



**Asia-Pacific
Economic Cooperation**

PEER REVIEW ON ENERGY EFFICIENCY IN MALAYSIA

May 2011

Report endorsed by the APEC Energy Working Group

CONTENTS

Contents.....	ii
Preface	iv
Executive Summary.....	v
Recommendations.....	1
PART 1: Background information.....	5
1. Statistics and Trends in Energy supply and use	6
2. Energy Efficiency policy framework and institutional setup.....	10
2.1. Energy Efficiency Under the Current Energy Policy	10
2.2. Institutional Setup.....	11
3. Energy Efficiency Programmes	12
3.1. Energy Efficient Building Showcase Models	12
3.2. Auditing and Retrofitting Existing Buildings into Energy Efficient Buildings	12
3.3. Green Building Certification (Green Building Index, GBI)	12
3.4. Malaysia Industrial Energy Efficiency Improvement Project (MIEEIP)	12
3.5. Electrical Equipments Labelling Programme	13
3.6. Energy Efficiency Awareness Campaign	13
4. The National Energy Efficiency Master Plan (NEEMP)	13
4.1. The Plan Objectives and Activities	14
4.2. Targets and Impact of the Plan	17
4.3. Costs and Benefits.....	18
PART 2: Review team report.....	19
1. Institutional Context	20
1.1. Critique.....	20
1.2. Recommendations	21
2. Energy Efficiency Goals, Targets and Strategy.....	21
2.1. Critique.....	21
2.2. Recommendations	23

3.	Energy Data Collection and Monitoring.....	24
3.1.	Critique.....	24
3.2.	Recommendations	26
4.	Policy Measures – Industry Sector	27
4.1.	Critique.....	27
4.2.	Recommendations	28
5.	Policy Measures – Electricity Sector	28
5.1.	Critique.....	28
5.2.	Recommendations	30
6.	Policy Measures – Commercial and Residential Sector	31
6.1.	Critique.....	31
6.2.	Recommendations	32
7.	Policy Measures – Transport Sector	33
7.1.	Critique.....	33
7.2.	Recommendations	36
8.	Appliances and Equipment	40
8.1.	Critique.....	40
8.2.	Recommendations	41
9.	Energy Efficiency Related Research and Development	42
9.1.	Critique.....	42
9.2.	Recommendations	43
	Appendix A: Peer Review Team Members.....	45
	Appendix B: Organisations and Officials Consulted.....	46
	Appendix C: References	48

PREFACE

According to the guidelines for the APEC Peer Review on Energy Efficiency (PREE), the objectives of the PREE, endorsed by APEC leaders at their 2007 meeting are to:

- share information on energy efficiency performance as well as on policies and measures for improving energy efficiency
- provide opportunities for learning from the experience of other economies and for broadening the network among energy efficiency policy experts
- explore how energy efficiency goals on an overall and/or sectoral basis and action plans could be effectively formulated in each economy under review, taking into account the range of possible strategies that could be used, according to the circumstances of each economy
- monitor progress towards attaining energy efficiency goals on an overall and/or sectoral basis and implementing action plans, if such goals and action plans have been already formulated at the time of the review
- provide recommendations for voluntary implementation on how implementation of action plans could be improved with a view to achieving energy efficiency goals.

Two activities are undertaken as part of the PREE:

- a) **Peer Reviews** of volunteer member economies
- b) The **Compendium** of energy efficiency policies of APEC member economies based on either the APEC voluntary PREE or energy efficiency aspects of the IEA Energy Policy Review.

This report presents the findings of a peer review of energy efficiency policies conducted in Malaysia. Malaysia volunteered to undertake a peer review.

The primary accountability for each peer review is shared by the economy being reviewed and the Review Team. The peer review in Malaysia was conducted by a team of nine experts (see Appendix A) who visited Malaysia from 29 November to 3 December 2010.

During the visit, the Review Team had comprehensive discussions on energy efficiency with representatives and experts from government agencies, private and state companies, higher education institutions and non-governmental organisations (see Appendix B). The Review Team wishes to thank all the presenters and others that spent time with the team for discussions, especially the representatives of the Ministry of Energy, Green Technology and Water who organised the event.

EXECUTIVE SUMMARY

The Malaysian Government is bringing in energy efficiency as one of the important elements in its energy policy framework. Energy issues such as the security of energy supply, the depletion of indigenous energy resources and climate change have made the Malaysian Government to embrace energy efficiency policy tool. The Malaysian Government also realises that energy efficiency potentials can mitigate the growing energy demand in the economy.

The PREE Team commended the effort by the Malaysia Government to enact an energy efficiency law. The law will be the fundament of Malaysia's energy efficiency policy framework to promote better energy efficiency improvement. Currently, most of the energy efficiency improvement efforts in Malaysia are voluntary. The voluntary energy efficiency improvement efforts have been promoted and supported through incentives by the Malaysian Government. However, the efforts have produced a limited success to improve energy efficiency in the economy. The voluntary nature of energy efficiency improvement efforts itself has been one of the impeding factors. In this regard, the decision to legalise energy efficiency improvement will eliminate the impediment.

Malaysia is also strengthening its institutional capacity to promote energy efficiency by designating an agency called The Energy Efficiency and Conservation Agency Malaysia (EECAM). EECAM would focus its efforts on the implementation of energy efficiency programmes. The PREE Team welcomed the decision to establish EECAM. With a specific role and responsibility, EECAM could mobilise more concerted efforts to promote energy efficiency in Malaysia. EECAM also would help the government to manage better resources allocation for energy efficiency efforts while at the same time could bring EECAM to account for the outcomes of those efforts.

The Malaysian Government is recommended to strengthen the energy institutional setup by taking into account that energy efficiency improvement is an across-the-board approach. In this regard, the responsibility and accountability to improve energy use by various sectors in Malaysia must be shared by all stakeholders especially policy-makers at ministerial level. The main energy efficiency policymaker in Malaysia is the Ministry of Energy, Green Technology and Water (MEGTW). However, the MEGTW jurisdiction on energy matters is limited on electricity and gas supply at reticulation ends. Currently, the National Green Technology and Climate Change Council chaired by the Prime Minister is the highest level of policy-makers meeting where deliberations on green technology and climate change issues including energy are made.

Malaysia is beginning to promote energy efficiency improvement efforts by setting goals and action plans. The MEGTW is in the process of finalising a National Energy Efficiency Master Plan (NEEMP) from 2011 to 2020. The main goal of the NEEMP is to stabilise energy consumption against economic growth in three main economic sectors, i.e. the industrial, the commercial and the residential sector. The PREE Team reviewed the NEEMP goal and recommended that the NEEMP should stretch its goal not only to stabilise energy use but to improve the energy use against the outputs of energy services. The NEEMP also should have a comprehensive coverage by including the transport sector.

A Data and Statistics Unit (DSU) would be designated under the EECAM's organisational structure. The DSU would manage energy data and statistics as well as monitor and evaluate programmes carried out by EECAM. The PREE Team recommended the DSU should operate independently to maintain its neutrality in reporting the progress and evaluation of programmes under the NEEMP. The PREE Team also recommended that energy data collection is legislated under the proposed energy efficiency law to improve energy end-use data collection from various energy users and also to spread the burden of data collection among the government agencies. EECAM is recommended to develop a set energy efficiency indicators to monitoring and evaluate the NEEMP programmes. The development of the indicators should be based on criteria such as the ability to convey information clearly, developed on sound scientific basis, cost effective to develop and relevant to the NEEMP goals.

Malaysia has to review its energy pricing mechanism to encourage and promote efficient use of energy. The current pricing mechanism with heavy subsidies is clearly hindering energy efficiency improvement efforts. The subsidies become disincentive for energy efficiency improvement efforts. The Malaysian government should consider a pricing mechanism which gradually reduces energy subsidies but encourages investment on energy efficiency efforts by linking the efforts with incentives. The incentives could be sourced from the savings of energy subsidies.

The Malaysian Government has been using persuasive approaches to promote energy efficiency improvement in the industrial, commercial and residential sectors. Energy efficiency demonstration & showcase projects, energy labelling, awareness campaign, publications of energy efficiency guidelines, trainings and workshops programmes have been carried to persuade energy users throughout the economy. The persuasive strategy is aimed to bring in voluntary behavioural shift among energy users in the economy. The government is also providing fiscal incentives like tax exemptions to promote energy users to reduce energy use by energy-efficient technologies and management. However, the government is changing its strategy by introducing more regulatory approach. The enactment of energy efficiency law is hoped to fill the missing gap in the current strategy and to serve as a complement to the current approach. The PREE Team welcomed the mixed strategies and provided recommendations to enhance the achievement of the programmes designed for the sectors.

The transport sector is the second largest energy user in the economy with the share of 36.9% of the final energy use in 2008. The large use of energy by the sector was attributed to a high usage of private cars for passenger transport, even in the densely built urban areas. The transport energy demand is growing bigger from year to year. Meeting the growing energy demand would be a great challenge for the Malaysian Government in the future. Recently, the Malaysian government is taking efforts to improve the public transportation, an energy efficient transport mode. The government is also planning to promote the use of green-technology vehicles such as electric vehicles. Programmes to increase the patronage of public transportation, improving traffic congestion and introduction of greener vehicles have implication to reduce energy use indirectly but specific programmes with focus on energy efficiency improvement are needed to mitigate the growing energy demand by the sector.

Energy efficiency related research and development (R&D) is a small and relatively new sector in Malaysia. The ongoing R&D efforts are mostly academic and very small are driven by demand factor. Funds for R&D are sourced from both the government and the private sector and research priorities are determined by either the researchers' preferences/interests or are requests from the provider of the funds. The PREE Team welcomed the strategic action under the NEEMP to empower more demand driven energy efficiency related R&D especially energy efficient technologies in manufacturing sector.

RECOMMENDATIONS

Institutional Context

Recommendation 1 Enhance inter-ministerial institutional setup to address cross-cutting energy efficiency policy issues by establishing a permanent energy committee chaired by the Prime Minister.

Recommendation 2 Exhibit constant and consistent leadership on energy efficiency policy issues especially policy coordination among agencies.

Energy Efficiency Goals, Targets and Strategy

Recommendation 3 The NEEMP should set a stretch goal beyond just balancing or stabilizing the energy consumption/GDP ratio – GDP growth should exceed energy growth.

Recommendation 4 NEEMP's current focus is only on 3 sectors (industrial, commercial and residential), the plan should include the transportation sector as well.

Recommendation 5 The NEEMP should explicitly state that energy efficiency is a fuel resource equal to natural gas, oil, hydro, coal and renewable.

Recommendation 6 The NEEMP should strongly advocate for regulatory reform & incentives to create a viable business model for utilities to promote energy efficiency

Recommendation 7 The NEEMP should focus on programs that will build an indigenous ESCO industry

Recommendation 8 The NEEMP's focus on first promoting programs that deliver energy efficiency by going after "low hanging fruit" should be modified to promote the combining of low hanging fruit with more expensive measures as a means to deliver greater EE in the economy.

Energy data collection and monitoring

Recommendation 9 Locate the Data and Statistics Unit (DSU) of EECAM as an independent unit under the CEO of EECAM. The proposed structure would ensure DSU maintains its neutrality in reporting the progress and evaluation of NEEMP programmes.

Recommendation 10 Enact a provision under the proposed EE Act to empower the government to obtain energy and economic data for energy efficiency analysis from various energy users at supply and demand sides as well as to spread the responsibility and burden of the data collection among relevant government agencies.

Recommendation 11 Develop an analytical energy efficiency monitoring framework. The analytical framework should help to be a communication tool for policy makers and energy users.

Recommendation 12 Develop a set of energy efficiency indicators at a sectoral and sub-sectoral level for the NEEMP and define the data needs according to the indicators.

Recommendation 13 Carry out factorisation or indexation techniques on the indicators to remove the non-energy factors as well as to create economy-wide indicators by aggregation.

Recommendation 14 Publish, periodically, energy efficiency monitoring reports and disseminate the reports to stakeholders and energy users.

Industry Sector

Recommendation 15 Review the energy pricing mechanism for the industry sector to gradually remove energy subsidies. Energy efficiency improvement will not get buy-ins from the industrial energy users if the energy subsidies are behaving like disincentives.

Recommendation 16 Develop and promote energy efficiency improvement business models for the industry sector. The business models should help to explain the nature of energy efficiency investment and the profitability of the investments.

Recommendation 17 Develop funding mechanisms for energy efficiency investments. The funding mechanisms should be developed according to local needs and innovative to attract investments.

Recommendation 18 Create channel for interaction among the interested parties of NEEMP programs. Active and close interactions will help to smooth the implementation of NEEMP programs.

Recommendation 19 Identify human resource needs for the implementation of NEEMP programs and develop programs to train the human resource.

Electricity Sector

Recommendation 20 Make continuous efforts to further reduce transmission & distribution losses.

Recommendation 21 Formulate a policy framework to promote more cogeneration and tri-generation system in the industry and the commercial sector.

Commercial and Residential Sector

Recommendation 22 Expand the scope of MS1525 codes to include new residential buildings.

Recommendation 23 Promote energy efficiency in residential building by demonstration projects.

Recommendation 24 Enhance the MS 1525.

Recommendation 25 Expand the soft loan facility under the Green Tech Fund Scheme (GTFS) for energy efficiency renovation/retrofitting projects in the residential sector.

Recommendation 26 Promote the ‘Government take lead’ measure to drive energy efficiency in commercial buildings.

Recommendation 27 Continue cooperation with non-governmental bodies to promote energy efficiency and energy conservation measures at the residential sector.

Transportation Sector

Recommendation 28 Continue to enhance the integration across Government Agencies on the policy, planning, financing, regulation and management of all aspects of the land transport system in order to achieve the common goals of improving urban public transport and energy efficiency.

Recommendation 29 Develop regular working mechanisms for relevant Ministries and Agencies to make concerted efforts to address the challenges and bridge the gaps in new initiatives such as energy efficiency.

