Kementerian Tenaga, Air dan Komunikasi Malaysia

Malaysia Energy Centre

ACHIEVING INDUSTRIAL ENERGY EFFICIENCY in MALAYSIA

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GEF

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Foreword

Industrialization and modernization are spreading everywhere, albeit at differing paces and with differing consequences. And as they spread, alongside increased GDP and reduced poverty, there is increasing fossil fuel use, natural resource depletion, and loss of biodiversity.

The energy-intensive lifestyle of those living in developed countries is now being adopted among rapidly developing Asian countries. And this means, *inter alia*, increasing emissions from automobiles, factories, and power plants. Global warming and climate change are consequences. So too are air and river pollution. Given the increased scale of global economic activity, international trade is a major driver of environmental change. Advancing economic growth requires intensifying the use of finite natural resources, but large-scale use of these resources is leading to ecological disequilibrium.

Spiraling oil prices, environmental degradation, and global warming and climate change have contributed to a re-evaluation of energy use in all economic sectors. The need for sustainable energy use has become more evident. Not surprisingly, the challenge of improving energy efficiency is being taken up by the Malaysian industrial sector.

In 1999, the government of Malaysia initiated a project: Malaysian Industrial Energy Efficiency Improvement Project (MIEEIP) to improve the use of energy in the industrial sector, with support and funding from the United Nations Development Programme (UNDP), the Global Environment Facility (GEF) and the private sector. The project's primary objective is to develop and implement activities that will build stakeholders' capacity and facilitate improved industrial energy efficiency. It focuses on eight energy consuming industrial sub-sectors - wood, food, pulp and paper, rubber, iron and steel, ceramic, glass and cement.

The project has highlighted a number of important issues and some significant lessons have been learnt. It is hoped that as the project moves towards completion, these experiences and the outcomes in the form of industry involvement and the demonstration models will provide exemplars for further steps in energy efficiency throughout Malaysia. The information presented in this publication provides an indication of the efforts being made at selected factories and the related policy implications.

This is the second of a new series of periodic publications that will report on UNDP Malaysia's work in its energy and environment practice area. The large range of projects being undertaken in this area are designed to support Malaysia's effort to achieve the Millennium Development Goal 7 (MDG7), of ensuring environmental sustainability. The series of publications will also be made available through UNDP's website, http://www.undp.org.my.

I would like to thank the GEF for funding this project and the Ministry of Energy, Water and Communications (MEWC) for implementing it with UNDP. I would also like to thank other institutional participants and members of the MIEEIP team (page viii). Special thanks go to the report team and PTM for their professionalism and good efforts in putting this publication together. I sincerely hope that it will be widely read and will increase awareness of the critical importance of good environmental management and efficient energy use.

Richard Leete Ph.D
Resident Representative
United Nations Development Programme
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Acronyms and Abbreviations

AAIBE	Akaun Amanah Industri Bekalan Elektrik (Malaysian Electricity Supply Industries Trust Account)
ADB	Asian Development Bank
ASEAN	Association of South-East Asian Nations
bpd	barrels per day
CDM	Clean Development Mechanism
DANIDA	Danish International Development Assistance
EC	energy conservation
EE	energy efficiency
EPU	Economic Planning Unit
ESCO	energy services companies
FDI	foreign direct investment
FMM	Federation of Malaysian Manufacturers
GDP	Gross Domestic Product
GEF	Global Environment Facility
GJ	Giga joules
GWh	Giga watt hours
kV	kilovolts
kWh	kilowatt hours
LEO	low energy office
LNG	liquefied natural gas
LPG	liquefied petroleum gas
MECM	Ministry of Energy, Communications and Multimedia
MEWC	Ministry of Energy, Water and Communications
MIDA	Malaysian Industrial Development Authority
MIEEIP	Malaysian Industrial Energy Efficiency Improvement Project
mmscfd	million standard cubic feet per day
MTJDA	Malaysia-Thailand Joint Development Area
MW	megawatts
NDP	National Development Policy, 1991–2000
NEP	New Economic Policy, 1971–1990
NG	natural gas
NVP	National Vision Policy, 2001–2010
PJ	petrajoules
PTM	Pusat Tenaga Malaysia
RM	Ringgit Malaysia
Sdn. Bhd.	Sendirian Berhad (Private Limited)
SEC	specific energy consumption
SIRIM	Standard Industrial Research Institute of Malaysia
SREP	Small Renewable Energy Programme
tcf	trillion cubic feet
UNDP	United Nations Development Programme
ZEO	zero energy office

Stakeholders

Institutional Participants

Executing Agency	Ministry of Energy, Water and Communications Government of Malaysia
Implementing Agency	Pusat Tenaga Malaysia
GEF Implementing Agency	United Nations Development Programme (UNDP)
UNDP GEF	Bangkok Regional Office
Donor Partners	AAIBE, The Government of Malaysia

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Economic Planning Unit

Ministry of Energy, Water and Communications

Ministry of Natural Resources and Environment

Energy Commission

Cement and Concrete Association

Federation of Malaysian Manufacturers (FMM)

Malaysian Association of Energy Service Companies (MAESCO)

Malaysian Energy Professionals Association (MEPA)

Malaysian Industrial Development Finance Bhd (MIDF)

Malaysian Iron and Steel Industries Foundation

Malaysian Rubber Products Manufacturers Association

Malaysian Timber Industry Board

National Productivity Corporation (NPC)

Standard Industrial Research Institute of Malaysia (SIRIM)

Small and Medium Industries Development Corporation

ENERGY IN MALAYSIA

Background

Malaysia is well endowed with natural resources that provide the raw materials for wealth-creating economic activity such as rubber, palm-oil, tin, petroleum and natural gas. Over the last few decades this natural wealth has provided the basis for transforming Malaysia from a country reliant on primary production into an industrialized society. Malaysia has achieved sustained growth in gross domestic product (GDP), 1957–2005, at an annual rate of 6.5 per cent, largely due to substantial public and private investment, including foreign direct investment (FDI) in industrial projects, and by expanding trade, especially exports.

Malaysia's development has been shaped by the vision encapsulated in the three key national policy frameworks: the New Economic Policy (NEP), 1971–1990; the National Development Policy (NDP), 1991–2000; and the National Vision Policy (NVP), 2001–2010. Over this period the circumstances and environment in which the country operates have changed significantly. Malaysia is now an open trading economy operating in an extremely competitive and fast-moving global marketplace.

Economic growth based largely on industrialization, combined with population growth and urbanization, has created an expanding demand for energy. In response, the development of the energy sector has emphasized the establishment of a secure, reliable and cost effective energy supply. The need now is to ensure efficient utilization of energy resources, diversification of sources and minimization of wastage.

Energy Demand

The transport sector is the largest consumer of energy in Malaysia, accounting for 40.5 per cent of the total final commercial energy demand in 2005 (Table 1). The industrial sector is next at 38.6 per cent, and the residential and commercial sector combined repre-sented 13.1 per cent of total demand.

Table 1 Final Commercial Energy Demand by Sector, Malaysia, 2000–2010

Source	Petajoules			Per cent of Total			Average Annual Growth Rate (%)	
	2000	2005	2010	2000	2005	2010	8MP	9MP
Industrial[1]	477.6	630.7	859.9	38.4	38.6	38.8	5.7	6.4
Transport	505.5	661.3	911.7	40.6	40.5	41.1	5.5	6.6
Residential & Commercial	162.0	213.0	284.9	13.0	13.1	12.8	5.6	6.0
Non-Energy[2]	94.2	118.7	144.7	7.6	7.3	6.5	4.7	4.0
Agriculture & Forestry	4.4	8.0	16.7	0.4	0.5	0.8	12.9	15.9
Total	**1,243.7**	**1,631.7**	**2,217.9**	**100.0**	**100.0**	**100.0**	**5.6**	**6.3**

Source of Data: Ninth Malaysia Plan 2006–2010, Table 19-2.
1 Includes manufacturing, construction and mining. 2 Includes natural gas, bitumen, asphalt, lubricants, industrial feedstock and grease.

Overall energy demand is expected to increase at an average rate of 6.3 per cent per annum between 2005 and 2010 due to the anticipated higher GDP growth. With improvements in the quality of life of the Malaysian population there will be an increase in energy consumption for many reasons ranging from increased use of electrical appliances to more frequent travel. In an effort to improve energy efficiency, consumption will be benchmarked against that of other countries such as Denmark, Germany, the Republic of Korea, and the other countries of ASEAN. Initiatives are to be intensified to ensure efficient energy utilisation and minimization of wastage, thus contributing to the sustainable development of the energy sector.

The transport and industrial sectors will continue to be the major energy consumers constituting 41.1 per cent and 38.8 per cent of the total energy demand by 2010. Demand for transportation services will be required by the manufacturing and agriculture sectors as well as the tourism industry. In the industrial sector, energy intensive activities such as chemical, cement, ceramics, iron and steel, and food processing industries are expected to remain the major consumers.

Energy Supply

The total supply of energy in Malaysia increased from 2,003 petajoules (PJ) in 2000 to 2,526 PJ in 2005 (Table 2). The main sources of supply were crude oil and petroleum products, and natural gas. The share of crude oil and petroleum products declined while that of coal and coke

Table 2 Primary Commercial Energy Supply[1] by Source, Malaysia, 2000–2010

Source	Petajoules			Per cent of Total			Average Annual Growth Rate (%)	
	2000	2005	2010	2000	2005	2010	8MP	9MP
Crude Oil & Petroleum Products[1]	988.1	1,181.2	1,400.0	49.3	46.8	44.7	3.6	3.5
Natural Gas[2]	845.6	1,043.9	1,300.0	42.2	41.3	41.6	4.3	4.5
Coal and Coke	104.1	230.0	350.0	5.2	9.1	11.2	17.2	8.8
Hydro	65.3	71.0	77.7	3.3	2.8	2.5	1.7	1.8
Total	**2,003.1**	**2,526.1**	**3,127.7**	**100.0**	**100.0**	**100.0**	**4.7**	**4.4**

Source of Data: Ninth Malaysia Plan 2006–2010, Table 19-3.
1 Refers to the supply of commercial energy that has not undergone a transformation process to produce energy.
2 Excludes flared gas, reinjected gas and exports of liquefied natural gas.

increased, reflecting reduced dependence on a single source of supply in keeping with the Fuel Diversification Policy. By 2010, all of the main forms of energy supply will experience growth in response to expanding demand but, consistent with the Fuel Diversification Policy, the share of petroleum products is expected to decline to 61.9 per cent while that of natural gas is projected to increase to 15.8 per cent by 2010. However, although crude oil and petroleum products will still contribute the greatest proportion of the total supply, a further increase in the use of coal and coke will allow some reduction in the annual growth rate of the oil supply, while the contributions by natural gas and hydro will remain about the same.

