Honeywell and Energy Efficiency: Strategy Before Solutions

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Honeywell’s Energy Efficiency Strategy Classifies Many Types of Possible Improvements

Honeywell Uses a Consistent Methodology for Improving Energy Efficiency
In spite of the drop in energy prices during 2008, energy efficiency remains an important consideration for process manufacturers. Honeywell brings a well defined strategy and a rigorous energy methodology to its energy practice. ARC believes these are more important to end users than the actual products.

**Energy Challenges are Permanent**

The recent financial turbulence quickly made its way into the manufacturing sector and into the energy supply chains that keep this sector functioning. The resolution of the current economic crisis is unclear at this point. However process manufacturers must note the important ways in which their business environment has changed and begin their adaption to these new conditions. For energy-intensive process manufacturers, these new conditions must drive their enterprise energy strategies going forward.

Greater market volatility is a more important change than the decline in global demand. A huge increase in market volatility began in 2008 and persists to some degree. This volatility is felt in the market for products and for energy supplies. The price and availability of energy has bounced between extremes. The recent volatility in the cost of energy has erased the expectation of sustained high energy prices that existed a year ago. Futures markets indicate an expectation that energy and material prices will again rise. However the implied uncertainty of all future energy price estimates is substantially greater. How to operate in this environment?

**Energy Strategy for the Process Industries**

Process manufacturers are major users of energy. In the aggregate, the process industries represent a majority of industrial energy consumption. Many plants in the most energy intensive industries (Iron and Steel, Refining, Petrochemicals, Chemicals, and Pulp and Paper) have already taken steps to control their energy use. Within each industry, there are a small number of manufacturing operations that are the most energy intensive. These areas are generally the focus of energy management programs.

How should these programs work? There are three major components of a sound energy strategy:

- Energy accounting and visibility
- A strategy for developing and comparing alternatives
- A rigorous project execution methodology
Leading manufacturers will expand and refine each of these components over time. Energy accounting and visibility come first. As investments are made in energy measurement and visibility, manufacturers obtain more detailed and granular information about their energy consumption patterns. They divide their operations into progressively smaller fractions, and measure the energy in each. This reaches a practical limit as larger investments are required to identify smaller energy expenditures. But in general most process manufacturing operations have grown over time in ways that obscure the connection between particular operations and energy consumption. This is often the case because at times energy has been cheap, and because all types of process operations use the same types of energy resources (heating, cooling, electricity, and drive steam).

The strategies for choosing energy improvements and for project execution are critical and permanent parts of a sound energy plan. ARC finds that leading manufacturers have mature business processes for both. Leading manufacturers also make it a practice to periodically re-evaluate a large portfolio of potential energy saving investments. Actual projects are chosen from among this portfolio. Periodically new potential projects are added to and others are culled from this set. As capital and energy costs have become more volatile, this practice assures that limited resources are being focused on the most important improvements.

**Honeywell in Energy**

As a leading supplier of process plant, technology, automation and optimization solutions, Honeywell is well positioned to support process manufacturers in their energy initiatives. Through its huge automation business, Honeywell has accumulated deep expertise in the most energy-intensive vertical industries, as well as knowledge of the specific operating practices of many of its customers. Honeywell has developed a portfolio of products that can be used to achieve energy visibility and to optimize energy use. These products and services can extend across the full range of Honeywell capabilities. These include not only automation but also engi-
neering design services and solutions that require overall plant modeling and new plant energy equipment.

Improving energy efficiency requires products, services, and methodologies. While Honeywell has all these capabilities, it is methodologies that are the most important component for energy projects. Let’s pay specific attention to Honeywell’s energy methodology, and then look at the products and services they bring to bear.

**Honeywell Energy Methodology**

In working with its clients, Honeywell uses an overall strategy consisting of 3 major areas:

- Energy use
- Energy production
- Greenhouse gasses

These first two areas are mature while the third is newer and based on new regulations of greenhouse gasses and the availability of renewable energy sources. Honeywell sub-divides each of these areas into 2nd and 3rd level energy strategies (refer to the inside cover figure). This is where things get interesting. Examining these strategies, it is apparent that they represent a broad range of requirements. Some require measurement and data collection, some new automation, some optimization. Others (such as improved heat integration) may require changes not only in operations but in the manufacturing process. These are the types of efforts where Honeywell’s process design and simulation expertise can deliver value to a project without engaging yet another party.

**Project Methodology**

Honeywell also brings a specific methodology to energy projects (see inside cover Figure). This method is consistent with energy management best practices of manufacturers. Note that it divides energy programs into 3 classes: “quick hits”, operation/maintenance, and equipment/control. A quick hit (or “low hanging fruit” to use the more common buzzword) is most likely to be found when energy considerations have been neglected for some time and when operating conditions have changed substantially. Operation/maintenance programs require changes in practices, but not changes to the plant configuration or the manufacturing process. The third class of program requires some modification to the manufacturing process and/or new capital equipment for improved energy efficiency. This can be
done entirely by Honeywell in refining and some petrochemical complexes (utilizing both Honeywell Process Solutions and UOP capabilities), and with external partners for other chemical industries and pulp and paper. Again, in ARC’s view, some leading manufacturers maintain a set of potential energy projects as part of their intellectual property, for which they periodically re-evaluate the financial metrics. If they don’t exist, or do not holistically represent the entire operation, then following Honeywell’s energy methodology will serve to create and prioritize them.

