- In this module we will explore:
  - Performance Data Fields
  - Identification Section
  - Required Data Section
  - Optional Data Section
  - Turbine State Review
  - IEC / IEEE / NERC GADS Comparison

Performance Record Fields

Col	Field Name	Column Header Label	Entry Type	Mandatory or Optional
1	Utility ID	UtilityID	Alpha-Numeric - 10	Mandatory
2	Plant ID/Name	PlantIDName	Alpha-Numeric - 45	Mandatory
3	GroupID/Name	GroupIDName	Alpha-Numeric - 45	Mandatory
4	Sub-Group ID	SubGroupID	Numeric - 10	Mandatory
5	Report Period (month)	ReptMonth	Numeric - 2	Mandatory
6	Report Year	ReptYear	Numeric - 4	Mandatory
7	Sub-Group Status	SGStatus	Alpha-Numeric - 2	Mandatory
8	Gross Actual Generation (GAG)	GAG	Numeric - 10 + 3	Mandatory
9	Net Actual Generation (NAG)	NAG	Numeric - 10 + 3	Mandatory
10	Net Maximum Capacity (NMC)	NMC	Numeric - 8 + 3	Mandatory
11	Period TH (PDTH)	PDTH	Numeric - 10 + 2	Mandatory
12	Contact TH (CTH)	CTH	Numeric - 10 + 2	Mandatory
13	Reserve Shutdown TH (RSTH)	RSTH	Numeric - 10 + 2	Mandatory
14	Forced TH (FTH)	FTH	Numeric - 10 + 2	Mandatory
15	Maintenance TH (MTH)	MTH	Numeric - 10 + 2	Mandatory
16	Planned TH (PTH)	PTH	Numeric - 10 + 2	Mandatory
17	OMC Forced TH (oFTH)	OFTH	Numeric - 10 + 2	Mandatory
18	OMC Maintenance TH (oMTH)	OMTH	Numeric - 10 + 2	Mandatory
19	OMC Planned TH (oPTH)	OPTH	Numeric - 10 + 2	Mandatory
20	Research Unavailable TH (RUTH)	RUTH	Numeric - 10 + 2	Mandatory
21	Inactive Reserve TH (IRTH)	IRTH	Numeric - 10 + 2	Mandatory
22	Mothballed TH (MBTH)	MBTH	Numeric - 10 + 2	Mandatory
23	Retired Unit TH (RTH)	RTH	Numeric - 10 + 2	Mandatory
24	Equivalent Forced Derated TH (EFDTH)	EFDTH	Numeric - 10 + 2	Optional
25	Equivalent Maintenance Derated TH (EMDTH)	EMDTH	Numeric - 10 + 2	Optional
26	Equivalent Planned Derated TH (EPDTH)	EPDTH	Numeric - 10 + 2	Optional
27	OMC Equivalent Forced Derated TH (oEFDTH)	OEFDTH	Numeric - 10 + 2	Optional
28	OMC Equivalent Maintenance Derated TH (oEMDTH)	OEMDTH	Numeric - 10 + 2	Optional
29	OMC Equivalent Planned Derated TH (oEPDTH)	OEPDTH	Numeric - 10 + 2	Optional
30	Equivalent Reserve Shutdown Derated TH (ERSDTH)	ERSDTH	Numeric - 10 + 2	Optional
31	Forced Delay TH (FXDTH)	FXDTH	Numeric - 10 + 2	Optional
32	Maintenance Delay TH (MXDTH)	MXDTH	Numeric - 10 + 2	Optional
33	Planned Delay TH (PXDTH)	PXFTH	Numeric - 10 + 2	Optional

The Performance record is divided into 3 sections:
1. Identification
2. Required Data
3. Optional Data

There are 33 columns (fields) of data in the Performance report. 7 are for record identification and status, 16 are required data points and 10 are optional fields that are derates and delays.

Col	Field Name
1	Utility ID
2	Plant ID/Name
3	GroupID/Name
4	Sub-Group ID
5	Report Period (month)
6	Report Year
7	Sub-Group Status

Seven fields or columns in this section define a unique and correctly identified record:

1. Utility ID, PlantID/Name, GroupID/Name and Sub-Group ID. These fields must be <u>identical</u> to the associated Sub-Group record. Data will not be accepted if they are not identical.
2. The Report Period (month) and Report Year cannot be a future period. The record will be rejected.
3. Sub-Group Status is the status of the <u>entire</u> group and is defined in Appendix F table 11. Basically, the Sub-Group is in an Active or Inactive state?

