

# Module 1: Introduction to Industrial Energy Management

Organisations that successfully manage energy have business processes to plan, monitor, and control energy use, just as they do for other corporate priorities, such as labour, materials, and other costs. For these organisations, energy management is “business as usual”.

Module 1 provides a context for industrial energy management in South Africa in terms of market conditions, energy supply issues, government regulations and initiatives, and international practice pertaining to energy efficiency and the concomitant environmental impact concerns. It develops a practical approach to effective energy management by highlighting the multidimensional nature of this organisational function.

## Module 1 Learning Objectives

After completing this module you will be able to:

- Define energy management;
- Provide a rationale for industrial energy management in terms of South African and global market conditions;
- Describe energy supply pressures and government actions in South Africa that are driving industries towards effective energy management;
- Explain effective energy management as a multi-dimensional activity.

## 1.1 A Context for Industrial Energy Management in South Africa

### 1.1.1 A definition of energy management

Many definitions have been offered for “energy management”. One definition that captures the key principles is as follows:

***“The judicious and effective use of energy to maximize profits (that is, minimize costs) and enhance competitive positions.”***

(Capehart, Turner and Kennedy. Guide to Energy Management, 2nd Edition. Fairmont Press Inc., 1997)

Among the practices that arise from this definition are the following:

- ♦ **ELIMINATE WASTE:** Ensure that energy is used at the highest possible efficiency.
- ♦ **MAXIMISE EFFICIENCY:** Utilise the most appropriate technology—from a business case perspective—to meet organisational needs.
- ♦ **OPTIMISE SUPPLY:** Purchase or supply energy at the lowest possible cost.

Energy management takes many different forms. It may vary from simple maintenance and operational activities that ensure equipment and systems use energy efficiently and effectively, to capital intensive installation of new, more efficient technology. It may involve “fuel switching” to energy sources that are inherently more economical for a given application.

### **1.1.2 Motivation to manage energy**

Interest in energy management is a consequence of several inter-related pressures that are presently acting on the industrial sector. They are:

- ◆ **Industrial Competitiveness:** reductions in energy consumption and therefore energy costs flow directly to the bottom line. While energy may be a relatively small component of total operating cost, for many industries, it is one of the most manageable components.
- ◆ **Restructuring of the Energy Supply Sector:** there is an international movement towards the introduction of competition into the energy supply sector. In North America, this includes both natural gas and electrical utilities. As a result, energy consumers are being given the opportunity to select energy suppliers and negotiate purchase agreements to a greater extent than in the past. In South Africa as well, the electrical utility sector is being restructured and commercialised, while natural gas from Moçambique will soon be available in Gauteng, Kwazulu-Natal and parts of Mpumalanga and the Free State previously served by SASOL gas. The implication for industry is that more must be known about how, when and where energy is used in order that the benefits to the consumer from competition in energy supply can be maximised.
- ◆ **Energy Supply Limitations:** Some industries in South Africa experience power supply problems—in terms of reliability and quality—due to limitations in the power supply infrastructure. More significantly, the continued growth in the economy, coupled with expansion of electrical service to new areas and new users, has led to predictions of a serious supply shortfall by 2006. Conservation programs such as ESKOM's DSM programme can alleviate this supply shortage to some extent, but it is now clear that much greater efforts will be required to reduce demand from industrial and commercial energy users.
- ◆ **Environmental Management:** the ISO 14001 standard on environmental management is increasingly becoming a requirement for trade in certain parts of the world, especially Europe. In South Africa, the opening up of the EU market to South African products means that companies will have to meet this standard if they are to remain competitive. Compliance with this standard, as with the other ISO standards, leads to tangible savings due primarily to the reduction of waste—of water, energy and materials. Energy management is an important component of environmental management and waste reduction strategies, and features significantly in ISO14001.
- ◆ **Climate Change:** there is a large body of evidence to support the conclusion that the global climate is changing because of human activity, and that one of the major causes of climate change is the emission of Greenhouse Gases (GHG), principally CO<sub>2</sub>, into the atmosphere from the combustion of fossil fuels. Since fossil fuels, directly or indirectly, are important energy sources to industry, there is international pressure to reduce GHG emissions by reducing energy consumption. International accords, begun in Rio de Janeiro in 1992 and taken to new levels of commitment in Kyoto in 1997, provide a basis for international action. As of February, 2005, the Kyoto Protocol has taken on the weight of international law.

Because of heavy reliance on coal for both power generation and industrial energy, South Africa's CO<sub>2</sub> emissions per unit of GDP are among the highest in the world. Although South Africa is not required to meet CO<sub>2</sub> emission reduction targets during the initial commitment period for the Kyoto Protocol, it can benefit from sale of certified emissions reduction (CER) credits sold to

countries which do have commitments—for example, the EU, Canada, and Japan. The opportunity to sell credits from energy efficiency projects offers a major opportunity for South African companies to reduce their energy consumption cost-effectively.

