

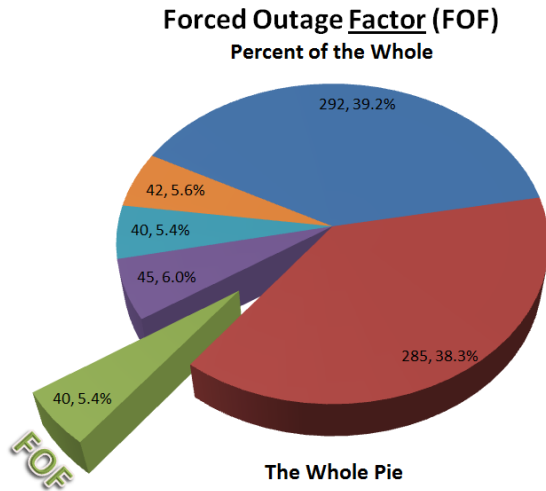
# Rate vs. Factor

GADS Wind Training Module 20  
April 2019 - Final

**RELIABILITY | ACCOUNTABILITY**



- This module will review:
  - What is a Factor
  - Equipment Forced Outage Factor
  - What is a Rate
  - Factor versus Rate
  - Equipment Forced Outage Rate
  - Equipment versus Resource



- On-Line (CTH)
- Lo / Hi Winds (Ruth)
- Forced (FO)
- Planned (PO)
- Maintenance (MO)
- RS

Category	Hours	
On-Line (CTH)	292	39.2%
Lo / Hi Winds (Ruth)	285	38.3%
Forced (FO)	40	5.4%
Planned (PO)	45	6.0%
Maintenance (MO)	40	5.4%
RS	42	5.6%
	744	100.0%

Factors represent a piece of the whole pie. When considering factors, only Active Turbine Hours (ACTH) are considered. In the above example 5.4% of the time represents Forced Outage Factor (FOF)

The Equipment Equivalent Forced Outage Factor is listed in the Wind DRI as Equation 1.B.5 in Appendix E.

Remember that Equivalentents come from the derate term. In this case we are not calculating derates, the term become zero and there are no equivalent hours. The name is essentially Equipment Forced Outage Factor.

ACTH is the total Active Hours (Calendar hours minus Inactive Hours)

Category	Hours	
On-Line (CTH)	292	39.2%
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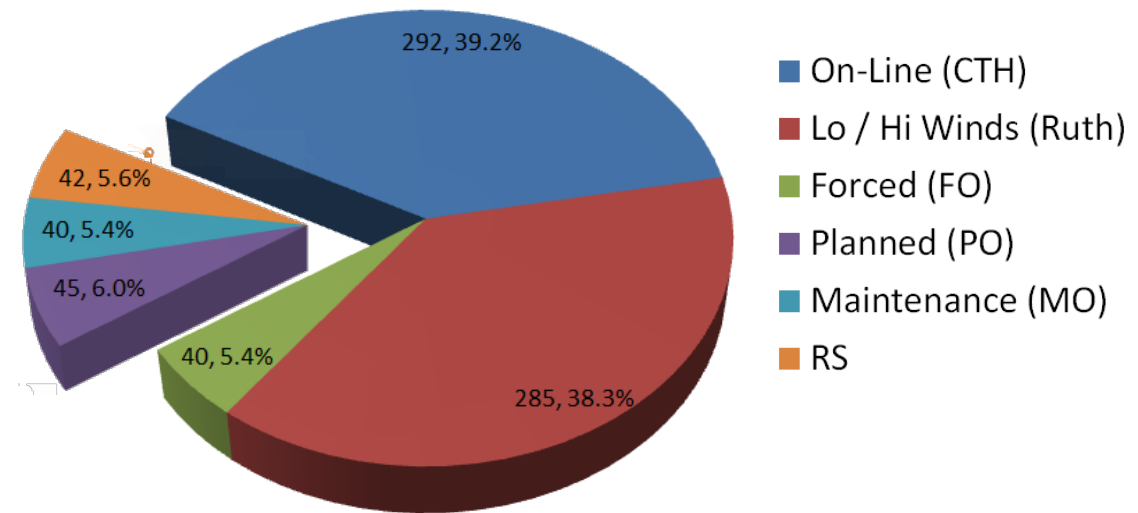
$$EEFOF = \frac{(FTH + EFDTH)}{ACTH} \times 100$$

$$EEFOR = \frac{(40 + 0)}{744} = 5.4\%$$

Remember that equivalent hours are calculated. Two things are going on at the same time and the calculation determines the portion that contributes to the factors. The denominator (ACTH) already contains all the hours, they just need to be accounted for in the numerator. If there are no equivalent hours, as in the above example, the value is zero and there is no impact.