The security, reliability, quality and cost effective supply of energy will be enhanced through an optimal energy mix pre-dominantly from domestic sources. To meet Malaysia's energy requirements, total supply is projected to reach 3,128 PJ in 2010, of which the share of crude oil and

petroleum products is expected to decline to 44.7 per cent while coal will increase to 11.2 per cent. The price of crude oil in international markets is expected to remain high so that further attempts will be made to reduce dependence on petroleum products and to utilise them efficiently. By 2010, alternative fuels, including renewable energy, are expected to contribute 350 megawatts (MW) to the total energy supply.

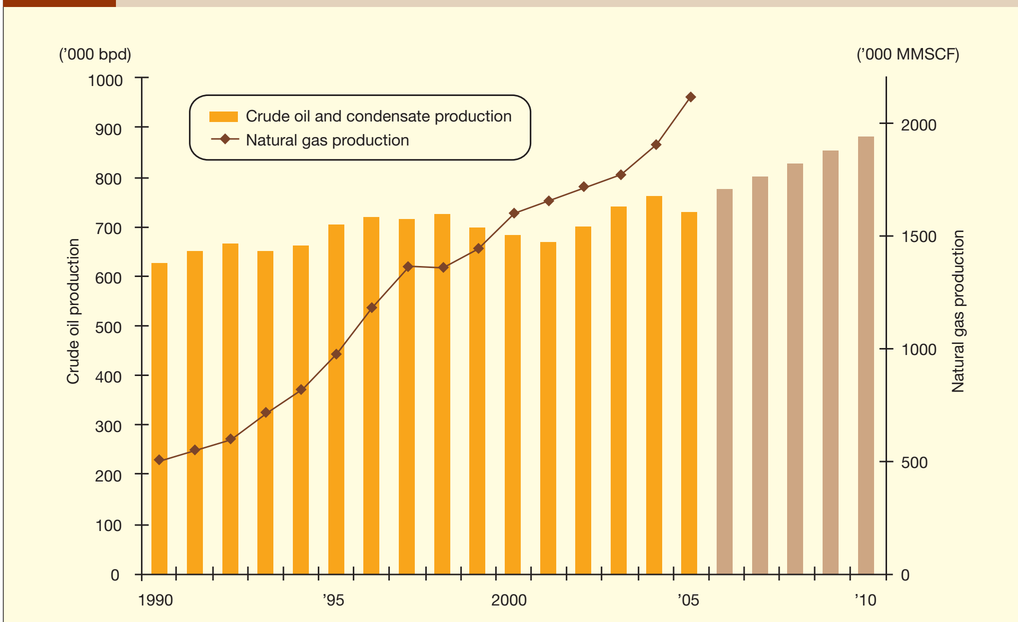
Fossil Fuels

Crude Oil

Estimated crude oil and condensate reserves increased from 4.5 billion barrels in 2000 to 5.3 billion barrels in 2005 (Figure 1). The average production of domestic crude oil and condensate increased from 681,000 barrels per day (bpd) in 2000 to 727,000 bpd in 2005. Based on this production level, which is in line with the National Depletion Policy, the reserves are projected to last for 19 years. Although total refining capacity declined from 591,000 bpd to 546,000 bpd, it was sufficient to meet the demand for petroleum products.

To ensure a sustainable supply of oil and gas, appraisal wells will continue to be drilled in small oil fields offshore as well as in deepwater areas. Efforts will also continue to be undertaken to attract international oil companies to invest in exploration, particularly in water deeper than 200 metres and in ultra-deep water of more than one kilometre to increase domestic petroleum reserves. Over the period 2005 to 2010, crude oil production is expected to average 695,000 bpd.

Figure 1 Crude oil and condensate production, estimated and forecast, Malaysia, 1990–2010



Note: MMSCF = Million Standard Cubic Feet; bpd = Barrels Per Day
Source of data: (1) EPU, Malaysia Five Year Plan, (7th, 8th and 9th)
(2) Department of Statistics, Malaysia Economic Statistics-Time Series, 2005

Map 1 Gas supply network, Peninsular Malaysia, 2005–2010

Source: Petroliam Nasional Berhad

Natural Gas

The discovery of new gas fields contributed to the increase in reserves from 84.3 trillion cubic feet (tcf) in 2000 to 85.2 tcf in 2005 and is expected to last for 33 years. The average natural gas production increased from 4,367 million standard cubic feet per day (mmscfd) to 5,800. Natural gas was also imported from West Natuna (Indonesia) beginning in 2002 and the Malaysia-Thailand Joint Development Area (MTJDA) in 2005 and these two sources are expected to supply about 20 per cent of the total by 2010 (Map 1).

The average demand for natural gas in Peninsular Malaysia increased from 1,643 mmscfd in 2000 to 2,141 mmscfd in 2005. The power sector continued to be the major consumer accounting for 66 per cent, and the non-power sector consumed 28 per cent. To meet the increasing demand from the non-power sector, the Natural Gas Distribution System was expanded from 455 kilometres to 1,365 kilometres.

Coal

The commissioning of two new coal based generation plants in Peninsular Malaysia is expected to increase the consumption of coal for power generation (19.0 million tonnes) and industrial use (2.2 billion tonnes) by 2010. Most of the coal is imported but efforts are continuing to enhance the security of supply by exploring the potential for development of local sources, particularly in Sarawak, as well as securing long-term supplies from abroad.

Table 3 Fuel Mix (per cent) in Total Electricity Generation, Malaysia, 2000–2010

Year	Oil	Coal	Gas	Hydro	Other	Total (GWh)
2000	4.2	8.8	77.0	10.0	0.0	69,280
2005	2.2	21.8	70.2	5.5	0.3	94,299
2010	0.2	36.5	55.9	5.6	1.8	137,909

Source of Data: Ninth Malaysia Plan 2006–2010, Table 19-5.

Electricity

Between 2000 and 2005, the sources of fuel for power generation were further diversified with the increased use of coal, consistent with the strategy to ensure security and reliability of electricity supply as well as to reduce the high dependence on gas.

Altogether, between 2000 and 2005, a total of 6,420 MW of new generation capacity was installed. Efforts were undertaken to reduce the high dependence on natural gas in the generation mix by increasing the use of coal. As a result, the share of coal in the total generation mix increased from 8.8 per cent in 2000 to 21.8 per cent in 2005 whereas that of natural gas declined from 77.0 per cent to 70.2 per cent (Table 3).

During this period the electricity transmission system was further expanded with the completion of new transmission projects linking generation plants to the main grids as well as providing connections to new industrial and commercial areas. Implementation of the rural electrification programme (which now stands at 92.2%) benefitted residences in Sabah and Sarawak in particular.

Peak demand for electricity is expected to grow at an average rate of 7.8 per cent per annum to reach 20,087 MW in 2010, by which time the accumulated installed capacity is planned to be 25,258 MW, still giving a reserve margin of 25.7 per cent.

Initiatives are being taken to further enhance the efficiency and viability of the utility companies and the independent power producers enabling a reduction in the reserve margin while improving the security, reliability, quality and cost-effectiveness of supply to customers.

The fuel mix for power generation will mainly comprise coal and natural gas, with coal playing an increasingly important role. New coal based independent power producer plants utilizing electrostatic pre-cipitators and a flue gas desulphurization process will enable coal-based production to meet environmental standards. In addition, as part of efforts to promote the optimal utilization of municipal waste for electricity generation, a pilot project on waste-to-energy is being implemented in Peninsular Malaysia.

MALAYSIAN GOVERNMENT ENERGY POLICY

When Malaysia formulated its first energy policy, concern over efficient utilization of energy and the need for energy development to take account of environmental issues were fundamental. These concerns were driven by the oil crises of 1973 and 1978 and the underlying issue was the need to ensure adequate and reliable supplies of energy.

The Energy Policy of 1979, the National Depletion Policy of 1980 and the Four Fuel Diversification Policy of 1981, have provided the framework for the development of energy supply. The main thrust of the energy policy works within a framework of three broad policy objectives; supply, utilization and environment objectives. These policy objectives are instrumental in guiding the formulation of the Malaysia five-year development plans. Since then the focus in the energy sector has shifted to the sustainable development of non-renewable resources and the diversification of energy sources. The Four Fuel Diversification Policy identified the country's preferred energy mix as oil, natural gas, coal and hydro power. In 2001, Government articulated the Five Fuel Policy, adding renewable resources and linking this to sustainability and efficiency.

Energy Efficiency

Energy efficiency, as a significant element of Government policy, is explicitly addressed in the Ninth Malaysia Plan. Energy efficiency programmes will focus on energy saving features in the industrial and commercial sectors as well as residential in the domestic sectors. The industrial sector is expected to implement measures for improvements in plant, equipment and processes as well as the end uses. Efficient Management of Electrical Energy Regulations are to be introduced, Uniform Building By-Laws to be amended to incorporate energy efficiency features, and specifications promulgated for

accurate and informative electrical appliance labeling to be futher enhanced. Promotion of the use of high efficiency motors includes initiatives to develop local expertise in the manufacture of energy efficient equipment and machinery. Energy efficiency measures are to be intensified in the industrial, transport and commercial sectors, and in government buildings.

