Unlocking potential

Industrial energy saving – an untapped opportunity

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The International Energy Agency estimates that the world's manufacturing industries could reduce their energy consumption by 600 to 900 million metric tons of oil equivalent a year. This represents a potential reduction in total annual global CO_2 emissions of between 7 and 12 percent. Why is this opportunity still being missed? After all, it could be a relatively "quick win" for many companies and also deliver considerable cost savings.

For energy intensive industries, greater energy efficiency is vital to improving competitiveness, security of energy supply and environmental protection.

Given these strong action imperatives, it is surprising that many energy savings opportunities remain untapped. They can provide "quick wins" for business, often with short payback times and long-term benefits.

In many cases, organizations are unable to respond to opportunities due to lack of time or personnel to implement the savings projects, difficulty in raising finance or the perception that implementing such projects will compromise customer service or product quality.

For many organizations, energy is one of the top three production costs.

ABB's Industrial Energy Efficiency program is designed to address these factors, securing the management commitment needed to unlock the required resources in a structured and long-term approach to continuous improvement 1.

Starting with a structured process to identify savings, ABB develops an Energy Management Master Plan which details all that is needed for the successful delivery of improvement projects. This plan is then carried through as part of an energy performance contract, with savings shared between the customer and ABB over the life of the contract.

Energy audits gathering dust

The most troubling fact is that many of the recommendations made in energy audits are never carried out.

Of the 844 variable speed drive energy saving assessments undertaken by ABB in the United Kingdown. from June 2004 to October 2007, only about 20 percent of the improvements identified were implemented. These missed opportunities represent a potential annual energy saving of 350,000 megawatt-hours and an emissions reduction equivalent of 154,000 metric tons of CO_2. What is more, the average payback period for these investments was just over 12 months.

A recent report by the International Energy Agency estimated that the opportunity for energy efficiency in the global manufacturing industry alone is equivalent to 600 to 900 million tons of oil [1]. The corresponding emissions reduction potential is 1.9 to 3.2 metric gigatons of CO_2 a year, about 7 to 12 percent of today's global emissions of the gas.

These savings contribute to future revenues by enhancing a company's environmental brand, improving profitability and reducing its vulnerability to future energy shortages or price increases.

From plant room to boardroom

One part of the problem is that too many energy efficiency initiatives are driven from the plant room rather than the boardroom. In these cases investment opportunities are often tactical, fragmented and perceived as small and unambitious. They fail to catch the attention of the people responsible for creating future business value. Instead, capital flows to higher profile strategic investments for expanding capacity, especially when market prices are high. When prices are low, managers opt for no investment at all rather than making what they see as marginal efficiency improvements. Under these conditions, energy efficiency investments often fail to attract managerial commitment and time at a high enough level [2].

Delivering the full potential of energy efficiency improvements requires energy to come out of the plant room and secure a seat in the boardroom. This is the key step to achieving management commitment to a structured and long-term approach to continuous energy efficiency improvement.

ABB assessments regularly identify savings opportunities of 5 to 20 percent of a site's utility consumption.

Delivering sustainable improvements

How can a company organize itself for sustainable energy efficiency improvement? What is needed is clear leadership and an empowered, well-motivated and competent workforce. Energy savings targets should be clearly communicated, ambitious and achievable. The organization must allocate sufficient resources to deliver the improvements and to deploy energy efficient technologies effectively.

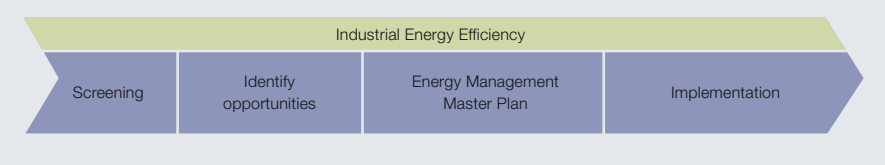
Fundamentally this calls for leadership commitment in five key areas: setting policy and direction, establishing an effective energy management organization, identifying and selecting energy saving improvement projects, action-planning for targeted improvements, and implementing an efficient management control and reporting system.

Setting policy and direction

A clear and widely communicated energy strategy is a way of coordinating such activities, either within a single site or across a multi-site enterprise. 2 describes the components of an energy strategy in varying stages of maturity.

