves % Deployed
- 1.5 Total Balancing Reserves Deployed INC Max
- 1.6 Total Balancing Reserves Deployed DEC Max
- 2. For each of their Wind Plants, the following data will be posted privately:
 - 2.1 INC Reserve Allocation
 - 2.2 DEC Reserve Allocation
 - 2.3 INC Target (aka desired gen)
 - 2.4 DEC Target (aka desired gen)
 - 2.5 Limit Level 1 ACK (indication they have ACKed a Level 1 req)
 - 2.6 Limit Level 2 ACK (indication they have ACKed a Level 2 req)
- 3. Rules:
 - 3.1 A private Phase II Web Application (called Generation Advisor or GA) will be set up for each wind plant. GA will contain BPA Balancing Authority data that will be posted globally for all wind plants and private data that can only be viewed by those operating/managing the specific wind plant. The data is intended to be a supplement to the telemetry and notifications to the wind plant, with enhanced visualization.
 - 3.2 No data or ACK is sent back to BPA via the web application (Generation Advisor).

VI. DEFINITIONS FOR DATA ELEMENTS

A. Data Sent to SCADA ICCP and GenICCP Plants and the Web Application

A more detailed description of the data sent:

Wind State

The wind state is used to notify the wind plants that they need to take no action, they need to limit their wind generation, or their e-Tags are being cut. For ICCP and GenICCP sites an integer (-3 to +3) is sent. For the Web Application, the state is displayed as text (e.g. Limit Warning). The wind state sent/posted is either:

- +3 = Curtail Level 2 (Tags being cut to actual)
- +2 = Curtail Level 1 (Tags being cut to actual + INC allocation)
- +1 = Curtail Warning
- 0 = Normal (No action being taken)
- 1 = Limit Warning
- 2 = Limit Level 1 (Limit wind to schedule + DEC allocation)
- 3 = Limit Level 2 (Limit wind to schedule)

Total Reserves Deployed

The amount of Reserves that BPA has deployed. This includes both Reserves needed for Balancing Reserves and Contingency Reserves.

Total Balancing Reserves Deployed

The amount of Balancing Reserves that BPA has deployed.

Total Balancing Reserves % Deployed

This is the percent of total available Balancing Reserves that have been deployed. Once this value is over 85% (more than 85% reserves deployed), then AGC will issue a warning, a limit gen message, or a curtailment.

Total Balancing Reserves Deployed INC Max

This is the Max amount of balancing reserves that BPA maintains for all the plants that are under-generating. As plants under-generate these reserves are depleted as BPA increases other generation. This value is used, along with the Total Balancing Reserves Deployed to come up with the Total Balancing Reserves % Deployed.

Total Balancing Reserves Deployed DEC Max

This is the Max amount of balancing reserves that BPA maintains for all the plants that are over-generating. As plants over-generate these reserves are depleted as BPA decreases other generation. This value is used, along with the Total Balancing Reserves Deployed to come up with the Total Balancing Reserves % Deployed.

INC Reserves Allocation

The amount of scheduled e-Tags above the wind plants actual generation that this plant's tags will be cut to for a Curtail Level 1 event. In other words the plants tags will be cut to actual Gen + this value if over 90% of INC reserves are used.

Plant's DEC Reserves Allocation

The amount of generation above the plants schedule that this plant will be required to limit their generation to in a Limit Level 1 event. In other words the plants will be required to reduce their generation to their schedule + this value if over 90% DEC reserves are used.

Plant's INC Target

This is the value that the wind plant's e-Tags will be cut to for a Curtail Level 1 or Curtail Level 2 event. At the point an event is initiated, the value will be frozen. The value will be set to:

- ◆ Current Generation + Plant's INC Allocation for Level 1.
- ◆ Current Generation for Curtail Level 2.
- ◆ The default value will be the Level 1 value, so the plants will know what the Target would be if a Level 1 event were to occur. This value will not be frozen.