Recommendation 30 Develop large scale demonstration projects of energy efficient transport systems in the newly developed districts (e.g. Putrajaya, Cyberjaya) or in new eco-City / eco-Town, to demonstrate the benefits and to understand the planning, funding, coordination and implementation efforts required to achieve the desired energy efficiency improvement in transport.

Recommendation 31 Set fuel economy target to the vehicle Original Equipment Manufacturers (OEMs), provide fuel economy information to consumers, and in the long-term introduce fuel economy-based or CO₂-based vehicle acquisition or road tax.

Recommendation 32 Estimate energy consumption by transport mode and type of transport activity, and prioritise the implementation plans for energy efficiency and green transport plan based on cost-benefit analysis.

Appliances and Equipment

Recommendation 33 Focus overall Appliance Standards and Labels on moving from “voluntary” to mandatory” standards and labels.

Recommendation 34 Develop a “top end” performance level program.

Recommendation 35 Enhance testing procedures and protocols.

Recommendation 36 Develop a long-term public awareness label strategy and program.

Education and Energy Efficiency Related Research and Development

Recommendation 37 *Provide a firm commitment to energy efficiency related R&D spending and expand the budget over time.*

Recommendation 38 *Establish a flexible, clear and transparent framework for establishing R&D priorities and monitoring/ assessing performance.*

Recommendation 39 *Establish a long-term technology roadmap for EE that sets out R&D priorities.*

Recommendation 40 *Increase cooperation with universities and the private sector in application research.*

Recommendation 41 *Require all government officials to undergo energy efficiency training.*

PART 1: BACKGROUND INFORMATION

The background information contained in this report has been contributed by Malaysia. This information is intended to provide some context to the recommendations of the PREE Team. The first section discusses the trends in Malaysia's energy consumption. The second section provides information on Malaysia's energy efficiency institutions, current policies and objectives and energy efficiency programmes.

1. STATISTICS AND TRENDS IN ENERGY SUPPLY AND USE

Malaysia is one of Southeast Asia's fast developing economies. Its economic has been principally based on manufacturing and resource extraction, although there are ongoing initiatives to expand services and higher-value-added activities. In 2008, the manufacturing sector's share accounted for 28.9% of GDP. The major energy-intensive segments of the manufacturing sector are iron and steel, cement, wood, food, glass, pulp and paper, ceramics and rubber industries. During the same period, the mining sector, including oil and gas extraction, accounted for 7.9% of GDP.

Malaysia is well endowed with conventional energy resources such as oil and gas as well as renewable energy sources such as hydro, biomass and solar energy. Malaysia's domestic oil production occurs offshore, primarily near the Peninsular Malaysia. At the end of 2008, Malaysia's crude oil reserve, including condensate, was 5.5 billion barrels of equivalent. Malaysia also has an abundant natural gas reserve. At the end of 2008, Malaysia's proven natural gas reserves were 14.66 billion barrels of equivalent. Malaysia's hydropower potential is assessed at 29 000 megawatts (MW); 85% of potential sites are located in East Malaysia. Biomass resources are mainly from palm oil, wood and agro-industries.

Malaysia's total commercial energy supply was 64,040 kilotonnes of oil equivalent (ktoe) in 2008. The largest energy source was gas, which accounted for 27,800 ktoe, or 43.4% of the total primary supply. Oil was ranked second, with 26,776 ktoe, followed by coal, with 9,782 ktoe, and hydropower, with 1,964 ktoe. In 2008, Malaysia produced an average of 689 900 barrels of crude oil per day. During the same period, domestic consumption was around 492 000 barrels. Malaysia exports the majority of its oil to Singapore, Thailand, Japan and South Korea. Malaysia's oil production is expected to fall in future, mainly due to the natural depletion of its reserves.

In 2008, Malaysia's natural gas production was 198.8 million cubic metres per day and domestic consumption was 26.7 billion cubic metres. The Peninsular Gas Utilisation pipeline system supplied 61.4 million cubic metres per day of domestic gas, mainly for power generation and industrial use. Malaysia is one of the world's leading exporters of liquefied natural gas (LNG). In 2008, it exported a total of 22.5 million tonnes of LNG to Japan, Korea and Chinese Taipei.

Coal is one of the primary fuels in Malaysia's energy sector. Coal is used primarily for power generation, and by the iron and steel industry and cement manufacturers. Malaysia's coal consumption in 2008 was 1,713 ktoe. Malaysia imports coal from China, Australia, Indonesia and South Africa. In 2008, total gross electricity generation was 105,803 gigawatt-hours (GWh). Thermal generation, mostly from natural gas and coal, accounted for 91.8% of total generation and hydropower for the remainder. Natural gas accounted for 56.5% and coal accounted for 33.4% of the total fuels input for electricity generation.

In 2008, total final energy consumption in Malaysia was 44,901 ktoe. The industrial sector was the biggest final energy user at 18 667 ktoe, or 42.6% of total final energy consumption, followed by the transport sector at 16,395 ktoe, or 36.9%, the commercial and residential sector at 6,205 ktoe, or 13.8% and other sectors (agriculture, and non-energy) at 3,163 ktoe. By energy type, petroleum products

contributed the largest share, with 54.4% of consumption, followed by gas (23.9%), electricity (17.8%) and coal and coke (3.8%).

The role energy plays in achieving the goals of sustainable development in Malaysia had been recognised many years ago. As a result, strategic planning and management of energy resources have been given high priority in Malaysia’s development plans. The sustainability of energy resources have been strategically planned over the years. Energy policies were developed after careful evaluation of the current and future energy needs and the supply of energy. This has resulted in the transformation of Malaysia’s fuel mix for power generation from mostly oil to natural gas and coal as shown in the Figure 1.

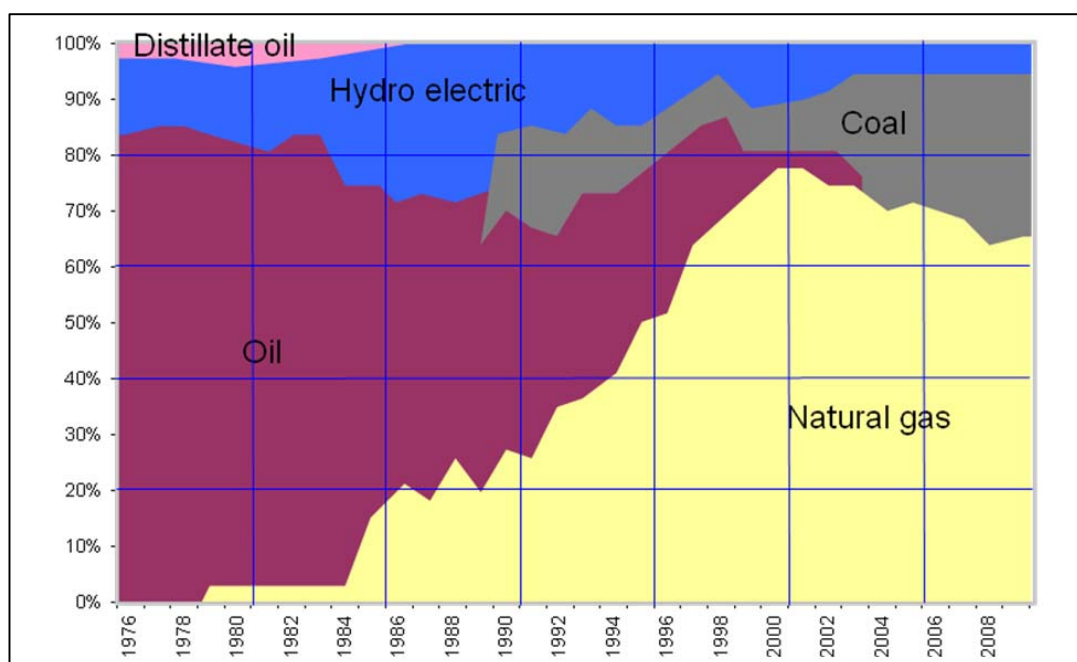


Figure 1 : The transformation of Fuel Mix Structure in the Power Generation sector (source: MEGTW,2008)

The National Depletion Policy was introduced in 1980 to safeguard the exploitation of natural oil reserves. This was due to the fact that Malaysia’s production of crude oil had increased dramatically from 1975 until 1979 and if the rate of production continued, Malaysia’s oil reserves would be exhausted very quickly. To prevent this from happening, production from major oil fields was controlled.

In 1981, the Four Fuel Diversification Policy was introduced to prevent overdependence on oil as the main energy resource especially for electricity generation. The aim was to ensure reliability and security of energy supply by focusing on four primary energy sources namely oil, gas, hydro and coal in the energy mix. In line with the policy, utilisation of gas in electricity generation increased from 67.8% in

1995 to 78.7% in year 2000. On the other hand, the contribution of oil in generation mix declined from 11.0% in 1995 to 5.3% in year 2000.

As a result of the Four-Fuel Diversification Policy, natural gas became the major fuel for the electricity sector. 75% percent of the fuel mix in the electricity sector for the year 2000 was from natural gas, followed by hydropower 10%, coal 9% and oil 6%. However, as seen from past experience, it is necessary to avoid over-dependence on any one fuel. Thus, the percentage of all the different energy sources in the fuel mix is closely monitored to avoid over-dependence on any one fuel and to allow further diversification in the fuel mix for power generation.

As Malaysia's Gross Domestic Product (GDP) increases over the years, so is the electricity consumption. The increment rate for GDP and electricity consumption had been consistent until mid 1990s where Malaysia experience a slump in GDP but our electricity consumption continued to increase. This resulted in higher energy intensity per GDP. The figure below shows the trend of GDP and electricity consumption from 1990 to 2008.

The industrial sector had been the highest electricity consumer until mid 2000s where the residential and commercial sector overtook the industrial sector as the highest electricity user. Nevertheless, most of the electricity generated is still used in the industrial, residential and commercial sectors. The transport sector is also picking up in terms of electricity consumption through the growth of electric train systems as shown in the figure below.

Malaysia stands in the middle in terms of energy intensity per capita and energy intensity per GDP in the ASEAN region as shown in the figures below.

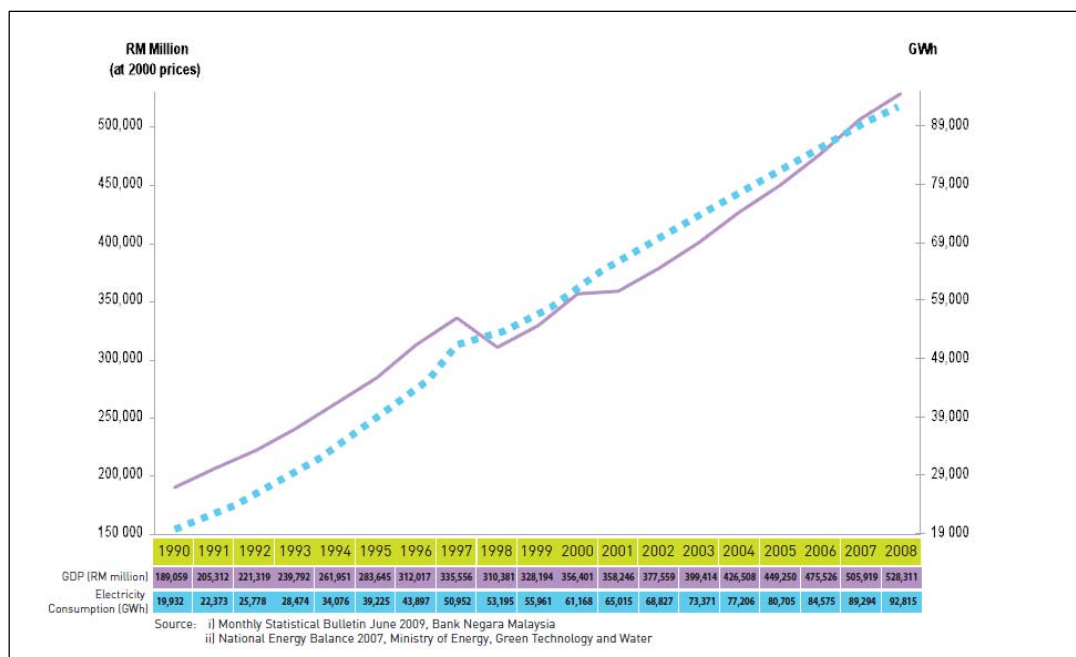


Figure 2 : Trend of GDP and Electricity Consumption from 1990 to 2008 (source: MEGTW,2008)

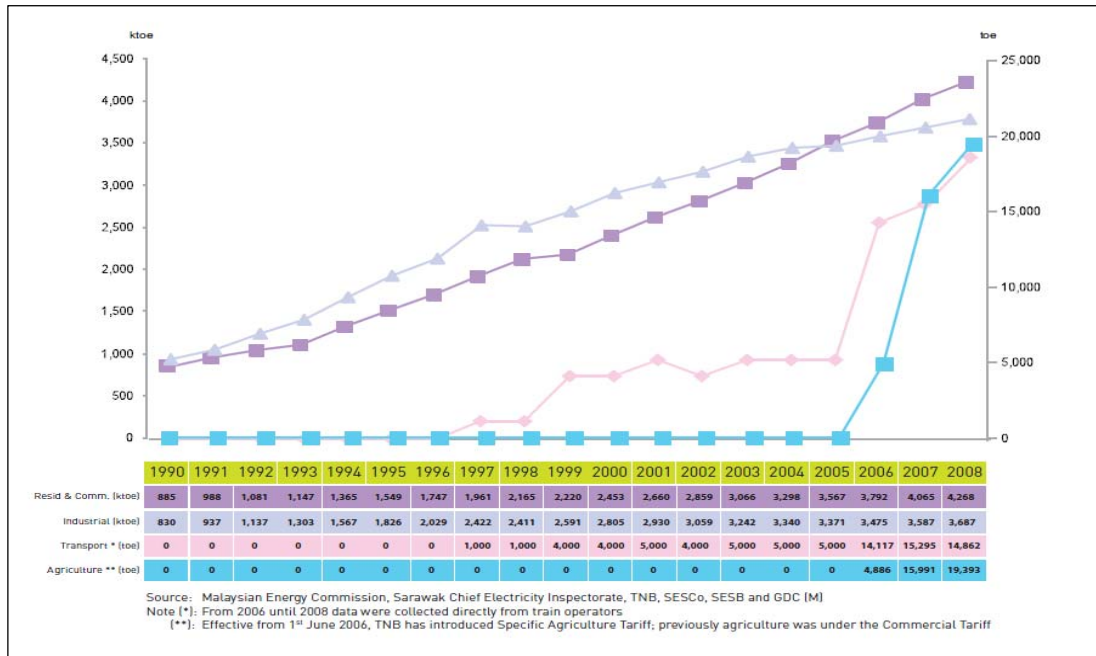


Figure 3 : Electricity Consumption by Sector (source: MEGTW,2008)

