



Technology That Loves Complexity

 Brochure

Aspen Utilities OnLine Optimizer



The Challenge: Reduction of Production Costs

Energy is often the second-largest operating expense for the process industries, trailing only raw materials. Managing and optimizing these costs are critical to meeting profitability targets. At the same time, the volatile price of energy, the ongoing liberalization of the world's energy markets and emissions taxes and trading, mean that there are considerable opportunities to improve the way companies source, trade and use energy.

The challenge is to operate the existing utilities system with **minimum** cost and **maximum** reliability to satisfy the energy demands from the production processes, while considering ever-changing environmental, organizational, and technical constraints.



“We believe that the energy optimization and management system will provide our managers with the ability to identify the operating strategy that delivers the greatest overall financial benefits to BP.”

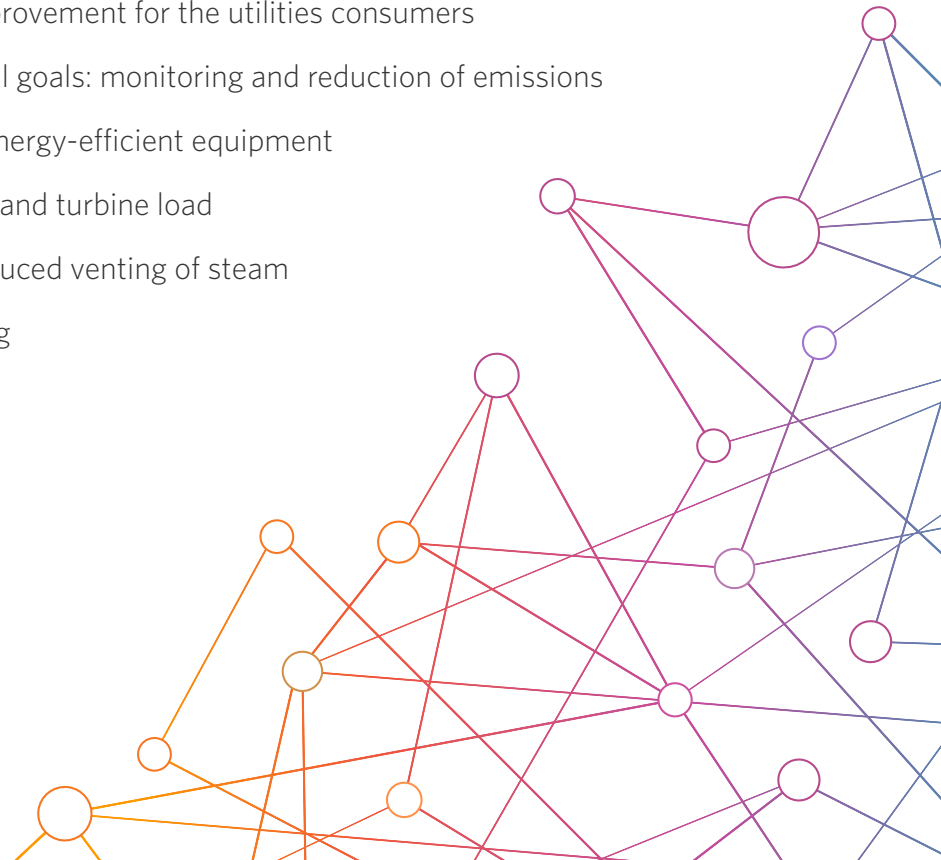
**Terry Harclerode
BP Texas City**

The Opportunity: Energy Management and Optimization

Minimum-cost and maximum-reliability operation of the utilities system can be achieved simultaneously by the implementation of an integrated energy management and optimization system that links business and operational objectives and therefore enables companies to make more profitable decisions about how to use and source energy across an entire production site.

Such a system facilitates the optimization of the power plant operations, energy utilization across the site and energy purchasing decisions. Key benefits for manufacturers include:

- Better purchasing (lower contract price, more reliable nominations)
- Well-informed energy and emissions trading
- Faster identification of and response to problems within the utilities system
- Better cost accountancy, better decisions based on true costs
- Plan vs. actual continuous improvement for the utilities consumers
- Achievement of environmental goals: monitoring and reduction of emissions
- Maximizing use of the most energy-efficient equipment
- Optimized allocation of boiler and turbine load
- Reduced hot stand-by and reduced venting of steam
- Better maintenance scheduling
- Improved fuel selection



The Solution: Aspen Utilities OnLine Optimizer

Aspen Utilities OnLine Optimizer is an integrated software solution that enables process plant operators to manage and optimize the way they use and source energy in the power station and across an entire production site. It enables companies to ensure that all their processes receive reliable supplies, while at the same time minimizing running costs by reducing overall consumption and identifying the most economical sources of supply.