For example, ABB recently helped a division of a major metals producer develop a strategy to meet corporate energy efficiency objectives. The corporate objective was ambitious and required the divisional managers to address the issue strategically rather than tactically.

1 ABB Industrial Energy Efficiency program



In this case, the energy policy sets out the guiding principles for managing energy across the organization, in particular the focus on continuous improvement in energy consumption per unit of production (specific energy). The policy also provides guidance for considering investments in energy efficiency, including life cycle energy costing. It also sets out individual responsibilities for energy conservation in the workplace.

2 Evolution of energy strategy from tactical to strategic

	Policy	Structure	Resources
Strategic	Formal energy policy and implementation plan; commitment and active involvement of top management	Energy management fully integrated into management structure and systems from board level down	Full-time staff and budget resources related to energy spent at recommended levels
↑	Energy policy set and reviewed by middle management	A management structure exists but there is no direct reporting to top management	Staff and budget resources not linked to energy spent
Tactical	Technical staff have developed their own guidelines	Informal and unplanned	Informal allocation of staff time and no specific energy budget

The divisional objectives were clearly articulated, ambitious and achievable. The corporate targets were devolved to individual sites, taking into account the particular conditions of each and focusing on those sites or operations where the maximum energy savings or emissions reductions would be obtained. The strategy included a description of the mechanism for measuring and reporting energy efficiency performance and how the performance indicators would link between corporate, site and project levels.

The ABB Industrial Energy Efficiency program is a structured methodology with proven tools to identify and deliver real energy savings to process plant operators.

The strategy also defined the organizational structures needed to deliver the desired improvement. This included the mechanism for managing and monitoring the direction of the improvement program, reviewing performance and adjusting targets, as appropriate. In each plant clear responsibilities for energy management, particularly within the production units that consume energy, were recommended. The enabling works and budget requirements necessary to deliver the defined improvements were also detailed. After all, the strategy can only be delivered if adequate resources are available.

Establishing an effective energy management organization

For many organizations, energy is one of the top three production costs, along with labor and raw materials. Yet all too often it attracts little management attention. What interest there is, is usually focused on procurement policy or on energy plant operations (steam raising and other plant room or power house activities).

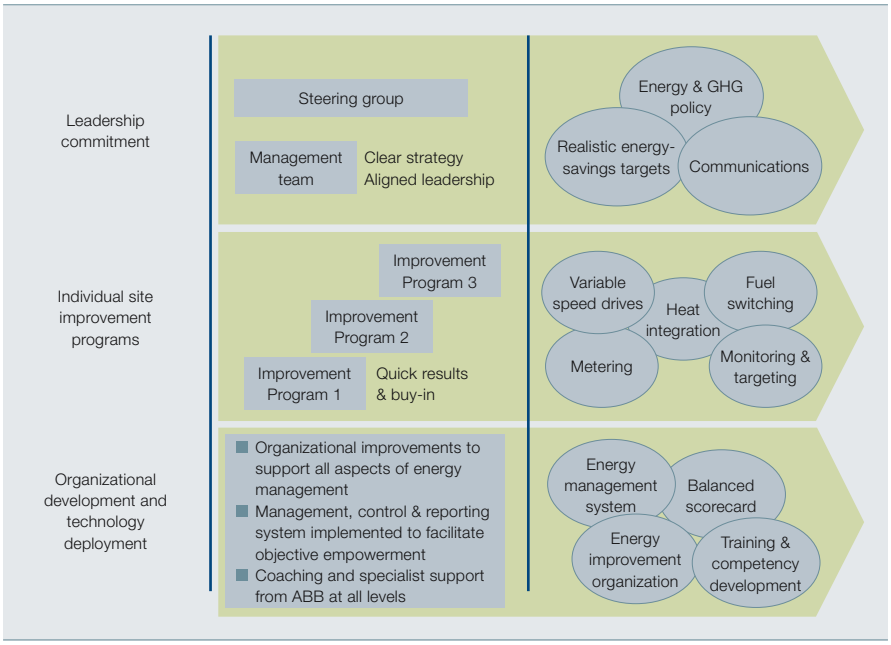
Effective energy management requires careful oversight of the full energy value chain from procurement and generation, through distribution to point of use in the production process. 3 shows the structure of an effective energy efficiency improvement program with governance activities, organizational development and site-based improvements.

