





The frugal manufacturer

Part 1, Using energy sparingly

CHRISTOPHER WATTS – As the world leaves a long era of energy abundance and enters an era of constraint, many complex challenges face government, business and society. Among these is resolving the conflict between raising living standards in developing regions by continuing to expand industrial production, and lessening the negative environmental impacts of industrial manufacturing activities across the world. One of the approaches to addressing this challenge is to improve energy efficiency in the core of industry's production processes.

In January-February 2011, the Economist Intelligence Unit surveyed 348 senior executives, mostly in North America, Asia-Pacific, and Western Europe, on their plans to invest in improving energy efficiency in production processes, the issues they face as they consider these investments, and the factors that are likely to influence industrial energy efficiency in the coming years. This is the first of three articles to appear in *ABB Review* based on the results of that survey, as well as on a program of in-depth interviews and desk research on the topic of industrial energy efficiency. In addition, the study is based on a separate comprehensive analysis of the worldwide energy consumption patterns of seven energy-intensive industries, carried out by the energy information and consulting firm, Enerdata.

More than two-thirds of respondents to the survey are executives at director level. Respondents are most likely to have responsibility for strategy and business development, finance, general management, and operations and production. Around 58 percent are from businesses with \$500 million or more in global annual revenues. The survey focuses entirely on the manufacturing and power sectors, with manufacturing having the strongest representation.

Title Picture

The Palmachim water desalination/purification plant. The desalination process is energy intensive. ABB has supplied energy-efficient drives for this installation. ABB's contribution to water supplies will be discussed at length in *ABB Review* 4/2011.



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In addition to the online survey, the Economist Intelligence Unit conducted 15 in-depth interviews with senior business executives, policy makers, and other experts in industrial energy efficiency. The insights from these interviews appear in all three articles.

Industry accounts for around one-third of the world's final energy demand; around 60 percent of which is from developing countries. Industry's total energy use continues to grow as a result of expanding production volumes, a trend that is likely to continue in the coming decades as living standards rise in developing regions. Meanwhile, energy efficiency leaves much room for improvement in many parts of the world and in many industries.

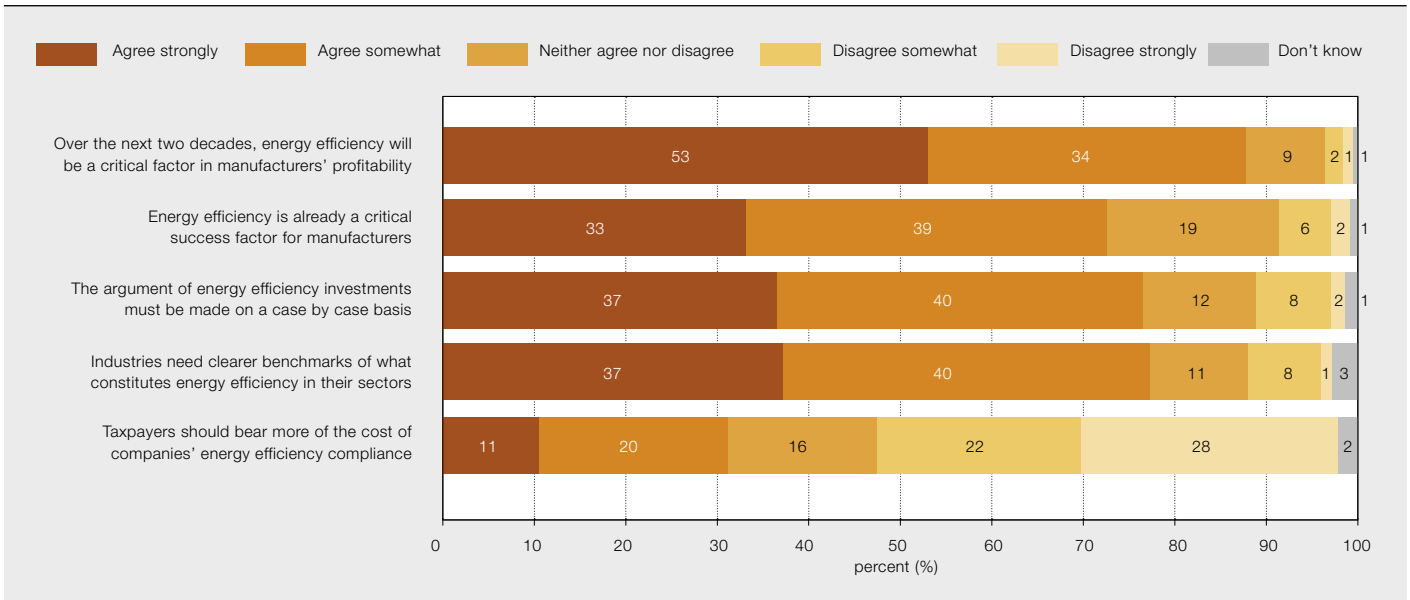
Against this background, businesses are facing a future of constraints, including restricted access to energy and curbs on carbon dioxide emissions. As such, improving industrial energy efficiency is no longer optional but a clear pre-requisite for long-term financial growth. Those companies that do not address energy efficiency are likely to find that their long-term financial performance will be negatively affected. Meanwhile, those firms