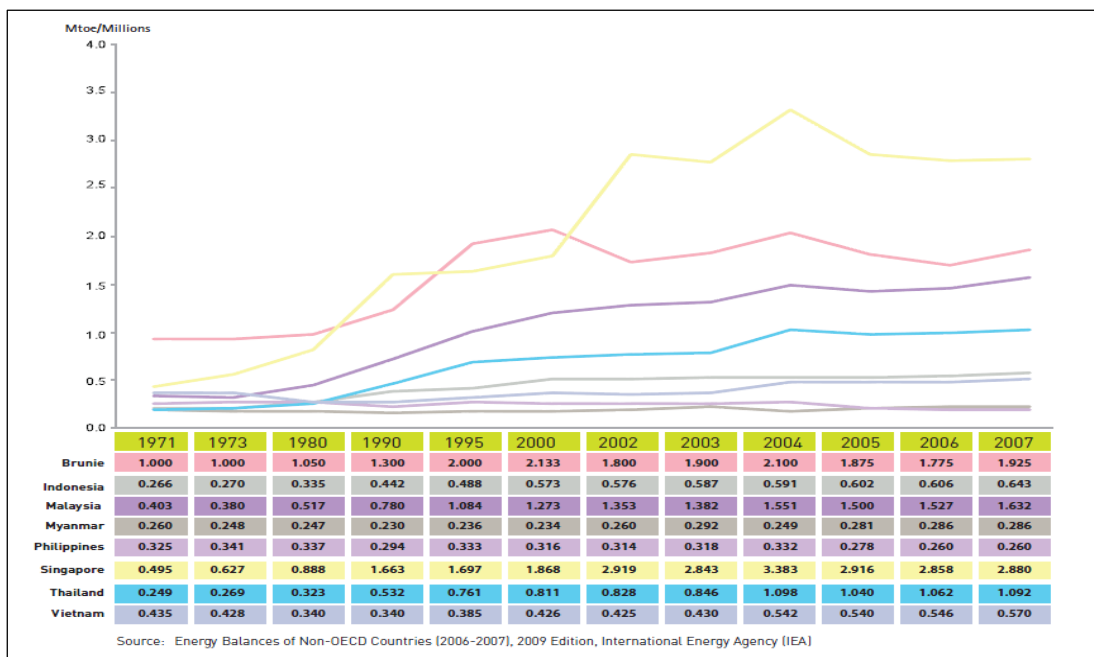


Figure 4 : Energy Intensity per capita in ASEAN (source: MEGTW,2008)

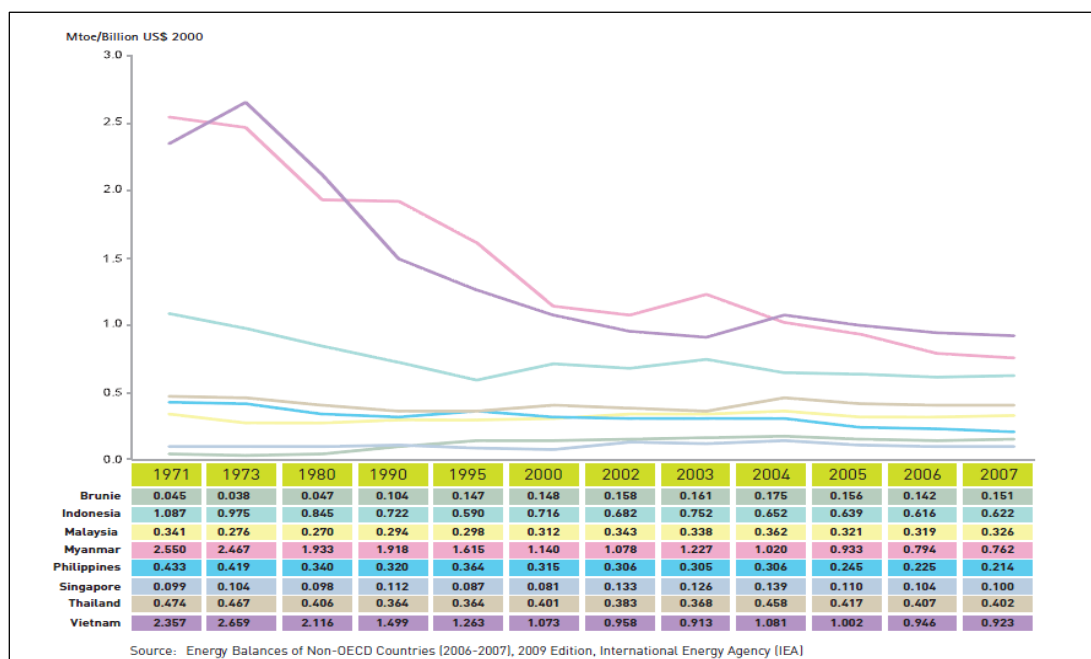


Figure 5 : Energy Intensity per GDP in ASEAN (source: MEGTW,2008)

2. ENERGY EFFICIENCY POLICY FRAMEWORK AND INSTITUTIONAL SETUP

2.1. Energy Efficiency Under the Current Energy Policy

The National Energy Policy

An overall energy policy was formulated in 1979 with broad guidelines on long-term energy objectives and strategies. The aim of the National Energy Policy was to ensure an efficient, secure and environmentally sustainable supply of energy in the future. The three key objectives of the policy are:

Supply Objective:

To ensure adequate, secure and cost effective energy supply by developing and utilising energy sources (both renewable and non-renewable) and to diversify supply sources from within and outside the country.

Utilisation Objective:

To promote efficient utilisation of energy and discourage wasteful and non-productive patterns of energy consumption.

Environmental Objective:

To minimise the negative environmental impact on the whole energy supply chain i.e. energy production, conversion, transportation and utilisation.

The Electricity Supply Act 1990 and the Electricity Supply Act (Amended) 2001

The main purpose of the Act is to regulate the electricity supply industry. The Act also has provisions on efficient use of electricity. The Act has following provisions on efficient use of electricity

-Section 23A: The Minister may, from time to time, prescribe the standards, specifications, practices and measures to be adopted and any other matters in respect of the efficient use of electricity.

-Section 23B: No person shall use or operate any installation unless the installation meets such requirements as may be prescribed in respect of the efficient use of electricity.

-Section 23C: No person shall manufacture, import, sell or offer for sale or lease any equipment unless the equipment meets such requirements as may be prescribed in respect of the efficient use of electricity.

The Efficient Management of Electrical Energy Regulation 2008

The Efficient Management of Electrical Energy is a regulation formulated under the Electricity Supply Act. The regulation was gazetted on 15 December 2008. Under the regulation, any installation with total electricity consumption of 3 million kWh or more over 6 consecutive months is required to implement measures to reduce the consumption by efficient management. The installation also is required to engage an electrical energy manager who shall, among others, be responsible to analyse the total consumption of electrical energy, to advise on the development and implementation of measures to ensure efficient management of electrical energy as well as to monitor the effectiveness of the measures taken.

2.2. Institutional Setup

The Sustainable Energy Division, Energy Sector, Ministry of Energy, Green Technology and Water

The division's key role is to formulate policies related to sustainable energy. Energy efficiency is one of the components under the division's purview. The division among others recommends national energy efficiency policies, management and development plans; establish energy efficiency measures and the framework of energy efficiency promotion; and coordinate, follow up and evaluate the implementation outcome of the policies, management and development plans.

The Demand Side Management Unit, Energy Commission

The Unit performs regulatory functions in the efforts to promote energy efficiency which enforces the Efficient Management of Electrical Energy Regulations 2008. The unit also implements provisions on energy efficiency improvement under the Electricity Supply Act 1990; develop standards and rate electrical appliances under the labelling programme.

SIRIM Berhad

SIRIM Berhad is involved in compliance testing of energy efficient products and promoting energy efficiency management standard. Currently, SIRIM is working with the Energy Commission on the energy performance of electrical appliances for the labelling programme.

Centre for Education, Training and Research in Renewable Energy and Energy efficiency (CETREE)

CETREE is a body funded by Ministry of Energy, Green Technology and Water to conduct programs to create awareness and disseminate knowledge on energy efficiency and renewable energy among energy users in Malaysia. The main target groups for CETREE's programs school children and higher institution students.

3. ENERGY EFFICIENCY PROGRAMMES

3.1. Energy Efficient Building Showcase Models

The Malaysian Government is leading energy efficiency by example through the building of state-of-art energy efficient and green buildings. The first energy efficient building that was built is the Low Energy Office (LEO), housing the Ministry of Energy, Green technology and Water. The LEO building was completed in 2004 and subsequently won the ASEAN Energy Award in 2006 under the efficient building category. Other energy efficient buildings built by the Government are the Green Energy Office (GEO), the first green building in Malaysia and the Diamond Building. These buildings serve as demonstration project to encourage more energy efficient and green buildings to be built in the future especially in the private sector.

3.2. Auditing and Retrofitting Existing Buildings into Energy Efficient Buildings

Besides building new model buildings, the Malaysian Government is also auditing and retrofitting some of its existing complexes to turn them from normal buildings to energy efficient and green buildings. Thorough energy audits were carried out in these complexes and it shows that a minimum of 20% reduction in electricity consumption could be achieved through simple retrofitting.

3.3. Green Building Certification (Green Building Index, GBI)

GBI is Malaysia green building rating system that was launch on 21 May 2009 to rank commercial and residential buildings according to six (6) criteria namely energy efficiency; indoor environment quality; sustainable site planning; materials & resources; water efficiency; and innovation. GBI is undertaken by the Building Professional Bodies. Buildings that met the minimum "greenness" level will be awarded with GBI Certified. Higher levels of award are GBI Silver, GBI Gold and GBI Platinum with GBI Platinum as the highest rank. The awards will expire in three (3) years to ensure that building owners maintained their buildings in a proper manner.

3.4. Malaysia Industrial Energy Efficiency Improvement Project (MIEEIP)

MIEEIP is a collaborative project on energy efficiency between the Malaysian Government and United Nations Development Programme (UNDP) – Global Environment Facility (GEF). The project started in 2000 and ended in 2007. The prime objectives of this project are to:

- create awareness on energy efficiency among industry players;
- reduce barriers in the implementation of energy efficiency efforts;
- encourage the implementation of energy efficiency initiatives in eight (8) energy intensive sub-sectors, namely iron & steel, cement, wood, food, glass, pulp and paper, ceramics and rubber; and
- to implement demonstration project.

A few manuals were published under this project which had helped the industry players to understand and apply energy efficiency practices more effectively.

3.5. **Electrical Equipments Labelling Programme**

Malaysia electrical appliances labelling programme was introduced in 2005 and covers several item namely the refrigerator, air-conditioner, television, motor, lamp and fan. The labelling programme is being expanded to cover more electrical appliances. Appliances are labelled in a scale of five (5) stars with three (3) stars as the average and the more stars an appliance gets, the higher its efficiency is.

3.6. **Energy Efficiency Awareness Campaign**

Awareness campaigns are carried out to educate the public on the benefits of energy efficiency and its practices. Besides the continuous awareness programmes organised, a compilation handbook on energy efficiency practices in the household was published and distributed to the public in 2008. This handbook serves as a handy reference to the household.

4. **THE NATIONAL ENERGY EFFICIENCY MASTER PLAN (NEEMP)**

The National Energy Efficiency Master Plan (NEEMP) is prescribing a path towards improving the energy efficiency by pursuing the implementation of measures that are considered low hanging fruits, as they are viable for the nation as well as the end users. The plan builds on the experiences from past projects and programmes, which have been implemented by various institutions and agencies, but are lacking a coherent framework to ensure sustainability in the longer term.

The barriers that the past experiences have shown to be:

- Lack of overall national plan for Energy Efficiency
- Lack of legal and regulatory framework for Energy Efficiency
- Lack of champion to drive Energy Efficiency

- Low energy prices
- Lack of Funding
- Lack of consistency in embarking on the energy efficiency
- Lack of finance for energy efficiency

The NEEMP presents the instruments for a successful implementation of energy efficiency in Malaysia for the period between 2011 and 2020, which will address and mitigate these barriers. The NEEMP is intended to jump start a long term national energy efficiency culture in order to address a number of important national goals;

- ▶ Reduce rate of depletion of indigenous fuels
- ▶ Reduce imports of required fuels
- ▶ Reduce adverse environmental impacts and CO₂ due to the consumption of energy
- ▶ Better manage electricity demand
- ▶ Manage overall energy growth
- ▶ Reduce the energy consumption per GDP ratio to 1:1
- ▶ Get the price signal right; remove fuel subsidies and move to market pricing

4.1. **The Plan Objectives and Activities**

The NEEMP is presenting a strategy for a well-coordinate and cost-effective implementation of energy efficiency in all segments of the society, which will lead to reduced energy consumption and economic savings for the consumers and the nation.

