Texas RE and ERCOT Workshop for Generator Weatherization 9/10/14

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Resource Weatherization Objective

"By failing to prepare, you are preparing to fail." -- Benjamin Franklin

"Going into the February 2011 Storm, neither ERCOT nor the other electric entities that initiated rolling blackouts during the event expected to have a problem meeting customer demand." They all had adequate reserve margins, based on anticipated generator availability. But those reserves proved insufficient for the extraordinary amount of capacity that was lost during the event from trips, derates and failures to start."

Declaration of Completion of Generation Resource Weatherization Preparations (Winter)

- *Nodal Protocol 3.21 (3)*
- ***No earlier than November 1 and no later than December 1 of each year***, each Resource Entity shall submit the declaration Section 22, Attachment K, Declaration of Completion of Generation Resource Weatherization Preparations, to ERCOT stating that, at the time of submission, each Generation Resource under the Resource Entity's control has completed or will complete all weather preparations required by the weatherization plan for equipment critical to the reliable operation of the Generation Resource during the winter time period (December through February).
- ***If the work on the equipment that is critical to the reliable operation of the Generation Resource is not complete at the time of filing the declaration, the Resource Entity shall provide a list and schedule of remaining work to be completed.***

✓ Submit declaration to: eop@ercot.com

Declaration of Completion of Generation Resource Weatherization Preparations (cont.)

- *Nodal Protocol 3.21 (1)*
  - NPRR604 changed submittal of revisions for weatherization plans from 30 days to twice per year; by June 1 for any updates made between November 1 and April 30, and by December 1 for any updates made between May 1 through October 31.

- *Nodal Protocol 3.21 (2)*
  - For any Generation Resource for which ERCOT has expressed an intent to conduct a site visit to evaluate weather preparedness, a Resource Entity shall submit to ERCOT, within three Business Days of ERCOT's request, its most recent weatherization plan or a listing of the portions of its most recent emergency operations plan that address weatherization.

- *Nodal Protocol 3.21 (5)*
  - On or before January 15 each year, ERCOT shall report to the Public Utility Commission of Texas (PUCT) the names of Resource Entities failing to provide the declaration required by paragraph (3).

- Submit declaration and weatherization plan updates to eop@ercot.com

Extreme Weather Assessment

Under PUCT Rules, ERCOT is charged with assessment of the reliability and adequacy of the system during extreme weather after the events of February 2, 2011.

For the winter 2013-2014 fifty three generation sites were selected for review of weatherization preparedness.

- ✓ ERCOT started with black start units that were undergoing qualification testing.
- ✓ Operations Planning randomly selects a subset of generators to be included in spot checks.
- ✓ Five generators were a follow up from freeze related issues experienced on January 6, 2014 when ERCOT was in EEA 2.
- ✓ The implementation of weatherization plans submitted to ERCOT by resource entity is reviewed during site visits for completion. This is cross referenced to ERCOT's best practice checklist for recommendations to the plant.

ERCOT observations from site visits

Plants have identified causes and taken the following measures to prevent freezing:

- Improvements to heat trace
- Identified a need for wind barriers
- Replaced insulation
- Relocated critical transmitters
- Improved or developed weatherization plans and procedures

ERCOT observations from site visits

1. Temperature design parameters of generating units.
   - It is sometimes not known without additional research by the plant at what ambient temperature (including wind chills) the unit will be able to operate, or to what temperature heat tracing and insulation can prevent the water or moisture in its critical components from freezing.
   - Engineering analysis would be helpful for plants that are unsure or do not know.

ERCOT observations from site visits

2. Weatherization plans, procedures and checklists.
   - Weatherization plans, procedures and checklists vary from detailed to general requirements.
   - Plants that have detailed weatherization plans, procedures and checklists remained on line with minor problems during February 2011.
   - Weatherization plans should be a living document with additions of lessons learned from previous winter, improvements made, etc.

ERCOT observations from site visits

3. Heat Tracing
   - All plants do not test amperage and voltage for their heat tracing circuits and compare to design criteria, if known, or to the previous years readings.
   - There are challenges with amperage readings and plants should contact their heat trace manufacturer for recommendations.
   - Inconsistency observed in records management of heat trace maintenance.

ERCOT observations from site visits

3. Heat Tracing (cont.)
   - For newer plants and upgrades, the heat trace panels have individual circuit amperage meters for operators.
   - Some plants telemeter heat trace panel alarms to the control room operator.
   - Some plants have implemented an annual audit by a heat trace contractor to qualify their heat trace.

ERCOT observations from site visits

3. Heat Tracing (cont.)
   - One practice observed was in addition to annual amperage readings, some plants installed small lights along circuits for an indication to operators that heat trace is energized.
   - Because heat trace worked last year doesn't mean it's working this year. Plants that audit heat trace annually report failure rates of heat trace ranging from 10-15%.
   - ***Maintenance of heat trace circuits is one step that is critical to prevent equipment from freezing***.