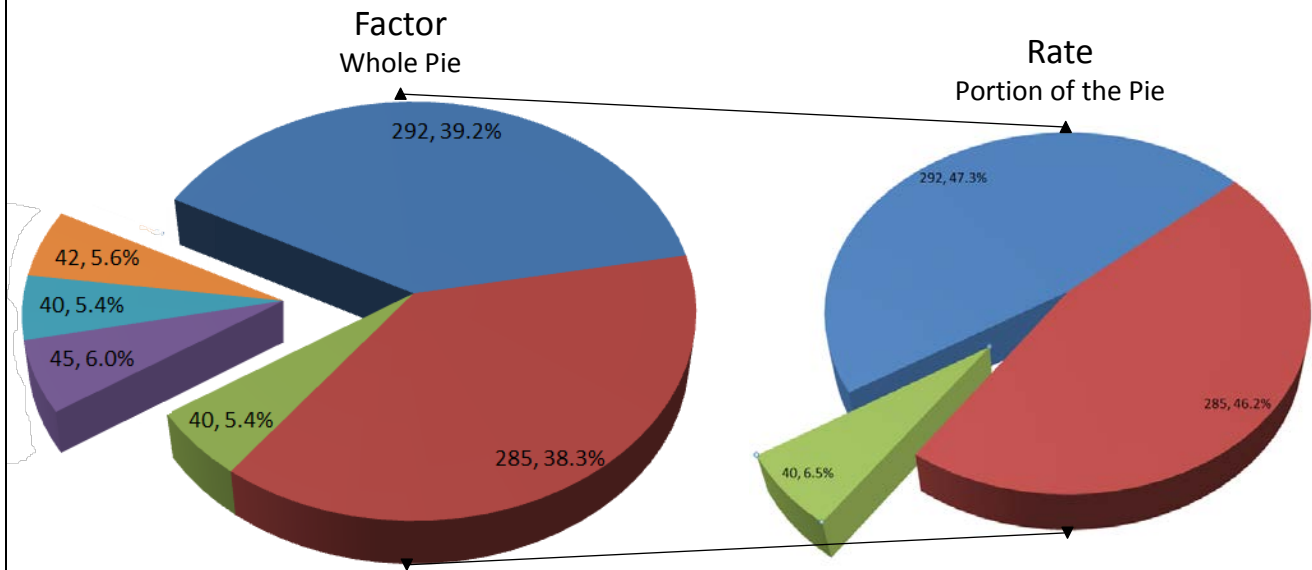
Forced Outage Rate (FOR) = The percentage of time that was FO when the plant should have been running. How often is FO occurring when the plant should be running.

Items where the plant is not expected to run are removed from the equation.



Rates are different than factors. Factors deal with a percent of the whole pie and Rates deal with a portion of the pie. Usually, the portion that the turbine is expected to run. It is expected that for Forced Outage Rate (FOR), On-Line, RUTH and Forced Outage the turbine should be running. It is not expected to run during Reserve Shutdown, Maintenance and Planned outages. So in the case of a Rate the denominator is smaller than a Factor.

By removing the hours that the plant is not expected to run, a smaller pie results with different percentages. 5.4% FOF versus 6.5% FOR.



Notice the green slice percent changes from a factor of 5.4% to 6.5% for the rate. This is because the denominator is smaller in the rate calculation. The rate calculation indicates the percent that the turbine was in Forced Outage when it should have been running. The factor calculation indicates the percent of Forced Outage whether the turbine was running or not.

The Equipment Equivalent Forced Outage Rate is listed in the Wind DRI as Equation 1.B.12 in Appendix E.

Remember that Equivalentents come from the derate term. In this case we are not calculating derates, the term becomes zero and there are no equivalent hours. The name is essentially Equipment Forced Outage Factor.

The denominator in the equation changed from ACTH (744) to 617 run hours.

Category	Hours	
On-Line (CTH)	292	47.3%
Lo / Hi Winds (Ruth)	285	46.2%
Forced (FO)	40	6.5%
	617	100.0%

$$EEFOR = \frac{(FTH + EFDTH)}{(CTH + RUTH + FTH)}$$

$$EEFOR = \frac{(40 + 0)}{(292 + 285 + 40)} = 6.5\%$$

Notice that EFDTH is not in the denominator. That is because EFDTH is part of CTH. Adding it to the denominator would be double counting the hours.

The Equipment EFOR Equation is 1.B.12  
The Resource EFOR Equation is 1.A.13

Category	Hours	
On-Line (CTH)	292	47.3%
Lo / Hi Winds (Ruth)	285	46.2%
Forced (FO)	40	6.5%
	617	100.0%

The equipment was unavailable to make power 6.5%  
The resource was unavailable to deliver power 52.7%

$$EFOR = \frac{(FTH + EFDTH)}{(CTH + RUTH + FTH)} = \frac{(40 + 0)}{(292 + 285 + 40)} = 6.5\%$$

$$RFOR = \frac{(FTH + EFDTH + RUTH)}{(CTH + RUTH + FTH)} = \frac{(40 + 0 + 285)}{(292 + 285 + 40)} = 52.7\%$$

Each set of equations has 2 parts, Resource (A) and Equipment (B). In the above example EFOR (Equipment) is equal to 6.5%. This rate demonstrates the dependability of the equipment.

The second equation, RFOR (Resource) is equal to 52.7% and relates to the forced unavailability to the Off-taker or the dependability of the plant to deliver power. Notice that RUTH is in the numerator of the RFOR equation. For this equation, lack of fuel is considered a forced outage.





**gadswind@nerc.net**