The aim for the plan is to promote energy efficiency in line with the following policy statement:

“Encourage Energy Efficiency to ensure productive use of energy and minimize waste to contribute to sustainable development and increase welfare and competitiveness.” To get final text from Ivy

The objectives to be fulfilled with the plan are expressed in 6 main thrust that will drive the Nation towards a more energy efficient use of energy:

- Thrust 1: Establish an overall long-term national plan for energy efficiency.
- Thrust 2: Create legal and regulatory framework for Energy Efficiency.
- Thrust 3: Create a champion for energy efficiency.
- Thrust 4: Create adequate and sustained funding mechanism for energy efficiency.
- Thrust 5: Implement Energy Efficiency Programmes.
- Thrust 6: Enable commercial finance institutions to support energy efficiency.

The above 6 thrusts will together ensure that the barriers to energy efficiency are addressed and energy efficiency will play an important role in the society during the next decade. The thrusts will reach out to all segments of society and ensure that all energy consumers are encouraged to implement energy efficiency and reap the benefits of the savings that energy efficiency will provide.

The plan is outlining strategic actions that will lead to a framework for energy efficiency. These are the following:

Action 1: Energy Efficiency Act

As it has been identified that there is no legal framework for mandating energy efficiency initiatives, nor responsibilities for implementing energy efficiency it is crucial to prepare and implement an Energy Efficiency Act that place the authority for energy efficiency with the Minister of Energy, Green Technologies, and Water. The Act will also define the organisational framework and funding mechanism for energy efficiency initiatives as well as provide the legal backing for mandatory energy efficiency measures.

Action 2: Energy Efficiency and Conservation Agency (EECAM)

EECAM will be the focal point for energy efficiency planning in the country and ensure that programmes are being prepared and implemented, as well as ensuring that the impact is continuously monitored and evaluated.

Action 3: Funding for energy efficiency

Funding for energy efficiency is necessary in order to overcome the main investment barrier for energy efficiency, which is identified to be the higher capital cost for energy efficient equipment. It is proposed that the fund is capitalised through a small levy on electricity sales, which will provide continuously funding proportional to the electricity consumption. This sustained funding will allow programmes to be developed and implemented under this and future plans. As the funding is collected by the energy consumers and the support from the fund will be returned to the energy consumers to enable them to save energy and thus money it will lower the overall energy cost for the consumers instead of being a burden.

Action 4: Government led initiatives

The government is identified as a major consumer of energy and buyer of energy consuming equipment and appliances. The government institutions can therefore play a major role in transforming the society towards a more energy efficient one, by creating demand and purchasing energy efficient equipment and demonstrating good energy management in its buildings.

Action 5: Capacity Building

It is required to build a strong, knowledgeable mass of professionals to implement energy efficiency initiatives such as energy audits, energy management, develop energy efficient products etc. Capacity building of the general public and businesses is also required to create awareness about energy consumption and energy efficiency options available.

Action 6: Research, development and innovation

Research and development is important for a further progressing of energy efficiency and universities and institutions will be encourage to focus on research in areas related to energy efficiency. Manufacturers shall be spurred to innovate and develop products that are more energy efficient than traditional ones both in order to meet the future market demand for more efficient technologies.

The plan proposes 18 specific energy efficiency programmes to be implemented over the next 10 years period. The programmes can be grouped into 6 key initiatives related to the design of the programmes.

Key initiative 1: Rating and labelling of appliances. Mandatory labelling of electrical appliances are proposed for initially 3 appliances; refrigerators, air-conditioners and fans. As the Energy Commission has already introduced a label for these appliances it is planned to make the labelling mandatory and provide rebates to consumers, who purchase the most efficient 5-star appliances. The rebates will be used to kick start the market transformation and will phased out as the market penetration for high-efficient products is evident.

Key initiative 2: Minimum Energy Performance Standards (MEPS). MEPS will be implemented for energy consuming equipment to be sold in the market. Initially it is planned to introduce MEPS for lighting as incandescent light bulbs will be banned and the lighting is to be provided by more efficient compact fluorescent lamps. Also for electrical motors a MEPS will be introduced to ban in-efficient models to enter the market.

Key initiative 3: Energy Audits in Buildings and Industries. Energy audits and consultancy services for identification of energy saving potentials in facilities will be introduced. It has been demonstrated in earlier studies that savings of 10% or more are readily available at low or no cost, just by introducing better practices and reducing leaks etc. Energy audits will be done in commercial buildings and industries. As a kick start activity government facilities will be subject to energy audits as well.

Key initiative 4: Targeted rebate and support programmes. Energy efficiency programmes will be designed and implemented to create a market transformation towards more energy efficient technologies. Rebate programmes will be made available to provide support to cover the incremental capital costs for energy efficient technology e.g. 5-star appliances. Rebate schemes are envisaged to be finite in terms of amount of support to be given and will be phased out when the market transformation is evident.

Key initiative 5: Cogeneration and Tri-generation. Cogeneration is the simultaneous production of heat and power and tri-generation is also including cooling. By installing engines and turbines with heat recovery, it will allow that the utilisation of the fuel is maximised, compared to the separate production of heat in boilers and power in central power plants. The energy saving potential is in terms of the overall fuel savings to be achieved, which is a measure to conserve especially natural gas. Cogeneration will be promoted to facilities using boilers to generate heat and chillers for cooling.

Key initiative 6: Energy Efficient Building Design. For new and existing buildings programmes will be undertaken to demonstrate energy efficient design features. This will be in the form of demonstration and show-case projects within various building types e.g. offices, shopping centres, hotels and dwellings, development of guidelines and enhancement of the uniform building by-laws.

4.2. Targets and Impact of the Plan

The target of the plan is to reduce the electricity consumption by 10% in the year 2020 compared to a business-as-usual scenario. The proposed 18 programmes in the plan will result in significant energy savings over the plan period and beyond. As implementing energy efficiency measures will provide energy savings for the lifetime of the technologies there are a long-term benefits associated with energy efficiency. The proposed plan meets the set target and saves more than 10% of the year 2020 electricity consumption.

The total energy savings of the proposed programmes over the lifetime of the technologies will be about 181 TWh, which is about two times the yearly energy consumption in the country at present. By 2020 the plan will already have saved a total of 85 TWh in the period 2011-2020 and reduced the annual electricity consumption by nearly 19 TWh, which is a reduction of more than 10% of the business-as-usual consumption.

The electricity savings will directly lead to savings in peak demand and the need for new power plant capacities. The plan will avoid planting up of about 3.9 GW of new power plant capacity, which corresponds to more than five power plant units at today's average size of 700 MW. This avoided capacity will save capital expenditure for power plants and the energy savings will save the procurement of fuel such as coal and gas to generate the electricity.

Savings of fuel consumption will also lead to less environmental impact from combustion and the greenhouse gas emission reductions of the plan is projected to be 144 million tonnes of CO₂ over the lifetime of the energy efficiency initiatives. A total 67 Million tonnes CO₂ will be saved during the period 2011-2020 and the annual emission reduction in 2020 will be about 14 million tonnes CO₂. The increase in greenhouse gas emissions from power generation will be almost 25 lower than the business-as-usual scenario.

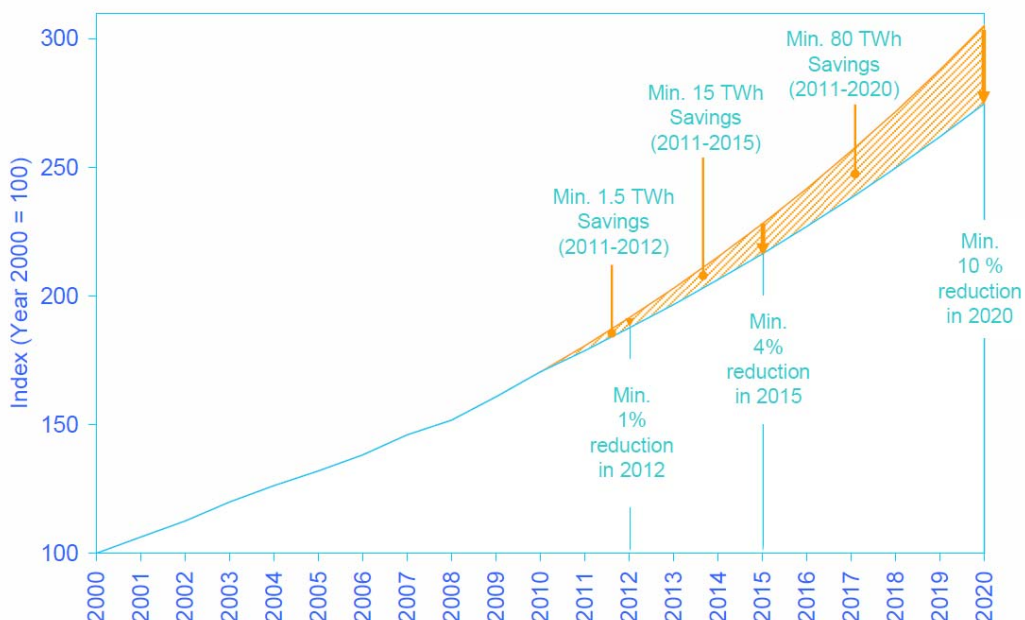


Figure 6 : Business-as-usual vs NEEMP (source: MEGTW,2010)

4.3. **Costs and Benefits**

The implementation of the NEEMP will require RM 225 Million annually for support and incentives. A continuous funding mechanism is proposed that will collect funds from the electricity sale through a levy of 0.75% on the electricity tariff. This electricity cost increase will be offset by the electricity savings that will be provided to the consumers and they will experience a reduced overall energy cost.

The funds will be used as a catalyst to spur the consumers to invest in energy efficient technologies and projects. The total public funds to be disbursed during the plan period are about RM 2.3 billion and this amount will leverage RM 12.1 billion to be invested by the private sector. As the energy efficiency investments lead to energy cost savings in a magnitude of RM 52 billion over the lifetime of the energy efficiency initiatives the total invested capital is returned more than 3 times, with a cost-benefit ratio of 3.6.

PART 2: REVIEW TEAM REPORT

This part of the report presents the PREE Team's conclusions and recommendation about energy efficiency policies and programmes in Malaysia.

1. INSTITUTIONAL CONTEXT

1.1. Critique

In Malaysia, the jurisdiction on energy supply and use is vested with the Federal Government. The Federal Government formulates and implements energy policies including energy efficiency policies. Under the current institutional setup, energy matters are handled mainly by the Economic Planning Unit of Prime Minister's Department (EPU), the Ministry of Energy, Green Technology and Water (MEGTW) and the Energy Commission (EC). The EPU decides macro energy policies including energy subsidies, energy market structure, and energy infrastructure development. The MEGTW is in-charge for policies related to electricity supply and gas supply at reticulation ends. The EC is the regulator for the MEGTW. In hierarchal order, the EPU as a central agency sits at the top of institutional setup and then followed by the MEGTW and the EC.

Malaysia's energy demand has been growing significantly, outstripping the GDP growth. The growth is attributed mainly to the energy-intensive industry sector and the transport sector. The growing energy demand would impose a risk on the Malaysian Government since the indigenous energy resources are fast depleting and the cost energy supply is associated with the scarcity. In this regard, the Malaysian Government should focus its energy policy to reduce the growing energy demand. Energy efficiency improvement can offer a good solution to mitigate the growing demand of energy in Malaysia and to ensure the security of energy supply.

Even though energy efficiency is a good policy choice for Malaysia to address the growing energy demand, the ability to attain the potentials of energy efficiency improvement at various sectors and sub-sectors is limited under the current energy institutional setup. The current structure of institutional setup does not spreading the need and responsibility to improve energy efficiency among various stakeholders. For example no government agency can be called to account to reduce energy demand in the transport sector despite the sector's energy demand has been growing from year to year. Currently, the responsibility to promote efficient use of energy is resting mainly with MEGTW. However, the jurisdiction of MEGTW on energy efficiency issues is limited on electricity supply and gas supply at reticulation ends.

Malaysia's energy institutional setup needs to take into account that energy efficiency improvement is an across-the-board approach. In this regard, the responsibility and accountability to improve energy use by various sectors in Malaysia must be shared by all stakeholders especially policy-makers at ministerial level. Currently, the National Green Technology and Climate Change Council chaired by the Prime Minister is the highest level of policy-makers meeting where deliberations on green technology and climate change issues including energy are made.

The effort to strengthen the institutional capacity on the implementation side of energy efficiency programs is an apt move. The establishment of Energy Efficiency and Conservation (EECAM) under the NEEMP will boost energy efficiency improvement programs by having explicit organisational objective to improve energy efficiency. This will help energy efficiency programs to have more focus and resources

for effective and efficient implementation. The achievement of energy efficiency programs also can be easily monitored and evaluated when the accountability and deliverables are defined clearly.

1.2. Recommendations

Recommendation 1 Enhance inter-ministerial institutional setup to address cross-cutting energy efficiency policy issues by establishing a permanent energy committee chaired by the Prime Minister.

Recommendation 2 Exhibit constant and consistent leadership on energy efficiency policy issues especially policy coordination among agencies.

2. ENERGY EFFICIENCY GOALS, TARGETS AND STRATEGY

2.1. Critique

The MEGTW has recognised the need for a comprehensive national energy policy and is currently in the process of finalising a National Energy Efficiency Master Plan (NEEMP) for 2011 to 2020. In the draft final report of the NEEMP reviewed by the PREE team, energy efficiency and demand side management are seen as the critical path that must be followed for the economy to achieve Malaysia's economic growth while meeting its sustainability and environmental goals by 2020.

The NEEMP is intended to prescribe a strong foundational framework that will allow for implementation of significant energy efficiency measures and best practices that will overcome many of the typical barriers to energy efficiency (e.g. subsidized fossil energy prices, lack of readily available financing for energy efficiency, missing legal and regulatory policies, etc) that Malaysia shares with other economies. The need for a strong NEEMP is further driven by Malaysia's commitment to reducing carbon emissions and establishing a national indicator to assess efforts undertaken to address the adverse impacts of climate change.

