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Why Generation Availability Data System Wind

GADS Wind Training Module 01

March 2019 – Final

RELIABILITY | ACCOUNTABILITY

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Content

- The following will be reviewed in this module:
  - The mission of the North American Electric Reliability Corporation (NERC)
  - The impact of Wind on the Bulk Power Supply?
  - History of GADS Wind
  - What and Why do we need a 1600 Wind Data Request?
  - Who is required to report and when?
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  - GADS Wind Data Reporting Instructions (DRI) Overview
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Mission of NERC

NERC assesses and reports on the reliability and adequacy of the North American bulk power system.

- It is divided into the seven Regional Areas as shown on the map.
- Users, owners, and operators of the bulk power system within these areas account for virtually all the electricity supplied in the U.S., Canada, and a portion of Baja California Norte, México.

NERC Regional Entities	
FRCC Florida Reliability Coordinating Council	SERC SERC Reliability Cooperation
MRO Midwest Reliability Organization	TRE Texas Reliability Entity
NPCC Northeast Power Coordinating Council	WECC Western Electricity Coordinating Council
RFC Reliability*First Corporation*	

- The US, Canada and parts of Mexico are divided into 7 regions.
- There is a regional coordinator for each NERC region.
- The regional coordinator or their assistant will be responsible for data submittal and resolving any data submission conflicts.
- Process improvements, new code request and coding issues can be presented at the regional coordinator meetings.
- Items can be rolled up from the regional groups to the Wind Turbine Working Group (WTWG) or the Generating Availability Data System Working Group (GADSWG) for further clarification.
- Training modules, frequently asked questions and event classification determinations will be available on the NERC web site and should be the first place to look for answers.
- In 2007, the Federal Energy Regulatory Commission (FERC) granted to the North American Electric Reliability Corporation (NERC) the authority to enforce the bulk energy reliability standards.

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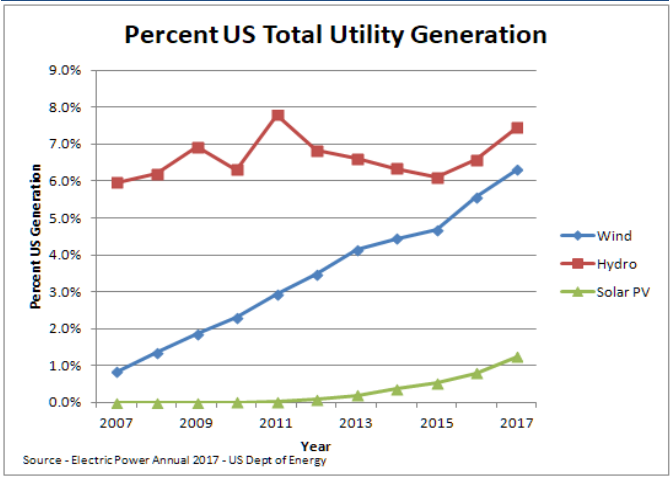
What is the Impact of Wind on the Bulk Power Supply?

- Figure 1 shows the growth of wind as a percent of US generation
- Wind was 6.3% of total US generation in 2017 and probably pass hydro in 2018
- In a few locations, wind is supplying as much as 60% of the bulk power supply needs
- The impact of wind has become a major player in the energy market, changing system dynamics and energy reserves

Figure 1 – US Utility Generation



Conclusions from the GADSTF (2010)

This Task Force was comprised of members from all facets of the generation industry including operators, manufactures, government, system planners and etc. Their charter was to determine if mandatory reporting is needed to ensure the stability and reliability of the bulk power system and what would be reported. This would then go through a section 1600 data request process with time for public input. Below are some of the conclusions from that report.

