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Dividing Time

GADS Wind Training Module 05

March 2019 – Final

RELIABILITY | ACCOUNTABILITY

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Event vs. Hourly Reporting

Conventional GADS reports events. Why the switch for Wind?

800MW Plant	Conventional	Wind
1. Generators	1-5	300-500
2. Maintenance	Annual Overhaul	1-4 per year
3. Events	5-15 per year	12,790 – 21,320
4. Fuel	Stable Lack of Fuel = EFOR	Variable Lack of Fuel = Available
5. Period Hrs.	9K – 45K	2,628K – 4,380K
6. Generation	Demand	As Available

Reporting events becomes economically challenging for Wind. Tracking wind turbine hourly operating states provides an alternative without the cost.

Event reporting for conventional plants requires coding the event, time stamping the beginning and end of the event, supplying a description, and determining root cause. Usually, dealing with a hand full of generators, 1 major overhaul a year, 5-15 events, and a stable fuel supply.

The same plant capacity for wind will have 300-500 generators, 1-4 maintenance cycles per year, up to 21,000 events and a fuel supply that comes and goes. Imagine just the tracking that would be required to track fuel outages. The cost to report events for Wind could easily reach 1-2 man years per plant and this does not count the cost for application development and maintenance.

Generation type poses a huge difference between the two types of generation. Conventional is demand based. A generation demand in MW is sent to the plant. The plant sets the generation level to the demand. The demand can be anywhere from 0 to maximum generation. In wind the contracts are usually “As Available” based on the wind resource that is available. This type of access gives first access but at a reduced MWH rate. Wind is expected to run at maximum capacity based on the resource that is available. Anything less is a loss and should be accounted for.

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Calendar Basis

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

Total hours of each Wind turbine are tracked. As we go through the different levels, various data checkpoints will be pointed out.

First, check to see if all the hours add up to the **Calendar Turbine Hours** (CalTH)

Example: Each turbine in a 31 day month should report 744 hrs

Rather than event tracking, Wind tracks the total calendar hours for each reporting period. Each hour is dropped into a particular bucket that describes the turbine activity at the time.