ERCOT observations from site visits

4. Instrument air maintenance and dryers.
   - Most plants do maintenance bi annually.
   - Moisture is removed by air dryers, dew point monitoring or periodic automatic blow downs.
   - Instrument air drying is normally remotely alarmed.
   - One plant during site visits in 2013-2014 reported an instrument air issue that tripped the plant.

ERCOT observations from site visits

5. Winter weather supplies needed for extreme weather.
   - Locked job boxes at strategic plant locations with a laminated list for the supplies it should contain.
   - Supplies staged in the stores warehouse.
   - One common observation is the winter supplies are secured.
   - Consistency observed for supplies.

ERCOT observations from site visits

6. Plant walk down and inspection of insulation.

- ✓ Are there parts of the insulation that are damaged that will let allow moisture in? This should be discovered and repaired in time for winter.
- ➢ Repairs are tracked by plants PM system.
- ➢ Installation of temporary insulation on auxiliary equipment in the fall.
- ➢ Not all weatherization plans include inspection of insulation.

ERCOT observations from site visits

7. Plant training for extreme cold weather event.

- Does the plant do an annual extreme cold weather drill or training?
  - ✓ 60% of the plants visited during the winter 2013-2014 reported they conduct annual training and provided records.
  - ✓ 40% of the plants visited during the winter 2013-2014 reported they do not conduct annual training.
  - ✓ All plant personnel should be aware of the critical components that could freeze and train accordingly.

ERCOT observations from site visits

8. Operator training – critical transmitters

- Training would be beneficial to include the loss of critical transmitters.
- How many critical transmitters can be lost and the plant remain on line?
  - ✓Some plants are willing to run with one drum level transmitter in service and remain on line.
  - ✓Consistency observed for control room operators training for the loss of critical transmitters.

Additional information for 2013-3014 spot checks

Combustion tuning during a cold weather event for emission compliance.

- What measures have been taken for tuning during an extreme cold weather event?

- All combustion turbine generators visited reported having a factory representative under contract for assistance with tuning, auto tuning software capability or staff engineer.

ERCOT recommendations from site visits

- Annually audit of heat trace circuits for functionality.
- Develop a spreadsheet with the annual audit results for heat trace circuits.
- Provide annual training on cold weather procedures.
- Update weatherization plans to include lessons learned from previous winter.
- Improve wind break with the use of heavy duty tarps or hardened wind break.
- Add walk down of the boiler to inspect insulation to weatherization plan.

Results from 2013-2014 winter fuel survey

Units with alternate fuel capability

- Total capability 5985MW.
  - ✓ Units that were tested in 2013 – 2131MW (36%)
  - ✓ Units that were tested in 2012 – 1811MW (30%)
  - ✓ Units that were tested between 2003-2011 – 2043MW (34%)
  - ✓ Does your weatherization plan include critical equipment needed to burn alternate fuel?
- Max Net MW Capacity of units capable of using 100% alternate fuel
  - ✓ 3605MW
- Max Net MW Capacity of units not capable of using 100% alternate fuel
  - ✓ 2380MW
- ERCOT will be sending a fuel survey to all Resource Entities in the Fall for the 2014-2015 Winter.

Best Practices Observed

- ✓ Detailed records management.
- ✓ Annual audit of heat trace for functionality with records management.
- ✓ Installation of hardened wind breaks; permanent structures with doors, heavy duty plastic tarps, plywood with metal reinforced edging that is bolted in place, and permanent walls.
- ✓ Annual plant training for severe cold weather event.

Challenges and Success

- January 6, 2014 (EEA2) was a test of the improvements that have been made since 2011. Although this day was not identical to February 2011 from a weather standpoint, it was needed for generators to test their plants ability to withstand extreme cold weather.

- Five plants that experienced freeze related issues were visited within days following January 6, 2014.
  - ✓ Plant A tripped due to heat trace failure. Plant has implemented a QC program with their staff electrician and heat trace contractor.
  - ✓ Plant B had one phase of a three phase contactor that failed to energize 1/3 of the heat trace circuits for critical equipment. Plant to install indicators or alarms.
  - ✓ Plant C had many of the same elements freeze that they experienced in February 2011. ERCOT followed up with the company executive management.
  - ✓ Plant D had critical transmitters freeze that were on the NE side of the boiler that were unprotected from the wind and cold temperatures. Plant to install all transmitters in boxes with heaters.
  - ✓ Plant E had a critical transmitter freeze that the plant had not experienced in the past. Plant will improve their inspection process.

What will ERCOT be focusing on for 2014-2015 spot checks?