The solution combines both **technical and business approaches** to satisfy operational requirements, while at the same time achieving business objectives of lowest cost and reduced environmental impact. The Aspen Utilities approach is based on defining and improving the energy business processes that are important to the economic performance of the site. By considering all site utilities systems within a single environment, Aspen Utilities OnLine Optimizer can capture all relevant data and provide clear and consistent recommendations on how to achieve lowest cost operation. The system can be used both offline, such as for 'what if' analysis, and online, to provide real-time recommendations to operations personnel.

- **Business Approach:** Aspen Utilities OnLine Optimizer considers all aspects of the operation of a utilities system — e.g., not only a reliable supply of energy, but energy sourced at the lowest overall cost that also meets reliability and environmental goals — and can thus support the optimal operation that supports the overall business strategy. In this way, companies can achieve both technical and commercial excellence in energy and utilities management.
- **Robustness:** While Aspen Utilities OnLine Optimizer uses modern software technology from AspenTech, it is built on years of experience in utilities optimization. This helps to ensure confidence in both the software itself and the solution identified.
- **Role-based Usage:** Aspen Utilities OnLine Optimizer provides 'role based' user interfaces designed to support specific business process, providing the right data to the right user in the right way. This can include Microsoft Excel for engineers or web pages for operations personnel. This helps foster acceptance of Aspen Utilities applications for different types of users — from plant operators to utilities contract managers to senior company management.
- **Integration:** Aspen Utilities OnLine Optimizer is designed to be integrated with existing and future plant information and business systems. Information can be automatically extracted from existing systems (such as the planning/scheduling system, information management systems for historical data, and ERP systems for resource planning) to Aspen Utilities. This increases, both, the relevance and the usability of Aspen Utilities as the latest information is used without manual data transfer.

Aspen Utilities OnLine Optimizer Benefits and Applications

The implementation of Aspen Utilities OnLine Optimizer to improve on the current practice of energy management has enabled users to reduce site energy costs by up to 5 percent, with a project payback time of always less than one year. The benefit potential of implementing an Aspen Utilities OnLine Optimizer-based energy management and optimization system is site-specific and depends on several parameters, such as the complexity and size of the site as well as the implementation scope.

Aspen Utilities OnLine Optimizer has three main areas of application:

1. As an online operational advice system for the operators to optimize the utilities plant operation
2. As a tactical and strategic advice system to improve on utilities plant planning, including utilities nomination, CO2 trading, power trading and maintenance scheduling, as well as contract negotiations and investment analysis
3. As a "plan vs. actual" management system for utilities consumers to allow the tracking and evaluation of actual performance compared to target performance

The list shown here describes the main Energy Management Business Processes that Aspen Utilities OnLine Optimizer supports. An energy management business process consists of a sub-set of these main business processes — the selection being based on the benefits each of them delivers to the site. In addition to these main business processes, in many cases, additional site-specific business processes are defined and implemented based on the same consistent, model-based information without further development effort.



Aspen Utilities OnLine Optimizer business processes

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Optimal Plant Operation Using Online Optimization

Up-to-date online information is essential to ensure the right and cost-optimized action throughout plant upsets. While a production plan may be developed in advance, in practice the operations of the plant may change within that period, thereby invalidating the optimum plan. Even if the steam and power demands do not change within this period, other factors such as electricity price and gas price may vary. Aspen Utilities OnLine Optimizer can be connected online to a real-time database (such as Aspen InfoPlus.21®), automatically updating its internal models with real-time data to provide up-to-date online advice to operations personnel on how to achieve the lowest possible utilities costs for a single period or across multiple periods. Due to the two-way connection between Aspen Utilities OnLine Optimizer and the real-time data base, the optimization system can be extended to include closed-loop optimization.

Plan vs. Actual (Operational Users)