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Active vs. Inactive

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

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

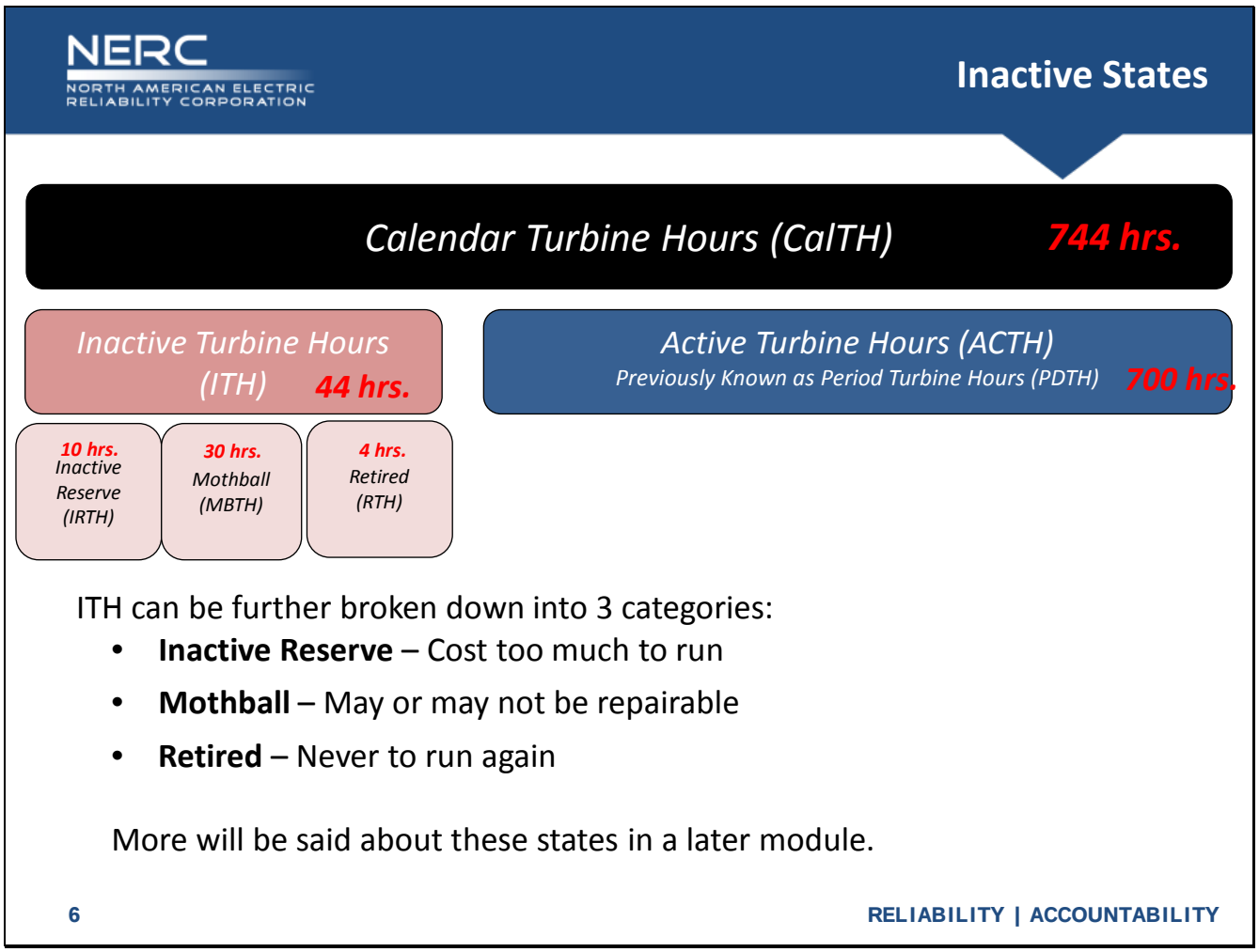
Active Turbine Hours (ACTH)
Previously Known as Period Turbine Hours (PDTH) **700 hrs.**

The first split separates **Inactive** (ITH) from **Active** turbine hours (ACTH)

Inactive Turbines are turbines that have been removed from the production pool. There are restrictions that prevent popping in and out at will. ITH are removed from the performance equations

Active Turbines participate in the production pool. This does not mean they are all running. Some may need repairs

Historically, Active Turbine Hours as been known as Period Turbine Hours (PDTH). Period is often confused with Calendar hours so the IEEE 762 standard is changing to Active Hours to be more descriptive. The complete change in the Wind DRI will take place in the next revision schedule for January 2018.



There are times, for various reasons, it is necessary to remove turbines from the Active Turbine pool. This will be discussed in more detail in a later module but the basics are:

- 3 categories – Inactive Reserve, Mothball and Retired
- Inactive Reserve is a form of RS. The turbines are capable of running but O&M cost or MWH rates make the plant costly to run. After 60 days of RS the turbines can be moved to Inactive Reserve.
- Mothball is a category where you are not sure if you will repair the turbine. Maybe the nacelle caught on fire and it takes a long time to investigate and determine repair cost. After 60 days of outage (Planned, Maintenance or Forced) a turbine can be put into this category.
- Retired – The turbine has reached the end of its useful life. There is no waiting period.