The NEEMP is broadly based through the entire economy (with the exception of the transport sector) and includes key elements of economic, environmental and social policies. The strategy is formulated around the experience and lessons learned from prior energy legislation, guidelines, and programmes as the foundation for moving forward on accelerating energy efficiency into the marketplace.

NEEMP's strategic approach focuses on first implementing energy efficiency measures that are considered "low hanging fruit". While this generally seems to be a low cost approach to getting more efficiency quickly into an economy, it can stymie greater energy efficiency savings over the long term and frustrate efforts for financing energy efficiency measures that take longer to payback the capital, but higher, investment needed to implement them. A better approach would be to carefully look at bundling the cheap and easy, with quick payback, low hanging fruit measures with selected more expensive and longer payback measures in order to garner higher energy savings while now making the overall energy savings package financeable. This type of approach ensures that the economy does not place a barrier in front of higher savings, but more expensive, energy efficiency measures and miss opportunities or put them off for many years.

The Malaysian government recognises that in order to achieve its strategic goals, an overall energy efficiency law must be created. The NEEMP sets forth a plan to create a national Energy Efficiency Act (EE Act). As currently envisioned by MEGTW, the EE Act would encompass three of the most critical actions needed to ensure that energy efficiency becomes part of the mainstream energy business and culture of the economy: development of a framework for implementing energy efficiency programmes and policies; assignment of the needed authorities and responsibilities throughout the government; and creation of long-term funding mechanism for Energy Efficiency.

These three actions provide the foundation needed to meet the economy's national energy efficiency goals. An overall framework sets forth the direction for subsidiary legislation that would cover such critical areas as regulatory reforms and regulations, specific directives and orders governing such areas as codes, standards, and energy management, as well as the pathway to implement energy efficiency through government leadership and assistance. The laying out of specific authorities and responsibilities for the Minister of MEGTW is the proper step to enable energy efficiency to be in the forefront of the economy's overall energy strategy for the next decades. The Minister's expanded role in the energy arena sends a strong message to the businesses and citizens of Malaysia that energy efficiency is as, or more, important than the conventional sources of energy. Government leadership at this highest level also provides businesses and financing organisations the assurance that the programmes and policies the Minister initiates will be long lasting and enduring.

Finally, the EE Act's provision for a sustainable funding mechanism (similar to the "public benefit" funding schemes in other economies, i.e. levying a small charge on electricity, gas, or motor fuels) is a key strategic action that ensures that needed funding will be available to underpin the needed overall public and private financing that will place Malaysia as a leading economy on energy efficiency. Most importantly, the NEEMP explores the impact of such a levy on the consumer and finds that the benefits in lower bills outweighs the slightly higher rate charged.

As part of its strategic approach, the Malaysian Government also recognises that there is a need for an overall, quantifiable energy efficiency target. The NEEMP sets such a target of 10% reduction of electric consumption from "Business-As-Usual" (BAU) scenario in 2020. The total energy savings of the proposed programmes over the lifetime of the technologies will be about 181 TWh, which is about two times the yearly energy consumption in the country at present. By 2020 the plan will already have saved a total of 85 TWh in the period 2011-2020 and reduced the annual electricity consumption by nearly 19 TWh, which is a reduction of just more than 10% of the BAU consumption. In addition, the plan does set interim target goals (e.g. 2015 4% reduction, or 5.5 TWh/year).

The NEEMP also recognises that the energy intensity of the economy is much higher than many of its neighbouring economies and far greater than more developed economies. Historically, the energy growth rate has been at 7%/year (with electricity at 9%/year) while economic growth (Gross Domestic Product or GDP) has been at only 6% year. By becoming more energy efficient, the economy can continue to grow its GDP while decreasing its energy input. While the plan proposes that the economy balance (and stabilize) energy and economic growth, this should be a short term goal, while the longer

term goal should be to ensure the economy “stretches” that goal to have the energy growth rate become lower than the GDP growth rate.

The NEEMP identifies a variety of key energy efficiency programme initiatives that are critical to meeting the plan’s strategic objectives. Programmes such as appliance standards and building codes often provide the biggest and most long lasting energy savings in an economy. This is an excellent pathway to accelerate energy efficiency into the economy. However, evaluation, monitoring and verification (EM&V) must be a key part of these programs. Enforcement of codes and standards is also critical to ensure that the codes and standards are adhered to at all times. A minimum energy performance standard program (MEPS) is also an important practice to initiate. And finally, codes and standards need to be updated on a regular basis, and where applicable, testing procedures must be in place to ensure the credibility of the programs.

The NEEMP also has a variety of energy efficiency programmes for the buildings and industry sector. While these programmes will reach two key sectors which often have tremendous opportunities to reduce energy consumption through efficiency measures, the transport sector is notable by its absence. The government should pursue, and the NEEMP reflect, transportation efficiencies that will reduce the consumption of motor fuels in particular. These programs could not only include the promotion of higher efficiency vehicles, but also more mass transit options and the incorporation of smart growth planning and design in both new and existing cities and communities.

Overall, the economy and the NEEMP are headed in the right direction. The recommendations below identify some gaps in the economy’s/plan’s direction and provide the rationale why such gaps should be remedied. Some of the gaps have been discussed above, while others relate to general actions that will help introduce and implement more energy efficiency into the Malaysian culture.

2.2. Recommendations

Recommendation 3 The NEEMP should set a stretch goal beyond just balancing or stabilizing the energy consumption/GDP ratio – GDP growth should exceed energy growth.

Energy growth exceeding GDP growth on an annual basis indicates that little efficiency is in the economy. Many highly productive economies continually reduce the energy consumption/GDP ratio over time. Malaysia should set a goal to implement efficiency programs that will reduce the ratio to better than 1 to 1.

Recommendation 4 NEEMP’s current focus is only on 3 sectors (industrial, commercial and residential), the plan should include the transportation sector as well.

Transportation energy consumption (2008) is 36 % of the total energy consumption in Malaysia, but no transportation efficiency has been included in NEEMP. MEGTW should include transportation efficiency measures in the plan and increase them through 2020.

Recommendation 5 The NEEMP should explicitly state that energy efficiency is a fuel resource equal to natural gas, oil, hydro, coal and renewable.

Energy efficiency is an indigenous energy resource that can help meet future energy demand. It is the cheapest, cleanest, fastest and easiest resource to deploy. It should be considered the “first fuel”.

Recommendation 6 The NEEMP should strongly advocate for regulatory reform & incentives to create a viable business model for utilities to promote energy efficiency

A barrier to energy efficiency is the traditional compensation scheme that rewards utilities for generation, but not for energy efficiency. It is critical that the new efficiency agency lead the effort to advocate for the reforms that will create the incentive for utilities to pursue energy efficiency.

Recommendation 7 The NEEMP should focus on programs that will build an indigenous ESCO industry

An effective and competitive ESCO industry can deliver energy efficiency in both the industrial and commercial sector. Legal and regulatory measures can help establish the industry. Coupling this recommendation with that on financing and commercial lending above can drive energy efficiency deeply and broadly throughout the economy.

Recommendation 8 The NEEMP’s focus on first promoting programs that deliver energy efficiency by going after “low hanging fruit” should be modified to promote the combining of low hanging fruit with more expensive measures as a means to deliver greater EE in the economy.

The cheap “low hanging fruit” can deliver quick and immediate EE but doing so may eliminate deeper and more expensive EE measures that otherwise could be effected if the “cheap” and the “expensive” measures are coupled together and the joint savings would result in an acceptable payback.

3. ENERGY DATA COLLECTION AND MONITORING

3.1. Critique

An energy data collection framework is one of the important components of energy efficiency improvement system. Generally, the success of energy efficiency improvement efforts is depending on the understanding on “how well” energy is used to produce useful outputs. Good understanding on energy efficiency drivers at the various sectors and sub-sectors is essential and would help policy-makers to plan effective and efficient strategies and measures to improve energy efficiency.

The MEGTW has developed an energy data collection framework in Malaysia. Energy data such as primary energy supply, energy transformations and final energy use are collected and reported, annually, in the form of energy balance table with the breakdown of type of fuels and economic sectors. The report provides the state of energy supply and use as well as energy transformations and flows in Malaysia. From the report, indications such as the efficiency of primary energy transformation into final energy and the efficiency of energy flows can be obtained.

Malaysia's current energy data collection structure has not been designed to collect data for energy efficiency analysis at sectoral and sub-sectoral levels. The analyses of energy efficiency improvement at sectoral and sub-sectoral levels need end-use energy data and the useful outputs delivered by the end-use energy. However, the process to collect end-use energy data is expensive and requires massive resources. In APEC economies with good progresses on energy efficiency improvement efforts, the collection end-use energy data and associated data for energy efficiency analysis is legalised. In those economies, legislations help to reduce the cost and resources issues by making access to those data is possible and easier and spread the responsibility and burden of the data collection among various relevant agencies.

The PREE Team was informed that a unit named Data and Statistics Unit (DSU) would be established under EECAM. The unit is responsible to collect, manage and analyse energy data for the energy efficiency programmes of EECAM. The DSU also would monitor and evaluate the efficiency and effectiveness of the NEEMP programs. The establishment of DSU is an important step to institutionalise the monitoring and evaluation of energy efficiency improvement works in Malaysia.

One of the key elements in energy efficiency improvement programme is monitoring and evaluation. The monitoring and evaluation of energy efficiency programme needs an analytical framework which should be tied to the NEEMP. The framework should be structured in the way that data collection, analysis, monitoring, evaluation and reporting involve all stakeholders of the NEEMP. The framework also needs to spread the responsibility of reporting to various stakeholders.

The framework needs to develop a set of energy efficiency indicators. The indicators should cover various economic sectors and sub-sectors and build on criteria such as ability to convey information clearly, developed on sound scientific basis, cost effective to develop and relevant to energy efficiency program's targets. Apart from sectoral and sub-sectoral energy efficiency indicators, Malaysia also should have economy-wide energy efficiency indicator.

The Malaysian Government can develop the economy-wide energy efficiency indicator from sectoral and sub-sectoral levels indicators by the aggregation method. Figure 7 shows an example of aggregation structure of energy efficiency indicators at various economic levels and their data requirement. The similar structure can be considered by Malaysia. However, the aggregation of sectoral energy efficiency indicators is always limited by the different measurement units of the energy-use outputs.

The economy-wide energy efficiency indicator can be a good tool to tell 'how well' the energy use is improving over time. Nonetheless, the main weakness in the use of this tool is its non-energy elements such as economic structure change and activities change. Elimination of non-energy factors from the energy indicator will provide better understanding on the real efficiency improvement and the underlying drivers. The influence of non-energy factors is depending on level of aggregation, rise as the level of aggregation increases (moving up the pyramid in the Figure 7).

Energy efficiency indicators are developed from energy and economic data. Therefore, data collection and energy efficiency indicators development should be developed together. By integrating data

collection and energy efficiency indicators development, the Malaysian Government can manage some of the common problems of energy data collection such as high cost and work load. The indicators also will define the types of data needed; this will narrow the scope of data.

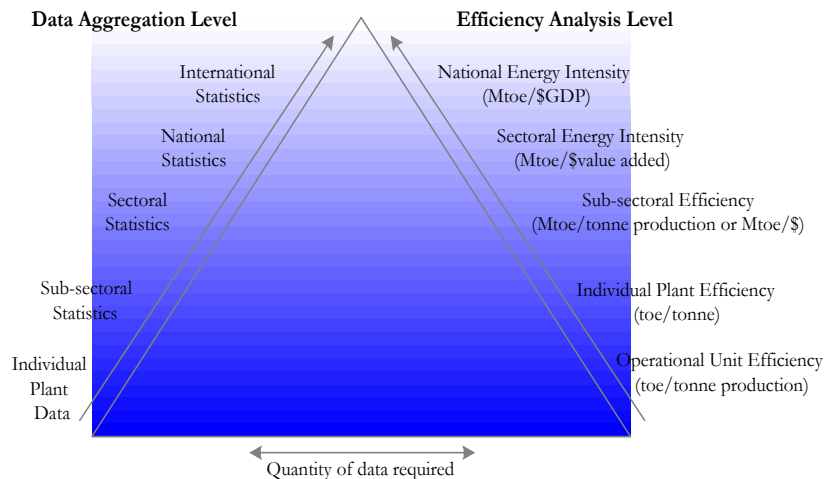


Figure 7 : Energy Efficiency Indicator Pyramid (Source: Phylipsen et al, 1998)

Malaysian public must be informed the progress and evaluation of NEEMP programs from time to time. Progress and evaluation information will elevate the level of confidence and commitment of the public to further support the energy efficiency programs. Hence, periodic dissemination of monitoring and evaluation reports of the NEEMP programs is needed.

3.2. Recommendations

Recommendation 9 Locate the Data and Statistics Unit (DSU) of EECAM as an independent unit under the CEO of EECAM. The proposed structure would ensure DSU maintains its neutrality in reporting the progress and evaluation of NEEMP programmes.

Recommendation 10 Enact a provision under the proposed EE Act to empower the government to obtain energy and economic data for energy efficiency analysis from various energy users at supply and demand sides as well as to spread the responsibility and burden of the data collection among relevant government agencies.

Recommendation 11 Develop an analytical energy efficiency monitoring framework. The analytical framework should help to be a communication tool for policy makers and energy users.

Recommendation 12 Develop a set of energy efficiency indicators at a sectoral and sub-sectoral level for the NEEMP and define the data needs according to the indicators.

Recommendation 13 Carry out factorisation or indexation techniques on the indicators to remove the non-energy factors as well as to create economy-wide indicators by aggregation.

Recommendation 14 Publish, periodically, energy efficiency monitoring reports and disseminate the reports to stakeholders and energy users.

4. POLICY MEASURES – INDUSTRY SECTOR

4.1. Critique

Energy consumption in Malaysia has been increasing quite sharply. From year 2005 to 2008, the growth of energy consumption was around 5 – 6 % per annum. The increase was driven mainly by the energy use in the industrial sector, which grew at 7% per year. In 2008, the industrial sector accounted for about 43% of the total final energy consumption. The sector also consumed about 47% of the total electricity during the period. In terms of fuels, natural gas was the largest fuel consumed by the sector, followed by petroleum products, electricity and coal. The share of natural gas in the industrial sector is in growing trend.