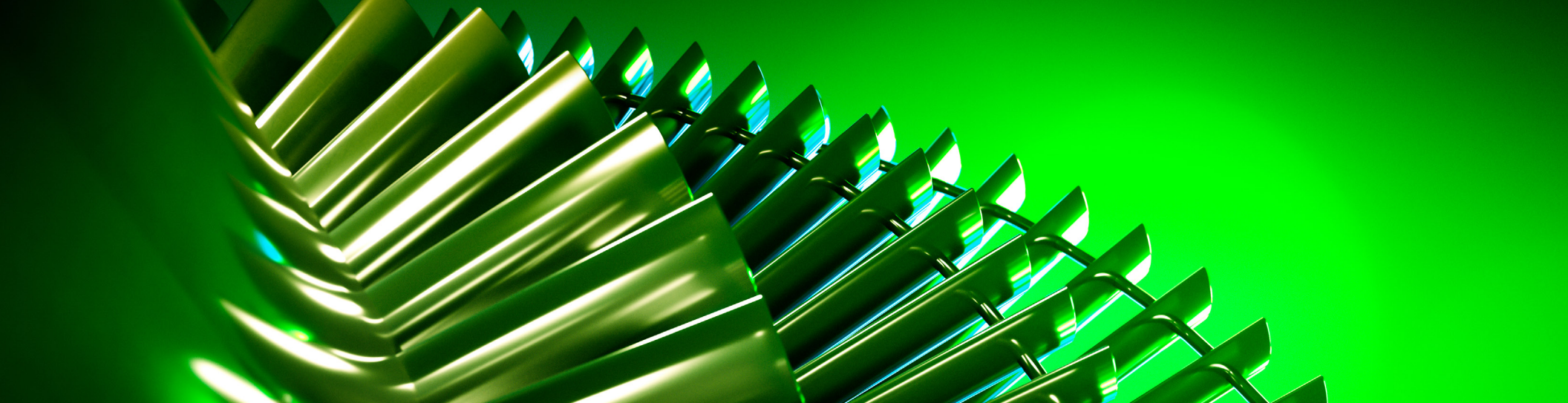
Tracking of planned energy and utility usage versus actual is a well-established methodology for continuous improvement. This allows the operator to develop a daily production plan and to compare the actual daily performance with the plan, which highlights areas where there were deviations from the plan. Traditionally, plan vs. actual is an offline activity using historical performance data to check actual operation against plan. Aspen Utilities OnLine Optimizer facilitates proactive responses to deviations from plan (and hence higher costs of operation) by informing the operator in real-time of any such deviation and its cost.

Demand Forecasting (Tactical Users)

To operate and manage the utilities supply system at the lowest cost requires knowledge of the current demands and likely future demands. This helps to minimize the use of hot standby (e.g., boilers), the venting of steam due to excess online capacity and the loss of supply due to insufficient standby or control. It also ensures that penalties are not incurred due to violation of take-or-pay contracts, maximum demand charges or load factor clauses in both the electricity and gas contracts.

“Energy and environment are key elements of Celanese’s operations strategy. We believe that utilities optimization using Aspen Utilities OnLine Optimizer will provide a consistent decisionmaking framework and better monitoring capability for our site directors, resulting in the optimum supply of utilities to our process plants and reduced utilities bills.”

Jim Alder
VP Operations and Technical,
Celanese Chemicals



Utilities Production Planning (Tactical Users)

Aspen Utilities OnLine Optimizer uses the demand forecast to provide an optimum utilities production plan within existing constraints of equipment availability, emissions and available gas and electricity tariffs. Production planning can typically be carried out daily on a tactical basis for the next 24 hours and on a strategic basis, such as reviewing the best configuration when a gas turbine needs to be brought down for inspection or when a process unit is to shut down or start up.

Power and Fuel Trading (Tactical Users)

As part of an ongoing strategy to reduce the cost of utilities, the process industries have increasingly invested in cogeneration plants. Additionally, global utilities markets are becoming deregulated and are opening up to competition. This has given the process industry new options to reduce utilities costs by contracting with different suppliers and through new types of supply contracts. Some companies are even producing excess power for export and then trading in both the longer-term contractual market and the short-term spot market. While there is significant value to be gained by trading in utilities, there are also significant risks. The key to optimal trading lies in knowing the current utilities situation and the ability to deviate from it in terms of technical capability and cost. For example, to profitably export electricity into the spot market, the trader needs to know exactly how much power is available for trading and at what cost the power can be generated internally. Armed with this information, the trader can commit with confidence to export or import power. Aspen Utilities OnLine Optimizer can provide this information online in real time and support efficient trading.

Legend	Unit	Period1		Period2		Period3	
		Min	Max	Min	Max	Min	Max
Alkylation Unit Fuel Consumption	MMBtu/hr	91.47	91.47	91.47	91.47	91.47	91.47
Alkylation Unit 250# Steam Consumption	Mlb/hr	39.56	39.56	39.56	39.56	39.56	39.56
Alkylation Unit 40# Steam Consumption	Mlb/hr	71.21	71.21	71.21	71.21	71.21	71.21
#1 Crude Unit Fuel Gas Consumption	MMBtu/hr	274.9	274.9	274.9	274.9	274.9	274.9
#1 Crude Unit 250# Steam Consumption	Mlb/hr	28.58	28.58	28.58	28.58	28.58	28.58
#1 Crude Unit 40# Steam Consumption	Mlb/hr	13.15	13.15	13.15	13.15	13.15	13.15
#2 Crude Unit Fuel Gas Consumption	MMBtu/hr	216.1	216.1	216.1	216.1	216.1	216.1
#2 Crude Unit 250# Steam Consumption	Mlb/hr	58.25	58.25	58.25	58.25	58.25	58.25
Delayed Coker Natural Gas Consumption	MMBtu/hr	349.6	349.6	349.6	349.6	349.6	349.6
Delayed Coker Fuel Gas Consumption	MMBtu/hr	349.6	349.6	349.6	349.6	349.6	349.6
Delayed Coker 600# Steam Consumption	Mlb/hr	18.98	18.98	18.98	18.98	18.98	18.98
Delayed Coker 250# Steam Consumption	Mlb/hr	63.76	63.76	63.76	63.76	63.76	63.76
Delayed Coker 40# Steam Consumption	Mlb/hr	16.98	16.98	16.98	16.98	16.98	16.98
Coker Gas Plant Fuel Gas Consumption	MMBtu/hr	96	96	96	96	96	96
Coker Gas Plant 600# Steam Consumpt.	Mlb/hr	2.21	2.21	2.21	2.21	2.21	2.21