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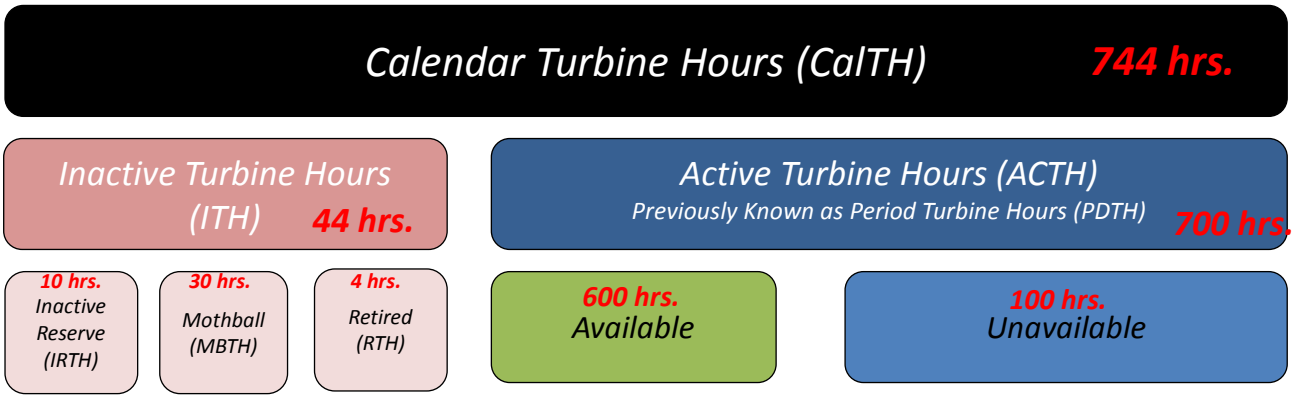
Available vs. Unavailable