Renewable Energy

Efforts are being made to actively promote the utilization of renewable energy resources. Under the Small Renewable Energy Programme (SREP), two projects with a combined capacity of 12 MW were officially implemented in the 2000–2005 period. Waste from palm oil industries, land-fill gas and mini hydro systems are most popular due to the abundance of those resources. A roadmap for the development of solar, hydrogen and fuel cells was also formulated, UNDP/GEF assisted Biomass Power Generation and Cogeneration in Palm Oil Mills (BIOGEN) and another UNDP/GEF assisted Malaysia Building Integrated Photovoltaic Technology Application Project (MBIPV) were launched.

Further applications of new energy sources are planned for the immediate future. Solar and wind technologies will be developed with emphasis on utilizing cost effective methods as well as strengthening capacity building. Activities outlined in the roadmap on solar, hydrogen and fuel cell technology will be expanded with priority being given to research and development. Biofuel using palm oil as a renewable source of energy is part of an initiative to make Malaysia a world leader for palm oil production and utilization.

Implementation of Policy

Many government departments and agencies have responsibility for the implementation of elements of official energy policy. Three of the leading government agencies are: the Ministry of Energy, Water and Communications, the Energy Commission, and Pusat Tenaga Malaysia - the implementing agency of the MIEEIP which is discussed more fully later.

Ministry of Energy, Water and Communications (MEWC)

The role of MEWC is to facilitate and regulate the electricity sectors in the country and to ensure affordable energy is available to consumers throughout the country. As the country is maturing, its responsibility has shifted from being a service provider to policy formulation.

In 2004, MEWC moved to its own building in the Federal Government Administrative Capital, Putrajaya. The Government wanted this building to be a low energy office (LEO) building and a showcase for energy efficiency and low environmental impact. Design support to achieve this was provided by the agency for Danish International Development Assistance (DANIDA) and the local consultants. An ambitious goal of energy savings of more than 50 per cent was set for the energy efficiency of the building with an extra construction cost of less than 10 per cent, giving a payback period for the extra investment of less than 10 years. To date, the MEWC LEO has achieved its building energy index close to 100 kWh per m^2 per year and declared winner of the ASEAN Energy Awards 2006, Best Practice in the New Energy Efficient Building category.

Energy Commission

The Energy Commission (Suruhanjaya Tenaga) has been the regulatory agency for the electricity and piped gas supply industries in Malaysia since 2002 replacing the Department of Electricity and Gas Supply (DEGS). The Commission's main tasks are to provide technical and performance regulation for the electricity and piped gas supply industries, as the safety regulator for electricity and piped gas and to advise the Minister on all matters relating to electricity and piped gas supply including energy efficiency and renewable energy issues. The Commission is also the technical secretariat for the Small Renewable Energy Programme (SREP).

Energy efficiency measures are being promoted both in the home and in the workplace. The Commission is attempting to emulate the experiences of efficiency standard setters and labeling programmes worldwide. The two common appliances for which the Commission is particularly promoting energy saving versions are high performance motors and energy efficient refrigerators.

Pusat Tenaga Malaysia (PTM), the Malaysia Energy Centre, was established by the Malaysian Government in 1997 for the development and coordination of energy research. PTM's aim is to be the focal point and catalyst for linkages with universities, research institutions, industry, and national and international energy organizations.

The PTM has four major functions.
- energy policy research
- guardian and repository of the national energy database
- promoter of national energy efficiency and renewable energy programmes
- coordinator and lead manager in energy research and development, and demonstration projects

PTM offers membership to individuals and companies across the entire spectrum of the Malaysian energy industry including the electricity power industry, the oil and gas industry, research institutions, institutions of higher learning, service providers, suppliers and energy consumers. Membership provides access to informational databases; consultancy services on building and industry energy audits; energy efficiency and renewable energy; training programmes; and opportunities for industry networking.

PTM Projects

The Malaysian Industrial Energy Efficiency Improvement Project

This project is discussed in detail in the following section.

Building Energy Efficiency Programme

Energy efficiency in buildings promotes the optimal use of energy for heating, cooling and lighting. This is achieved by several strategies that optimize and regulate energy use in the building envelope. Measures include: structural elements such as windows with glazing to prevent heat gain, and controls for regulating energy use. PTM services include energy audit in buildings, technical advisory on energy efficiency features for new premises, standard development and linkages with suppliers on new technologies.

The Biomass Power Generation and Co-generation in the Palm Oil Mills (BioGen) Project

This project is jointly funded by the Government of Malaysia, the Global Environment Facility (GEF), and the private sector. The main objective is to reduce the growth rate of greenhouse gas emissions from fossil fuel fired combustion processes by utilizing biomass waste from palm oil mills. The project is crucial in providing key policy recommendations for renewable energy policy to the government. A Full Scale Demonstration project is also ongoing and once complete will act as the sample resource for the industries to emulate.

The Malaysia Building Integrated Photovoltaic Technology Application Project

This project is jointly funded by the Government of Malaysia, the Global Environment Facility (GEF), and the private sector. It is intended to encourage the long-term cost reduction of non-emitting greenhouse gas technologies by the integration of energy generating photo-voltaic technology in building designs and envelopes. The project has several demonstration PV projects in various sectors including residential houses.

ASEAN Energy Efficiency Sub-Sector Network

PTM is the country focal point and projects include ASEAN Energy Awards Best Practices in Building, industry energy audits and building energy audits in member countries; and benchmarking in buildings.

ASEAN New and Renewable Energy Sub-Sector Network

PTM is the country focal point and projects include information for the Commercialization of Renewables in ASEAN (ICRA), a regional dialogue on international experience in harnessing renewable energy; and ASEAN Energy Awards in New and Renewable Energy projects and ASEAN-AusAID on Energy Planning and Analysis.

Clean Development Mechanism Programme

PTM acts as the Secretariat (Energy) and reports to the Technical Committee (MEWC) in carrying out its responsibilities. It provides input for the formulation of CDM policy, conducts technical evaluation as well as creates a national database on major stakeholders.

PTM Building Project

The new PTM building project is a zero energy office (ZEO) initiative that requires that the building must not consume more electricity than can be produced using renewable energy sources on site. The intention is not only to make the PTM building a key demonstration building for energy efficiency in Malaysia with a targeted building energy index of 50kWh per m^2 per year, but to provide a platform for advancing the Malaysian construction industry towards adoption of ZEO standards within two decades.

THE MALAYSIAN INDUSTRIAL ENERGY EFFICIENCY IMPROVEMENT PROJECT

The MIEEIP was launched after a period of national and international audit and review of the energy situation in Malaysia by the Asian Development Bank (ADB), Japan International Cooperation (JICA), government departments and relevant agencies. Industry was chosen as the sector in which the greatest commercial and environmental impacts could be achieved. However, there are barriers hindering the implementation of energy efficiency measures, conservation efforts and sustainable energy use.

The Malaysian Industrial Energy Efficiency Improvement Project (MIEEIP) is part of the Global Environment Facility (GEF) Operational Program No. 5: Removing Barriers to Energy Efficiency and Energy Conservation. The Malaysian project was initiated in mid-1997 and commenced in 2000.

The project incorporates measures for capacity building and a demonstration incentive scheme to address inadequate information and perceived risk in industrial procedures.

Barriers to Achievement of Energy Efficiency and Energy Conservation

TThe main barriers to implementation of energy efficiency (EE) include:

- limited knowledge or awareness of EE techniques and their economic benefits;
- limited access to information and benchmarks for EE technologies
- an unwillingness to incur what are perceived to be the 'high-cost / high-risk' transactions
- preference for industries to focus on investments in production rather than on efficiency
- lack of financiers prepared to finance EE investments
- insufficiently stringent regulations on EE standards and their implementation
- few EE technology demonstration projects by industry or Government
- inadequate local energy support services and lack of trained industry and financial sector personnel in energy management

The Energy Intensive Manufacturing Sub-Sectors

The MIEEIP designated eight energy intensive industries as the primary focus for energy efficiency promotion. This strategy was not intended to exclude other sub-sectors, but to focus on the main energy users that stood to benefit relatively quickly and substantially as the project built up its capacity to promote and fufil the objectives of the programme.

The Selected Energy Intensive Manufacturing Sub-Sectors

Wood	Glass
Rubber	Pulp and Paper
Food	Cement
Ceramic	Iron and Steel

Additional Manufacturing Sub-Sectors Subsequently Identified

Plastic	Chemical
Textile	

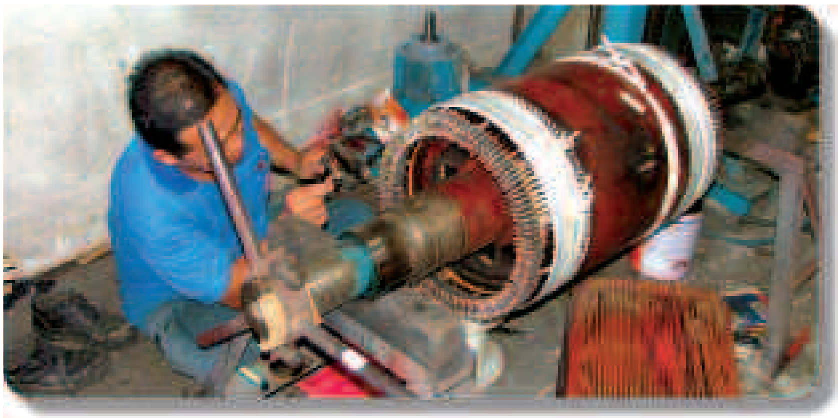
Development Objective

to improve energy efficiency in the industrial sector –

- by removing barriers to efficient industrial energy use
- by creating a sustainable institutional capacity by providing –
  - ~ energy efficiency sources
  - ~ a conducive policy, planning and research framework

Anticipated Outcomes

By the conclusion of this project (most component programmes conclude in 2006–2007) Malaysia will have an institutional and technical foundation for continued efforts to capture the energy efficiency potential within the industry sector and achieve reductions in greenhouse gas emissions. Outcomes include:



- information on EE technologies that is documented, accessible and widely disseminated
- promotional campaigns on the rational use of energy by industry
- establishment and publication of sectoral energy benchmarks
- investment by industries in economically and financially viable EE projects and practices
- trained personnel in energy management throughout industry
- financiers prepared to fund EE projects for industry
- affordable energy efficient equipment available to industry
- introduction and enforcement of stringent EE regulations by Government
- promotion, strengthening and utilization of local energy support services
- implementation of significant EE technology demonstrations by Government and relevant agencies in collaboration with the private sector and financial institutions.