Examples from Industry Leaders

Honeywell has partnered with many of its clients to deploy energy management projects of all types—from minor improvements in automation strategy to complete plant-wide energy projects. Here are several recent examples of such projects:

Greenhouse Gas Reduction for Saskferco

An example with the application of advanced control using Profit Suite is the Saskferco Products nitric acid plant in Canada. The issue was meeting the tight requirements for emission of greenhouse gasses at the back end of the plant, especially NOx and methane. The undesired gasses were burned in a combustor and then reduced across a catalyst to produce Nitrogen, CO2 and water.

The undesirable gasses could easily be chemically reduced and the emission standards be met, but the easiest way to do this was to over-burn the stream. This consumed more energy and also consumed some of the de-
sired products. The effect of the “easy” compliance was to reduce the overall plant production capacity in order to assure compliance with environmental regulation.

The Honeywell Profit Controller applications enabled the nitric acid plant to produce at capacity while maintaining control of emissions and at the same time reducing the energy consumed in the combustor. The methane emissions were reduced by 25%, and fuel consumption was decreased by 5%, while plant production increased by 3%, yet with greater stability. The project achieved a net decrease in energy consumption and an increase in plant capacity, while maintaining environmental compliance. By all accounts this was a most valuable improvement in plant operations.

**Multi-Unit Optimization at YNCC**

Yeochun NCC Company Ltd. (YNCC) in Yeosu, South Korea is an example illustrating the value of applying both advanced control and optimization to an ethylene complex. YNCC’s three large naphtha cracking units had all been expanded. Each unit had a different design and a different DCS. The increasing variability of feedstocks required more flexible operations and automation. Different parts of the plant represented production bottlenecks, depending on the feedstock and the unit. YNCC needed an integrated solution of optimization and multivariable control to maintain optimal conditions during changing operations.

YNCC’s objective was to maximize on-spec production across 7 furnaces while processing feedstocks of greatly varying quality. There were numerous operating constraints including the capacity of furnaces, refrigeration compressors, and fractionators. The objective was to be met while minimizing energy consumption.

Honeywell designed a solution that consisted of 17 Profit Controller applications on the various process units. A single Profit Optimizer application provided yield predictions and man-
aged the controller gains. Since the cracking process is highly non-linear, a separate process model developed real-time estimates of conversion and coking rates as well as metal temperatures. These estimates were used by the Profit Controllers. Honeywell also provided OPC connectivity for integration of the other plant automation systems.

The project was completed in under a year and YNCC measured the major results as follows:

- 3% increase in feed rate
- 3.2% decrease in energy consumption per unit of product

The energy savings came from reduced steam to fractionation columns and from reduced loading of refrigeration circuits. Besides these benefits, the plant has gained new flexibility in terms of its operations. The plant model and optimizer allow much more consistent operation of the plant and enables variations in feedstock quality to be handled far more easily. Having chosen Honeywell to optimize their plant because of their “technical superiority and detailed knowledge of various process control solutions”, YNCC’s plant manager comments that he expects his company to “strengthen its competitiveness in the ethylene business through its APC alliance with Honeywell”.

**Huge Material and Energy Savings at Catalyst Paper**

With 2008 sales of a $1.8B (CAD), Catalyst Paper is one of the largest mechanical paper producers in western North America. Its giant Elk Falls Division is located in British Columbia near the city of Campbell River. Catalyst products are used in newspapers, inserts, telephone and other directories, retail promotion, and packaging.

Catalyst uses the thermo-mechanical pulping (TMP) process. This often requires the mixing of mechanical and kraft pulps in order to meet product specifications. In such mixing, the kraft pulp is far more expensive, so the economic objective is to minimize the amount of kraft pulp added to the finished product.
In order to do this, the highly interactive and dynamic TMP operation needs to be stabilized. This produces pulp with a more uniform fiber length and “freeness”. Freeness is the readiness with which water drains through the pulp, as it must do during the paper-making process.

Honeywell’s Profit Suite for TMP solution uses the Profit Controller to stabilize the various refiner lines which produce the pulp. TMP refiners have two distinct sets of dynamic responses, so two controllers are used. One Profit Controller provides the control required to control the fast dynamics of each refiner line. A second controller models the remaining process dynamics for control of the final pulp quality. The controllers manage the interactions of refiner feed rates, plate positions, motor loads, consistency and dilution to stabilize the operation and to minimize pulp quality variability and power consumption.