GADS is vital to measure generation reliability and performance information used in modeling energy resources and providing NERC committees, subcommittees, working groups and task forces data for:

- Reliability Assessment reports and modeling;
- Loss-of-load expectation (LOLE) studies and modeling;
- Understanding how the changes in resource availability/performance translate into required Planning Reserve Margins as the resource mix and associated infrastructure changes;
- Understanding the performance of existing and new resource technologies is essential to comprehending the reliability of the projected bulk power system in North America;

- The use of historical event data to develop a severity metric risk measurement tool to establish the bulk power system's characteristic performance curve;
- Calculation and measurement of both Event and Condition-Driven risks, detailed event and performance information;
- Monitor impacts of transmission outages on generators and generator outages on transmission;
- Power plant benchmarking, equipment analysis, design characteristics, projected performance, avoid long-term equipment/unit failures, etc.

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The History of GADS Wind

Year	Event
1982	The first conventional generation DRI introduced to the industry with voluntary reporting
2007	The Wind GADS DRI working group formed
2007	NERC became the legal authority to enforce the bulk power supply reliability standards
2010	A taskforce was assembled to determine the need for mandatory reporting
2011	The first Wind GADS DRI completed and posted on the NERC web site with voluntary reporting requirements
2011	Section 1600 data request for conventional plants approved
2012	Mandatory reporting for conventional plants greater than 50MW began
2014	The second Wind DRI was completed and the Section 1600 process initiated
2015	The Wind mandatory reporting Section 1600 process was completed and data collection approved by the Planning Committee
2017	Voluntary report began with mandatory reporting phased in starting 2018

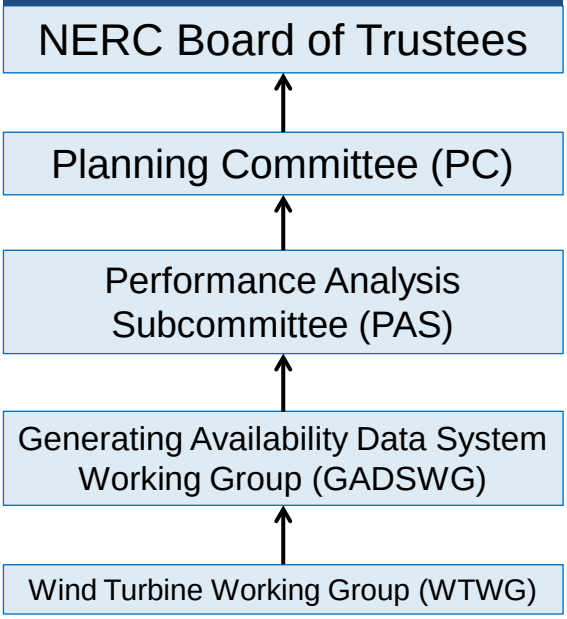
- Generation and outage data began being collected on a voluntary basis in 1982 for conventional generation (35years).
- 1981-1982 was when the first commercial wind farms were installed in California.
- 25 years later (2007) the first Wind GADS DRI working group was formed.
- The first Wind DRI was published 4 years later (2011).
- In the meantime there had been a lot of major issues with the bulk power supply and a taskforce was put together in **2010 to evaluate mandatory reporting** for all types of generation. There were several significant outcomes:
  - **Mandatory reporting of renewables would be delayed for further review.**
  - Voluntary reporting was not capturing enough data to get a good look at system reliability.
  - A Section 1600 data request was initiated that resulted in a phased in mandatory reporting approach starting in 2012 for conventional generation.
- In 2014 the 2nd Wind DRI was completed and the Section 1600 data request process was started.
- Mandatory reporting for wind generation was approved in 2015.
- Because wind reporting is significantly different from conventional reporting:

    - A long phased in approach beginning with voluntary reporting in 2017. This gives the industry a chance to test and develop software and procedures.
    - Mandatory reporting of the larger wind sites, 200MW and larger, in 2018. The balance of generation (>= 75MW) phased in over the following 2 years.
    - This allows for training, testing and software development to take place at a manageable pace.
    - Remember that conventional reporting had 30 years to mature before it became mandatory.
- Overall, it has taken 10 years to create an effective Wind DRI, create new software for data collection / analysis, start registering users and collecting data.