MIEEIP Components

1. Energy Use Benchmarking
2. Energy Audit Programme
3. Energy Rating Programme
4. Energy Efficiency Promotion
5. Energy Service Companies (ESCO) programme
6. Energy Technology Demonstration Projects
7. Local Energy Efficient Equipment Support Programme
8. Financial Institutional Participation

Quotation

"Environmental responsibility and competitive operating performance are important goals of our company. With the implementation of MIEEIP demonstration project at our premise, we are assured of improving out bottom line and at the same time conserving energy and reducing waste to preserve the environment."

Tn Hj Mas'ut A.Samah , Managing Director , Pascorp Paper Industries Berhad

THE MIEEIP COMPONENTS FOR ACHIEVING ENERGY SUSTAINABILITY

Energy Use Benchmarking Programme

Objective: To establish and develop energy use benchmarks for various industry sub-sectors as guides in their energy efficiency (EE) efforts.

Process: An industrial establishment that has an energy use record higher than the established norm is a potential candidate for saving energy. As such, industries will improve their processes in order to manufacture products with less energy usage. Achieving and improving benchmarks is enhanced by reviewing information on energy utilization performance of industrial processes and operations in other countries with similar conditions to those in Malaysia. Bechnmarking will also educate industries on energy use reporting and awareness for continuous improvement.

Success Criteria: By the conclusion of this programme, the project will have achieved the following results:

- data collection and database system for energy benchmarking set up
- established industrial energy use benchmarks.

Energy Audit Programme

Objective: To achieve widespread use and practice of energy auditing as a tool in energy management in industry.

Process: Energy auditing is a proven and effective energy management tool. However, many industries and firms have been unaware of the benefits of undertaking an energy audit. This programme was set up under MIEEIP to assess current practices in energy auditing, and to develop standardized energy audit tools and procedures. During the audit process, data from the energy bills and from the field (using specialized measuring equipment) will be collected and analyzed. Potential energy savings can then be identified and suitable recommendations including follow up programme will be provided. Forty eight factories will be audited by 2005 and additional six more factories by the year 2007 from eleven various sub-sectors of industries.

Success Criteria: By the conclusion of this programme, the project will have achieved the following results:

- developed standardized energy audit procedures and energy audit tools
- conducted energy audits in selected industry sub-sectors and evaluated the results.

Energy Rating Programme

Objective: To provide information on energy efficient equipment and energy rating programmes by establishing energy standards and labeling for key industrial equipment.

Process: Application of efficiency standards is a cost effective action to improve overall energy efficiency. It involves recommending suitable policy for equipment standards, setting up of an industrial equipment testing facility, establishment of comparative ratings, nameplate specification of characteristics, and the assembling, organization and dissemination of the information to increase awareness and encourage the use of energy efficient equipment. High efficiency motors and boiler best practice programme have been identified as the critical activities to begin with. PTM is taking the lead responsibility by providing rating policy recommendation and techno-economic studies and works in close cooperation with other relevant government agencies.

Success Criteria: By the conclusion of this programme, the project will have achieved the following results:

- released to industry information on energy efficient equipment and energy rating programmes
- developed an implementation plan for a comparative energy rating programme for key equipment.

Energy Efficiency Promotion Programme

Objective: To disseminate information on energy efficient practices in industries and EE and EC technology applications, and to establish an association of accredited energy specialists, consultants and technology developers and providers.

Process: This programme addresses the information barriers that hinder the implementation of EE efforts in industry. To provide a user-friendly way of accessing and retrieving relevant information, the programme has built on the information dissemination activities of PTM. Energy project profiles and case studies of successful EE applications are being documented and disseminated to encourage participation, mainly through the Federation of Malaysian Manufacturers (FMM) or specific industry associations. A collection of techniques and technology applications is being compiled as a computerized database to support industrial firms in their energy saving efforts. The programme will utilize its own publication (MIEEIP Newsletter), various conferences and workshop seminars and website as the medium of dissemination.

Success Criteria: By the conclusion of this programme, the project will have achieved the following results:

- enhanced the information dissemination activities of the public and the private sectors
- established a professional organization of local energy specialists, consultants and technology developers and providers.

ESCO Support Programme

Objective: To enable PTM to determine the optimal structure for the development of energy services company (ESCO) industry in Malaysia which includes issues on regulatory framework, financing and risk evaluation on projects.

Process: The model of industrial ESCOs was not well developed when the MIEEIP was initiated where local energy support services were weak, and there were few full-time professional energy auditors. Lack of technical expertise and the absence of performance-based project financing have been identified as the underlying causes which should be overcome. MIEEIP is attempting to overcome the lack of finance available to ESCOs to implement projects. It also aims to educate ESCOs in the identification of feasible projects, technical know-how, services they can recommend and advise them on how to determine acceptable levels of risk associated with performance contracting.

Success Criteria: By the conclusion of this programme, the project will have achieved the following results:

- evaluated the capacity and capabilities of known ESCOs
- developed and monitored the institutional and legal framework for the delivery and cost recovery of ESCO services.

Energy Technology Demonstration Programme

Objective: To demonstrate the applicability, technical and economic feasibility of proven energy efficiency technologies in various sectors of industry.

Process: Two major attitudinal barriers exist. Firstly, energy in Malaysia is readily available and relatively cheap, and companies do not perceive any problem as long as production remains profitable. Secondly, many companies have only a vague understanding of the sort of measures and technologies available to assist them and a belief that any improvements in energy efficiency are costly.

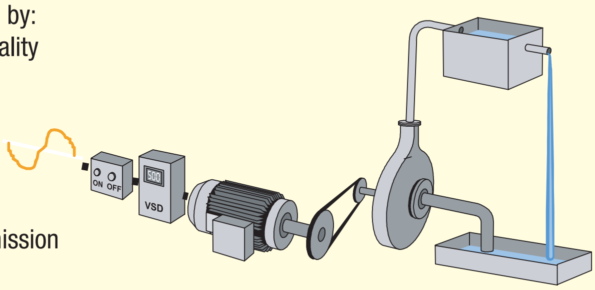
The energy technology demonstration programme is being implemented to convince industrial firms that this is not necessarily the case. By demonstrating actual applications, it is possible to show that substantial benefits can accrue and need not be costly. The major activities in this programme involving feasibility studies, the engineering design, installation, operation, monitoring and evaluation. Several demon-stration projects with proven technologies will be developed, implemented and moni-tored in selected sub-sectors of industry. For example, energy efficiency improvement for a typical motor-driven system (Figure 2) can be implemented in various industries.

Success Criteria: By the conclusion of this programme, the project will have achieved the following results:

- identified and implemented potential

Figure 2 Energy efficiency improvement for a typical motor-driven system

Improve efficiency by:
- better power quality
- switching off
- slowing it down
- VSD
- high efficiency motor
- reducing transmission loss



energy saving technologies
- monitored and evaluated each project for information dissemination purposes.

Local Energy Efficient Equipment Manufacturing Support Programme

Objective: To have energy efficient manufacturing improvements replicated by local equipment manufacturers and feature these improvements as a means of promoting and accelerating the production and utilization of locally produced energy efficient equipment.

Process: PTM set out to determine what realistic improvements could be achieved with more efficient and reliable locally manufactured equipment by assessing the equipment manufacturing capabilities of local equipment manufacturers, determining and evaluating the manufacturing processes involved. Training, technical assistance and financial incentives have been provided to encourage and assist with retrofitting manufacturing systems to the selected manufacturers. The programme is being implemented in conjunction with the technical assistance provided under the energy rating programme (Component 3) and has focused on production of such components as: fans, blowers, boilers, motor rewinding and industrial kilns.

Success Criteria: By the conclusion of this programme, the project will have achieved the following results:
- assessed, evaluated and implemented the typical energy performance and identified potential improvements and new designs for locally manufactured industrial equipment
- provided technical assistance and funding to eligible equipment design and manufacturing improvement projects of selected local industrial equipment manufacturers.

Financial Institutional Participation Programme

Objective: To engage financial institutions on the feasibility of project financing by establishing energy business fund and related frameworks.

Process: Finance and banking institutions in Malaysia have been reluctant to fund EE projects. MIEEIP is creating opportunities for the Government, through PTM, to demonstrate the viability of energy efficiency measures and of the ESCOs that are now undertaking energy saving projects. ESCOs and their projects will be fully scrutinized, and PTM will review and evaluate their technical and financial viability, the financial performance of the firm, the energy saving potential and the corresponding potential for GHG emissions reduction.

Success Criteria: By the conclusion of this programme, the project will have achieved the following results:
- trained local banking and financial institutions on funding EE projects in industry
- developed criteria for the selection and identification of eligible companies for energy technology demonstration scheme financing assistance and industrial equipment manufacturing improvement financial assistance.

FINDINGS OF THE ENERGY AUDIT

Energy audits must be well planned and key resources must be specified (Figure 3). Participation from the host companies is critical, especially when disclosing proprietary data and information.