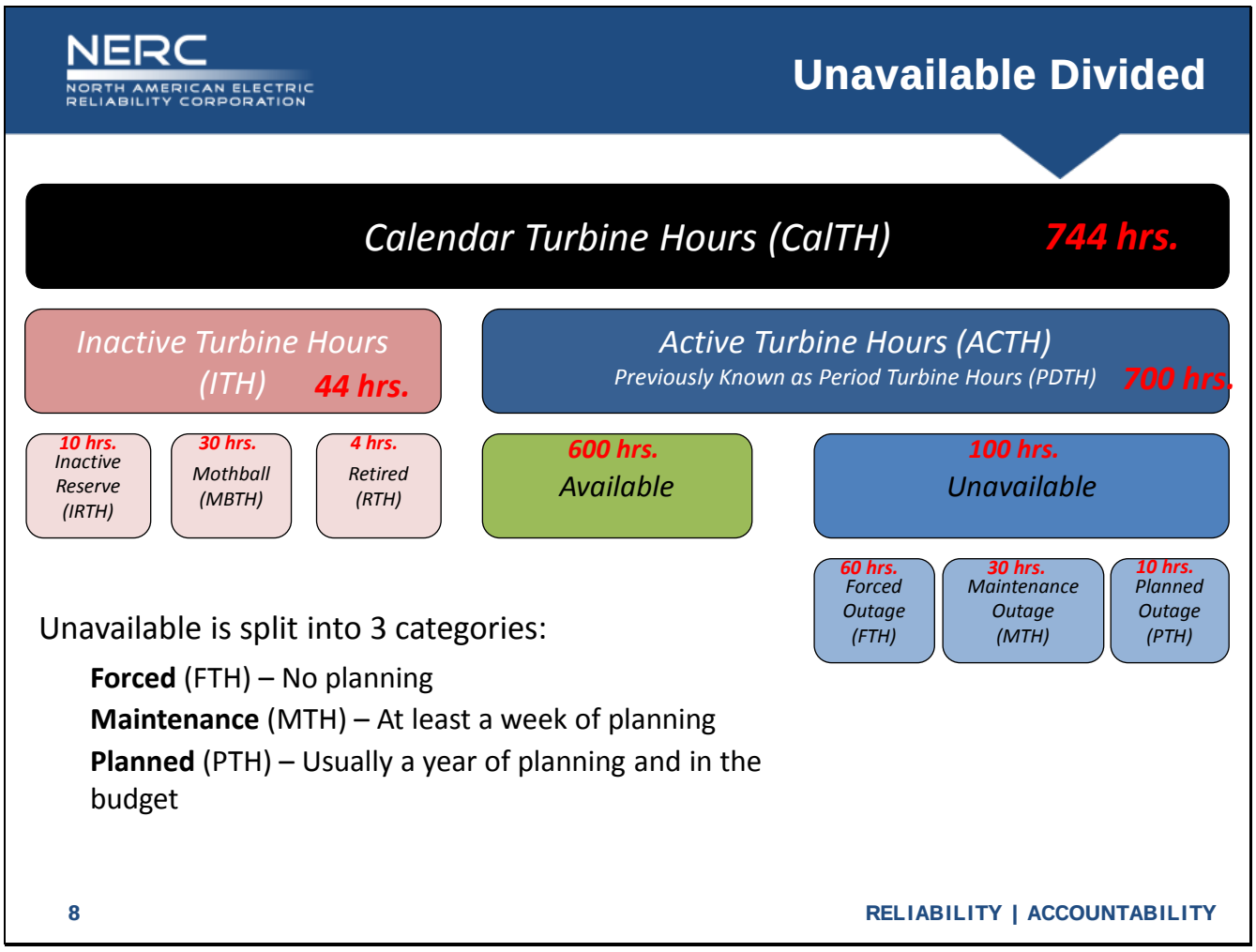


The ACTH hours can be split between Available and Unavailable.

