What if you had had a better power plant last year?

This question sounds strange, doesn't it? Since there's no choice in arrears, this leads directly to the point we want to make: How to choose the best option for improving your plant for the future?

First, identify your current problems and limitations.

Clearly, your finance manager can tell you about your bottom line after doing the math on fuel bill, cost and revenues. For technical matters, your operators and your performance engineer may already know very well the root cause of your problems related to plant performance and capacity. If you are uncertain or want to have the full picture, you may also consult an expert company for assessing your plant in a comprehensive performance test. Or you may analyse historical records for specific operating modes in which the plant has been underperforming.

Look at the options from a technical point based on in-house experience as well as external know-how.

Now that you know what has gone wrong, how can you improve? Some problems have a simple solution, others may need more efforts to design the right remedy for your plant. And you can be sure that the moment that it becomes known on the market that you are willing to invest in plant improvements, there will be a vast bouquet of ideas and advice offered by equipment vendors and service companies. Gas turbine and steam turbine uprates, cooling system improvements, inlet air treatment, boiler modifications, controls upgrades and many more ideas will be floated. Most of them may have a positive impact on the performance of your plant, but all of them will come at a price.

Which investment will bring the biggest bang for the buck?

This is the decisive and toughest question to answer, as it is well known that it is difficult to make predictions, especially about the future. In theory, the evaluation sounds simple, as you just need to compare expected fuel savings and/or increased output against your current performance numbers.

Technically, the entire power plant process and not just the equipment under consideration should be covered in the analysis, since you must make sure to capture all effects of the modification. For example, an uprate that significantly improves the heat rate of the gas turbine may produce much less benefit, if the subsequent bottoming cycle will receive exhaust gas at much lower temperature which reduces the impact on the overall plant efficiency.

But besides generating a comprehensive process model of the plant, there is a much more challenging task in order to produce a reasonable techno-economic analysis of your plant modification:

Which operating modes are representative for your plant and how many operating hours should you allocate to them? You'll probably not know.

Comparing options by name plate numbers at base load under ISO conditions may be a fatal shortcut, as your day-to-day operation certainly differs from such single reference case assumption, and thus the benefits of the modification may be largely overestimated. Common engineering practice has therefore been to generate one or several representative load cases with respective durations which shall capture the "typical operating modes". But do they exist? Given seasonal changes in ambient conditions and daily and weekly load patterns, or considering the complexity of cogeneration plants, it will certainly be a very challenging task to summarize this variety of operating modes into a few cases for evaluation. And even if you choose tens or hundreds of cases, can you be sure they will be representative for your plant?

The ENEXSA approach: look at the very detail in as many cases as possible, but don't waste time.

If you have a record of the operation of the plant through the last year, why not use it in its entirety? **ENEXSA**, an Austrian expert company for consultancy and software systems for the power industry, has developed a new methodology that bases its modelling on integral tuning, removing the necessity to identify individual representative operating points from operating data. This makes the resulting model most representative of your plant, even if it does not hit every individual operating point spot-on (for which the reason may be transient operation, anyway).

The methodology developed by **ENEXSA:**

1. Create a model based on OEM heat balances for the plant (consistent data, representing performance as initially guaranteed or expected). If adjusted properly to fit vendor performance data over the entire load range, this model will already contain very good part load characteristics of the individual equipment, even if the absolute performance numbers may differ from what has been measured during operations.
2. Simulate the entire year of operation and adjust key performance parameters of the plant (such as GT heat rate, ST efficiencies, HRSG steam production etc.) such that the integral of simulated fuel consumption of the year coincides with the actual measured value. This model will be most representative of your plant under current conditions and shall serve as the benchmark for the evaluation.
3. Create separate models for the plant modifications that are under investigation with respective performance characteristics as per vendor information. Simulate the entire operating year with every option and compare the integral results in terms of fuel savings or additional output.

With this approach, the result of your evaluation will be of superior quality, as it will provide a number for the estimated benefit under most realistic conditions.

Why has this method not been applied before?

The pre-conditions for this methodology are (a) a fast and reliable heat balance software and (b) the technology to manage a massive amount of calculations through distributed computing. Based on its long-term experience and its expertise in both, process simulation and software development, **ENEXSA** has established a new quality in the evaluation of plant modifications:

More and better results in shorter time!

ENEXSA

Energy Expert Software Applications

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