Results of the energy audits in 48 factories representing different sub-sectors were classified into three main categories as follows:

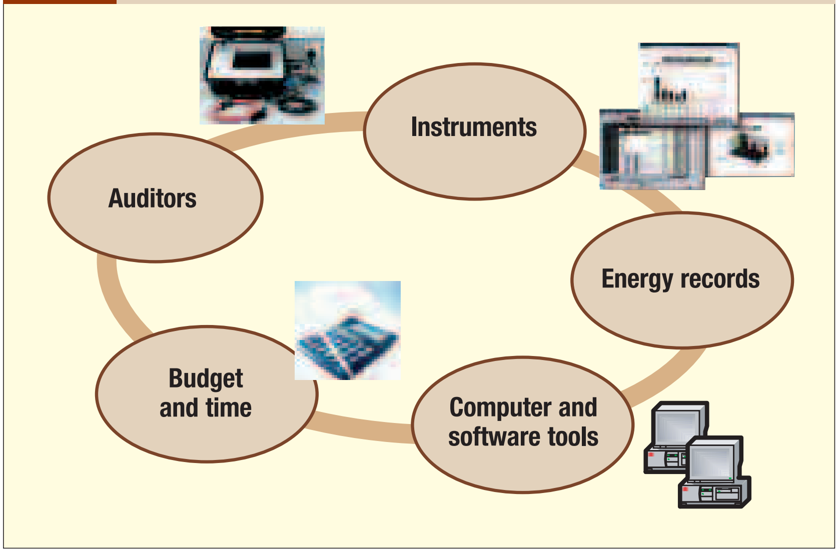
1. no-cost measures
2. medium cost measures
3. high cost measures

No cost measures: These are easy to implement, dealing mostly with measurement and control along with maintenance. These measures could be further divided into two classes, related to thermal and electrical measures such as combustion and steam blow-down control, improvement of electricity supply and distribution network.

Low cost measures: These are applied to thermal (replacements of burners, heat recovery system) and electrical utilities (efficient air conditioning and compressed air systems) as well as process improvements (variable speed drives, batch to continuous process). These require low investment and proven technologies to be implemented.

High cost measures: These involve large investments and innovative technologies. Two classes of measures are possible. The first includes incorporation of new technologies in an existing plant, such as co-generation. The second concerns process modifications and the installation of new processes.

Figure 3 Resources for energy audits



Greater potential saving could be realised if measures are implemented for thermal energy utilization which normally requires financial incentives or financing aid to make it attractive. Except for the cement and glass sub-sectors, the thermal energy reduction strategies would result in saving between 6 to 15 per cent. Notably, greater energy reductions could be realised if the higher cost measures could be implemented by the industries involving capital investment.

Findings from the forty eight factories

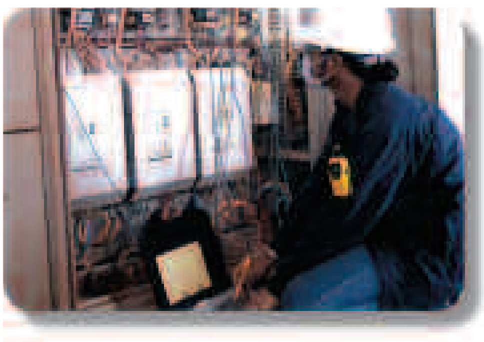
Table 4 Potential Energy and Cost Saving Identified from the Factories Audited Under the MIEEIP, Malaysia, 2004

	Sectors	Food	Wood	Ceramic	Cement	Glass	Rubber	Pulp & Paper	Iron & Steel	Total
	Annual Energy Consumption (GJ/year)	1,835,430	1,031,528	774,061	21,556,595	4,000,370	611,307	5,080,208	4,223,247	39,112,746
	Annual Energy Costs (Th. RM/year)	42,233	13,512	24,061	204,149	97,830	16,908	84,201	160,131	643,026
Measures	No Cost Energy Savings (GJ/year)	24,361	7,996	38,566	1,375	31,449	57,010	51,559	64,194	276,510
Measures	Low Cost Energy Savings (GJ/year)	111,087	131,702	75,229	6,866	13,732	21,171	69,100	56,985	485,872
Measures	High Cost Energy Savings (GJ/year)	238,139	220,863	41,561	337,266	58,913	84,292	690,889	148,874	1,820,796
Measures	Total Energy Savings (Total GJ/year)	373,587	360,561	155,356	345,508	104,095	162,472	811,547	270,053	2,583,178
	Total Cost Saving (Th. RM/year)	8,515	5,201	5,992	33,752	2,485	4,313	19,767	5,247	85,272
	CO_2 Emissions Reduction Potential (Tons/year)	**27,988**	**30,378**	**14,463**	**444,667**	**8,069**	**18,931**	**194,403**	**22,836**	**761,734**

Source of Data: PTM. Findings of the Energy Audits.

show that if all measures are implemented, an energy reduction between 2% to 34% of the Annual Energy Consumption (AEC) could be realised across the individual sectors (Table 4). In general, those factories consumed approximately 39 PJ per year, equivalent to 9.0 per cent of the total final energy consumed by the Malaysian manufacturing sector. It is envisaged that if all the measures are implemented by the factories, electricity consumption will be reduced by 5.6 per cent and fuel demand reduced by 26.7 per cent with nearly 800,000 tons/year of avoided CO_2 emissions.

Details of potential energy savings and CO_2 reductions are as shown in Table 4.



HeveaBoard Berhad Gemas, Negeri Sembilan

Product: Particleboard
Sub-sector: wood

HeveaBoard is a particleboard manufacturing company that was founded in 1993 and commenced operation in 1996. The company was listed on the Bursa Malaysia (formerly the Kuala Lumpur Stock Exchange) in 2005.

The particleboard produced by the factory in Gemas, Negri Sembilan, is made from rubber (hevea) wood—a product that is renewable, sustainable and environmentally friendly. The finished product is covered with veneer or décor melamine paper lamination. The plant has an installed production capacity of 360m^3/day and an annual capacity of 120,000m^3.

The production process involves the reduction of rubber wood to fine flakes of specified dimensions that are dried out to reduce their moisture content from about 40 per cent to 3–4 per cent. After mixing with adhesives the particles are formed into mats according to rigorous specifications and then compressed in a hot press under high pressure and controlled temperature into boards of designated dimensions. The hot press process operates at a temperature of 210°C at the outlet of the thermal heater which consumes large amounts of energy in order to maintain such a high temperature. After the raw boards have been stored and conditioned they are sanded, dimensions are calibrated, and the boards laminated or veneered. The various stages of the manufacturing process produce large amounts of wood waste in the form of bark, and saw and sander dust.

The company was approached by the MIEEIP which offered to assemble a team to undertake an energy efficiency audit of the manufacturing process. After a detailed assessment of the existing system the audit report recommended that management consider the use of a wood dust fired fuel thermal oil heater, replacing the existing medium fuel oil fired thermal oil heater that heats the hot press. The company management recognized the potential benefits in terms of cost and reduction of CO_2 emissions and agreed to proceed.

The MIEEIP, together with the Malaysian Industrial Development Finance Berhad and using a pre-determined set of criteria, selected a local ESCO company, Mensilin Holdings Sdn Bhd to work with HeveaBoard

This case study provides an example of:
- Energy use benchmarking
- Energy audit
- Energy efficiency promotion
- ESCO support
- Energy technology demonstration
- Financial institutional participation

Impact

The increase in energy efficiency and the cost savings have been outstanding:

annual fossil fuel savings	37,385 GJ
energy cost savings	RM720,000 approximately
annual CO_2 reduction	2,916 tonnes approximately

and to manage, implement and finance the project. The ESCO undertook further auditing investigations, conceptual and engineering design work and responsibility for the contracting, construction and overall monitoring of the project.

The project replaced the medium fuel oil fired thermal oil heater which consumed approximately 37,385 GJ of medium fuel oil annually, or 46 per cent of the factory's total thermal energy consumption, with a 2.9 MW wood dust fired thermal oil heater that utilizes the waste generated in the manufacturing process. The new underfeed stoker system was installed in parallel to the old system (that now serves as a standby facility), and relies on biomass in the form of timber waste ducted from all around the factory into a holding silo adjacent to the heater which consumes about 1300 kg of wood waste per hour – an amount well within the factory's capability to supply.

Quotation

"The transfer of technology from the demonstration project has equipped our staff with the ability to conduct and manage such projects in the future. Overall our participation in the MIEEIP has created awareness and greater understanding and appreciation of energy efficiency and conservation."

Mr S. Ganesan, General Manager, Heveaboard Berhad

Cargill Palm Products Sdn Bhd Kuantan, Pahang

Product: Refined palm oil
Sub-sector: food

Cargill, a subsidiary of Cargill United States, was formerly known as Kupak Sdn Bhd and commenced operations in 1980. The company manufactures palm oil products such as palm fatty acid and refined bleached deodorized palm oil, and specialty products such as olein and stearin (used in cosmetics and toiletries). The plant operates seven days a week and has an overall output of about 450,000 tonnes of palm oil and its by-products, more than 90 per cent of which are exported.

Crude palm oil passes through several processes in the company's two refining and two fractionation plants to produce edible and refined oils. These require large amounts of thermal and electrical energy to be fed to high and low pressure boilers, heaters, compressors, motors, pumps, and refrigeration and water cooling systems. About 85 per cent of the energy consumed is in the form of thermal energy (steam and a hot oil system) from fuel, while the remaining 15 per cent is in the form of electricity. Fuel represents 61 per cent of the energy costs and electricity 37 per cent.

An MIEEIP energy audit identified numerous no-cost, low-cost and high-cost measures that could achieve energy savings, and over the 3–4 year period of implementation the company itself also initiated further measures. Altogether nine significant modifications were undertaken as part of the project, leading to major savings and increased efficiency.

Repair of compressed air pipe leakages in the membrane presses, joints and pressure regulator in a fractionation plant that were resulting in a 30 per cent air leakage loss in the system. Immediate repairs reduced electricity consumption. On-going maintenance measures included operating the system at the lowest possible pressure, keeping the air intake clean and cool, and reducing leakage loss to an acceptable maximum of 5–10 per cent.

Steam leak minimization was a no-cost measure that was achieved by a monthly maintenance program. Inspection of piping joints and the remedying of small leaks reduced heat loss and made savings that cumulatively amounted to tens of thousands of RM annually.