The benefits of advanced control at Catalyst were measured as:

- Freeness variability reduced by 41%
- Fiber length variability reduced by 21%
- Kraft pulp fraction reduced from 30% to less than 2%
- Refiner energy consumption reduced by 2%

The largest savings came from improved quality of the TMP pulp, which dramatically reduced the amount of kraft pulp needed by Catalyst’s newsprint machine. This alone saved Catalyst about $3M per year. In addition the refiner energy savings are worth almost $1M per year. Driving this much cost out of their operation has proven timely for Catalyst in today’s stressed paper markets.

### Heat Recovery Projects Estimated to Save $4.5 MM per year

A 110,000 barrels per day refinery in North America had an older 1970’s vintage diesel hydro treating unit which had a combined feed exchanger, charge heater, one reactor, and a stripper. To help this refinery reach their desired level of energy efficiency, it was determined that capital cost modifications were required to increase heat recovery within and across these process units.

UOP, a Honeywell Company has 95 years experience in refining and has thousands of patents to their credit. Their
process consultants use a methodology which not only considers value and cost of improved heat recovery but also the impact on operating flexibility, especially with respect to startup, shutdown, maintenance and control. When UOP process consultants studied this refinery, they recommended adding 4 heat exchangers to recover more heat from the process and also generate steam. This scheme reduced the product rundown temperature by 107°C and the temperature to the products condenser by 150°C which reduced the amount of heat lost in the fin fans. The capital cost for this project was $3 million but resulted in energy savings of $4.5 million per year.

Projects to improve process unit heat recovery can typically improve energy efficiency by 4-8%. The CO₂ reduction for a typical 100,000 BPSD refinery that results from these projects is 48 to 96 M T/year.

Utility Plant Optimization at Samsung Fine Chemicals

Samsung Fine Chemicals in Ulsan, Korea has a powerhouse that is very typical for chemical plants. There are 3 oil-fired boilers, 3 back-pressure turbines, a condensing turbine, 3 levels of process steam, and an electric tie-line to the Korean grid.

The company wanted to optimize this operation in order to improve their energy efficiency and reduce emissions. Like any powerhouse, large or small, this requires a number of applications for performance measurement, advanced control, and optimization. For Samsung, Honeywell deployed applications from its Advanced Energy Solutions portfolio, including:

- PPM - Plant Performance Measurement for boilers and turbines
- ACC – Advanced Combustion Control for boilers
- MPC – Master Pressure Control for steam systems and headers
- ELA-B – Economic Load Allocation for Boilers
- ELA-T – Economic Load Allocation for Turbines
- PPO – Plant Performance Optimization

While the configuration of each utility plant is different, all utility plants produce the same products (electricity and steam). What are the potential savings from these advanced applications? Samsung Fine Chemicals meas-
ured their utility cost savings at just over $1M per year. Most of the savings came from improved efficiency in steam generation, and about 15% came from larger in-house generation of electricity due to optimization. No credit was given for the more stable operation of the entire utilities operation that comes from a more integrated approach to controlling the boilers and the various steam headers. Like process plants, utility plants can generate substantial savings when advanced control and optimization are effectively applied to typical operations.

**Recommendations**

Honeywell energy products and services can bring significant benefits to manufacturers. There are three differentiating factors that ARC believes should be weighed by potential customers:

First is the depth of Honeywell’s process industry and energy efficiency knowledge. Both of these are important for automation and optimization projects. In order to realize the potential savings, operating practices need to change. The supplier must be familiar enough with the operation to appreciate the range of feasible solutions and to make wise trade-offs between the value of greater energy efficiency and other business values such as process stability, fault tolerance, and ease of operation.

Second is the argument for a single source supplier. Honeywell (with business units like UOP in refining) has process design capabilities that are well above the norm for an automation supplier. If this discipline is needed for a project, keeping all the required work under a single supplier and contract may well speed up and simplify the project.

The third differentiator is the ability to service energy applications in an ongoing basis. This is critical for energy programs. They must deliver sustained benefits in order to provide economic value. Of course this capability will be strongest when the manufacturer already uses Honeywell automation systems, but the ability to support energy applications is a critical success factor, regardless of what types of automation systems are managing the process.
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Acronym Reference: For a complete list of industry acronyms, refer to our web page at www.arcweb.com/C13/IndustryTerms/

API   Application Program Interface
BMS   Burner Management System
CAS   Collaborative Automation System
CMM   Collaborative Manufacturing Management
CPM   Collaborative Production Management
CRM   Customer Relationship Management
DCS   Distributed Control System
DOM   Design, Operate, Maintain
EAM   Enterprise Asset Management
EPC   Engineer-Procure-Construct Firm
HMI   Human Machine Interface
I-MAC Integrated Main Automation Contractor
IT    Information Technology
MAC   Main Automation Contractor
OpX   Operational Excellence
PAS   Process Automation System
PLC   Programmable Logic Controller
PLM   Product Lifecycle Management
RFID  Radio Frequency Identification
ROA   Return on Assets
RTLS  Real-time Location System Management
SCM   Supply Chain Management
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