that seek continuous improvement in energy efficiency are likely to steal a march over competitors.

In all, 88 percent of manufacturers say industrial energy efficiency will be a critical success factor for their business in the coming two decades. The reasons are largely related to cost competitiveness, especially for companies in energy-intensive manufacturing sectors. Above all, companies look for financial returns when investing in energy efficiency. Sub-optimal efficiency practices are widespread across industry and the potential for saving through improvement in energy efficiency is large. In making the financial and business case for investments in efficiency, the price of energy is one of the biggest factors, cited by 59 percent of survey respondents.

"In our Indian operations, around 50 to 55 percent of the direct costs to convert raw materials into finished goods is energy," says Satish Agarwal, Chief of Corporate Manufacturing at Apollo Tyres, based in Gurgaon in northern India. That's one of the reasons why, in the past three years or so, Apollo Tyres has invested some \$12 million in energy effi-

2 Perception of the need for energy efficiency in industry (survey responses, 348 respondents)



ciency improvements to its plants, including the installation of heat exchange devices for its boilers, flash steam systems to capture and use process heat, and insulation materials to reduce heat loss. These latest investments are part of an ongoing initiative that has so far led to a 40 percent reduction in the firm's energy intensity.

Against a background of intensifying competition, rising energy prices, and closer regulatory scrutiny, Agarwal is not alone in understanding the extent to which energy efficiency is a critical success factor in industry. Indeed, among manufacturing sector managers that responded to the survey, 72 percent "agree strongly" or "agree somewhat" that energy efficiency is a critical success factor for manufacturers today. Looking forward over the next two decades, 88 percent of respondents expect energy efficiency to be a critical factor in manufacturers' profitability.

Variations in these results highlight the diverse backgrounds of companies represented in the survey. For example, among companies in particularly energy-intensive manufacturing segments, such as iron and steel, chemicals and petrochemicals, cement, pulp and paper, and aluminum, 82 percent of executives agree that industrial energy efficiency is a critical factor in their profitability today → 1 (versus 67 percent in less energy-intensive activities). This apparent sharper awareness of the role of

energy efficiency perhaps reflects characteristics of energy-intensive segments such as high energy costs as a proportion of total costs; recent energy price volatility and price increases; and relatively thin profit margins → 2.

Seen from a regional viewpoint, executives in developing countries are more likely to agree that energy efficiency is a critical success factor for manufacturers (82 percent) than in developed countries (67 percent). "We believe that, in developing countries, one of the reasons they are more aware of energy efficiency is that energy is a scarce resource," says Pradeep Monga, Director of Energy and Climate Change at the United Nations Industrial Development Organization (UNIDO). Indeed, the survey findings

appear to confirm a greater appreciation of energy efficiency in those economies that use most energy → 3 and → 4.

Why are improvements in energy efficiency critical for long-term profitability? For a start, because of the significant cost savings they bring. Doug May, Vice President of Energy and Climate Change at The Dow Chemical Company in the US, says that his firm's energy efficiency efforts since 1994 have contributed total cost savings of some \$9.4 billion. "Ener-

gy efficiency is a gift that keeps on giving," he says.

The "co-benefits" of improving efficiency

Cost savings are one thing. In fact, behind headline figures such as Dow's, there are further advantages of improving industrial energy efficiency that contribute to long-term financial performance. For example, using less energy in production processes means companies can face relatively higher energy prices without feeling the pinch – a clear competitive advantage. "[Improving] en-

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ergy productivity is one of the best risk management approaches that a manufacturing company can undertake in the current market place," comments Neal Elliott, Associate Director for Research at the American Council for an Energy-Efficient Economy (ACEEE). Luis Fariás, Vice President of Energy and Climate Change at Mexican cement producer CEMEX, agrees: "Energy is a large cost component in cement," he says. "So energy efficiency gives us more predictability in our future earnings and cash flows."