What and Why do we need a Section 1600 Data Request?

- The Section 1600 data request is the legal method by which required NERC data submittals are evaluated and approved
- The Wind DRI was completed by the WTWG and reviewed by each level up to the PC. Figure 2
- The PC initiates a 1600 request with the details of what is to be collected
- There is a period for public comments and answers with adjustments to the DRI
- When the public comment period is complete the final request is reviewed and approved by the NERC Board of Trustees

Figure 2 – NERC Organizational Path for Approval



- Work was completed on revision 2 of the Wind DRI in late 2014.
- There were no major methodology changes to the DRI. Revision 2 added clarification, guidance, optional derate calculations and a few new component codes.
- The DRI worked its way up through the various committees and was approved to proceed with the Section 1600 process.
- There was a period for Public Comments. Comments were submitted from various groups and were answered. Most of the comments wanted additional clarification on exactly what was going to be required. Also, as a result of the comments there were a few minor adjustments made to the Wind DRI.
- After the Public Comment period the Section 1600 request was approved by the PC and Board of Trustees with voluntary reporting starting in 2017 and a phased in approach to mandatory reporting starting in 2018.

Mandatory GADS GADSTF Report

- The electric industry is projecting an **unprecedented change** in the existing North American resource mix of over one million megawatts (MW) as it reduces the use of coal-fired units, while increasing gas-fired, variable energy resources (wind, solar), nuclear, and demand/energy efficiency resources.
- This recommendation will improve NERC's reliability assessments and performance analysis, while not overburdening the industry. Further, this recommendation balances NERC's current approach to collect similar information on the bulk power system infrastructure, such as bulk transmission and demand response performance data through Transmission Availability Data System (TADS) and Demand Response Availability Data System (DADS). Like these existing systems, GADS data will continue to be confidential under NERC's *Rules of Procedure*, Section 1500: *Confidential Information*
- Further, as new technologies are integrated into the bulk power system, a complete set of design, event, performance, and renewable data will be critical to planners and operators for use in resource adequacy and operations planning to ensure bulk power system reliability.
- Projections of system demand and resources are used to assess whether sufficient resources will exist to meet extreme weather conditions, accommodate demand forecast errors, and remain capable of responding to unexpected generating unit forced outages.
- Understanding the performance of existing and new resource technologies is essential to comprehending the reliability of the projected bulk power system in North America.
- Timely provision of accurate and well-vetted unit performance data is essential, especially as the resource mix is projected to transition through an unprecedented change.
- In order to have a more complete and accurate picture of the generation side of the equation, it is vital to have a broader, higher population of availability data from generating units in all parts of the NERC footprint.

Who is Required to Report and When?

- Who will report:
  - Plants with a Commissioning date of January 1, 2005 or later
  - Plants greater than or equal to 75MW
  - Any plant of any size can voluntarily report. You do not need to wait until the phase in period
- How often:
  - Quarterly on a monthly basis
  - 45 days after the end of the quarter
- When will it start:
  - January 1, 2017
- Phased in approach:
  - 2017 - Voluntary reporting
  - 2018 – Plants >= 200MW
  - 2019 – Plants >= 100MW
  - 2020 – Plants >= 75MW

What Will Be Reported?

What will be reported:

- Sub–Group Data – The initial Sub-Group submission registers the Sub-Group with NERC and a unique Sub-Group ID is assigned. Often called the Sub-Group configuration report
  - After this the only time the Sub-Group data needs to be submitted is when change occurs. The Sub-Group data file also contains the Plant and Group data
- Performance at the Sub-Group level – Quarterly by month. Derates and delays are optional
- Component level reporting is optional but can be reported on a voluntary basis

What will be reported:

- Plant data – Part of Sub-Group data
- Group data – Part of Sub-Group data
- Sub-Group data – Sub-groups are composed of the same type of turbine. There can be many sub-groups in a group or plant. The Sub-Group is the basic configuration information and is assigned a unique ID by NERC
- Performance data – This is the basic reporting level that is required. The individual turbine data for the sub-group is rolled-up into summary data. Derate data is optional.
- Component level data – this can be reported on a voluntary basis. The component level data rolls up into the performance data and there is error checking.