Aspen Utilities OnLine Optimizer profile editor

Performance Monitoring of Utilities Equipment (Tactical Users)

Aspen Utilities OnLine Optimizer can track the performance of utilities equipment to help optimize their cleaning and maintenance schedules and provide early indications of potential issues. For example, the efficiency of the boilers and gas turbines can be tracked to ensure optimal utilities operations.

Emissions Monitoring, Management and Trading (Tactical Users)

Most plants must operate within strictly defined environmental constraints. In these situations, the monitoring and regular reporting of emissions is a key business requirement, as this can constrain both production and the operation of the utility system. Aspen Utilities OnLine Optimizer can provide emissions prediction and reporting for CO₂ and SO_x, and can be integrated with predictive NO_x models. This not only helps to ensure emissions compliance, but can also be used to support trading of emission "credits."

Cost Accounting (Tactical Users)

In many companies, the allocation of utilities costs is arbitrary and may be very inaccurate. Aspen Utilities OnLine Optimizer can provide a more accurate assessment of utilities cost allocation. It can be configured to provide real-time utility costs a change in cost that would occur given a reduced or increased use of utilities. This information can be used to support managerial decision-making concerning utilities, such as the costs of increasing steam use to a particular unit to enhance throughput or the costs of steaming-out of equipment.

Investment Planning (Strategic Users)

Aspen Utilities OnLine Optimizer can be used to evaluate design options for new utilities equipment and modifications of existing equipment to identify the most beneficial investment. The interface is designed to enable the user to quickly configure and evaluate equipment and estimate the economic benefits compared to the current configuration. This provides the project engineer with greater confidence that any proposed changes will prove beneficial.



Aspen Utilities Features

Multi-period Plan Optimization

Combined with the nonlinear simulation capabilities based on Aspen Custom Modeler®, the core of Aspen Utilities OnLine Optimizer is a mixed-integer, linear programming (MILP) optimizer that provides recommendations for the optimal configuration and load for the utilities plant. This optimization drives the system to minimum-cost operation based on user-defined constraints, which can reflect multi-tier gas or electricity supply contracts, equipment availability or emission limits. The system can be used both offline, such as for “what-if” analysis, and online, to provide real-time recommendations to operations personnel. In online mode, the optimizer runs automatically at regular intervals. Actual steam, fuel, power and water flows are read from the site’s information management system, then validated and reconciled to establish the current operating point. Utility prices and equipment availabilities and constraints may also be entered into Aspen Utilities OnLine Optimizer for use during optimization. The optimization can be based on a single period (current operation) or for multiple periods, if planned production rates and operating modes for the production plants are entered into the system. The results of the optimization may be entered into the information management system, with customizable screens displaying both actual and optimized data and recommendations, helping operations personnel understand what action should be taken to move the utility system to a more optimal operating mode, as well as the value of doing so.

Software Integration

Aspen Utilities OnLine Optimizer has been designed to integrate with commonly used site information management systems and modeling software. This integration includes:

- Aspen OnLine®, to enable connectivity to most popular data historian software for historical data access
- Production planning software, such as Aspen PIMS™, Aspen Petroleum Schedule and Aspen SCM to automatically incorporate up-to-date production information
- Site data reconciliation and yield accounting systems, such as Aspen Operations Reconciliation and Accounting™, to provide an integrated mass and energy balance
- aspenONE Manufacturing Execution Systems, to support collaborative information sharing and workflow

AspenTech is a leading software supplier for optimizing asset performance. Our products thrive in complex, industrial environments where it is critical to optimize the asset design, operation and maintenance lifecycle. AspenTech uniquely combines decades of process modeling expertise with machine learning. Our purpose-built software platform automates knowledge work and builds sustainable competitive advantage by delivering high returns over the entire asset lifecycle. As a result, companies in capital-intensive industries can maximize uptime and push the limits of performance, running their assets faster, safer, longer and greener.

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