### **1.1.3 Government Action on Industrial Energy Management**

The Industrial Sector in South Africa has a relatively high demand for energy, and accounts for over 45 to 50% of the total final energy demand in the country. This sectoral consumption is dominated by a few energy-intensive sub-sectors in which energy intensity is typically higher than that found in 1<sup>st</sup> world countries.

Thus, it is envisaged that potential exists for energy savings in the sector by replacing old technologies with relatively new ones and by employing best energy management practices.

To identify and implement cost-effective efficiency interventions within this sector, the draft National Energy Efficiency Strategy—for which final publication was imminent in early 2005—makes provision for the use of Energy Management within the industrial sector. The Strategy addresses all economic sectors in setting broad sustainability goals, sectoral objectives and targets, and provides for the development of sectoral action plans.

There are two industry sector objectives:

1. ***To delineate the growth of industrial energy consumption from the rate of growth in industrial output; and***
2. ***To bring energy intensities of major industrial sectors into line with international standards and best practice.***

The approach incorporated into the Strategy combines voluntary action—in pursuit of energy management best practice—and mandatory measures—efficiency standards for selected technologies, requirements for energy audits, and requirements for implementation of measures based on audit findings.

Actions that are being taken to achieve the industry sector objectives include:

- The development of a programme of support for industry energy training
- The establishment of a “Corporate Commitment” programme
- Encouragement of and support for energy management demonstration projects
- Implementation of energy monitoring and targeting.

#### **1.1.3.1 Capacity Building in Energy Efficiency and Renewable Energy (CaBEERE)**

Realising that major energy savings can only be achieved through changes in people’s behaviour by providing information about available options, the DME has endorsed the project “Capacity Building in Energy Efficiency and Renewable Energy (CaBEERE)” under the auspices of Danida. The sub-project “Industrial Energy Management” is one of the actions being undertaken under CaBEERE. It is intended to establish a Corporate Commitment programme to promote adoption of energy efficiency policy into existing corporate policies. A strong Energy Management foundation is essential in any firm in order to optimise energy efficiency best practice.

The key components of effective Energy Management are information (Monitoring and Targeting), Training and Awareness (Motivation) and corporate commitment (energy policy). “Monitoring and Targeting” is one of the actions being undertaken as a sub-project under CaBEERE.

### 1.1.4 Energy Supply Issues in South Africa

South Africa's primary energy supply is dominated by coal, which is plentiful and relatively inexpensive by international standards. In 2000, the total primary energy supply was approximately 4,782 PJ. Liquid fuel requirements in South Africa are imported as crude oil, whilst synthetic fuel produced by Sasol accounts for approximately 30% of the former. All the current natural gas produced at the PetroSA offshore rig in the Bredasdorp Basin is converted into liquid fuels, supplying 8% of national liquid fuel requirements.

Natural gas was delivered to South Africa from Mozambique in the first quarter of 2004 and is expected to reach a capacity of 120 MGJ per year in 2008.

South Africa has a mix of electricity generation power plants that use coal, hydro, gas and nuclear energy as sources of power. In 2003, Eskom – the national electricity utility – generated over 210 TWh of electricity with a net capacity of 36, 208 MW. With the excess power capacity of South Africa expected to run out in about 2007, Eskom is considering several additional power generation scenarios, including revamping its mothballed power stations.

There is largely untapped solar-based resource in South Africa that is variable, depending on weather conditions. A major source of energy in the rural areas is non-commercial biomass, which is unsustainably harvested. Renewable energy technologies are not fully developed in South Africa to the point of supplying reliable and bulk energy for various applications. Additionally, the harnessing of renewable energy is characterised by relatively high initial capital expenditure. This discourages the bulk utilisation of renewables as a viable source of energy.

## 1.2 Energy is a Manageable Expense

### Three Questions:

- 1 **What are your top three operating expenses?** For many organisations, the answer to that question includes energy (electricity, coal and fuel), labour and materials expenses.
- 2 **Through careful management, by what percentage could you reduce each expense?** One possible answer to this question is presented in Figure 1.1. The magnitude of each expense is represented along with the manageable component—the potential cost savings. Many companies have realised as much as 25% savings in energy costs by implementing an energy management program.
- 3 **What priority should energy management receive?** On the basis of the amount spent, energy often ranks third on the list behind labour and materials. However, if we rank these cost centres in terms of the potential for savings, many companies find that energy moves to the first priority position. In fact, in this illustration, energy management would deliver about twice the savings that materials management would and five times what labour cost management offers.