Malaysia has been subsidizing natural gas and electricity used by the industry sector. Besides that, some selected industrial energy users have been provided with special discount on their electricity tariff. The discount is given when their electricity cost exceed 5% of their production cost, irrespective of their pattern of use. The energy subsidies have strong implication on the trend of energy use as well as needs for efficient use of energy in the sector. In any case, energy prices play an important role in energy efficiency improvement effort. Higher energy prices, without subsidies, are strong motivators to drive efforts towards the more efficient use of energy without affecting benefits of the energy use.

Malaysia has to review its energy pricing mechanism to encourage industrial users to use energy efficiently. The current pricing mechanism with heavy subsidies is clearly providing a hindrance on energy efficiency improvement efforts. The subsidies are behaving like disincentive for energy efficiency improvement. The Malaysian Government is planning a strong strategy to restructure the energy subsidies- the Tenth Malaysia Plan (2011-2015) has details on the strategy. In this regard, a gradual reduction of subsidies would help even the energy-intensive industries to become more energy efficient if they are encouraged to invest on energy efficiency efforts by linking the efforts with incentives.

Persuasive strategy has been used by the Malaysian government to improve energy efficiency in the industry sector. Measures like energy efficiency guidelines, demonstration project, training, workshop and awareness programs have been carried under this strategy. However the persuasive strategy, which is voluntary, has produced limited success. Therefore, since 2008 the government has changed its strategy and started to use regulatory strategy together with its existing persuasive strategy. Under the regulatory strategy, the government enacted energy efficiency regulation and drafting an energy efficiency law as well as a national energy master plan, NEEMP.

The industry sector is one of the sectors which given important focus under the NEEMP. The energy efficiency improvement effort for this sector is mainly on the use of electrical energy. However, natural gas and petroleum products are the largest fuels consumed by the industrial sector. The rates of use of the fuels are on the growing trend. In this regard, it is important to expand energy efficiency programs to cover those fuels.

Limited or unavailable funding from commercial lenders is one of the main barriers for industrial energy users to start energy efficiency programmes. In general, industrial energy users have enough information about the benefits of energy efficiency improvement but the funding issue put them on hold. In Malaysia, funding for energy efficiency programs is not in the portfolios of most commercial lenders. As such, investments on energy efficiency programmes by the industry sector are depending fully on own equity. Without a funding mechanism, it will be hard for the Malaysian Government to encourage the industry sector to make investments on energy efficiency.

The implementation of NEEMP programs in the industrial sector needs interaction among various parties. The interaction will help to identify the needs of stakeholders in the implementation of energy efficiency improvements efforts. Issues that will be faced at implementation stage can be addressed by having a network among interested parties.

Energy efficiency improvement programs require special skills and knowledge. Insufficient human resources will delay the implementation of the programs. The needs of human resources must be clearly addressed and relevant training programs should be developed.

4.2. Recommendations

Recommendation 15 Review the energy pricing mechanism for the industry sector to gradually remove energy subsidies. Energy efficiency improvement will not get buy-ins from the industrial energy users if the energy subsidies are behaving like disincentive.

Recommendation 16 Develop and promote energy efficiency improvement business models for the industry sector. The business models should help to explain the nature of energy efficiency investment and the profitability of the investments.

Recommendation 17 Develop funding mechanisms for energy efficiency investments. The funding mechanisms should be developed according to local needs and innovative to attract investments.

Recommendation 18 Create channel for interaction among the interested parties of NEEMP programs. Active and close interactions will help to smooth the implementation of NEEMP programs.

Recommendation 19 Identify human resource needs for the implementation of NEEMP programs and develop programs to train the human resource.

5. POLICY MEASURES – ELECTRICITY SECTOR

5.1. Critique

In 2009, the electricity generation capacity in Malaysia was 27,700 MW and the total electricity consumption during the period was 116,114 GWh. By fuels type, natural gas was the major fuel used, accounting for a share of 58.0 %; followed by coal, at a share of 32.4 %; hydropower, 5.9 %; diesel, 2.2%; biomass, 1.2%; fuel oil, 0.1 % and others, 0.1%. Malaysia has three discrete power grid systems covering the Peninsular Malaysia, Sabah and Sarawak. The Peninsula grid is the largest, accounting for 78.7% of

the total installed generation capacity in Malaysia. In 2009 the maximum demand for the Peninsula grid system was 14,245 MW and the system reserve margin stood at 53%.

Figure 9 depicts the transmission and distribution (T&D) losses on the Peninsula Grid system for 2005 to 2009. On average, the losses in the transmission system have been maintained at approximately 2.0 % level which includes 275 kV and 132kV networks. Most of T&D losses were occurred in the distribution system.

The fuels mix of electricity generation Malaysia is determined by the government. The Malaysian Government has introduced various policies to govern the fuels mix structure in the economy. First, the Government introduced The Four-Fuel Diversification policy with the aim to reduce the over-dependence on oil as energy source and to optimum mix of oil, gas, hydro and coal. The policy has reduced the share of oil in the fuels mix but has increased the share of gas. The share of coal was also increased under this policy. Subsequently, the Small Renewable Energy Program (SREP) was introduced to promote the development of Renewable Energy (RE) as the fifth fuel resource under the Fuel Diversification Policy. The government has been keen in the efforts to promote greater use of RE in the electricity sector by providing favourable tariffs and fiscal incentives.

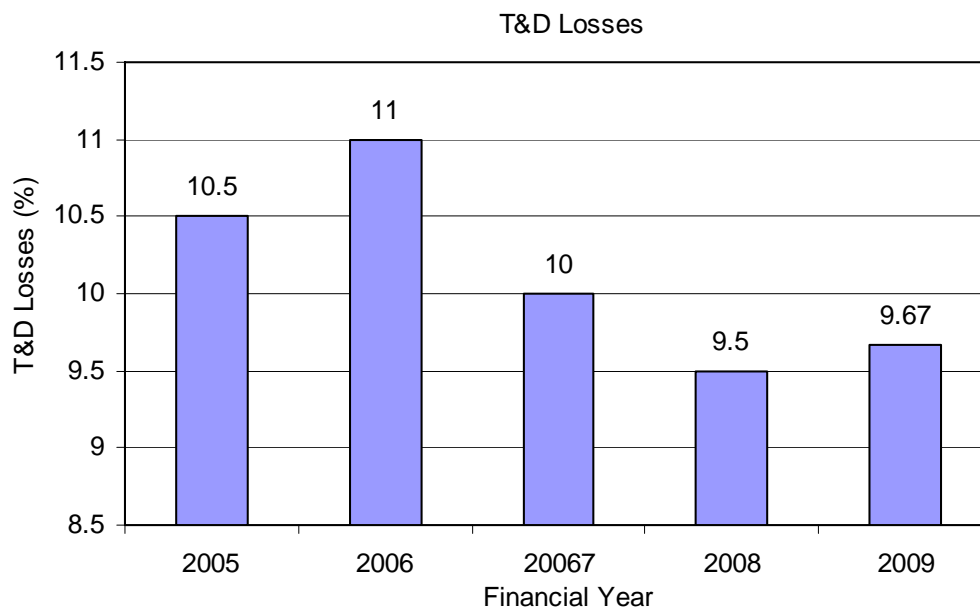


Figure 8 : T&D loses on the Peninsula Grid system (source: TNB,2010)

The key measure initiative for the electricity sector under the NEEMP is focused on demonstration projects of cogeneration and tri-generation in industries and commercial facilities. Cogeneration and tri-generation is a proven and mature technology that improves energy efficiency significantly. In Malaysia,

some large Malaysian industries and commercial complexes are already operating cogeneration plants. However, the effort to promote cogeneration and tri-generation technology in Malaysia should begin by having a dynamic policy framework. The policy framework should be able to promote the development of cogeneration and tri-generation technology by integrating the technology into the energy supply system. The technology can be a good complement to the electricity generation system. Normally, technical hindrances like supply reliability and grid stability are often used as excuses for not to allow cogeneration and tri-generation technology to be grid-connected. In this regard, the policy framework should be able to address the following issues: the effect of the technology on the existing system, impact of distributed generation, the sizing and location of the plant, types of allowable plants and fuel types.

5.2. Recommendations

Recommendation 20 Make continuous efforts to further reduce transmission & distribution losses. The following seven strategies can be considered

Strategy 1. Simplify the distribution voltage levels. The voltage level for the substation could be directly transformed from 132kV to 33kV. Current 132kV/22kV, 132kV/11kV substations should be replaced by 132kV/33kV substations.

Strategy 2. Raise the distribution voltage level. To match up the local demand, the distribution voltage level should be raised from 11kV and 22kV to 33kV as far as possible.

Strategy 3. Balance local supply and demand. To develop new power supply to meet local demand as far as possible, and to evenly allocate the power plant site so as to balance the local supply and demand, and to reduce the line flow between areas.

Strategy 4. Increase operating voltage adequately. Adequately adjust and increase the operating voltage at different levels of substations. Increasing the voltage of lines can effectively reduce the current required for a given amount of power, and therefore reduce the power transmission losses.

Strategy 5. Promote load management. By implementing time-of-use and seasonal pricing, interruptible power and ice-storage central air conditioning systems to improve system load factor and shift peak load. At the same time, use strategies of efficiency management, favourable incentives, technology transfer, technology service and education to gain energy conservation and enhance energy efficiency.

Strategy 6. Launch T & D development program. By installing new transmission and distribution facilities to enhance system operation security, power supply reliability, and upgrade the efficiency of transmission and distribution lines.

Strategy 7. Strengthen the inspection of energy theft. By reinforcing the prosecution of illegal use of electricity to reduce the theft of electricity.

Recommendation 21 Formulate a policy framework to promote more cogeneration and tri-generation system in the industry and the commercial sector. The policy framework should be able to improve and enhance the economic viability of cogeneration and tri-generation system use in Malaysia.

6. POLICY MEASURES – COMMERCIAL AND RESIDENTIAL SECTOR

6.1. Critique

In 2008, the commercial and residential sector accounted for 13.8 % of the total final energy use in Malaysia. The sector's final energy use was ranked at third position after the industry and the transport sectors. In terms of electricity, the sector consumed 53.6% of electricity supplied during the period, of which 60 % consumed by the commercial sector and the balance 40% by the residential sector. Buildings' energy-use accounted for the largest share of the final energy use by the commercial and residential sector.

In Malaysia, commercial buildings design and construction are regulated by the Uniform Building By-Law (UBBL). The by-law doesn't cover the buildings energy-use performance. However, the government is promoting commercial buildings to adopt energy efficiency through voluntary approach by providing a standard called MS 1525:2007 - Code of Practice on Energy Efficiency and Use of Renewable Energy for Non-Residential Buildings. Under the NEEMP, the government is planning to incorporate the MS 1525:2007 into the UBBL by 2015. The incorporation will enforce the adoption of MS1525 by commercial buildings.

Malaysian residential sector consumed about 20.7 % of the total electricity supply in 2008. The largest portion of the consumption was attributed to the buildings in the sector. Residential buildings' energy-use performance is not regulated nor promoted through voluntary energy codes like MS1525. Residential buildings without any consideration on their energy-use performance would have a significant implication on their energy use. Residential buildings with poor energy-use performances will require more energy and the problem will remain for many years due to the long life span of the buildings.

The Malaysian government promotes energy use in commercial buildings by developing demonstration projects. Demonstration projects are aimed to create awareness and disseminate information about high performance of energy efficient buildings. The awareness and information is expected to develop and elevate interest among building owners and developers to switch to energy efficiency buildings. Energy efficient buildings like the Low Energy Office of MEGTW, the Green Energy Office of Malaysian Green Corporation and the Diamond Building of The Energy Commission are the showcases developed by the government for this purpose.

Besides that, the government of Malaysia is promoting energy use in buildings by providing fiscal incentives for buildings with the Malaysian Green Building Index (GBI) rating scheme. The GBI, launched on 21 May 2009, is a private initiative developed by construction industry professionals to promote sustainability elements in buildings. Buildings that have been awarded with any grade of the GBI certificate are eligible to be considered for GBI incentives. The incentives are in the form of tax and stamp duty exemptions. The rating on energy is done

according to MS1525. The government is also promoting the adoption of green technologies by providing soft loan under the Green Technology Financing Scheme (GTFS). Buildings are one the components eligible for the funding from the GTFS.

Participation of non-governmental bodies in energy efficiency improvement programs in residential sector is very much needed. Energy users in this sector are myriad. As such it is difficult to depend only on government mechanisms to promote energy efficiency in this sector. Normally, non-governmental bodies have developed good networks among residents. The networks can be used by government to carry out energy efficiency programs with better penetrations and effectiveness. Currently, some Malaysian non-governmental bodies focusing on issues like sustainability and consumerism have been conducting programs to promote energy efficiency among Malaysian residents. However, the programs are mostly one-off basis and depending very much on external funding.

6.2. Recommendations

Recommendation 22 Expand the scope of MS1525 codes to include new residential buildings. Energy-use performance in residential buildings should be improved by incorporating at least some useful energy efficiency practises such as good passive design and day lighting.

Recommendation 23 Promote energy efficiency in residential building by demonstration projects. Encourage interested housing developers to construct demo energy-efficient houses throughout the economy. Demo EE houses could create wider EE awareness of which public can ‘touch and feel’ the energy efficiency houses that these houses are doable and cost effective.