This case study provides an example of:
- Energy use bench-marking
- Energy audit
- Energy rating
- Energy efficiency promotion
- Energy technology demonstration

Impact

The increase in energy efficiency and the cost savings have been exceptional:

total energy savings	24,522 GJ
total cost savings	RM1,911,00
annual CO_2 reduction	516 tonnes approximately

Steam trap maintenance was also readily accomplished by extending the company's regular maintenance and replacement procedures to more than 300 steam traps.

Thermal insulation maintenance was identified by the audit team as a significant issue that was occurring as a result of uninsulated pipes and fittings. This was not a simple matter to resolve as structural and maintenance issues discouraged or precluded insulation. Detachable insulating jackets and detachable types of insulation housings for valves and flanges overcame most of these problems.

Process heat recovery was made possible in an alternating heating and cooling process that reduces temperatures from more than 200°C to about 60°C by the installation of a heat exchanger that recovered heat from the dry fractionation processor and diverted it elsewhere for preheating purposes. A heat recovery system applies a similar concept as the installation of an economizer (Figure 4).

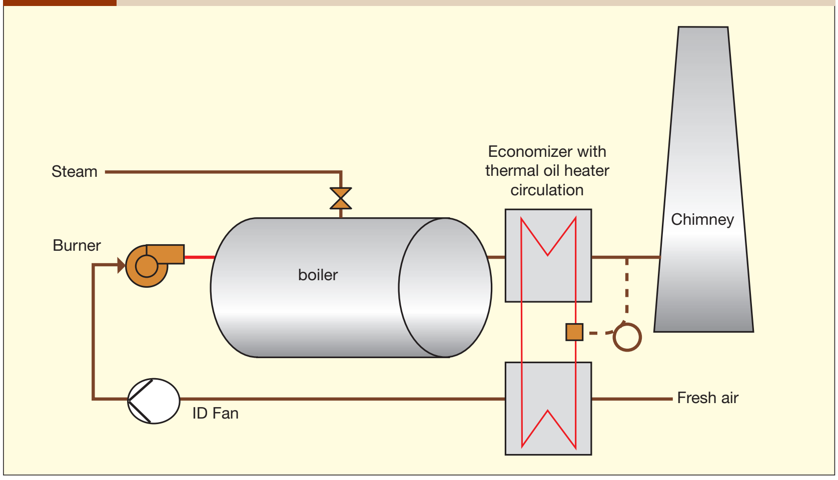
Process control measures to avoid unnecessary heating of the stearin holding tanks required the installation of temperature regulators to maintain the temperature at 60°C. The cost of this installation was significant but was exceeded by the energy savings in the first year.

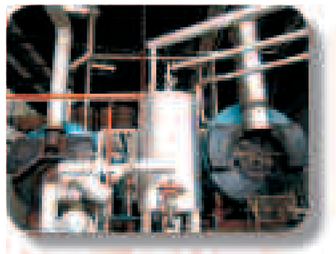
Boiler-fuel switching from medium fuel oil and diesel to natural gas for two boilers and two heaters involved the setting up of an above ground piping network to a nearby natural gas pipeline, the conversion of the burners and final commissioning. The company invested RM471,000 in the conversion and achieved an annual cost saving of RM1,400,000 – recovering costs over a period of about four months.

A new heat scheme (steam system) was installed by diverting clean condensate from heat exchanger systems, tank heating and steam headers in the refineries to the boiler feed water tank by a newly installed pipeline. The work also involved installing a hot tank complete with steam coil. The heat recovered from the system increased the temperature of the boiler feed water from 30°C to 60°C not only creating savings on fuel consumption but also on water usage.

Fractionation plant cooling system optimization necessitated the replacement of old inefficient chillers by a dedicated cooling tower to maintain water quality for the coolers.

Figure 4 Installation of an economizer





Pan-Century Edible Oils
Pasir Gudang, Johore

Product: Refined palm oil

Sub-sector: food

Pan-Century Edible Oils is a well established company located in Pasir Gudang, Johor. At the time of the audit the company's annual manufacturing capacity for edible oils and specialty products was about one million tonnes. The company had already formed a Focused Improvement Project Group, reflecting its desire to achieve greater efficiency and productivity, before the MIEEIP team undertook an energy audit. At that time the factory's monthly energy bill was RM2 million so that, with such a high level of energy consumption at stake, the audit team aimed not only to identify energy cost-saving potential, but also to transfer appropriate, on-going auditing skills and procedures to company staff.

More than 550 metric tonnes of steam is generated daily for physical oil palm refining, soap noodle production, tank farm heating and fractionation. Four major projects that would improve energy efficiency were identified and others have subsequently been initiated or are under review by the company which has its own monitoring and targeting system—an established policy of the Aditya Birla Group of which it is a part.

Steam system optimization entailed a number of measures including: substituting a low pressure steam system for a medium pressure system that would produce the requisite temperature of between 70°C and 80°C for tank farm heating and trace lines by installing pressure regulating valves; similar measures in vacuum circuits to maintain steam supply pressure; improved insulation of steam lines; replacement and maintenance of steam traps; purifying condensates and recycling them for re-use in the boilers; and replacement of steam ejectors by a vacuum pump to create vacuum pressure. Since fuel constitutes 90 per cent of the cost of steam generation, an holistic approach to optimizing the existing steam demand and supply structure has proved extremely beneficial financially.

This case study provides an example of:
- Energy use bench-marking
- Energy audit
- Energy rating
- Energy efficiency promotion
- Energy technology demonstration

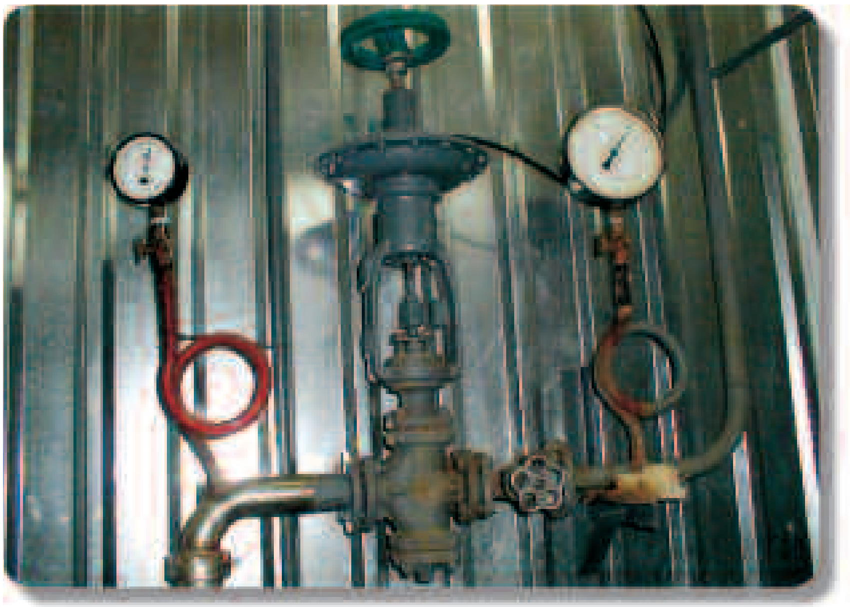
Impact

The increase in energy efficiency and the cost savings have been considerable:

annual energy savings	35,000 GJ
total cost savings	RM1,000,000
cost recovery	1–2 years

Cooling tower modification was required for more efficient supply of cooling water for crystallizers, heat exchangers, compressors and condensers. Seven cooling towers are located strategically in the fractionation, physical refining and soap noodle plants but the audit established that energy savings of about 25 per cent could be achieved by implementing thermal efficiency measures.

High efficiency motors are generally two to four per cent more energy efficient than standard motors so that despite an approximately 20 per cent higher purchase price, power savings in the medium to long term more than compensate. The total cost for the replacement of all existing standard motors to high efficiency motors was RM400,000 which was recovered within four years.



Energy monitoring and targeting within the company's installations is part of the parent company's purta system that monitors and benchmarks all aspects of manufacturing performance. The company installed metering equipment to monitor supply and consumption of electricity, steam flow and chiller load at critical points in the system. Centralized electronic data feedback and reporting through the local network has made the system extremely efficient.

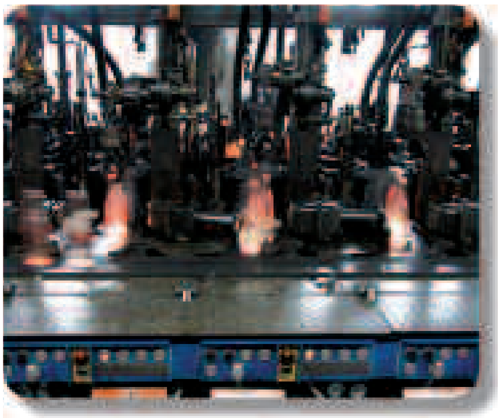
JG Containers Sdn Bhd
Klang, Selangor

Product: Glass containers
Sub-sector: glass

JG Containers is a medium sized glass container manufacturing company that has been operating in Malaysia since the early 1970s. Manufacturing capacity since refitting amounts to about 120 tonnes of glass containers per day, and energy to produce this output constitutes about 20 per cent of the firm's operating costs.

As a result of an MIEEIP audit the company undertook a series of modifications, both low and high-cost, to its production equipment and processes. At the time of the audit the glass furnace was inefficient because of heat loss and poor heat recovery from the exhaust, and these deficiencies were compounded by inadequate insulation of somewhat dated equipment and an inadequate control system on the furnace (Figure 5).

The glass furnace was completely rebuilt with an improved control and heat recovery system permitting an increase in output from 90 tonnes per day to 120 tonnes per day.



The specific energy consumption (SEC) for the process declined from 7.08 GJ/tonne to 4.94 GJ/tonne. The total cost of the project was RM7 million with a payback period of about four years.

The company also reconditioned one of the annealing lehrs at a cost of RM50,000 which resulted in energy savings of 750kWh per day. The annual savings in costs were approximately RM57,000 so that the payback period was less than one year. Production costs also benefitted as the SEC was reduced from 0.13 GJ/tonne to 0.075 GJ/tonne, an improvement in energy efficiency of 42 per cent.

