

# Resource Unavailable Turbine Hours **RUTH**

GADS Wind Training Module 08

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**RELIABILITY | ACCOUNTABILITY**



- This module will review:
  - What is RUTH?
  - What does it include?
  - How can RUTH be calculated?

### **RUTH = Resource Unavailable Turbine Hours**

- As the name implies, RUTH is dealing with **lack of fuel or too much fuel**. In case of wind technology that fuel is wind. All wind turbines have an operating envelope where they are capable of producing energy. The envelope is called the power curve which varies depending on temperature, pressure and humidity (Air density)
- **Other types of operating envelopes** impact the wind turbine. Turbulence, shear, temperature (hot and cold) and the electrical environment are a few examples. When these are outside the operating range they should be handled as Outside Management Control (OMC) events and not part of RUTH

Early during the first Wind DRI development, it was recognized that it was normal for renewables to be resource dependent. The wind turbine was available and not broken. A new category was created called RUTH which could be applied in various ways depending upon the customer. As a result of this variability, most interconnect agreements accept the wind generation as “As Available” but at a reduced MWH rate (\$). Because the Wind Turbine is expected to run at its maximum capacity based on the available resource, anything less is a loss that should be accounted for and is considered a loss.

### **RUTH = Resource Unavailable Turbine Hours**

- The primary contributors to RUTH are high and low wind events. These conditions are outside the engineered specifications for the wind turbine. This will be 95% or more of the hours that contribute to RUTH
- The balance of RUTH hours are contributed by the normal operational activities of the turbine. They are not considered an outage. Each wind turbine performs hundreds of these activities a day. There maybe Operation and Maintenance (O&M) value in tracking them but the impact to the bulk power supply is negligible. Some examples:
  - Cable untwisting
  - Battery test, brake test
  - Blade calibrations, load control calibrations
  - Start-up and shutdown, re-start time delays

In a pure world, RUTH would only be high and low wind hours. But in reality there are many turbine system operating events that take only a few minutes that occur throughout the day. For ease of tracking these types of events were added to RUTH. This improves tracking as RUTH becomes whatever is left once the general operating hours are subtracted out (See the Dividing Time Module)

**Calendar Turbine Hours (CalTH) 744 hrs.**

**Inactive Turbine Hours (ITH) 44 hrs.**

**10 hrs.**  
Inactive Reserve (IRTH)

**30 hrs.**  
Mothball (MBTH)

**4 hrs.**  
Retired (RTH)

**Active Turbine Hours (ACTH) 700 hrs.**  
Previously known as Period Turbine Hours (PDTH)

**600 hrs.**  
Available

**400 hrs.**  
Contact (CTH)

**50 hrs.**  
Reserve Shutdown (RSTH)

**100 hrs.**  
Unavailable

**60 hrs.**  
Forced Outage (FTH)

**30 hrs.**  
Maintenance Outage (MTH)

**10 hrs.**  
Planned Outage (PTH)

**50 hrs.**  
Non OMC (FO)

**10 hrs.**  
OMC (FO)

**28 hrs.**  
Non OMC (MO)

**2 hrs.**  
OMC (MO)

**8 hrs.**  
Non OMC (PO)

**2 hrs.**  
OMC (PO)

### Ways to determine RUTH:

1. Direct measurement of each individual component
2. Knowing all of the above and subtracting from CalTH

If we subtract all the known hours from Calendar turbine Hours, the balance is RUTH.

## So How is Ruth Calculated?

**Calendar Turbine Hours (CalTH) 744 hrs.**

**Inactive Turbine Hours (ITH) 44 hrs.**

**10 hrs.**  
Inactive Reserve (IRTH)

**30 hrs.**  
Mothball (MBTH)

**4 hrs.**  
Retired (RTH)

**Active Turbine Hours (ACTH) 700 hrs.**  
Previously known as Period Turbine Hours (PDTH)

**600 hrs.**  
Available

**100 hrs.**  
Unavailable

**400 hrs.**  
Contact (CTH)

**50 hrs.**  
Reserve Shutdown (RSTH)

**150 hrs.**  
Resource Unavailable (RUTH)

**60 hrs.**  
Forced Outage (FOTH)

**30 hrs.**  
Maintenance Outage (MTH)

**10 hrs.**  
Planned Outage (PTH)

**10 hrs.**  
OMC (FO)

**28 hrs.**  
Non OMC (MO)

**2 hrs.**  
OMC (MO)

**8 hrs.**  
Non OMC (PO)

**2 hrs.**  
OMC (PO)

There are 600 hours of Available time and 450 hours are consumed by CTH and RSTH leaving 150 hours unaccountable. This is RUTH.

The missing piece is a new term called RUTH. Resource Unavailable turbine hours. This term is not found in conventional GADS. The term is used to define the time the wind resource is outside the operating envelop of the turbine. This can be a difficult term to directly measure but if we know all the previous terms we can calculate RUTH as it is just the remainder. Calculating this value this way will include the normal system checks and calibrations in the RUTH category. This is a small number, required for system operations and not practical to track.



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