Think big in process simulation

How advances in information technology change work processes and applications for power plant simulation

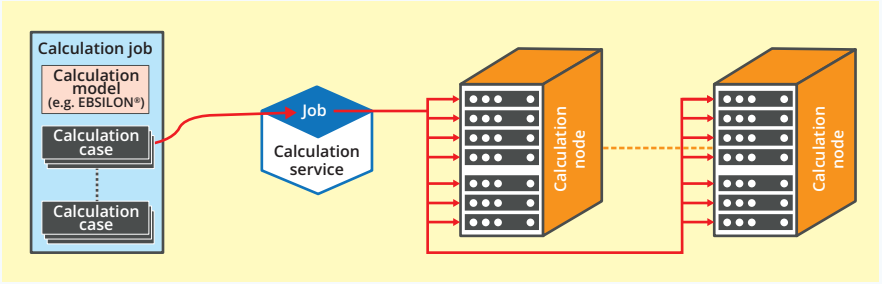
The first quarter of 2019 changed a lot for the Austrian company formerly known as VTU Energy. A management buy-out gave the long-term leadership team full control of the business, and the new name ENEXSA expresses the focus of the company more clearly: Energy Expert Software Applications. The company team remained the same, but the ENEXSA portfolio will grow in a new era for the power industry: the era of Big Data.

Traditionally, ENEXSA's portfolio has been based around process simulation: development of heat balance software, expert consultancy, plant simulation and fuel demand models, and settlement systems for IPPs. ENEXSA's products and services have been well received by customers all around the globe and ENEXSA will continue to serve them, but the advances of information technology have added improvements and new applications related to Big Data.

Calculation speed and connectivity are game changers for process simulation

Two parameters have changed the way we do process simulation at ENEXSA today: calculation speed and connectivity. While the EBSILON®Professional heat balance software by STEAG Energy Services, which is co-developed by ENEXSA, is probably the fastest and most stable heat balance code on the market, an off-design calculation takes around one second for a large power plant model with control algorithms. Considering the number of equations to be solved for a highly non-linear problem with nested loops, such calculation time is hard to beat with reasonable computer hardware. However, since the engineering task typically consists of many cases (eg, operating points of a development project, parametric studies, or correction curves), the decisive innovation was to introduce distributed calculation technology.

By sending all cases from Excel® to an external Calculation Service that distributes them to several server computers with multiple cores (see illustration, above), a multitude of cases is solved simultaneously, and the overall calculation time is drastically reduced. Moreover, since the calculations are performed on remote computers, the user can continue working with EBSILON and Excel® – a huge productivity gain, and a boost to the engineer's freedom to look at many more design options and cases.



Evaluating design alternatives based on a year's hourly data provides a reliable, and the most realistic, basis for investment decisions

In a consultancy project for the Austrian steelmaking company voestalpine, ENEXSA took advantage of this capability and evaluated various design options for a plant modification utilising hourly data over an entire year, ie, 8760 cases. This approach resolved two basic dilemmas of the classical engineering design study: (a) defining representative operating modes with respective duration; and (b) judging the applicability of the resulting benefit relative to real day-to-day operation. Based on accurate predictions of the additional kWh of output for the entire year 'as recorded', the selection of the most economic design was a clear and fast process for all stakeholders.

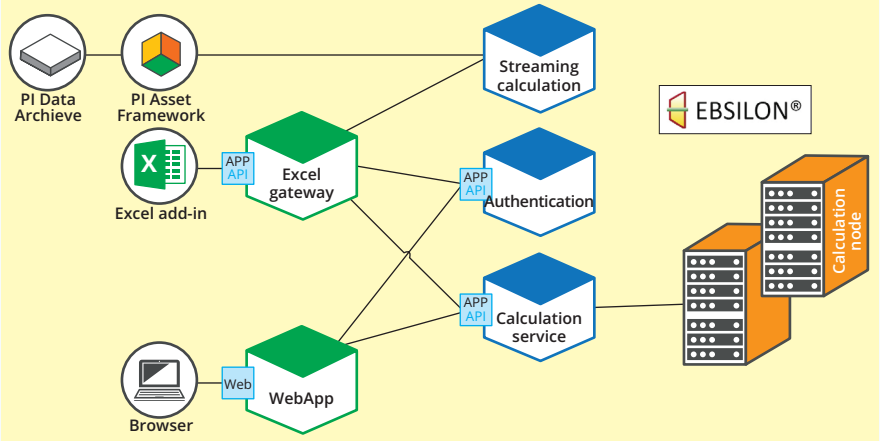
Machine learning can produce superfast digital twins of power plants, if sufficient data is supplied by process simulation

An even larger number of operating points – of the order of hundreds of thousands – is needed to map the entire operating range of a plant considering all possible equipment combinations. Since data recorded by a plant historian only contain a fraction of all possible combinations, and since these data are biased by inaccuracies of the instrumentation, relying on measured data for describing the plant is not recommended. Applying machine learning on simulated datasets, ENEXSA created superfast models that closely represent the detailed EBSILON model. In ENEXSA's optimisation systems for industrial cogeneration plants at two voestalpine sites and for the cogeneration facilities of Sembcorp Utilities on Jurong Island, Singapore, millions of heat balance calculations are performed per minute for optimising set points to maximise profit from operations.

Data science connects the data with a model. So do we, but with many in parallel

Connectivity is key to utilise models that process plant data to generate KPI, replacement values, or other business-related data. The interface to the OSIsoft PI System™ through ENEXSA's Streaming Calculation Service creates a single but fully scalable processing system that can be used in both ways, to scale out for many different PI archives as data sources, or to effectively back-fill or re-calculate past periods of time without infringing the performance of the PI server. The system shown in the scheme left is not restricted to EBSILON, it may be expanded for other industry-specific programs, if they run self-contained without the requirement for human interaction.

ENEXSA is offering these tools or may act as a consultant to make best use of your data, no matter how big they are. During the development of these tools new use cases oftentimes showed an even bigger benefit than initially anticipated, and so we are excited about any questions that you may have. Please contact us at www.enexsa.com. ■



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