***Energy is a manageable expense — perhaps your most manageable expense!***

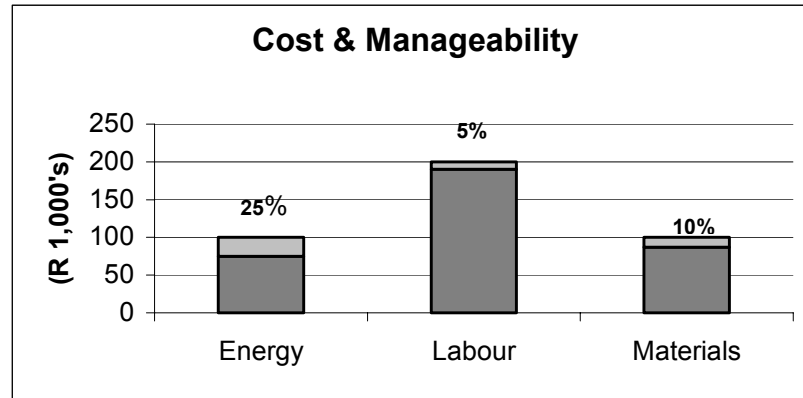
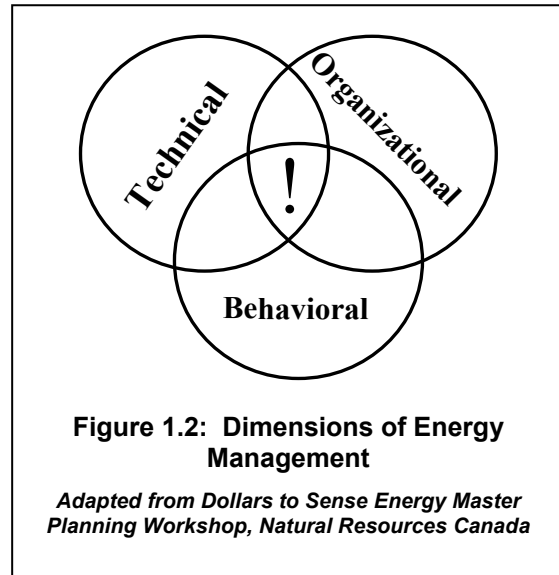


Figure 1.1: Energy is a Manageable Expense

### 1.3 The Dimensions of Energy Management

The experience of organisations that successfully manage their energy use indicates that technological solutions alone do not achieve maximum energy savings, and are less likely to be sustained in the long term. Rather, energy management has the greatest impact when organisations address these three dimensions:

- ◆ **technical**—the energy consuming devices and systems that use energy efficiently, or inefficiently
- ◆ **organisational**—the structure and management systems that can support or hinder the achievement of energy efficiency goals
- ◆ **human behavioural**—the personal values, attitudes and practices of individuals in the organisation that impact on energy use.



There are cases to demonstrate that a focus on people alone—their awareness of energy efficiency as corporate priority, their values and attitudes towards energy use, and their skills and knowledge related to the management and use of energy systems—can achieve significant and sustainable savings. The combination of these two approaches—technological and human resources—typically yields the best result.

Many cases can be found to demonstrate the wisdom of addressing the three dimensions of energy management listed above. One such case follows.

### **Case study: ChiRex Ltd.**

The British chemical company, ChiRex Ltd. (**Good Practice Case Study 331: Energy Management Within a Strategic Framework**) achieved savings in its production energy and water consumption equal to over 9% of the existing energy and utilities budget, £212,300 (or about US\$350,000) per year at 1994 rates through a variety of measures that included the following:

- ◆ **Senior management support** and leadership expressed through a policy of minimizing energy and utility costs;
- ◆ **Creating an organizational structure** to support energy management activities, using an “energy account center” approach for the production units;
- ◆ **Setting up Energy Teams** in each production unit comprised of engineering, maintenance and production personnel;
- ◆ **Communicating** on energy efficiency activities and progress by means of regular performance reports, energy notice boards to build broad awareness throughout the organization, publicity activities focused on quarterly energy performance reviews, and suggestion schemes open to all company personnel;
- ◆ **Monitoring and Targeting** to effectively collect, analyze and manage energy information

(Note: this case study and many other publications on good practices in energy management can be downloaded—in English only—from the UK Best Practice Program at <http://www.thecarbontrust.co.uk/energy/pages/home.asp>).

## **1.4 This Course**

This course is designed to develop the knowledge and skills related to organisational performance that energy managers need to implement and sustain effective practices. While we recognise that it is necessary to understand the technology of energy efficiency, many industrial organisations all over the world report that the most important barriers to improving energy efficiency are not the lack of technical knowledge, but rather the lack of sufficient organisational capacity to manage energy—leadership, information management, related skills and knowledge of workers, and other management practices.

This course focuses on the management side of the issue. It does address the technical dimension by means of an energy assessment methodology. However, it does not deal with the technological questions—what it is about technology that makes it efficient or inefficient, how maintenance impacts efficiency, and so on; we leave these questions for other training courses.

In sequence, then, the topics we will address are:

- ◆ how to approach the implementation of energy management strategically (Module 2)
- ◆ organisational capacity—how to assess it, and how to grow it (Module 3)
- ◆ energy policy—the role that it plays, and how to develop a good one (Module 4)
- ◆ structuring the organisation for energy management—ensuring accountability and effectiveness (Module 5)
- ◆ training and communicating for energy management—ensuring that employees have the skills, knowledge and information they need (Module 6)
- ◆ energy monitoring, targeting and reporting—using energy information to manage consumption downward (Module 7)

- ◆ developing the business case—analysing the financial merits of energy management measures, and presenting a persuasive business case to obtain approval (Module 8)
- ◆ assessing energy use and identifying savings opportunities—seven practical steps (Module 9).