- The Utility ID, Plant ID/Name, Group ID/Name and Sub-Group ID must be equal to the descriptions listed in the associated Sub-Group record (configuration). These 4 fields confirm that the record is legitimate. The Sub-Group-ID field is the only field that is permanent and never changes. The other fields can be modified in the Sub-Group record first and then the Performance and Component Records. This ID number is obtained when the Sub-Group is registered. Also, the Utility ID's that a utility is associated with are identified at the time of User Registration. If you should enter a Utility-ID that is not associated with your utility the record will be rejected.

- The Reporting Period (month and year) can only be for the period that you have ownership of the sub-group and cannot be a future date. The reporting requirement is 45days after the end of the quarter on a monthly basis. A separate record for Jan/Feb/Mar. You do not have to report quarterly. You can report monthly after the end of the month. This may be easier as it is easier to QC monthly, decreases the volume of work and distributes the work load evenly throughout the year.

- Sub-Group Status is for the <u>entire group</u>. It is Active, Inactive Reserve Shutdown, Mothball or Retired. Check the Appendix for abbreviations. If only part of the plant is impacted, report the hours separately in the Mandatory Data section. Also, if the entire group is in an inactive state, the rest of the record should be left blank.

Col	Field Name
8	Gross Actual Generation (GAG)
9	Net Actual Generation (NAG)
10	Net Maximum Capacity (NMC)
11	Period TH (PDTH)
12	Contact TH (CTH)
13	Reserve Shutdown TH (RSTH)
14	Forced TH (FTH)
15	Maintenance TH (MTH)
16	Planned TH (PTH)
17	OMC Forced TH (oFTH)
18	OMC Maintenance TH (oMTH)
19	OMC Planned TH (oPTH)
20	Resourch Unavailable TH (RUTH)
21	Inactive Reserve TH (IRTH)
22	Mothballed TH (MBTH)
23	Retired Unit TH (RTH)

There are 16 Performance record fields:
1. GAG – Sum of the generation (MW) of each turbine, usually at the controller at the base of the tower.
2. NAG - Energy delivered to the Off-Taker meter (MW).
3. NMC – Installed Capacity minus auxiliary loads.
4. The balance of the fields are in Turbine Hours. If there is 100 turbines in a Sub-Group and 744 hrs. in the month, 74,400 turbine hours needs to be accounted for.
5. One item to <u>pay attention</u> too is FTH, MTH and PTH which include OMC hours. (Example: oFTH is a subset of FTH)

- Gross Actual Generation (GAG) – This is the sum of all generation for the Sub-group at the turbine (usually measured at the turbine controller). Auxiliary loads in the turbine are ignored. These loads come from the controller and line loses between the generator and the meter. Compared to overall generation, they are small. The question often gets ask, "What accuracy is required for the meters?" or "Are revenue quality meters required?" Nowhere in the DRI is there a specification for the metering device. Usually, the meter at the plant boundary is revenue quality and occasionally calibrated. The data should always be checked to make sure it makes sense. Gross should be greater than net. Some very old sites may not have adequate metering but these sites will usually be under the 75mw reporting requirements.
- Net Actual Generation (NAG) is what is delivered to the grid. Usually there is a revenue meter at this point.
- Net Maximum Capacity (NMC) can be confusing to some people. Basically, it is what the plant is capable of delivering. If 100MW of turbines are installed and there is 3% line loss and auxiliary loads, the plant NMC is 97MW. This can be determined on a monthly basis by dividing NAG by GAG and multiplying by the Sub-Group installed capacity or Maximum capacity depending on which is higher.
- Make sure the hours submitted add up the total Turbine Calendar Hours or your data will get bounced.
- OMC is a subset of FTH, MTH and PTH.

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| Col	Field Name
24	Equivalent Forced Derated TH (EFDTH)
25	Equivalent Maintenance Derated TH (EMDTH)
26	Equivalent Planned Derated TH (EPDTH)
27	OMC Equivalent Forced Derated TH (oEFDTH)
28	OMC Equivalent Maintenance Derated TH (oEMDTH)
29	OMC Equivalent Planned Derated TH (oEPDTH)
30	Equivalent Reserve Shutdown Derated TH (ERSDTH)
31	Forced Delay TH (FXDTH)
32	Maintenance Delay TH (MXDTH)
33	Planned Delay TH (PXDTH)

There are 10 Optional record fields:

1. 7 of these are Derate fields. Derates are calculations the help us understand losses when the turbine is not capable of achieving 100%. For instance, a turbine may have been derated to 50% output for a failing gearbox. These are simple calculations but technically challenging as the % of derate can change frequently under certain situations.
2. The 2nd section is delays. These values do not impact any calculations but help us understand what is causing long return to service times.
3. If submitting optional data, is it all or nothing?