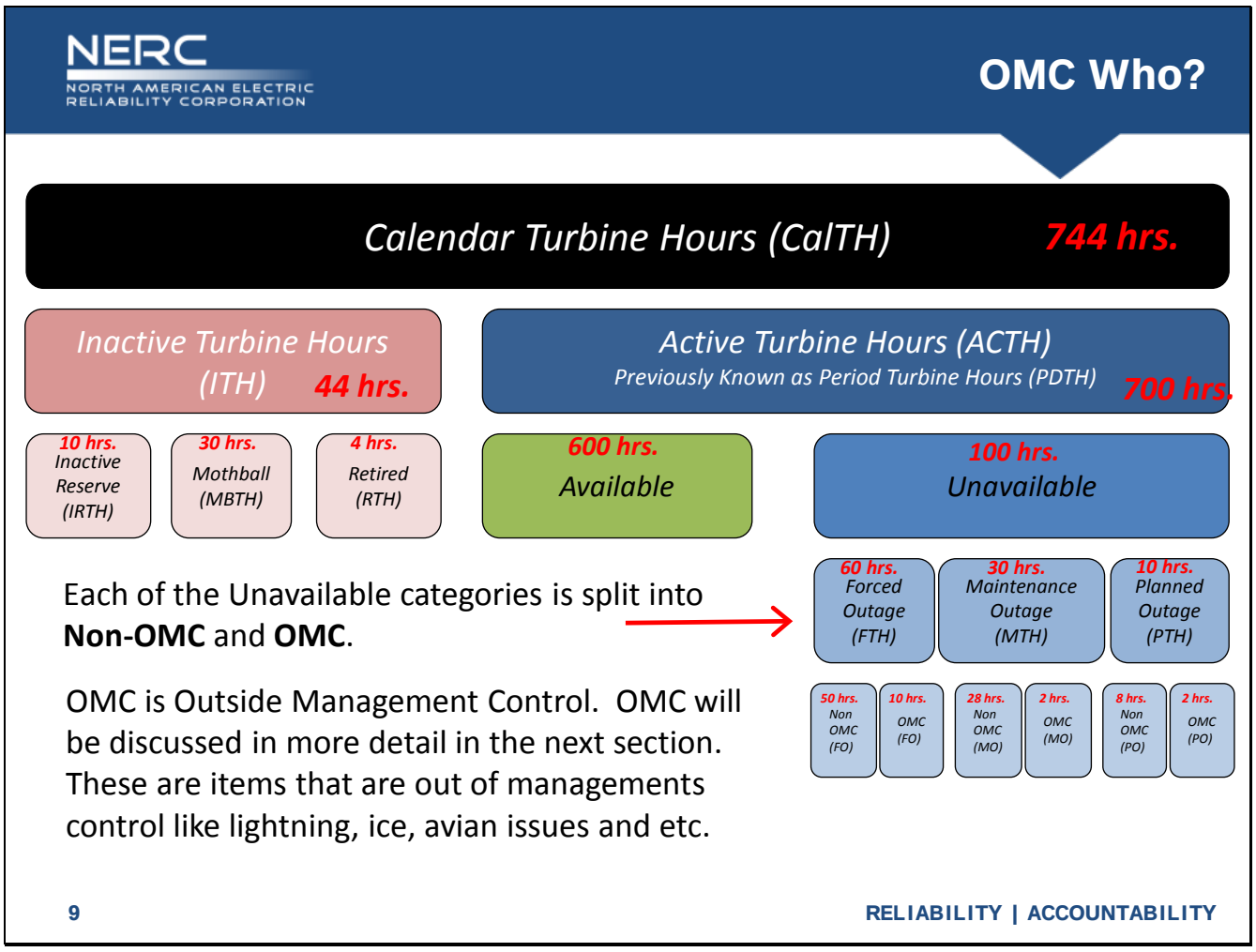
Available means the turbine is capable of generating when the wind resource is available.

