

PEER UNIT BENCHMARKING

ASSESSING FACTORS AFFECTING AVAILABILITY

Robert Richwine and Michael Curley

For decades generating companies have been comparing their plant's performance against other plants in order to 1) set realistic goals, 2) identify opportunities for improvement, 3) give advance warning of threats, 4) set appropriate incentives, 5) trade knowledge and experiences with their peers (and sometimes to brag about their successes), and 6) quantify and manage performance risks (an increasingly vital action in an increasingly competitive business environment). During most of this time it was assumed that the best selection criterion for the peer group was obvious (fuel and size range for fossil steam units, BWR/PWR/CANDU for nuclear, etc.). Recent studies, however, have raised serious questions about the appropriateness of this selection procedure. Other factors such as criticality, duty cycle, vintage, etc. have been identified as being far more important than fuel or size. Clearly, if the peer selection process is faulty, the entire benchmarking exercise will give misleading results. This case study will discuss an advanced selection process developed by the authors that statistically determines the best select criteria for any individual unit.

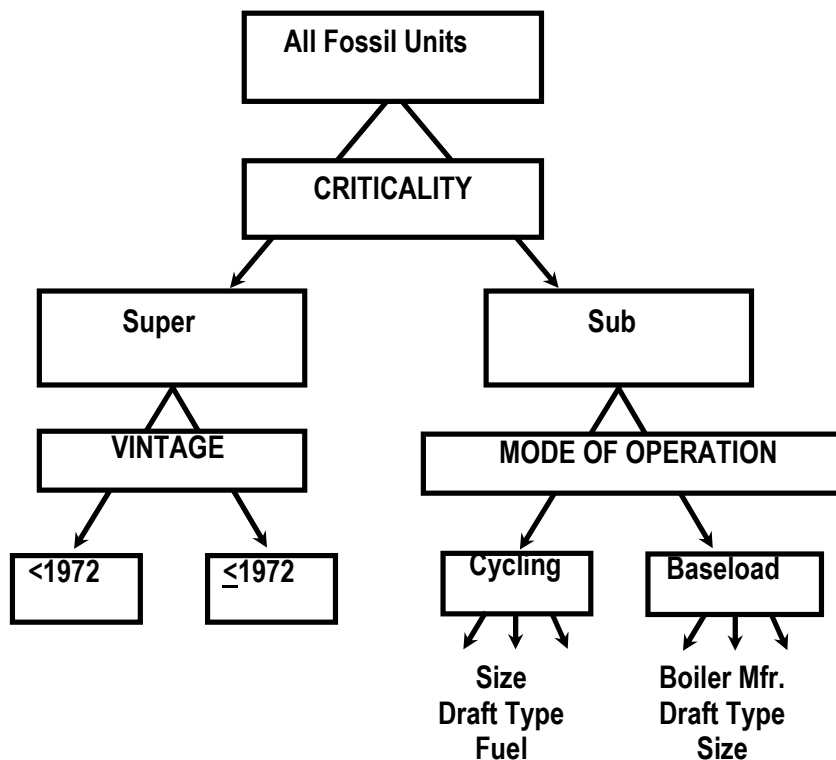
When you begin your peer selection process one goal is have a population that is large enough for statistical validity and the larger the better. We use the North American Electric Reliability Council's (NERC) Generating Availability Data System's (GADS) database which contains unit specific design and performance data on over 5000 individual units, with data extending back to 1982 (data is also available back to the 1960's from a predecessor system that evolved into the GADS program). Although the data is unit specific, it remains confidential through safeguards developed and administered by NERC.

Equally important as a large population is to ensure that the peer units selected have as close a match in design and operating characteristics as possible to your unit. However, if we were to require "exact" matches in all of the design and operational factors that have been identified as important, we will often end up with a peer group of "zero". Therefore, we must find a way to balance the need for a large population with the need for "exact" match. We achieve this by simultaneously statistically analyzing over 50 (for fossil steam units) design and operating characteristics of the unit being benchmarked to find the *most statistically important* features using techniques that compare the entire distribution of candidate unit's reliabilities. Once the *most important* characteristic is identified, we then analyze the remaining characteristics to find the *next most important* and continue until either there are no more statistically important features or the population is too small for statistical validity.

Some of the characteristics for fossil steam units we consider are:

- 1) vintage
- 2) age
- 3) criticality
- 4) fuel firing system
- 5) boiler circulation type
- 6) boiler draft type (pressurized vs. balanced vs. converted)
- 7) turbine manufacturer
- 8) boiler manufacturer
- 9) unit size
- 10) reheats
- 11) generator manufacturer
- 12) condenser cooling water type
- 13) duty cycle
- 14) fuel
- 15) etc.

After having done numerous benchmarking studies for utilities both in North America and around the world, we have been surprised at the number of times that characteristics which we previously assumed were key such as size and fuel type were much less important than others not previously considered. Although each unit must be individually analyzed to find its proper peer group, there are some new features that often are identified by the process as *most important*. The following diagram indicates one common result of the peer selection process.



We can see that the most important factor was criticality. Then for the supercritical branch, the second most important factor was vintage (early, pre 1972, vintage supercritical units have much lower reliability whereas recent vintage supercritical units have performed much better as learning curve theory predicts). After the second branch on the supercritical side, there are no longer enough units to be able to continue the process. However, we can see that both fuel and size ranges are less important than vintage for supercritical units. Also, it would be inappropriate to include subcritical units in the peer group.

On the subcritical side we find that the second most important factor is “Duty Cycle”. Therefore, including baseload units in the population for benchmarking a cycling unit would be improper, and may result in unrealistic expectations for reliability being imposed on the plant management.

Because there are many more subcritical units in the total population, we can continue the analysis and will finally find fuel type and size becoming relevant factors in addition to others.

In performing a benchmarking analysis the key activity of peer group selection is often overlooked by assuming traditional design and operating characteristics are adequate (fuel type and size for fossil steam units, etc.). However, we have found from our benchmarking analyses of hundreds of units from around the world that other factors are often much more statistically important. In benchmarking it is vital that the most similar units be selected for comparison to the candidate unit or the results will be invalid.

REFERENCES

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