An energy steering group or task force, with members drawn from production units as well as utility operations, should be set up to oversee the energy efficiency program. This group will have unambiguous corporate sponsorship.

Within the plant, energy efficiency experts or champions should be trained in energy saving techniques, from auditing to data analysis. Their role is to coach and support individual production units or departments and help them make the needed improvements in energy efficiency. Where established initiatives exist, for example in continuous improvement processes, energy efficiency can be co-opted into the existing structures.

Efforts should be coordinated across sites in order to share knowledge and promote good practices. Economies of scale may be realized where multi-site cooperation provides a bigger benefit than individual tactical interventions. Networks or communities of practice

3 Leadership, organizational development and individual site improvements in the ABB Industrial Energy Efficiency program



provide a valuable means of sharing good practices, benchmarking performance and piloting specific improvement opportunities.

Identifying and selecting energy saving projects

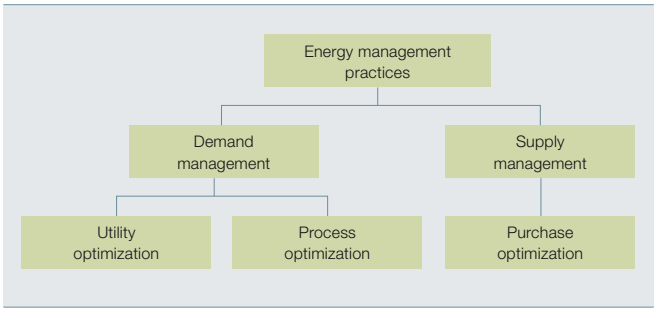
The starting point of the ABB Industrial Energy Efficiency program is the "Identify Opportunities" phase. This process identifies existing energy usage and highlights the potential areas for savings. It not only shows the environmental benefits, it also reveals the potential cost savings and the likely payback period.

A structured process is essential in order to identify and evaluate energy efficiency improvement projects. It should start with a high-level overview of energy management practices, demand management and supply management. This approach will focus effort on those areas that deliver the most value to the business. Expert intervention at this stage can accelerate the identification of savings opportunities and provide an unbiased appraisal of individual projects. It is important that decisions are based on data rather than opinion and address the requirements of the whole energy value chain 4.

In particular, process optimization is an often overlooked area where energy inefficiencies can be generated from poor plant reliability, excessive variability on product grade or production rate, and inherent inefficiencies in steady state production.

Benchmarking energy consumption at plant level or for individual unit operation can help to quantify savings opportunities and prioritize efforts in those areas that will offer the greatest returns. Such benchmarking can be carried out against nameplate performance (ie, what the plant was designed to achieve), best achieved performance (for a particular product grade or production volume), best available technique (what the world's best producers are able to achieve) or minimum practical energy (what is the minimum energy consumption that should be required to make the product?).

4 "Identify Opportunities" considers all aspects of energy supply and demand on the plant



Improvement projects should be identified and ranked according to their expected benefits (energy saving, improved reliability, reduced maintenance) and cost or difficulty of implementation (project costs, implementation time, risk to production, technology risks). At this stage a payback criterion can be applied so that only projects paying back within a particular timescale are considered.

The most troubling fact is that many of the recommendations made in energy audits are never carried out.