Unavailable means the turbine in need of repair, grid connection is not available or an external event is preventing generation

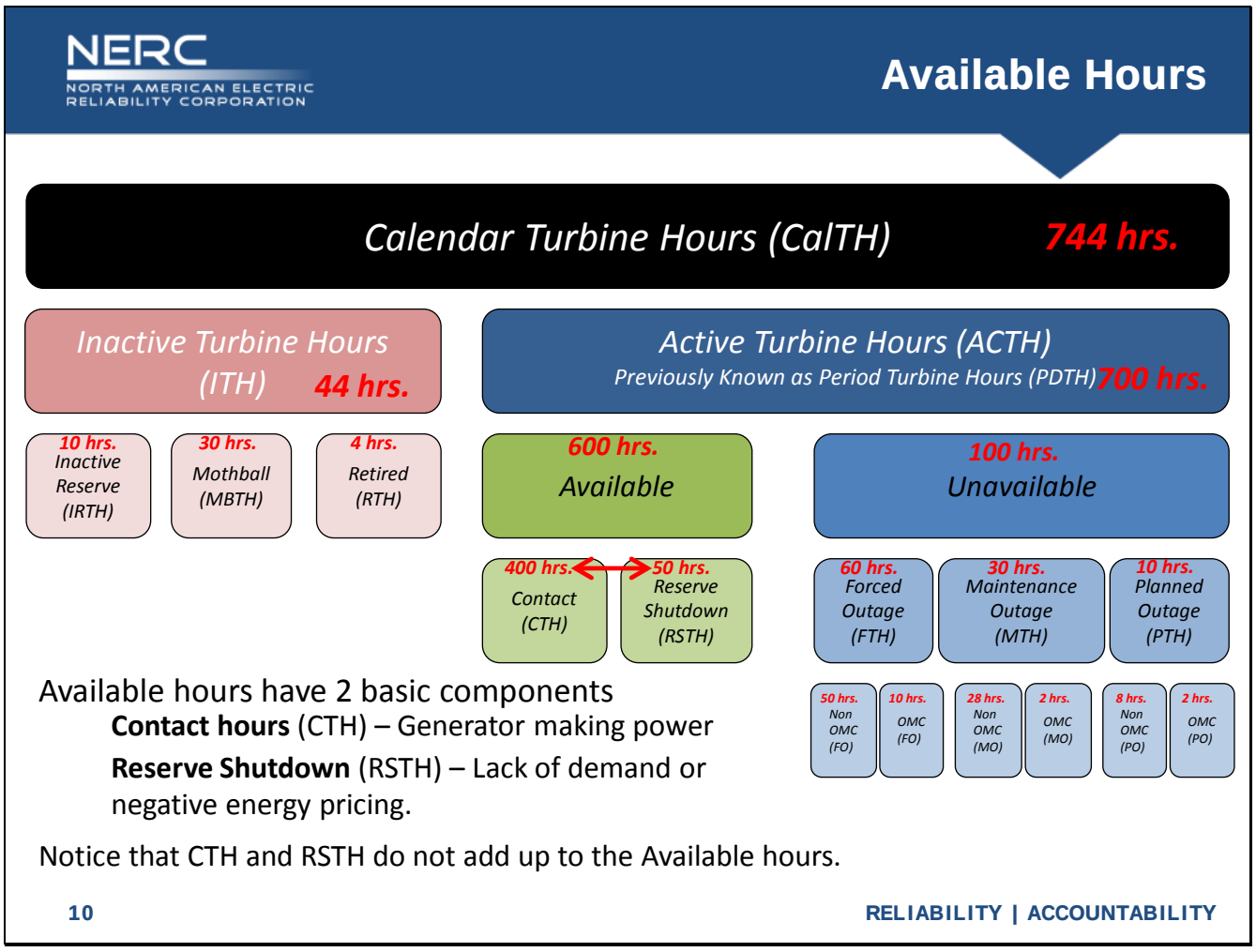
Active Turbine Hours (ACTH) can be divided into 2 sections, Available and Unavailable. Unavailable means that the turbine needs some help to become Available. Unavailable and Active often get confused. Actives just means that the turbine is part of the generating pool.