This case study provides an example of:
- Energy use benchmarking
- Energy audit
- Energy efficiency promotion
- Energy technology demonstration
- Financial institutional participation

Impact

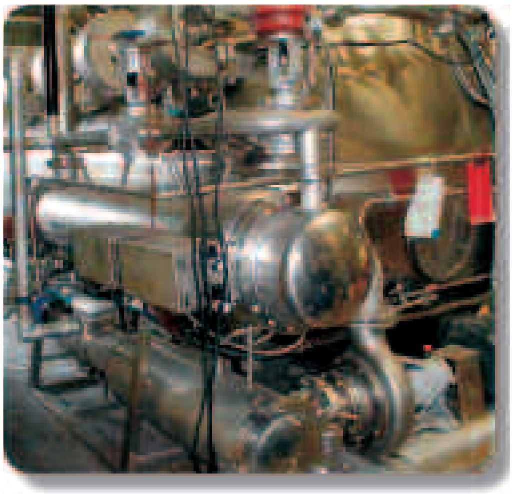
The increase in energy efficiency and the cost savings have been considerable:

annual energy savings	60,100 GJ
daily reduction in water consumption	25m^3 (through recycling)
annual cost savings	RM1,800,000

Another annealing lehr was completely replaced with a new energy efficient LPG/NG fired lehr at a cost of RM400,000. This resulted in net savings of RM62,000 per annum in energy costs and a payback period of 6.5 years. Output increased and the SEC was reduced from 0.13 GJ/tonne to 0.042 GJ/tonne, an improvement of about 67 per cent.

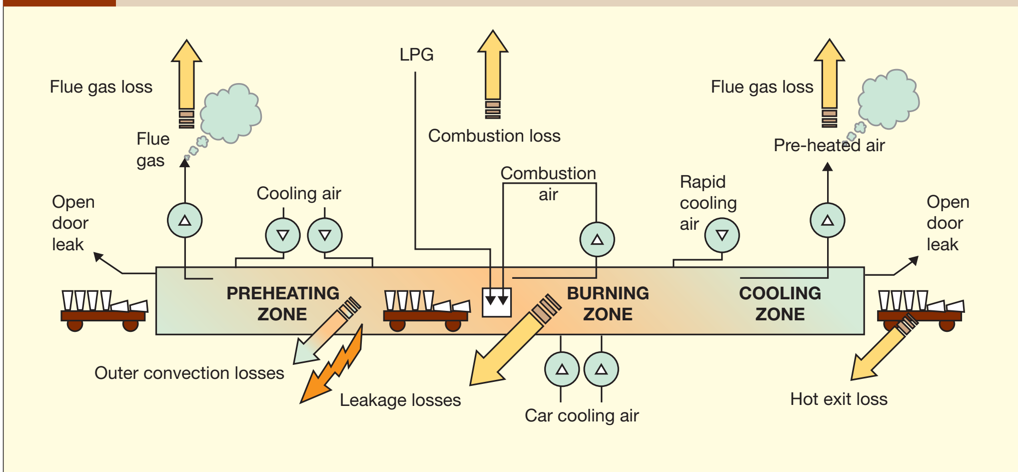
The rebuilding of the boiler and the replacement of one lehr and modification of the other substantially reduced CO_2 emissions.

Measures were also introduced to recycle water. The factory consumes about 100m^3 of water per day mainly for servicing coolers and cleaning cullets (glass fragments for re-melting). About 25m^3 are used daily just for washing cullets and this water had been allowed to run off into the drains. A simple tank with a filter was installed to remove sediment and grit before the water is recycled for further cullet washing. The cost of the installation was RM18,000 and the savings achieved about RM17,500 per annum.



JG Containers is committed to energy conservation and reviewing other potential energy efficiency projects that mainly involve fuel switching to realize the economic, technical and environmental benefits of natural gas. In particular, this would include LPG fired versions of the remaining electrically powered annealing lehr and the glass melting furnace. Use of LPG would result in further cost savings, improved processes, increased productivity and more acceptable emission norms.

Figure 5 Losses in industrial furnace



Jayakuik Sdn Bhd
Klang, Selangor

Product: Particleboard
Sub-sector: wood

JSB is a Malaysian company specializing in the manufacture of high quality particle-board and melamine-faced particleboard utilizing technically advanced manufacturing equipment in its plant located in Sandakan, Sabah. JSB has a production capacity of about 70,000m^3 per annum but operates at about 70 per cent capacity to produce about 50,000m^3 annually of which about two-thirds is exported. JSB generates its own electricity using diesel gen-sets (engine generator sets) and oil fired thermal energy supplemented by sander dust combustion for its heating needs.

The MIEEIP conducted an energy audit at JSB and recommended a total of seven energy saving initiatives and the option of replacing a fossil-fuelled boiler with a biomass boiler. The seven energy efficiency measures included three no-cost measures, three low-cost measures and one high-cost measure. The implementation initially of four of the measures had immediate beneficial results for the company.

Repair of compressed air leakages of up to 40 per cent identified by the energy audit had a major impact. In the course of the company's preventive maintenance operation the leaking pipes and solenoid valves were repaired. While not all leakages in a compressed air system can be eliminated this reduced the leakage problem to much nearer an acceptable 5–7 per cent for this medium-sized network. A staff member has been assigned to monitor the air pipe system and report any leakages. Wasteful practices such as using compressed air for cleaning purposes and cooling motors have been reduced or eliminated.

Inlet air temperature reduction of compressed air to as low an ambient temperature as possible in the compressed air station room was readily improved by increasing openings and installing ventilation fans. Quite minor modifications reduced the temperature in the room and consequently the inlet air temperature, improving the compressor's efficiency.

This case study provides an example of:
- Energy use bench-marking
- Energy audit
- Energy efficiency promotion
- Energy technology demonstration

Impact

The increase in energy efficiency and the cost savings were considerable:

Initiative	Fuel Savings (litres/year)	Cost Savings (RM/year)
Repair of compressed air leakages		
Inlet air temperature reduction	27,063	24,356
Installation of sky lighting at the packing bay		
Readjustment of thermal oil heating settings	15,629	14,066
Process management: increased use of sander dust for burner	410,785	363,707

Installation of sky lighting at the packing bay eliminated the necessity of providing artificial lighting throughout the day. Installing sky lighting in the packing bay roof enabled the plant lights to be switched off during the day and only used in the evenings, at night, or on dark, cloudy days.

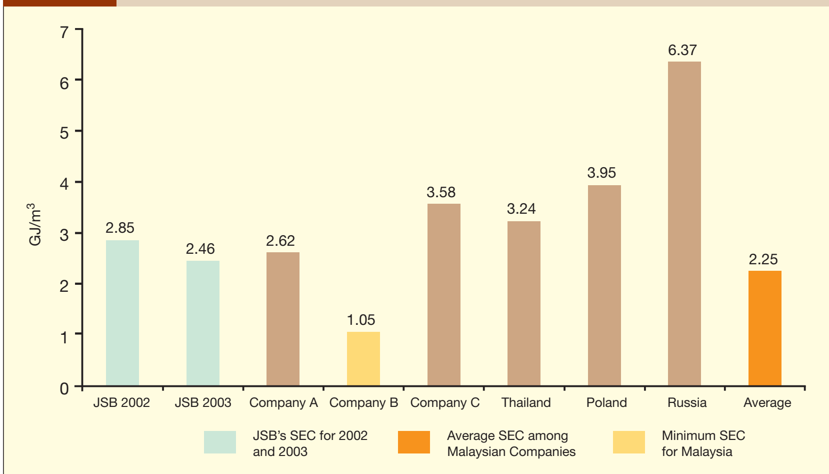
Readjustment of thermal oil setting temperature to take account of actual needs produced substantial savings. The temperature was automatically maintained at between 210 and 220°C. This setting met the requirements of both the press and the laminating machines of about 190-195°C and allowed for heat loss during transfer. However, when the laminating machines were not in use this allowance for loss was unnecessary because the press was only a short distance from the thermal oil heater. Lowering the temperature to 190-195°C during such periods reduced oil consumption and resulted in significant annual cost savings.

Process management: increased use of sander dust for the burner. Although sander dust provided some of the fuel for the wet flakes dryer burner, sander dust combustion was not effectively monitored. By maximizing sander dust use, burner diesel consumption was greatly reduced. Of all the initiatives implemented, this virtually no-cost measure gave the maximum savings, contributing about 90 per cent of the overall savings achieved.

The initiatives implemented in this first phase generated substantial savings. The installation of the sky lighting, the repair of the air leakages, and the adjustment to the air inlet temperature alone reduced the factories annual diesel consumption by more than 27,000 litres and achieved savings of nearly RM 25,000. The main expense incurred was for the installation of the sky lighting at a cost of approximately RM6,000.

The specific energy consumption (SEC) for JSB improved from 2.85 GJ/m^3 to 2.46 GJ/m^3, an improvement of about 14 per cent. Because of this improvement, JSB improved its national benchmarking rank from third to second (Figure 6).

Figure 6 Comparison of specific energy consumption for particle companies



Note: International benchmarks are for reference only. Benchmarks vary according to raw material, technology, and climatic and geographical conditions.