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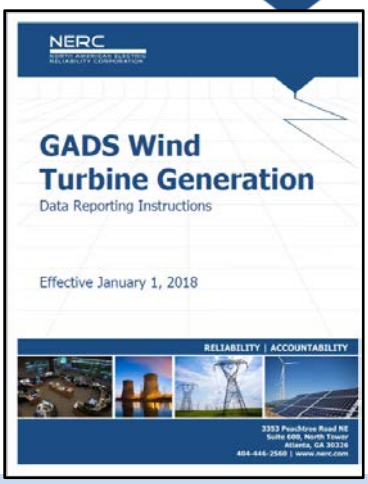
GADS Wind DRI Overview

The GADS Wind DRI provides:

- Detailed instructions for setting up the various files for submission
- Identification of Plant boundaries
- A list of definitions
- Equations for various calculations
- System component codes
- Out of Management Control (OMC)
- Outage classification guidelines
- Overlapping events
- Data quality control
- And more



The GADS Wind DRI will post minor updates as needed annually beginning January 2018. These will add new codes, fix grammar, add clarification. Request for additional data will always require a 1600 data request

- The GADS Wind DRI provides the instructions for submitting, classifying various event types and calculating various metrics.
- The current GADS Wind DRI has been 8 years in the making and was supported by all sectors of the industry.
- Is the DRI perfect? No, there is lots of room for the DRI to improve as we move into mandatory reporting.
- As a result we will post any changes to the DRI at 6mo to 12mo intervals until it is stable and then move to annual updates.
- There will not be any changes to the basic philosophy of the DRI as this would require an additional Section 1600 request.
- The first update was dated Sept / Oct 2017.

Major Differences Between Wind and Conventional Generation?

Issue	Conventional	Wind	Impact
Number of events / outages	5-15 event/outages per year for a typical 800 MW conventional plant	12,790 to 21,320 event / outages per year for an 800 MW wind plant using 1.5 MW turbines	Tracking, reporting and analyzing individual events in Wind is costly
Variable fuel source	• Stable fuel source. • Run based upon demand	• Fuel varies minute by minute. • Expected to run when the wind is available	Rate equations (EFOR) based on contactor hours plus Resource Unavailable Turbine Hours (RUTH)
Environmental exposure	Generator equipment usually in a structure	• Wind turbine sits in the elements. • Wind, rain, ice, snow, lightning, hail and etc.	More Out of Management Control (OMC) type of events
Geographic Distribution	Equipment located centrally	Equipment spread over many square miles.	Increases event time and return to service.
Grid stability	Located near the load	Located away from the load	Increased number of grid events and brown outs.
Control	Demand – Bottom up	As Available – Top down	Cannot meet a demand when the resource is not available

There were a number of public comments / questions about why Wind should be treated differently than conventional plants.

- **Number of Events** – The average 800 MW conventional plant has 5-15 trips/outages per year. The average 1.5 MW wind turbine has 24 to 40 trips/outages per year. It takes 533 1.5 MW wind turbines to equal 1 800 MW conventional plant. That's 5 – 15 trips/outages per year for a conventional 800 MW plant compared to 12,790 to 21,320 trips/outages per year for a 800 MW wind plant. Reporting this many events in wind would place a significant burden on wind. The countermeasure was not to report/analyze each individual event but to track and categorize the event/outages as PO, MO, FO and etc. at a minimum and preferably track to the component level.
- **Variable Fuel Source** – The typical conventional plant has control over their fuel source. Wind is subject to variability of wind speed and temperature (normal). Wind Turbine Generators (WTG) have a normal operating range for wind speed and temperature. When the resource is outside the working envelope for the turbine and the turbine is available, the hours are called Resource Unavailable Turbine Hours (RUTH). When calculating Equipment EFOR the denominator is contactor hours (CTH) plus RUTH. This is a number that a plant manager can be held accountable

for. A transmission or power distributor wants to know how dependable the plant is overall. They would use the Resource EFOR calculation which only uses CTH in the denominator.