Recommendation 24 Enhance the MS 1525 by considering the following aspects:

- Review and tighten MS1525 periodically. The code which was developed in year 2000 and introduced in 2007 could have been already obsolete;
- Include building undergoing major-retrofitting to be subjected to MS1525 requirement;
- Include other non-energy related measures (e.g. water efficiency) into MS1525 to save energy (less pumping energy to pump water);
- Conduct proper green cost study to meet the MS1525. Often, cost-neutral to meet the code-compliant requirement is possible judging from success cases in the region. This cost study should be conducted in preparation for the MS1525 mandatory implementation;
- Effective regulatory enforcement and supervision mechanism to ensure proposed energy efficiency solutions are effectively carried out.

Recommendation 25 Expand the soft loan facility under the Green Tech Fund Scheme (GTFS) for energy efficiency renovation/retrofitting projects in the residential sector.

Recommendation 26 Promote the 'Government take lead' measure to drive energy efficiency in commercial buildings by the following actions:

a) Government to consider green procurement to purchase energy efficiency equipments/systems. The Ministry of Finance could consider setting up purchasing guidelines based on life-cycle costing principle for agencies to adopt.

b) Compulsory energy audit and disclosure for Government buildings in a yearly basis. Energy disclosure is useful tool to rank and benchmark performance and to add peer pressure to improve the EE performance among Government agencies. Committee where all the Director-generals meet regularly could be a useful platform to report such energy consumption status and achievements.

c) Set higher energy efficiency standard for all new government buildings. It is strongly recommend that agencies do not settle for just code-compliance performance. Government buildings should set good examples by taking strong lead in driving energy efficiency measures. It is also useful to celebrate and share such successes with other to expand its circle of influence.

Recommendation 27 Continue cooperation with non-governmental bodies to promote energy efficiency and energy conservation measures at the residential sector. Help the bodies to perform energy efficiency programs effectively and continuously by providing better resources.

7. POLICY MEASURES – TRANSPORT SECTOR

7.1. Critique

Malaysia's transport sector accounted for 36.5% of the total final energy use in 2008. The level of energy use by the sector was high compare to the world average which was about 20% (EIA, 2010). A main reason for the sector's high energy use could be attributed to the high usage of private cars for passenger transport, even in the densely built urban areas. In Klang Valley where the capital city is located, for example, public transport modal share has been falling steadily from 34% in 1985, to 20% in 1997; today it is closer to 10–12%.

Traffic congestions in major cities in Malaysia due to high usage of private cars especially during peak hours are becoming serious problem in Malaysia. To ease the traffic congestions, the Malaysian Government has initiated moves to improve public transport, an energy efficient transport mode, through the Government Transformation Programme (GTP) (PEMANDU, 2010) and the Tenth Malaysia Plan (2011-2015) (EPU, 2010)

The Government Transformation Programme (GTP) has set clear targets and strategies to improve public transport. These include:

- Raise the modal share during the morning peak period of 7 AM to 9 AM of public transport in Klang Valley to 15% by 2010 and to 25% by 2012. The successful initiatives will be subsequently adapted and applied to other urban centres such as Penang and Johor Bahru

- Improve reliability and journey times
- Enhance comfort and convenience
- Improve accessibility and connectivity such that the percentage of the population living within 400 metres of a public transport route increases from 63% to 75% in 2012.

Early progress on improving urban public transport has been encouraging. Transfer times and waiting times have decreased; ridership on public transport has increased. It is estimated that public transport modal share in Klang Valley has reached 17% in 2010.

Four steps are continued to be taken between 2009 and 2012 and one additional step beyond 2012 to secure and extend these expected improvements:

- 1) **Streamline capacity of public transport system:** By 2012, the capacity on the KTM Komuter and LRT lines will be increased by 1.7 to 4.0 times, involving refurbishments and purchases of rolling stock and train sets. Dedicated rights-of-way for buses, including Bus Expressway Transit (BET) services and Bus Rapid Transit (BRT), will be introduced across 12 major corridors in Klang Valley, carrying in total 35,000 to 55,000 passengers during the morning peak hours. The size of the existing bus fleet will be increased by 850 buses. This will improve services on current routes and provide service to 53 new routes to address currently unserved areas.
- 2) **Stimulate demand to attract people to public transport:** Initiatives include introducing an integrated ticketing platform and fare structure, adding roughly 6,800 new parking spaces across 14 rail stations outside the urban core, enhancing feeder services into rail stations and upgrading high-traffic stations, terminals and bus stops. The physical connectivity between modes will be improved, e.g. via completely enclosed walkways. Enforcement and monitoring efforts will be enhanced ensuring operators adhere to minimum service and operational standards.
- 3) **Divert heavy vehicles from the Central Business District:** Three major integrated transport terminals (ITT) outside the city core will be created one of ITT; Bandar Tasik Selatan Integrated Transport Terminal (ITT) has been completed. The second integrated transport terminal will be located at Gombak and the government still finalising the concession agreement with the contractor. While the third ITT is still at the planning stage by the government. Within the city centre, there will be two types of public transport hubs – first, the inter urban transport terminal (IUTT) at Pasarama Kota, Hentian Putra and Pudu Raya to facilitate the flow of traffic from the suburbs into the city, and second, 14 Hentian Akhir Bandars (HABs) (end of town stops) that will facilitate the movement of passengers and public transport vehicles within the city centre to reduce congestion and streamline overlapping routes.
- 4) **Regulatory restructuring:** Land Public Transport Commission (SPAD, <http://www.ltc.gov.my/>) was officially established on 3 June 2010 following the passing of the Suruhanjaya Pengangkutan Awam Darat (SPAD) Act 2010. The Commission comes directly under the purview of the Prime Minister and

brings all aspects concerning land public transport under one roof. The Commission's primary tasks are the drawing up of policies, planning and regulating all aspects of train, bus and taxi services as well as freight transport via road and rail. It also has enforcement powers which it will carry out with close cooperation with other enforcement agencies such as the Royal Malaysian Police and the Road Transport Department.

And beyond 2012...**Manage demand:** Once public transport modal share is above 25% and the public transportation system has been improved in terms of reliability, journey times, comfort, accessibility and connectivity, the initiatives to increase the relative attractiveness of public transport vis-à-vis private vehicles will be accelerated, for example, congestion pricing.

The National Physical Plan-2 has proposed an integrated national transport system be developed in which railway forms the core system for the transportation of people and goods. It proposed a 30% public transport modal share for all major urban centres by 2020.

The Government has announced, in the Tenth Malaysia Plan, plans to build three Mass Rapid Transit lines, with a total length between 180km to 200km with a carrying capacity of two million passengers a day. Expected cost of the project is RM36 billion.

In addition, the Malaysian Government has been working closely with industry, especially in the land transport sector, to develop energy efficient and environmentally friendly vehicles for the market. It is working to develop a Green Transport Plan as part of the efforts to achieve the national target of reducing 40% carbon intensity per unit of GDP. Highlights include

- Modal shift to public transport - positive results have been observed in Klang Valley
- To re-structure regulation and develop infrastructure to encourage hybrid and electric vehicles (EV)
- Initiatives in aviation and marine transport sectors
- Most green initiatives planned would reduce carbon emission by improving energy efficiency

Having carefully studied the plans and presentations made by representatives from the ministries, agencies and industries involved in the transport sector, the Review Team noted that there would be great challenges in the implementation of the plans to improve public transport. The following are only a few examples of such challenges:

- How will the future rail-based transit systems be integrated into the regional/local plans and developed seamless with surrounding commercial, industrial, housing and recreational projects? How will an adequate transport capacity, especially public transport infrastructure, be supplied in tandem with the regional development when new commercial, industrial and housing areas are planned and delivered?

- How will the quality of connecting and feeder bus services be ensured? While the large projects of dedicated rights-of-way for buses will be introduced by the central government, the majority of public transport commuters will have to rely on connecting and feeder services to complete their door-to-door journeys (the last-mile problem). Will there be sufficient supply of connecting and feeder buses? Will the priority of such bus services be ensured by the road development and management agencies which are not responsible for bus operations? Which agency would and how to resolve the conflicting demand from different types of road users, for example, when public buses and motorists of private cars compete for road spaces?
- How will the long-term financial viability of the rail-based transit systems be sustained? While the government has committed the funding to build the infrastructure (such as the Tenth Malaysia Plan), the cost to maintain and operate these systems can be high. Will the maintenance, operating and upgrading cost of the public transport systems be covered by their fare revenue? If yes, have the political, legal and institutional mechanisms been setup to ensure a steady income of such revenue, considering the diminishing returns with the expansion of rail networks? If not, has the Government planned sufficient subsidy from other sources of income?

7.2. Recommendations

Recommendation 28 Continue to enhance the integration across Government Agencies on the policy, planning, financing, regulation and management of all aspects of the land transport system in order to achieve the common goals of improving urban public transport and energy efficiency.

Some 12 ministries and various agencies are involved in different aspects of public transport and there was no single agency leading the planning, development and regulation of public transport. This has resulted, as the Government Transformation Programme (GTP) pointed out, over-crowding during peak periods on the trains, unreliable public transport service with frequent delays and cancellations, poor connectivity between modes, and poor access to public transport services. With the setup of Land Public Transport Commission (SPAD) and commitment from the Government, the coordination, regulation and management on public transport matters will be greatly improved.

However, it is anticipated that conflicts from relevant ministries and agencies would surface when they compete for land, energy, funding, legal and political support, etc. for the different aspects of and matters affecting the transport system.

To ensure an adequate supply of public transport infrastructure and the financial viability of the public transport operations in the long-term, it is critical that the national and regional planning, housing and industry development, construction and maintenance of road and rail networks, development of intelligent road traffic control system and intelligent public transport ticketing system, regulation of private vehicles and public transport operations, etc. are centrally coordinated. Such coordination is best achieved through integrated organisational structure.

Examples: At the national level, the Japanese Ministry of Land, Infrastructure, Transport and Tourism

(MLIT) is an example of a single ministry responsible for all aspects of land transport and areas that have significant impact on the transport system, e.g. national and regional planning, city and regional development, road, housing, railway, road transport, tourism, etc.

At the city level, the Land Transport Authority (LTA) in Singapore and the Transport for London (TfL) in United Kingdom are examples of a single agency responsible for all aspects of land transport, including the planning, financing and construction of rail transit system and roads, traffic management, intelligent transport systems and integrated ticketing system, vehicle registration and licensing, public transport planning, regulation and promotion, etc.

Recommendation 29 Develop regular working mechanisms for relevant Ministries and Agencies to make concerted efforts to address the challenges and bridge the gaps in new initiatives such as energy efficiency.

Immediately, regular meetings of senior staff from relevant Ministries and Agencies should be held to address the key issues in the new initiatives, e.g. how to ensure that the transport sector, consumer of about 40% of the national energy, is given appropriate attention in the proposed NEEMP and the energy price rationalisation plan.

Going forward, collaboration and coordination among relevant Ministries and Agencies can be built into the performance metrics of these institutions. The measures tackling emerging issues, e.g. energy efficiency, green development, economic re-structuring, improving public transport, often span across many ministries. Such measures need to be prioritised by their cost-effectiveness to the whole of government, instead of individual ministries or agencies. In addition, cross-ministry committees have to be supported by close relationship at working levels to ensure their successfully implementation.

The targets of energy efficiency and environmental friendliness should be the key results areas in any proposed transport master plan, in addition to including the transport sector as an integral part of the proposed NEEMP and the energy price rationalisation. Only when the Ministries and Agencies in charge of the transport sector take ownership of energy efficiency, will it be dealt with systematically, and measures decided in the NEEMP be diligently executed.

Examples: The “White Paper on Energy” (see <http://www.berr.gov.uk/files/file39387.pdf>) and “Energy Efficiency Action Plan” (see http://ec.europa.eu/energy/demand/legislation/doc/neeap/uk_en.pdf) in the UK are examples of energy efficiency masterplans in which the transport sector plays an important part. On the other hand, the Department for Transport (DfT)’s “Low Carbon Transport Innovation Strategy” (see <http://www.dft.gov.uk/pgr/scienceresearch/technology/lctis/lctisdocpdf.pdf>) is published around the same time and echoes the same strategies and initiatives.

Recommendation 30 Develop large scale demonstration projects of energy efficient transport systems in the newly developed districts (e.g. Putrajaya, Cyberjaya) or in new eco-City / eco-Town, to demonstrate the benefits and to understand the planning, funding, coordination and implementation efforts required to achieve the desired energy efficiency improvement in transport.

Many challenges in Malaysia, as noted by the Review team, are institutional and need to be tackled by cross-agency collaborations. As many high-profile districts and economical zones are planned and developed to attract new growth opportunities along the key economic development corridors under the National Physical Plans, they are ideal for developing demonstration projects on energy efficient transport systems.

To make such potential demonstration projects successful, comprehensive policies, plans, infrastructure, regulation, etc. should be developed in the very beginning to meet all the potential transport demand in order to achieve high energy efficiency targets. Large scale projects demonstrate the complexity in execution and the cost-benefit in energy efficiency improvement in transport. They can be live laboratory for local transport industry to test their new technologies and innovative services of energy efficient transport.

Examples: Tianjin Eco-City, China, included green transport as one of its key result areas from the planning stage (see http://itaacademy.gov.sg/pdf/31_Goh_Simo-SporeTianjinEco-City.pdf). In response to the citizens' desire to own cars and the Government's drive for environmental sustainability, ambitious targets were set on the transport system in Tianjin Eco-City: 30% by 2013 (within Eco-City, internal trips), 90% by 2020 (within Eco-City, internal trips), and 65% by 2020 (external trips that start from Eco-city).

The approaches taken include managing road usage, introducing green vehicles and innovative eco-CBD transportation design. It is set to become a testing field for integrated land-use and transport planning, green vehicular technologies, and innovative transportation systems.

Recommendation 31 Set fuel economy target to the vehicle Original Equipment Manufacturers (OEMs), provide fuel economy information to consumers, and in the long-term introduce fuel economy-based or CO₂-based vehicle acquisition or road tax.

Setting fuel economy target to the vehicle OEMs, such as CAFE in USA and "Top Runner" programme in Japan, would improve the energy efficiency of the new models to be sold to the market.