Cement companies Peninsular Malaysia

Product: Cement

Sub-sector: cement

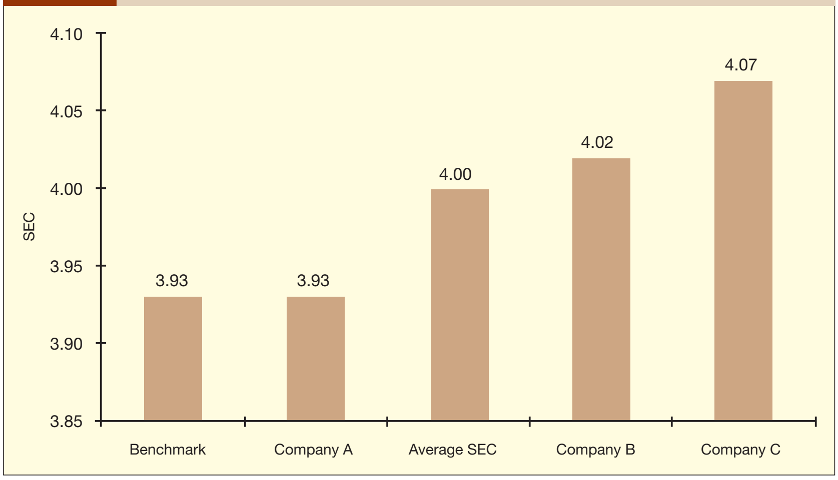
Cement production is an energy intensive industry and the largest energy consuming commodity in the building material category. Cement production accounts for two per cent of world primary energy consumption and up to six per cent of total energy consumption in cement producing countries.

For cement companies, energy costs alone typically account for up to 10 per cent of total operating costs. Benchmarking provides an effective tool for companies to determine whether or not they are performing at a level comparable to other firms in the industry. Energy inefficiencies can be identified by measuring and comparing the energy intensity at the process level and the overall company level against peers or a recognized leader in the industry.

Over a short period leading up to mid-2002, three Malaysian cement companies underwent energy audits. The companies operate integrated plants producing Ordinary Portland Cement and Masonry Cement. For benchmarking purposes an analysis compared the specific energy consumption (SEC) – the amount of energy consumed in producing one unit of output - for each of the companies. Company A, with the lowest energy use and as such the 'leader', established the current Malaysian benchmark at 3.93 GJ/tonne (Figure 7).

Overall the companies achieved an average of 4.00 GJ/tonne. Compared with other major cement producing countries this is a relatively low figure, partly due to the predominance of dry cement production in Malaysia.

Figure 7 Benchmark within Malaysia companies, 2002



Source of Data: PTM, MIEEIP News.

This case study provides an example of:
- Energy use bench-marking
- Energy audit
- Energy rating
- Energy efficiency promotion
- Energy technology demonstration

Despite the favourable comparison on the basis of international benchmarking (Figure 8), there was still scope for local companies to improve their SEC by implementing energy saving measures that had been identified during the energy audit. These findings indicated that the cement sector has the potential to make savings of up to 45 per cent, of which 17 per cent could be achieved without any additional investment (Figure 9).

For example, if Company A, with a SEC

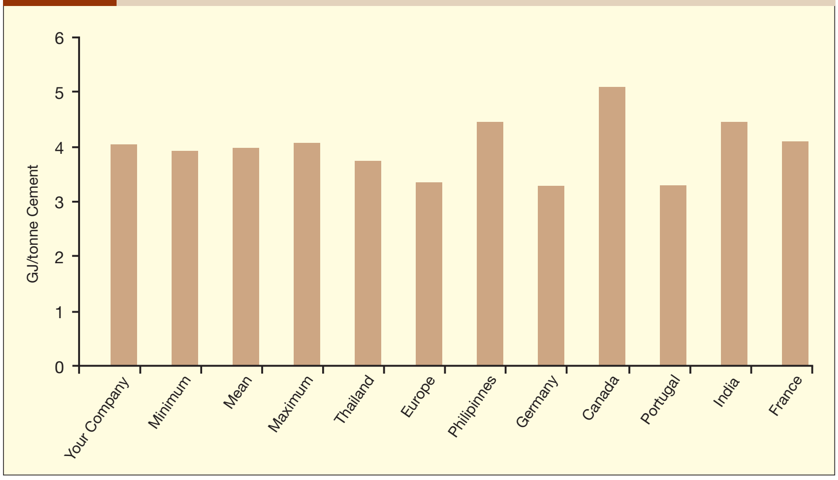
of 3.93 GJ/tonne and—from this exercise—the leader and benchmark setter for Malaysia, were to implement the no-cost and high-cost measures identified by the energy audit, it could improve its SEC as demonstrated in the graph. With these changes, Company A's international ranking could improve dramatically. Significantly, the no-cost and low-cost measures could be implemented by the companies using only their existing in-house expertise.

The energy saving measures applicable to the cement sub-sector concentrate mainly on improving fuel consumption which is more than 88 per cent thermal energy. Specific measures include:

- use of biomass as an alternative or supplementary fuel for drying and heating systems
- heat recovery from the kiln flue gas for raw mill air heaters and pre-heaters
- reduction in leakage and insulation of pre-heaters
- application of variable speed drives for fans and pumps
- reduction in leakage in compressed air systems
- improved handling of coal storage and transport to reduce loss.

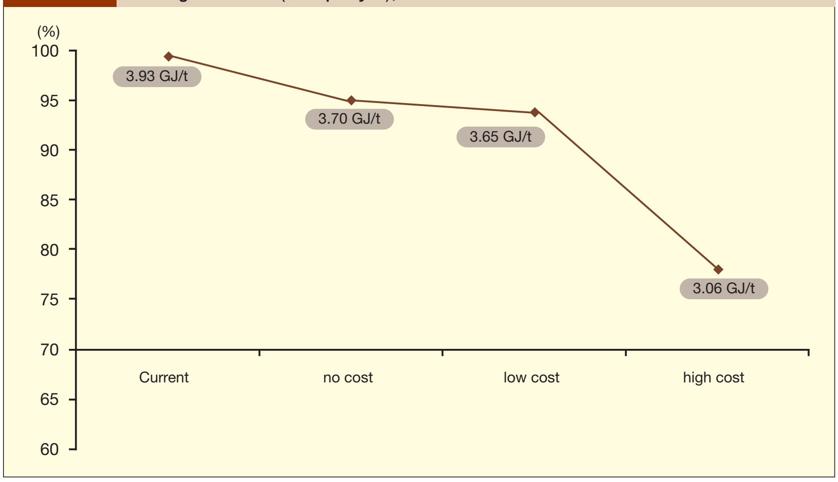
Benchmarking is an on-going process leveraging companies towards industrial excellence, and the first step is to understand the current situation. In the process of benchmarking, best practices are identified and shared. This creates an environment for creativity and innovation. The MIEEIP team recommends industries to adopt energy use benchmarking as a daily productivity improvement tool. Organizations actively supporting these measures in the cement industry include the Cement and Concrete Association, and the National Productivity Association which operates an online data collection system where the Industrial EE Community has been established.

Figure 8 Benchmark in cement industries, selected countries, 2002



Source of Data: PTM, MIEEIP News.

Figure 9 Changes in SEC based on the implementation of energy saving measure (Company A), 2002



Source of Data: PTM, MIEEIP News.

ACHIEVEMENTS OF THE MIEEIP PROJECT

Capacity Building

- PTM is now able to conduct comprehensive energy management analyses and provide advisory services to both the public and private sectors.
- Several ESCOs are now capable of assisting industries to conduct energy audits and implement EE projects.
- Individual industrial companies are now being provided with the information and guidance to implement no-cost energy efficiency measures.
- Financial institutions are now able to understand and implement the provisions for energy efficiency project financing.

Policy Implementation

- Specifications for high energy electric motors have been adapted to meet Malaysian operational standards.
- Energy management is recognized as the 'tool' for achieving energy efficiency, and is now being extended to other applications such as the design and construction of energy efficient and low energy buildings.
- The Malaysian Government's 12 per cent average increase in the electricity tariff in 2006 demonstrates a serious commitment to minimizing energy wastage, especially in the industrial sector.

Acceptance by Industry

- More than 50 factories have been audited and the number of requests is increasing.
- Almost all factories audited have implemented the recommendations of the energy audit team.

- As part of the demonstration programme, five factories have successfully utilized the financial scheme available through the MIEEIP to implement audit recommendations.
- More than two thousand industry professionals throughout Malaysia have benefitted from the seminars/workshops organized by the MIEEIP team.
- Two local manufacturers have implemented new specifications and processes in manufacturing energy efficient equipment.
- MIEEIP Website and the Newsletters are now widely circulated and feedback indicates that the information provided is valued by the recipients.

Impact on the Environment

- Implementation of energy efficiency measures has contributed in almost all instances to the reduction of greenhouse gases, particularly CO_2.

LESSONS LEARNT

Stakeholder Participation

Achieving a significant impact on policy requires consistency with the development aims of Government; this was substantially achieved through broad, high-level stakeholder participation in the project design and throughout the stages of implementation.

Institutional Focus

The pre-existing institutional focus of the PTM greatly expedited and helped sustain the project and its viability, and could be seen as setting a useful precedent for similar projects in the future.

Capacity Building

Retaining international consultants for technical inputs and building local expertise has been advantageous, but national project managers need experience and appropriate management skills to make optimal use of such resources, and in some instances further training to achieve this is desirable.

Long-Term Commitment

Promotion of energy efficiency is a long-term policy. Energy efficiency, as demonstrated by the work of UNDP/GEF in other countries, is a cost effective way of reducing emissions of greenhouse gases, but needs an achievement horizon of decades. Sustainability of this work and the impact achieved largely depend on the Government's willingness to put substantial resources behind such efforts on a continuing basis so that progress achieved so far is not squandered. It also requires support from civil society and the public. For similar projects, it is desirable that they should be predicated on the reasonable expectation of substantial Government funding to sustain momentum.

Managing Expectations

Care must be taken not to exaggerate the potential of certain instruments to deliver (such as ESCOs and specific financial incentives) as failure to achieve expectations can have negative impacts on industry.

Level of Subsidies

The main barrier to more efficient use of energy is its relatively low cost. The practice in Malaysia of substantially subsidizing consumer costs does not encourage consumers to improve efficiency and eliminate wastage.

Scaling Up

More demonstration projects in various sub-sectors of industry are needed to show that EE is indeed achievable and can be implemented despite the lower cost of energy.

Sustainability

Policy makers and authorities must continuously encourage and facilitate efficient use of energy in all economic sectors. This may include the provision of energy efficiency regulation and the enforcement of those where applicable. Although voluntary approach is desirable in the initiation phase, the transition to a long-term permanent approach is highly needed to sustain the EE programme.

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