

Cut emissions and boost profitability

Companies must embrace an integrated approach to reducing energy operating costs and emissions and sustaining energy performance, writes Francisco Alanis.

SITE Energy Management can be broken down into two key areas: (a) reducing energy demand and consumption, and (b) reducing the supply costs of the energy used.

An effective energy management plan must address both sides of this energy equation simultaneously.

The supply side includes public utilities and the site's utility plant; we will just call this 'utilities' for short.

The demand or consumption side includes all production processes and operations that consume fuel, steam and power. Figure 1 illustrates a simplified layout of a typical industrial site.

Energy Demand & Consumption. The production units usually require steam at different pressure levels, as well as fuel and power.

Steam is used for heating, stripping and tracing. >

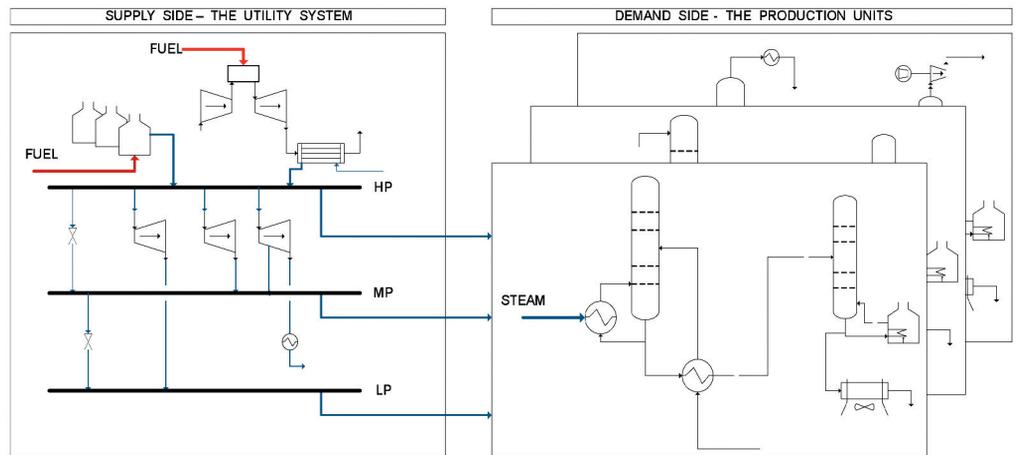


FIGURE 1: A typical industrial site's supply and demand sides.



SIMPLIFY PROCESSES



The best solutions are usually very simple.

Process automation is very much like other aspects in life. Complex systems are driven by astonishingly simple processes. Consider fieldbus. It offers straightforward communication from the control system to each field device. Control commands, closed loop control, and monitoring enable the management of the most complex processes.

FieldConnex® goes one step further. It simplifies the installation and the infrastructure, allowing you to design a fieldbus topology for your specific application. The High-Power Trunk, for example, transmits data and supplies power using only one cable and limits energy at the spur rather than the fieldbus trunk cable. Our Advanced Diagnostic Module in combination with a powerful commissioning wizard continuously monitors the fieldbus physical layer providing precise and detailed analysis. Intelligent components from the specialists who simply know what fieldbus is all about.