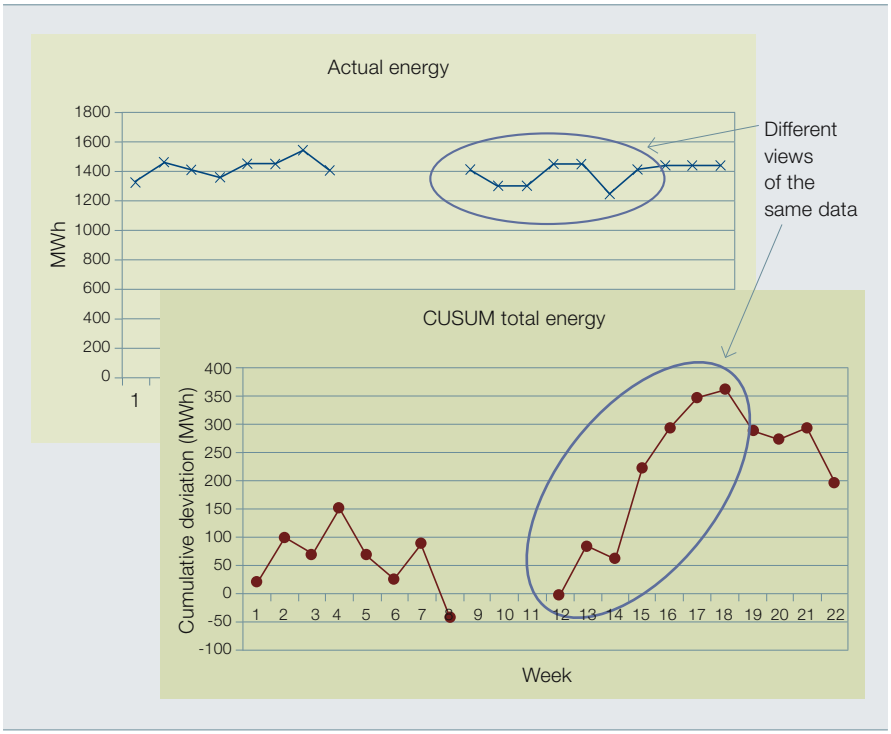
Assessments on pulp and paper mills, primary and secondary metals processing, chemical process plants and pharmaceutical facilities regularly identify savings opportunities of 5 to 20 percent of the site utility consumption. For a summary of some of these, see *ABB Review* 4/2007.

Action-planning for targeted improvements

A targeted improvement plan is essential to determine resource requirements and provide a mechanism for reviewing progress towards the energy strategy objectives. This plan will include detailed execution strategies for the selected improvement projects.

In the ABB Industrial Energy Efficiency program, this improvement plan is documented in the Energy Management Master Plan. For an individual site, the targeted improvement plan defines the local energy management structures, the competency and train-

5 Simple statistical techniques such as CUSUM (cumulative sum) detect trends and can be used to trigger corrective actions or monitor improvements



ing requirements for local energy champions and any required awareness training for the workforce at large. It also documents any required metering and measurement upgrades to support the improvement plan.

Specific improvement projects will have detailed execution strategies to define the scope of the project, the baseline performance (before implementation) and the expected benefits after implementation (including the mechanism for verification). They will also set out what activities are to be delivered, by whom, when and at what cost. If the improvements are to be implemented as part of an energy performance contract, the mechanisms for sharing savings will be defined at this stage.

Energy management control and reporting system

It is highly important that successes are visible and communicated widely throughout the organization. Energy efficiency improvements are a valuable tool for engaging a wide community of stakeholders, including employees and customers. It may be necessary to install meters to measure improvements – these should be specified as part of the implementation plan.

An energy management system can be used to collect and analyze data as well as provide the real-time performance information that allows operators to respond quickly to changes in conditions. Many energy management systems report monthly, perhaps based on billing data. However, this is too infrequent to be useful as it is difficult to connect perceived anomalies with actual plant conditions when looking back over three to four weeks. Any system used should be flexible enough to allow analysis based on product grade, batch, shift or specific time period.

Energy savings contribute to future revenues by enhancing a company's environmental brand, improving profitability and reducing its vulnerability to future energy shortages or price increases.

Statistical techniques such as CUSUM (cumulative sum), are useful for detecting small changes that appear insignificant in absolute data but accumulate over time [5].

Site energy champions will be trained in these techniques and supported with tools to collect and analyze data from the major energy consuming processes on the plant. If site resources are not readily available, then it is possible for energy data to be analyzed remotely.

Value from energy savings – delivered!

The ABB Industrial Energy Efficiency program is a structured methodology with proven tools to identify and deliver real energy savings to process plant operators. Energy efficiency and emissions reductions are recognized as drivers of value, supporting profitable and sustainable growth. Ambitious improvement targets can be set, together with the required management commitment and resource allocation to deliver. By engaging with ABB, plant owners gain the benefits of a greener brand and reduced energy consumption while continuing to maintain their primary focus on their customers and core business.

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References

[1] International Energy Agency. Tracking Industrial Energy Efficiency and CO_2 Emissions, 2007.

[2] McKinsey Global Institute. Curbing Global Energy Demand Growth: The Energy Productivity Opportunity, 2007.