- **Environmental Exposure** – WTG's are located out in the elements, exposed to everything from sun UV, hail, lightning, turbulence, icing and etc. This causes a lot of Out of Management control events. Therefore the categories for these types of exposures tend to be much wider than conventional generation.
- **Geographic Distribution** – Conventional plants are centrally located. All the components are located on a small platform. Whereas Wind Plants cover many square miles. This increases driving and return to service time (RTS). Also, during adverse conditions repair and maintenance time maybe extended due to access or other environmental conditions (snow, ice, flooding).
- **Grid Stability** – Conventional generation is usually located near the load, using large transmission conductors to distribute the power outward. The farther from the generator the smaller the transmission line. Wind generation is usually far from the load. Transmission lines tend to be smaller leading to an increased number of grid issues and line congestion. Recently, there have been a number of large projects to increase the grid stability for wind generation.
- **Condition Monitoring** – Conventional generation tends to be highly instrumented. There are few surprises and repairs/upgrades can usually be planned during an annual overhaul. With less monitoring equipment on WTG's there are more surprises. The reason for less instrumentation is cost. But as WTG increase in MW capacity, more instrumentation for condition assessment is being added. There is a lot of focus by AWEA, NREL and others in developing effective reliability centered maintenance procedures using less expensive monitoring equipment.
- **Remote Monitoring** – On the up side, modern Wind generation can be monitored remotely. Many plants can be controlled from a central location. Resetting of faults and diagnostics can be performed and repair crews dispatched during off hours if generation is greater than the dispatch cost.
- **Working Environment** – Conventional plants have resources for repair at the turbine location. If you need a tool or part, you do not have far to go. 75% of the time, the Wind work location is on top of a tower. With tower heights starting to exceed 300 feet, additional planning for parts and tools is required. We want to avoid bonus climbs due to the lack of a tool or part.
- **Large Cranes for Repair** – With 300+ foot towers, very large cranes are required to make repairs. Larger cranes require assembly time, do not move well in mud / snow and are subject to road restrictions during certain times of the year. Also, wind has a major effect on load handling particularly in high capacity wind regimes.

Data Release and Benchmarking

- Data submitted to NERC GADS is confidential. Guidelines are detailed in the DRI
- One of the benefits seen with Conventional GADS is the ability to acquire benchmarking data from the system to evaluate how a generator compares to its peers
- Strict guidelines are associated with benchmarking:
  - Depending upon the specific request, the data pool must be large enough that specific plants or companies cannot be identified. Example: If the request finds only 2 sub-groups, data will not be released
  - A generator may not request a comparison to a specific plant
  - A generator that only submits performance can only request performance data comparisons
  - A generator that submits component level data can request component or performance level benchmarking data if the data pool is large enough
  - At this time there is no charge for the data request. If in the future the number of request becomes large there may be a fee charged to cover cost

Links to Wind Resources on NERC Website

- Wind Data Reporting Instructions (DRI):
- NERC GADS web page:
  - https://www.nerc.com/pa/RAPA/gads/Pages/GeneratingAvailabilityDataSystem-(GADS).aspx
- GADS Working Group web page:
  - http://www.nerc.com/comm/PC/Pages/Generating-Availability-Data-System-Working-Group-(GADSWG)-2013.aspx
- GADS Wind web page:
  - http://www.nerc.com/pa/RAPA/gads/Pages/GADS-Wind-DRI.aspx

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Contacts

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https://www.nerc.com/pa/RAPA/gads/Pages/GeneratingAvailabilityDataSystem-(GADS).aspx

GADS Wind Reporting Contacts			
FRCC	MRO	NERC	NPCC
RF	SERC	Texas RE	WECC

Always check the NERC / GADS web site for the current contacts as they change occasionally.

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