Leading businesses are scrutinizing the energy efficiency of their manufacturing operations.

3 Emerging markets in the energy spotlight

Over the past several decades, developed countries have seen an ongoing structural shift in their economies – from manufacturing to services. These days, the services sector in most developed economies is significantly larger than the manufacturing sector, and is growing faster, too. Of course, the services sector uses significantly less energy per unit of economic output than the manufacturing sector – so when it comes to energy intensity, developed economies are becoming less energy-intensive.

Today, developing countries dominate global industrial energy use, for a number of reasons.

First, the economies in developing countries have shifted from agriculture to manufacturing in recent years. Second, recent economic development has increased demand for infrastructure and buildings, which in turn require large amounts of cement, steel and other energy-intensive materials. And third, developing countries comprise about 80 percent of the world's population.

These basic trends are reflected in economic growth and industrial energy demand statistics from the International Energy Agency (IEA) laid out in the table below and illustrated in → 4.

	GDP growth 1990–2008 (percent)	Industrial energy usage 1990–2008 (percent)
UK	54	-7
USA	66	4
India	205	63
China	485	172

Besides advantages such as these, efforts to improve the energy efficiency of industrial production processes are often associated with further benefits. These include lower plant downtime and longer maintenance cycles; improved productivity; better product quality; compliance with building and environmental codes; employee health and safety; or benefits around research and innovation. These so-called “co-benefits” are not to be sniffed at, according to Elliott: “We typically see non-energy savings benefits being three to five times the value of energy savings,” he says.

Despite an appreciation of the critical contribution of energy efficiency to long-term profitability among industry executives, relatively low energy efficiency appears to remain the norm in production processes across large sections of industry. In some cases, this is down to inefficient operation of plant and equipment – in its simplest form, leaving motors running continuously, whether they are in use or not. In other cases, it is down to inefficient equipment. Terry McCallion, Director of Energy Efficiency and Climate Change at the European Bank for Reconstruction and Development (EBRD) in London, puts it simply: “In some areas of industry, it seems like pumps and motors have got two modes: On, and Off.” Industry experts estimate around two-thirds of global industrial electricity is consumed by electric motors. And yet, market penetration of medium-voltage variable-speed drives –

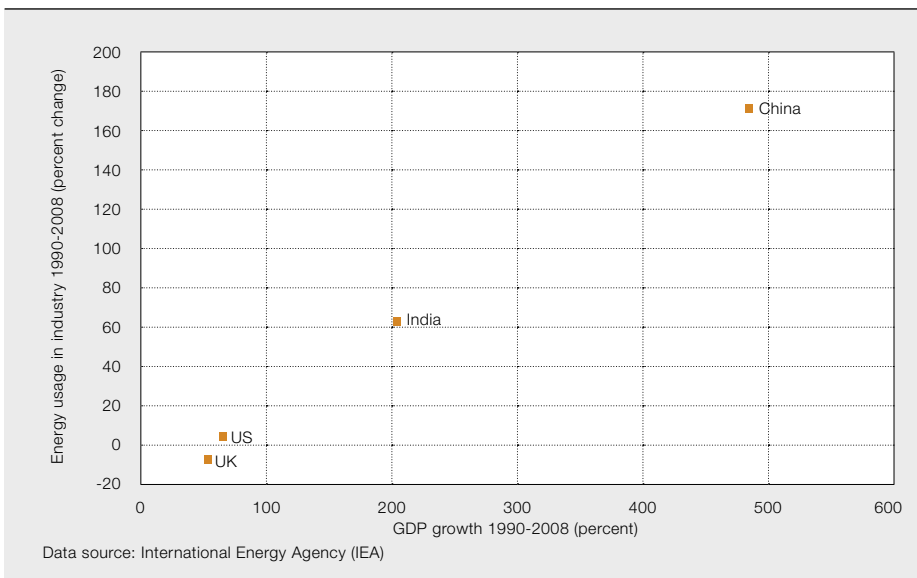
which improve the efficiency of industrial motors by as much as 40 to 60 percent by regulating their speed – was as low as 13 percent in Europe in 2009, according to estimates from market research firm Frost & Sullivan.

It's little wonder, therefore, that the scope for energy savings in industry is so great. According to analysis from UNIDO, the potential for energy savings in production processes is as high as 50 percent of current demand in some industry sectors → 5. In all, realizing these potential energy efficiencies would lead to estimated cost savings of \$230 to 260 billion a year. That is equivalent to cutting total production costs by around 3 to 4 percent, according to UNIDO.