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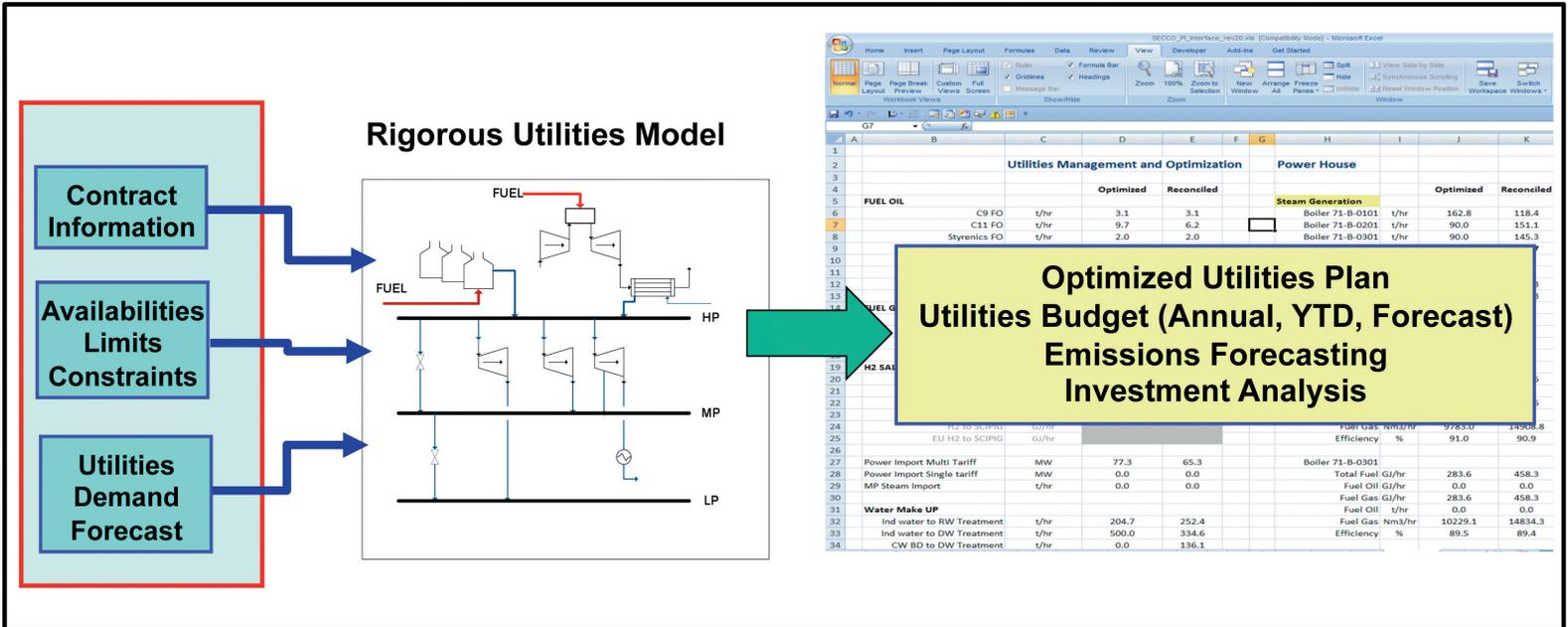


FIGURE 2: Overview of the online Energy Management and Optimisation system.

By implementing an energy management programme with elements focusing on both supply and demand organisations can achieve significant returns – sometimes over 15 per cent of their annual energy costs with very attractive payback on the capital invested.

Fuel is used in fired heaters. Power is required by pumps and compressors.

These power requirements can be supplied by electric motors and/ or steam turbine drives.

Energy Supply. The site’s utility system provides the utilities the production units require.

High Pressure steam (HP) is usually generated in steam boilers. Where gas turbines are installed, HP steam is also generated in Heat Recovery Steam Generators (HRSG) to recovery heat available from the exhaust of the gas turbine.

Medium and Low Pressure steam

(MP, LP) is generated by letting down HP and/or MP steam through steam turbines.

Let down stations between steam headers balance steam requirements. The steam generation boilers can usually burn fuel oil, fuel gas or both.

Power is usually generated in steam turbines. These could be steam turbines that drive rotating equipment (pumps and compressors) or steam turbo-generators that generate power and may include back pressure and condensing stages.

Power can also be generated in gas turbines. Power can be imported (or exported) from the grid to close the site’s power balance.

Supply-Side Energy Management

The goal in the utilities side is to reliably generate the energy the processes require in the least expensive and most efficient way possible.

Fuels consumption and electricity import/export define the utilities operating costs.

The following operating decisions will have the major impact on fuels use and power import/export:

- Choice of boilers and their loads (boiler load allocation)
- Choice of power generation turbines and their load (power load allocation)
- Choice of fuels

- Choice of drives (motor or turbine)

Additionally, system constraints and fuels and electricity contracts will also impact final operating costs and emissions.

System constraints may include boiler hot standby requirements, boiler capacity as a function of fuel used, fuel mix ratios, emissions limits, and equipment items that must be on because of reliability.

Energy contracts may include minimum and maximum rates, take or pay clauses, penalties, and hourly tariffs.

As a result, finding the optimum equipment set up to achieve lowest oper-

ating cost requires a system that takes into account equipment performance as a function of load, equipment interactions, system constraints and energy contracts.

A model-centric system like AspenTech’s Energy Management and Optimisation (EM&O) meets the above requirements.