- Heat trace functionality and records of maintenance or audits
  - ✓ The plants that have had success learned their lessons in 1989 and 2011.
- Insulation inspections
  - ✓ Inspection of critical equipment is necessary to prevent freezing due to intrusion of moisture or exposed heat trace.
- Lessons learned
  - ✓ Have plans been updated to include lessons learned from the previous winter?
- Wind breaks
  - ✓ Is your plant still relying on the blue off the shelf tarp as a wind break?
- Training
  - ✓ Conduct a winter readiness training on an annual basis.
  - ✓ Operations personnel should review cold weather scenarios affecting equipment and train accordingly.
- Alternate fuel units
  - ✓ Is critical equipment needed to deliver alternate fuel included in weatherization plan?
  - ✓ ERCOT would like to see 100% of the units that have alternate fuel capability with on site storage test capability in late fall.

2014-2015 Plant Spot Checks Schedule

- ✓ Any plant that experienced freeze related issue that was reported to ERCOT Operations, results from the RFI and GADS.
- ✓ Follow up from 2013-2014 spot checks if a generator reported it will be undergoing improvements or implementing corrective actions.
- ✓ New resources that have been released for commercial operations by December 1, 2014.
- ✓ Randomly selected units from a subset of generators.
- ✓ Follow up during winter operations 2014-2015 where any plant freeze related issues are reported to ERCOT Operations.

- An *international* generator weatherization forum/roundtable will be available from September - November 2014. The URL is: http://www.generatortechnicalforum.org/

In light of the past winter polar vortex and the February 2011 southwest cold weather event, generator weatherization is critical to ensure components are protected from freezing. Weatherization is complex and requires much preparation and attention to detail for inspection of insulation, heat trace functionality, wind breaks and plant training for personnel.

- The goal is for generator owners or operators to freely share information to improve reliability by sharing lessons learned, best practices and post questions and answers related to generator weatherization.
  - ✓ When registering please do not include reference to your company with your user name.
  - ✓ All registered members receive emails on posts and can respond to questions or comments.

- Contact for the IGTC Webmaster: webmaster@generatortechnicalforum.org

ERCOT

Posted IGTC questions for discussion

- What has been your approach to ensuring heat trace functionality?
  - Does your plant annually perform routine maintenance in the fall on heat trace circuits testing for amperage, voltage and meggar of circuits?
  - Are the results compared to design criteria or previous year's results?
  - What is the failure rate of heat trace from the previous year?
  - What are the challenges with annually testing of heat trace circuits?
- Do your plant personnel do a thorough walk down of the boiler in the fall to inspect insulation?
  - What is commonly found to be the cause of insulation failure?
- What has been your experience with installation of wind breaks for the winter?
  - What type of material has performed best?
  - What type of material has performed poorly?

Posted IGTC questions for discussion (cont.)

- Does your plant conduct annual cold weather training for plant personnel?
  - What does the training focus on?
  - Has the training been beneficial during a cold weather event?
- What best practices or lessons learned that your plant has initiated proved to be beneficial?
- Does your plant have a cold weather checklist to prepare for winter?
  - Has that proved to be a valuable tool in preparation for winter operations?
- During an extreme cold weather event, does your plant utilize a cold weather checklist for the operators and plant staff?
  - Has that proved to be a valuable tool?
- What have been experiences with alternate fuel capability?
  - When is that capability tested?
  - What is the most common piece of equipment that fails testing?
  - How often, if at all, during the winter is that capability tested?
  - Are there any components used for the delivery of alternate fuel that could freeze?
  - How is that equipment protected from freezing?

Example email from IGTC on a posting

Hello Snoopy,

A reply has been posted in the forum thread 'Replace Single flow Seal Oil to Double Flow' which you are tracking in the Generators group at IGTC Forum. Please remember that this is a members-only site, and you will need to login before you can view the thread. You can use the following link to view the reply:

http://www.generatortechnicalforum.org/portal/forum/viewthread.php?forum_id=71&thread_id=1103&pid=6519&fgroup=1#post_6519

If you no longer wish to watch this thread you can click the 'Stop tracking this thread' link located at the top of the thread.

Regards,
IGTC Webmaster

References

- ✓ http://www.nerc.com/pa/rrm/ea/Pages/February-2011-Southwest-Cold-Weather-Event.aspx#
  - ➢ Lessons learned - Southwest Cold Weather Event.
  - ➢ Previous Cold Weather Event Analysis.
  - ➢ FERC/NERC Report on Outages and Curtailments During the Southwest Cold Weather Event of February 1-5, 2011.
  - ➢ Reliability Guideline: Generator Unit Winter Weather Readiness
  - ➢ Cold Weather Training Materials

- ✓ Nodal Protocols for Weatherization Preparations.
  - ➢ 3.21 Submission of Emergency Operations Plans, Weatherization Plans, and Declarations of Summer and Winter Weather Preparedness.

- ✓ http://www.ercot.com/content/meetings/ros/keydocs/2014/0306/ROS_Jan_6_EEA_Report.pdf
  - ➢ Appendix A at the end has a list of issues ERCOT experienced for specific resources.

ERCOT would like to thank the generator owners, operators and plant staff for their cooperation and efforts on weatherization!

Questions