The search for financial return

Not surprisingly, given the potential for energy-related cost savings, executives interviewed for the report mostly say first and foremost that they are looking for a demonstrable financial return on any investment they make in improving energy efficiency. Typically, industry executives measure this return on the basis of simple payback period (investment cost divided by annual savings), or internal rate of return. For example, in March 2011, Indian cement producer UltraTech Cement placed an order for \$90 million-worth of waste heat recovery systems; L. Rajasekar, Executive President at the firm, expects these will have fully covered their costs after some six to eight years. In many cases, though, the pay-

4 Consumption of industrial energy grows more strongly in emerging economies than it does in mature economies.



back period on investments in energy efficiency is as short as six months.

As industry executives weigh up the financial case for investments in improving energy efficiency, several significant external factors come into play. One is the price of energy. Experts reckon that the higher the proportion of energy costs in total production costs, the more financially compelling the investments in improving energy efficiency can be. When asked to name the main factors influencing decisions about efficiency investments, 59 percent of respondents cite the price of energy. Among energy-inten-

is an essential and a large part of their costs, managing energy becomes amazingly important for their competitiveness.” Price volatility and long-term price trends, as much as current prices, are a factor in industrial companies’ investment considerations. “The immediate price spikes cause concern,” says Steve Schultz, Global Manager of Corporate Energy at US industrial and consumer goods maker 3M. “But the fact that the price trend is upward, and has been upward, helps solidify some of that action.”

Besides energy prices, other factors that survey respondents say influence their decisions to invest in energy efficiency improvements include national energy legislation, cited by 27 percent of executives. Some of these policies focus directly or indirectly on in-

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dividual manufacturers, the figure is 67 percent; among less energy-intensive manufacturers, it’s 57 percent → 6.

The investments made by Apollo Tyres are a case in point. As Ajay Mathur, Director General of the Bureau of Energy Efficiency (BEE), a Government of India body, further points out: “For industry in India, the delivered cost of energy is very high. And as far as India is concerned, the energy pressures will only increase. So for those industries for which energy

usage is a significant part of their costs, managing energy becomes amazingly important for their competitiveness.” Price volatility and long-term price trends, as much as current prices, are a factor in industrial companies’ investment considerations. “The immediate price spikes cause concern,” says Steve Schultz, Global Manager of Corporate Energy at US industrial and consumer goods maker 3M. “But the fact that the price trend is upward, and has been upward, helps solidify some of that action.” Besides energy prices, other factors that survey respondents say influence their decisions to invest in energy efficiency improvements include national energy legislation, cited by 27 percent of executives. Some of these policies focus directly or indirectly on industrial energy use. And another factor that influences decisions about investments in energy efficiency is a wish to improve the company’s image, cited by 26 percent of executives. This factor appears to be increasingly important as sustainability issues rise in prominence. Many of these factors vary from continent to continent; from region to region; and from plant to plant – explaining why 76 percent of survey respondents say investments in improving energy efficiency must be judged on a case-by-case ba-