Plant's DEC Target

This is the amount that this plant will be asked to limit their generation to for a Limit Level 1 or Limit Level 2 event. The value will be set to

- ◆ Current Schedule + Plant's DEC Allocation for Level 1
- ◆ Current Schedule for Limit Level 2
- ◆ The default value will be the Level 1 value, so the plants will know what the Target would be if a Level 1 event were to occur. This value will not be frozen

Plant's Limit Level 1 ACK (sent to plant only via web application)

This is confirmation sent to the wind plant that BPA received their Limit Level 1 ACK. When a plant is sent a Limit Level 1 Request to reduce their generation, they are required to return a Limit Level 1 Ack. Note: Plants with Web-only communications will NOT have the ability to send an ACK to BPA.

Plant's Limit Level 1 ACK (sent to plant only via web application)

This is confirmation sent to the wind plant that BPA received their Limit Level 2 ACK. When a plant is sent a Limit Level 2 Request to reduce their generation, they are required to return a Limit Level 2 Ack. Note: Plants with Web-only communications will NOT have the ability to send an ACK to BPA

B. Data Received from SCADA ICCP and GenICCP Plants

A more detailed description of the data received from ICCP and GenICCP plants follows:

1. **Plant's INC Target Sent**
This is an echo of the INC Target sent to the wind plant by BPA. It is just verification that the wind plant received the correct reading.
2. **Plant's DEC Target Sent**
This is an echo of the DEC Target sent to the wind plant by BPA. It is just verification that the wind plant received the correct reading.
3. **Plant's Limit Level 1 ACK (received from Plant)**
The plant will send this Limit Level 1 ACK after receiving a Limit Level 1 Request from BPA, to acknowledge that they received the request.
4. **Plant's Limit Level 2 ACK (received from Plant)**
The plant will send this Limit Level 2 ACK after receiving a Limit Level 2 Request from BPA, to acknowledge that they received the request.

C. Data Sent to GE D20 SCADA RTU Plants

A more detailed description of the data sent to the GE D20 SCADA RTU follows:

1. **Warning Control point**
The INC/DEC Warning control point, indicates that a Warning is in effect.
2. **Limit Level 1 Control point**
The Limit Level 1 trigger control point, indicates that a Limit Level 1 state is in effect (limit gen to schedule + allocation). An ACK response will be expected from the plant for this.
3. **Limit Level 2 Control point**
The Limit Level 2 trigger control point, indicates that a Limit Level 2 state is in effect (limit gen to schedule). An ACK response will be expected from the plant for this.
4. **DEC Target (Analog setpoint from SCADA)**
For a Limit Level 1 or Limit Level 2 condition, BPA will send the wind plant the requested generation target.
5. **Total Balancing Reserve% Deployed**
The Total Balancing Reserves % Deployed is the percent of total available Balancing Reserves that have been deployed. Once this value is over 85% (more than 85% reserves deployed), then a Warning, a limit gen message, or a curtailment will take place.

D. Data Received from GE D20 SCADA RTU Plants

A more detailed description of the data received from the D20 SCADA RTU follows:

1. **Warning Control point Status**
The INC/DEC Warning is a control point in the RTU. This is just the binary status of the Warning Control point (true/false).
2. **Limit Level 1 Control point Status**
The Limit Level 1 trigger is a control point in the RTU. This is just the binary status of the Limit Level 1 Control point.

3. **Limit Level 2 Control point Status**
The Limit Level 2 trigger is a control point in the RTU. This is just the binary status of the Limit Level 2 Control point.
4. **DEC Target sent by BPA (Analog input to SCADA)**
For a Limit Level 1 or Limit Level 2 condition, BPA will send the plant a new target generation. This is just an echo of that value.
5. **Plant's Limit Level 1 ACK (status input to SCADA)**
The plant will respond with this Limit Level 1 ACK status point after receiving a Limit Level 1 Control point from BPA, to acknowledge that they received the request.
6. **Plant's Limit Level 2 ACK (status input to SCADA)**
The plant will respond with this Limit Level 2 ACK status point after receiving a Limit Level 2 Control point from BPA, to acknowledge that they received the request.