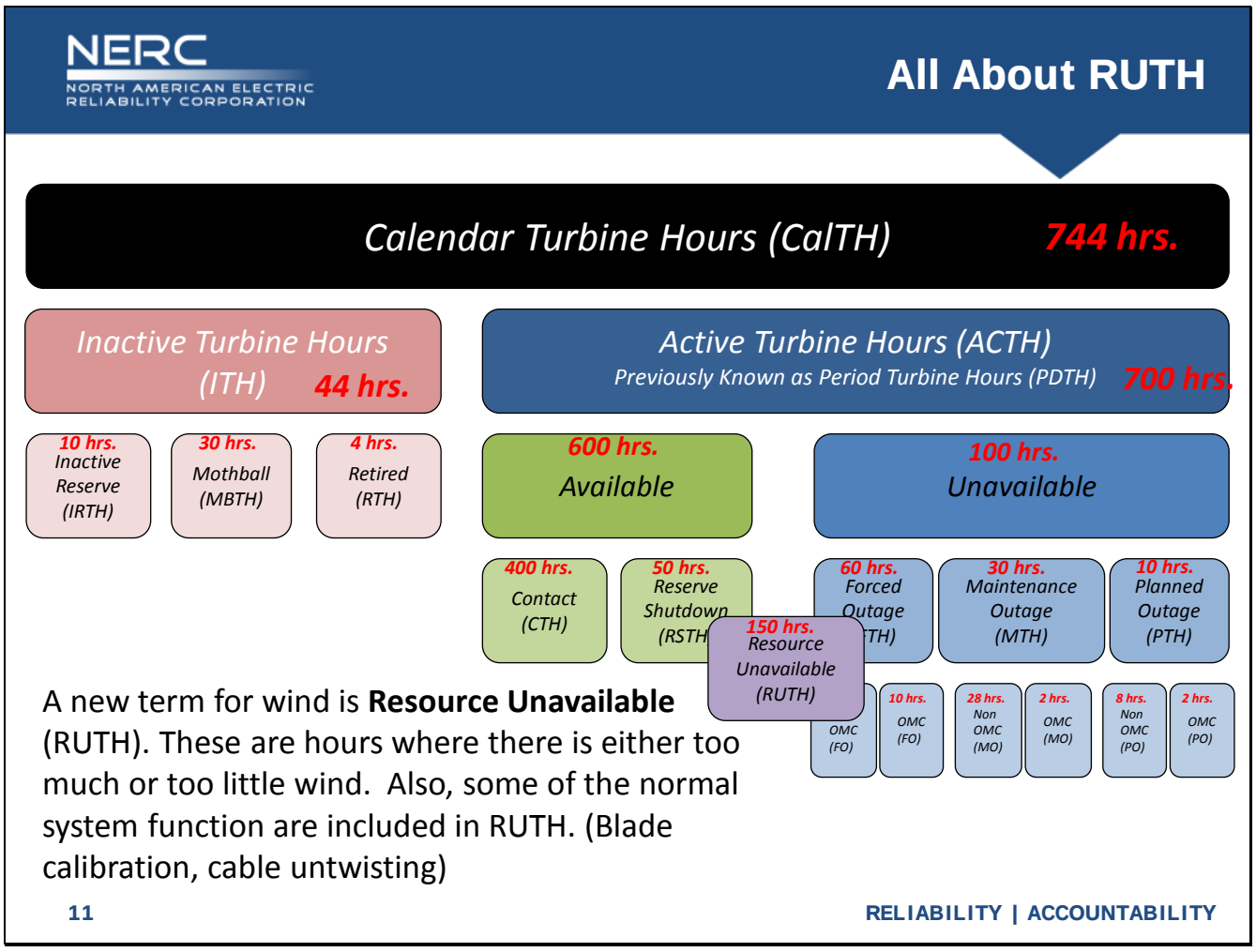
The definition of different outage types is extensive but the easiest way to remember the difference between different types of outage is the amount of planning required.
Forced – No planning – It broke – Even if you knew it was going to break and did nothing to prevent it, it is still forced.
Maintenance – At least a week of planning, you saw it coming and did something before it broke.
Planned – Long term planning, usually in the budget and scheduled specifically. The turbine maintenance includes these tasks and will be completed by this time.