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- Generally, the wind turbine is expected to perform at 100% of its capacity based on the resource that is available. (See the expected energy definition in the Wind DRI). Any production less than expected is lost opportunity and should be identified by the plant. This can be caused by outages, OMC events or derates. A derate is anything that prevents the wind turbine from achieving 100% based on resource while the turbine is on line. Derates will be talked about in more detail in a later module.
- Delays are anything that prevents a wind turbine being returned to service after an outage in a timely manner. Delay hours are a sub-set of the various outage categories and will be discussed later in another training module.
- You can submit partial optional data. Each data point is independent. I you are submitting partial optional data, it makes sense to submit 24-29 or 30 or 31-33 as blocks but it is not required

Critical – Must Understand

Figure 1 – Turbine States or Conditions
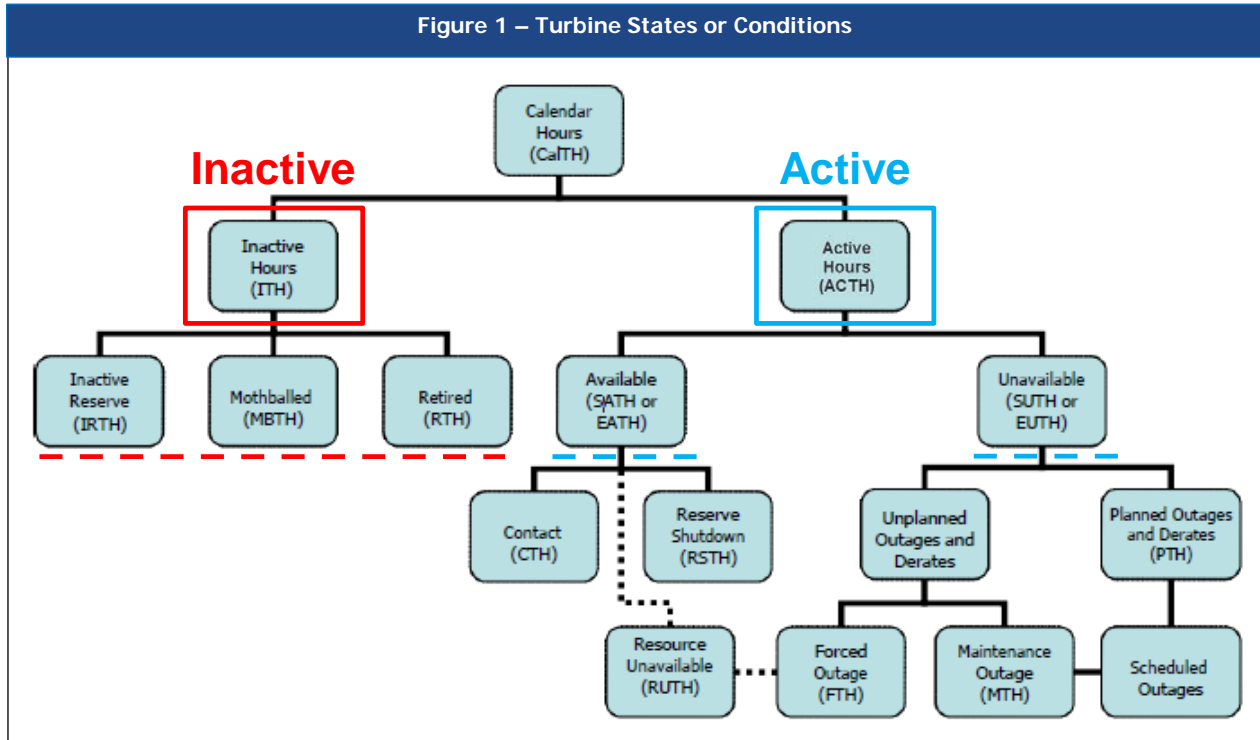
- Understanding the different turbine states or operating conditions is critical to correct categorization of the turbine hours
    - All metrics depend upon correct allocation of turbine hours
    - Operational reporting (Performance and Component) at the Sub-Group level
- Calendar Turbine hours (CalTH):
    - CalTH is the total WTG hours available during a reporting period (month) for a Sub-Group
    - It is the number of WTG (Sub-group configuration) times the hours in the reporting month
    - Example: There are 100 WTG in Sub-group A reporting in January (31 days X 24hrs = 744hrs) for a total of 74,400 turbine hours to account for
    - All the different WTG state categories roll-up and equal CalTH
    - **Data check**: The Inactive hours plus Active hours equal the calculated CalTH
- There are 2 basic states for a WTG, Inactive and Active
    - Inactive is often confused with Unavailable
    - Inactive means a WTG or group of WTG's that have not been operational for an extended period of time
    - Unavailable is an active state but the WTG is down for an outage
    - CalTH minus the Inactive Hours (ITH) equals the Active Turbine Hours (ACTH)