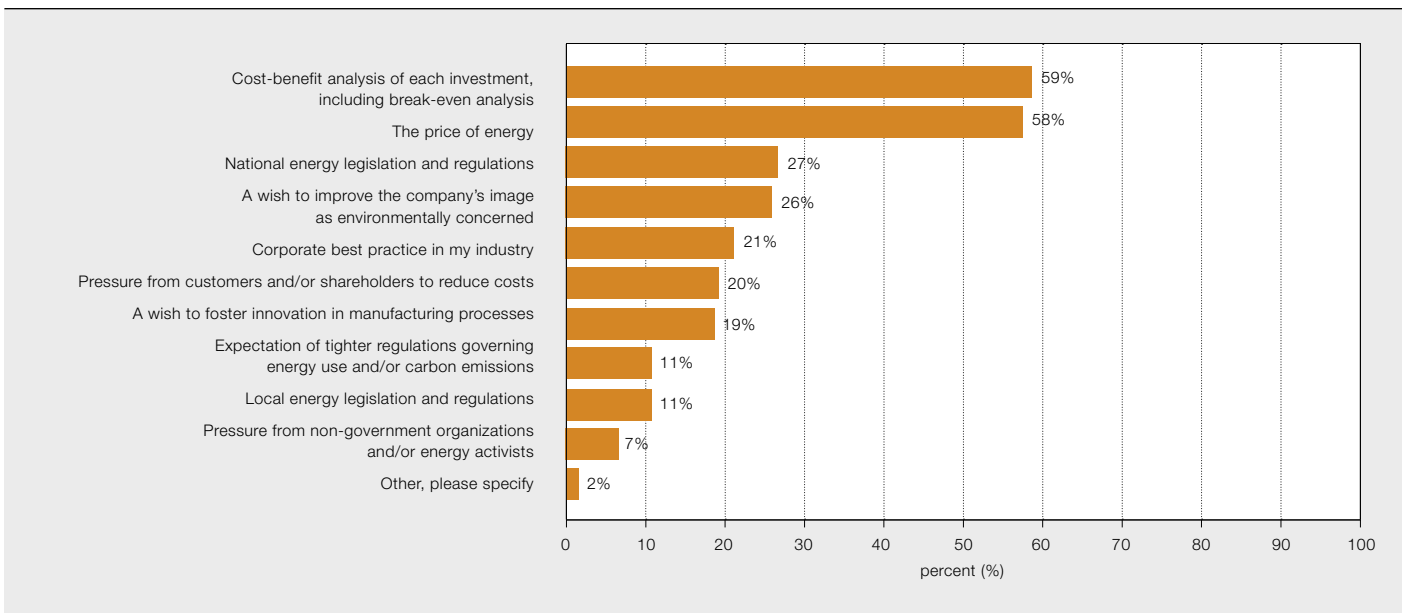
5 Where are the potential savings?

In a November 2010 working paper, Global Energy Efficiency Benchmarking – An Energy Policy Tool, the United Nations Industrial Development Organization (UNIDO) estimates the current energy saving potential in manufacturing industry and petroleum refineries to be some 23 to 26 percent of current total industrial energy demand worldwide.

While the energy efficiency potential in developed countries amounts to approximately 15 to 20 percent, the potential in developing countries is higher at around 30 to 35 percent. Industrialized countries have the potential to save \$65 billion or more in energy costs, according to the report. Developing countries have the potential to save \$165 billion or more.

Worldwide, the largest potential savings in absolute terms are in the energy-intensive sectors, such as metals, paper, cement, and chemicals. That said, the largest potential savings in percentage terms are in less energy-intensive sectors. In some, given the prevalence of small plants equipped with old technology, savings potential is as high as 40 to 50 percent.

6 Main factors that will influence investment in industrial energy efficiency over the next three years (survey responses, up to three responses per respondent permitted, 348 respondents)



sis. Andreas Genz, Senior Vice President of Energy Services for Finnish pulp and paper firm Stora Enso, is one executive who agrees. “Our machines all look the same, but they are tailor-made,” he says. “So you have to define tailor-made measures to improve energy efficiency, too.”

As industry faces the challenges of adapting to an era of energy constraints, leading businesses are scrutinizing the energy efficiency of their manufacturing operations. Efforts to measure, manage, and continuously improve energy efficiency save cash in the short term. In the longer term, such efforts enhance com-

Another factor that influences decisions about investments in energy efficiency is a wish to improve the company's image.

petitiveness, foster innovation, and pave the way for companies to meet environmental and other sustainability commitments. In other words, investments in improving industrial energy efficiency are critical not only for short-term profitability, but also for long-term financial performance. Despite the experiences and

viewpoints of executives, policy makers and other experts interviewed for the report, sub-optimal practices are widespread. Energy efficiency saves costs and makes companies more competitive. Amid volatile, but rising, global energy prices, efficiency is especially critical for those companies operating in energy-intensive industries, where exposure to cost fluctuations is high, and profit margins are thin. While companies recognize this, many continue to operate inefficient equipment, or to operate equipment inefficiently. A major reason for the gap between awareness of gains from efficiency and actual investment in efficiency is poor information. This includes lack of information on latest technologies and alternative ways to improve efficiency; lack of efficiency benchmarks, and insufficient information on the payback of specific projects.

This article is the first of three parts of the report, The frugal manufacturer: Using energy sparingly. The report was researched and written by the Economist Intelligence Unit and commissioned by ABB. The next article in this series, to be published in a forthcoming issue of *ABB Review*, will discuss in more detail why commitment to improvements in industry remain weak.

The Economist Intelligence Unit bears sole responsibility for the content of the report. The findings and views expressed in the report do not necessarily reflect the views of the sponsor.

For further information on energy efficiency of industry, utilities, buildings and transportation please visit www.abb.com/energyefficiency

The Economist Intelligence Unit would like to thank all survey respondents, as well as executives cited in the report

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