Non-OMC are the issues that the plant deals with on a daily basis. Maintenance, repairs, fault resets, collection system and etc.
OMC (Out of Management control) are those items that plant managers are not held accountable for. Examples: Abnormal weather such as lightning, ice, hail, tornado's, off-taker transmission reliability, environmental issues such as bird and bats.



Moving back to the Available hours, there are 2 primary categories Contact (CTH). These are the hours that the generator is on-line. The generator contactor is closed. The second category is Reserve Shutdown (RSTH). This is usually lack of demand (don't need your power) or negative energy pricing (the price of energy doesn't cover O&M). When we look at some typical numbers for these categories we find that they do not add up to the Available hours. Something is missing.



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.

In the above graphic are all the hourly metrics needed for the production report and how they roll-up. It is also easy to see how the different Quality checks work that are mention in Appendix J.

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All About RUTH

Resource Unavailable (RUTH)

RUTH deserves some special attention as it can belong to the Available or Unavailable group. This was an area of great debate in the Wind DRI process.

RUTH as Available Hours – This is where most of us would put these hours. Nothing is wrong with the turbine, it's ready to go. We don't want lack of fuel to count against us. RUTH is used in this way in Equipment Equations.

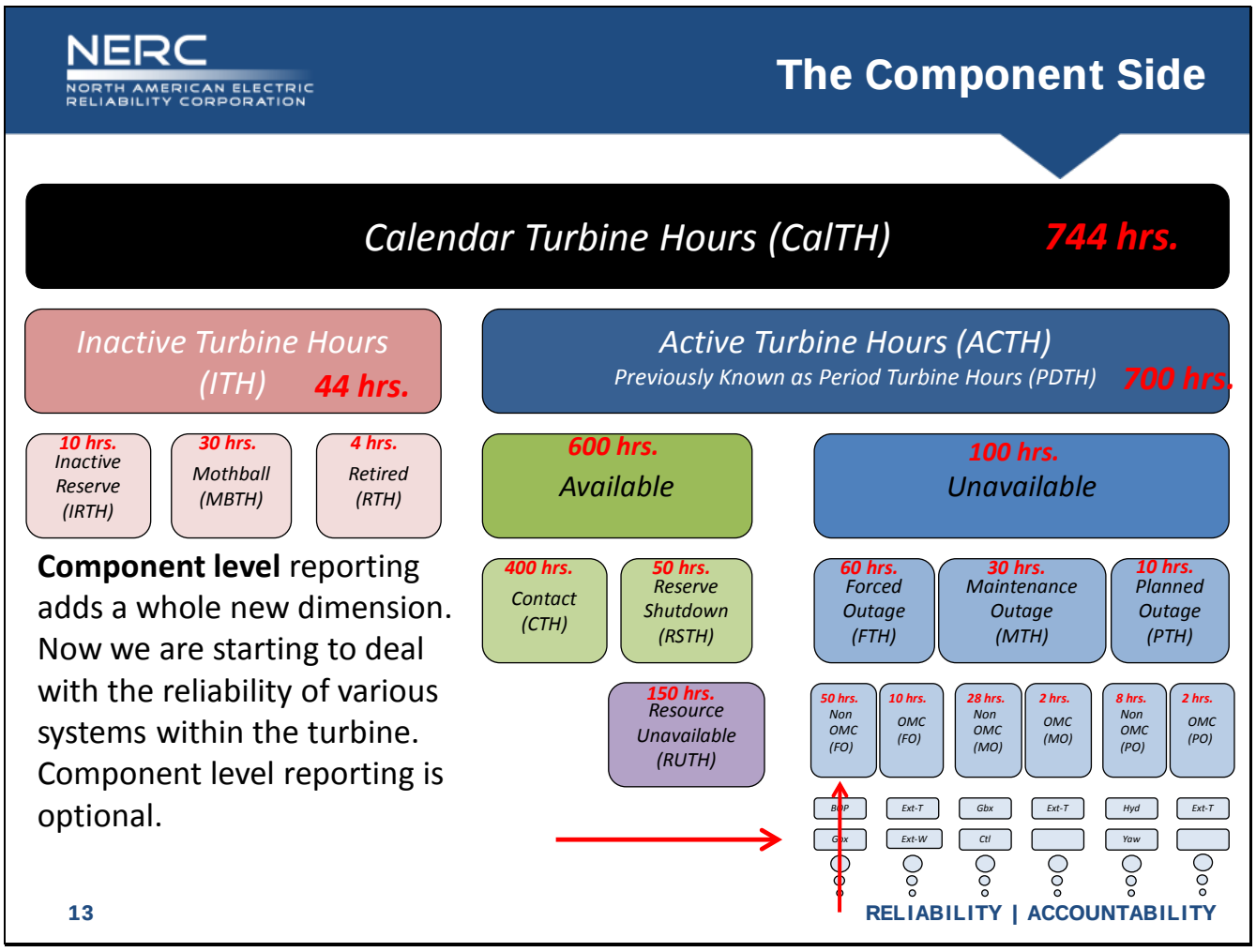
RUTH as Unavailable Hours – Power distributors look at this as lack of fuel (Forced Outage). They need calculations that indicate the dependability to deliver power. In these values are used in the Resource Equations

Early in the Wind DRI process of the concept of RUTH, several months of discussion centered on whether RUTH should be Active Turbine hours or a Forced event. There were 2 camps and both had legitimate concerns.

The turbine owners and O&M representatives did not want to be held responsible for downtime that they had no control over. If added to indicators like EFOR, it would completely bury the true work that would impact their indicators.

The camp of ISO's and power distributors were concerned about the plants ability to deliver power at the plant boundary. The availability of the resource would impact that ability to deliver. They looked at low winds as lack of fuel and should be a forced event.

Bottom line is that there are 2 customers with different needs. The Win-Win solution was to create 2 sets of formulas (Resource and Equipment). Resource formulas look at RUTH as a forced event. Equipment formulas look at RUTH as available hours.



Component level reporting gets down to equipment level downtime. As seen on the graphic the various downtime categories feed into the Non-OMC and OMC buckets. We will discuss component level reporting in more detail at a later date.

It is very important to understand how the different blocks of data roll-up. When dealing with component data the records should roll-up to the totals in the performance report. View the performance report as the summary report and the component report as the detail.

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gadswind@nerc.net