- o **Data check**: All the WTG states under Active roll-up to equal the ACTH
- The Inactive hours:
  - o ITH is the sum of Inactive Reserve (IRTH), Mothballed (MBTH) and Retired (RTH) turbine hours
  - o Inactive Reserve – Reserve Shutdown (RS) greater than 60days
  - o Mothballed – Outage state greater than 60days
  - o Retired – Removed from service – No waiting period. Update Group and Sub-Group capacity January 1. Reporting also stops for the Retired Sub-Group
  - o **Data check**: Sum of IRTH, MBTH and RTH equals ITH
- The Active hours (ACTH):
  - o ACTH is the sum of the Available and Unavailable turbine hours
  - o Available state – available to make power if the resource is available
    - Contact (CTH) – Generator on-line, generator contactor closed.
    - Reserve Shutdown – Generation not needed due to lack of demand or negative energy pricing
    - Resource Unavailable (RUTH) – Resource is outside of design specifications – Windspeed / Temp. See RUTH slide.
  - o Unavailable states – The WTG is not available to produce power due to an outage state.
    - Forced Outage (FTH) – Equipment failure
    - Maintenance Outage (MTH) – Short term planning – special requirements – see outing training module.
    - Planned Outage (PTH) – Long term planning – specifically in the budget.
  - o RUTH can be used in Available and Unavailable calculations depending on Equipment or Resource formulas.
  - o **Data Check**: The sum of CTH, RSTH, RUTH, FTH, MTH and PTH equals ACTH
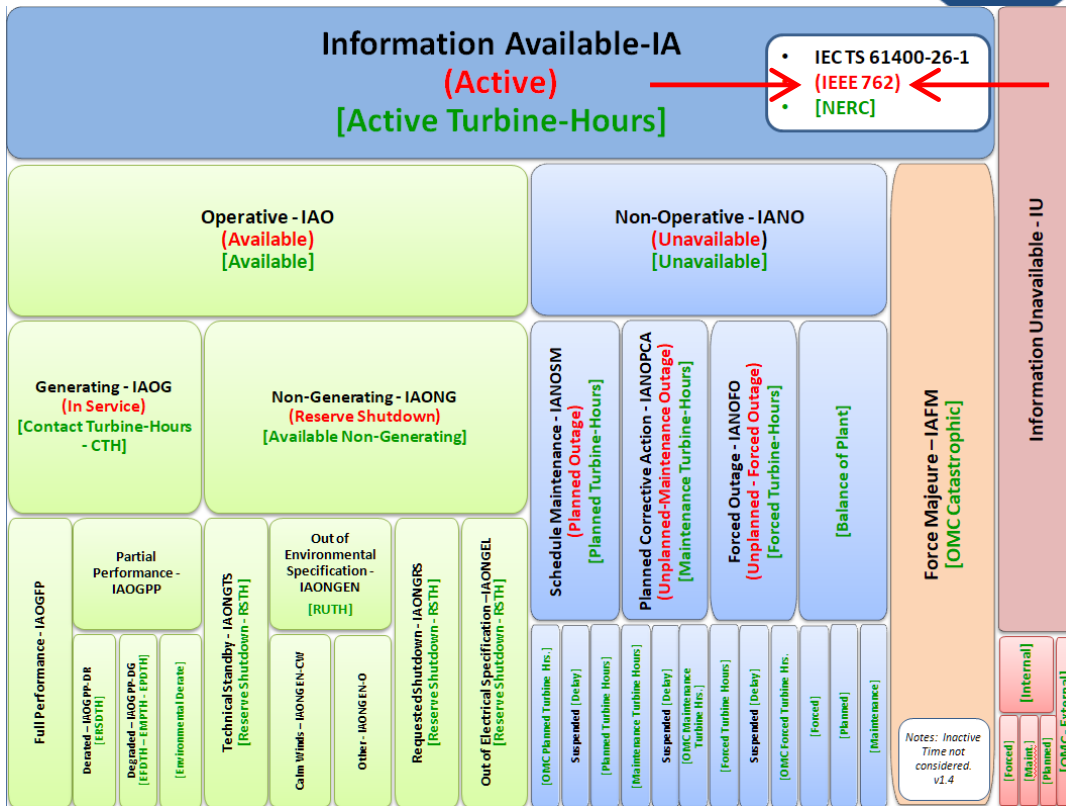
There are other International and IEEE standards. The NERC Wind GADS is an implementation of the IEEE 762 standard. The above displays the description cross reference.

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