Applications and benefits

Benefits can be realised through a variety of ways. The main opportunities can be broken down into two main tasks: operational and strategic.

Operational opportunities include:



SNAPSHOT

INTEGRATED SOLUTION

The integrated approach to energy management considers both the steam and power utility system and the production processes. An important component of the solution is provided by a rigorous model-based energy management system, which can be used to help take advantage of potential savings which have hitherto been largely unexploited in addition to providing optimised and consistent information about a site's key processes and facilities for decision-makers. This knowledge can be useful both in long-term, strategic decisions and in concluding energy supply contracts, in preparing budgets and in drawing up investment plans, as well as in optimising the energy costs of ongoing operations in real time, online optimisation based on current operation, utilities demands, costs and plant availability.

- Maximising use of most efficient equipment items
- Correct choice and use of fuels
- Correct choice of drives
- Reduced hot standby
- Reduce venting of steam
- Better cost accountability
- Better adherence to contract terms and reduced penalties

Strategic opportunities include:

- Better purchasing – lower contract price and more reliable nominations
- Emissions forecasts
- Optimum scheduling of maintenance
- Reduced capital investment for

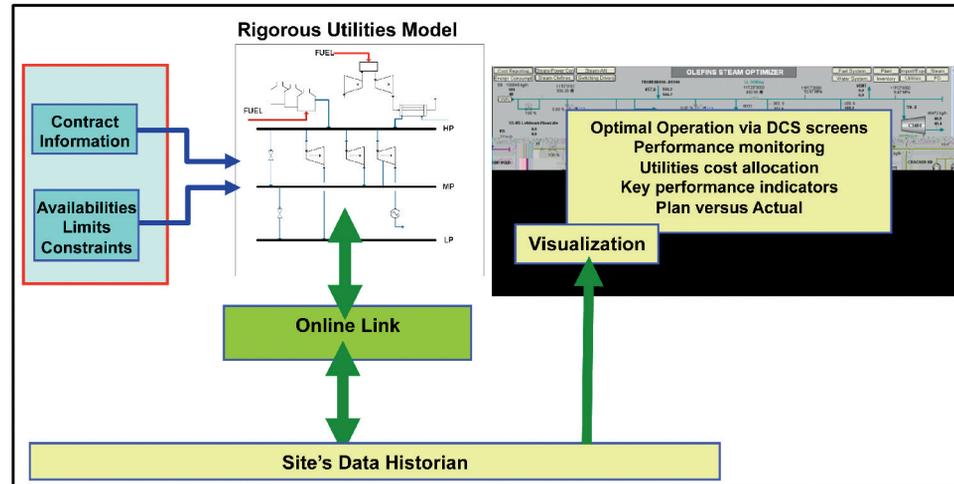


FIGURE 3: Overview of the offline Energy Management and Optimisation system.

improvements in energy efficiency. The operational benefits are achievable through the online functionality of the EM&O system.

This allows optimisation of the utility system in real time by identifying the lowest cost solution taking into account current changes in utilities demands, fuel and electricity prices, equipment availability and system constraints.

It also allows the real time monitoring of equipment performance, emissions, and other key performance indicators. An overview of the online architecture is provided in Figure 2.

The strategic benefits are achievable through the offline functionality of the EM&O system.

This allows performing multi-period optimisation and "What-If" analyses to identify the best (short to long term) schemes in response to seasonal fluctuations and site changes.

Cost savings in the 2-5% range have

been made by the applications outlined above with no capital expenditure other than software and dedicated servers or desk top computers.

Cost savings in the 10-20% range have been made with relatively low capital expenditure on simple changes to the process design of the production units.

Conclusions

An effective energy management plan must be holistic, addressing both sides of the energy equation effectively and monitoring and optimising both the supply and demand sides simultaneously.

They should be designed to sustain the gains as the plant evolves over time, as equipment ages and is modified, as product mix and loading changes.

The most effective programs should include at their core, a rigorous model of the utility system as well as continuous improvement capabilities.

To achieve these goals, simple data visualisation is not enough, but dashboard display of information synthesised via operating models from real-time data.

Energy management must be proactive and become part of the site operations.

About AspenTech

AspenTech is a supplier of software that optimises process manufacturing. The company's current flagship product is aspenONE v7, an application suite that enables process manufacturers to implement best practices for optimising engineering, manufacturing, and supply chain operations.

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