Providing fuel economy information to potential car buyers, either by mandating the vehicle dealers to display (e.g. Australia, Singapore) or by the Government to provide comprehensive and accurate information (e.g. USA), would help motorists make informed choices about the environmental impact of their new car and the fuel cost of running their vehicle.

Many European countries have introduced fuel economy-based or CO₂-based vehicle acquisition or road tax. Such tax structure rewards vehicles with higher energy efficiency or lower carbon emission and penalise the opposite. This would serve the long-term plan to encourage more energy efficient vehicles, e.g. hybrid, electric vehicles (EV), and any new vehicular technologies. To gain buy-in from the automotive industry and motorists, the revenue from fuel economy-based or CO₂-based tax can be earmarked to assist research and development (R&D) on more energy efficient vehicular technology.

Examples: The Corporate Average Fuel Economy (CAFE), USA, are fuel economy regulations intended to reduce energy consumption by increasing the fuel economy of cars and light trucks. CAFE is the sales-weighted average fuel economy of a manufacturer's fleet of passenger cars or light trucks manufactured for sale in USA, for any given model year. NHTSA sets minimum fuel economy standards. For cars, the standard has been raised from 18 miles per gallon (mpg) for model year 1978 to 30.2 mpg for 2011.

In Japan, fuel efficiency standards for vehicle manufacturers are developed using the "Top Runner", the vehicles whose performance is currently the best in the weight class, with a lag time for other vehicle models in the same class to improve to the current best practice (plus an escalation factor).

Many countries mandate the display of fuel economy information at showroom (e.g. Australia, see <http://www.greenvehicleguide.gov.au/GVGPublicUI/StaticContent/file/2010%20Fuel%20Consumption%20Label.pdf>; Singapore, see <http://app2.nea.gov.sg/mfel.aspx>). In USA, the Government (DOE and EPA) provides the Fuel Economy Guide (see <http://www.fueleconomy.gov/>).

Recommendation 32 Estimate energy consumption by transport mode and type of transport activity, and prioritise the implementation plans for energy efficiency and green transport plan based on cost-benefit analysis.

While it can be time-consuming and costly to collect and report a comprehensive and accurate breakdown of the energy consumption and carbon emission by transport mode, activity or vehicle class, it is relatively simple to estimate such breakdown on the basis of transport activities and average fuel / electricity consumption.

The energy consumption by transport mode indicates the energy and carbon benefit of rail-based transit system and bus services, and the energy consumption by activity, e.g. passenger and freight transport, domestic aviation, transport facility, etc. indicates the potential of energy efficiency improvement.

The estimated breakdown would help the Government

- understand the potential and cost-benefit of each new initiative
- prioritise funding and resources for implementation
- monitor the effects of the measures and initiatives towards energy efficiency and carbon reduction

8. APPLIANCES AND EQUIPMENT

8.1. Critique

As noted in the NEEMP, “Energy rating and labelling has been a keystone in the market transformation of household appliances towards more energy efficient models. It has been successfully applied worldwide in Europe, USA, Japan, Australia, Thailand etc. for more than a decade and has resulted in significant improvements in the energy efficiency of the technologies.” Trusted and easily understood labels allow the consumer to compare various products (on both first cost and operational cost, i.e. life cycle cost) and select the one that is most energy efficient and fits their need and budget.

A significant point to note is that NEEMP has identified “Rating and Labelling of Appliances” as its Key Initiative # 1. Minimum Energy Performance Standards (MEPS) is Key Initiative # 2. Malaysia’s standards and labelling program is centred in the Energy Commission and the authority for its work comes from Section 23a of the Electricity Supply Act of 1990. Malaysia already has a strong foundation for developing and implementing both MEPS and Labels.

Malaysia has a comparative “five star” label system that is easily recognizable and provides a rating (one star worst, 5 stars best) and good consumer information. In addition, Malaysia has a companion label to the Star Label system; an Endorsement Label from the Energy Commission. Examples of the labels are as follows:



The rating and labelling process is consistent across all products; a survey of available products is taken, an average consumption is determined and set as a three-star product, a reduction range from that average is then set for the four-star and then a further reduction range for a five-star product.

A label survey done by the Energy Commission showed that the Star Label is reasonably understood by consumers (though an independent survey in 2007 showed only 2% of respondents understood the label). This dichotomy in results points to the need for developing a plan to educate consumers about the labels and to ensure the education program is multi-year and funded sufficiently to reach the consumers over the long-term.

Currently, Malaysia has a voluntary rating and label program for 7 products: High Efficiency Motors; Domestic Fans; Televisions; Air conditioners; ballast, lamp and Domestic Refrigerators. During the NEEMP period, a mandatory appliance rating and labelling program will be introduced for Refrigerators (2011), Air conditioners (2011), and Fans (2012). Mandatory rating and labelling programs are much more effective than voluntary ones and this is a move in the right direction.

Regarding Minimum Energy Performance Standards (MEPS), the NEEMP correctly notes that “MEPS prescribe the minimum energy efficiency that products shall meet in order to be sold in the market. Similar to standards for product safety, MEPS is a way to protect the consumers from products that has a low energy performance. MEPS can be applied to most technologies; however it should only be applied when there is certainty that alternatives are available and these alternatives are affordable for the consumers.” Malaysia has enacted MEPS for both Domestic Fans and fluorescent lamp ballasts. NEEMP will initiate MEPS for lighting (2011) and motors (2012).

Malaysia also has energy performance testing standards for 8 products and a testing lab (SIRIM): Insulation Materials; High Efficiency Motors; Lamps; Ballasts; Domestic A/C; Domestic Refrigerators; Domestic Fans; and Televisions.

The Energy commission has noted that key stakeholders from both the manufacturing and consumer sector are involved in the Standard and Labelling program. Also, the Energy Commission chairs a technical committee for ISO 50001, the international energy management standard. Many Malaysian organizations are participating in this committee. These are all excellent actions regarding standards and labelling for the economy.

8.2. Recommendations

Recommendation 33 Focus overall Appliance Standards and Labels on moving from “voluntary” to mandatory” standards and labels.

While voluntary standards may be the easiest to start, they rarely are as effective as mandatory standards. MEPS set a minimum standard for a product category and eliminate the most inefficient products from the market. Mandatory labels compare all products in the market and provide the consumer with useful information on which to base their purchase. Voluntary labels are best suited for endorsement type labels.

Recommendation 34 Develop a “top end” performance level program.

Implementing a program that identifies the top end product performers, such as Thailand's HEPS or the proposed U.S. Energy Star "Superstar" program can help drive standards higher and more quickly than "normal" appliance standards program.

Recommendation 35 Enhance testing procedures and protocols

Standards and labels can only be credible (and therefore trusted) if uniform testing systems are in place and coupled with independent qualified testing labs. Lab certification (through ISO 17025) and "round robin" testing should be the minimum criteria for testing. Regional or other labs that meet these criteria can certainly supplement the economy's own lab and testing facilities.

Recommendation 36 Develop a long-term public awareness label strategy and program

The 2007 survey in which only 2% of respondents understood what the Malaysian Star Label represented points to a need for Malaysia to initiate a major public awareness program. Experience in other economies shows that it is essential to conduct information and education campaigns "early and often" so that consumers understand

- What information is contained in the label
- How to use the label (and information contained therein) to make sound purchase decisions
- How to compare products on both owning and operating costs (e.g. Initial costs and operating costs)

Depending on the information contained in the label, the consumer may also understand the social and environmental impacts of the desired product purchase. Further, it is also important that retail sales staff be informed and educated on the label so they can work with consumer and help with their decision to purchase the most efficient products.

Experience in many economies has shown that it is critical that public awareness campaigns for Labels need to be maintained over the long term, so a long-term strategy needs to be created that ensures the sustainability of such a campaign.

9. ENERGY EFFICIENCY RELATED RESEARCH AND DEVELOPMENT

9.1. Critique

Energy efficiency related research and development (R&D) is a small and relatively new sector in Malaysia. As a result, there are not many policies that deal with R&D. All energy efficiency related R&D is conducted by universities and the private sector. Funds for R&D are sourced from both the government and the private sector and research priorities are determined by either the researchers' preferences/interests or are requests from the provider of the funds.

While there are no fiscal incentives aimed specifically at energy efficiency R&D, those engaged in R&D are eligible for a number of fiscal incentives including:

- Grants from the National Development Authority

- Low interest loans through the Green Technology Finance Scheme
- Income tax exemptions of 25% on statutory income for 10 years from year of first sale of product (if gain “pioneer status”)
- A 100% deduction of capital expenditure incurred for 5 years under the investment tax allowance. Unused allowances can be carried forward to subsequent years.

Although the government is not currently involved in energy efficiency related R&D, its inclusion under Action 6 of the Master Plan is a positive step forward.

The Malaysian government and the private sector have recognised the importance of education and awareness in improving the energy efficiency of the economy. Both the government and the private sector are running a number of awareness raising programs. The campaigns are aimed to raise awareness about energy efficiency and conservation among Malaysians through practical tips and information contained on the website and programs conducted for primary and secondary schools and industry.

9.2. Recommendations

Recommendation 37 Provide a firm commitment to energy efficiency related R&D spending and expand the budget over time.

For Malaysia to achieve its aim of becoming a ‘knowledge-based’ economy and to increase its energy efficiency technology capabilities within the timescales required to achieve stated energy efficiency goals and targets, the Malaysian government will need to increase funding for R&D. Government investment in R&D can help ensure that attention is paid to both longer-term and short-term opportunities and reduces the risk of some innovations for the private sector and universities. This will encourage research in areas that are likely to result in technological breakthrough if the source of funding is certain.

Recommendation 38 Establish a flexible, clear and transparent framework for establishing R&D priorities and monitoring/ assessing performance.

Aside from increased funding, well designed policies and programs can help accelerate the development of energy efficient technologies. The framework should have a long-term, strategic focus that is consistent with Malaysia’s overarching policy objectives, and takes into account resource availability and capabilities. R&D goals should be well defined and quantified (preferably with a number of milestones) to assist in the monitoring process. R&D efforts should be monitored by a single body to ensure that there is no overlap in activities. At an individual project level, there should be a mechanism in place for monitoring and assessing performance to determine whether projects are achieving milestones and whether efforts should be redirected or terminated.

The establishment of a clear and transparent framework will ensure a clear understanding of the government’s priorities that all agencies can follow and that limited R&D funds are allocated to their best possible use. If the framework is flexible, programs can be modified in light of technology developments or changing objectives

Recommendation 39 Establish a long-term technology roadmap for EE that sets out R&D priorities. Targets should be clear and quantified.

A technology roadmap can be a useful tool to help policy makers, industry and society understand the optimum, cost effective paths that can be pursued to achieve energy efficiency goals. They provide a

quick and clear assessment of the technologies available and the steps required to accelerate adoption. The roadmap should identify milestones, financing policies and programs and public engagement required.

Recommendation 40 Increase cooperation with universities and the private sector in application research.

Energy efficiency related R&D is currently being undertaken by universities and the private sector. By increasing cooperation, the government can utilise their capabilities to achieve policy goals.

Recommendation 41 Require all government officials to undergo energy efficiency training.

Outside of the Ministry of Energy, Green Technology and Water, many government officials had limited knowledge of energy efficiency and how it could be applied in the context of their ministry. Ensuring that government officials have undertaken energy efficiency training (either on a one-off or regular basis) will improve awareness, potentially reduce energy use in the government sector through behavioural change and create more informed energy efficiency policies. For example, in Chinese Taipei, personnel of government agencies and schools must undertake four hours of study in the area of energy efficiency each year under the Environmental Education Act.

APPENDIX A: PEER REVIEW TEAM MEMBERS

Mr. Kenji KOBAYASHI, Peer Review Team Leader, President, Asia Pacific Energy Research Centre (APEREC).

Mr. Titovianto WIDYANTORO, Lecturer, Electricity & Renewable Energy Training Center, Indonesia.

Mr. George SUN, Deputy Director, Research and Statistics, Land Transport Authority, Singapore.

Mr. Jeffery NENG, Deputy Director, Building and Construction Authority, Singapore.

Mr. Chin-Chung WU, Chief of Planning Section, Taiwan Power Company, Chinese Taipei

Mrs. Sirinthorn VONGSOASUP, Director, Department of Alternative Energy Development & Efficiency, Thailand.

Mr. Brian CASTELLI, Executive Vice President, Programs and Development, Alliance to Save Energy, United States.

Mr. Chandran SUNDARAJ, Researcher, Asia Pacific Energy Research Centre (APEREC).

Ms. Kate PENNEY, Young Professional, Asia Pacific Energy Research Centre (APEREC).

APPENDIX B: ORGANISATIONS AND OFFICIALS CONSULTED

Ministry of Energy, Green Technology & Water (MEGTW)

Datuk Loo Took Gee, Secretary General

Mr. Badaruddin Mahyudin, Deputy Secretary General (Energy)

Mrs. Badriyah Abd. Malek, Undersecretary, Sustainable Energy Division

Mr. Anbalagan Kannan, Undersecretary, Policy Planning and International Relations Division

Mrs. Noreha Muslim, Senior Principal Assistant Secretary, Policy Planning and International Relations Division

Ms. Ivy Yap Lee Lian, Assistant Secretary, Sustainable Energy Division

Mr. Mohd Quyyum Ab Rahman, Assistant Secretary, Sustainable Energy Division

Mr Muhammad Daniyal Abd Kadir, Assistant Secretary, Policy Planning and International Relations Division

Economic Planning Unit of Prime Minister's department (EPU)

Mr. Mohd Sukri Mat Jusoh, Deputy Director, Energy Section

Mrs. Haniza Abd Aziz, Principal Assistant Director, Energy Section

Ministry of Finance

Mr. Muhammad Afnan Basir, Assistant Secretary, Tax Analysis Division

Ministry of Natural Resources and Environment

Ministry of Transport

Mr. Mano Verabathran, Senior Principal Assistant Secretary, Policy, Strategic Planning and Innovation Unit

Mr. Pardon Munawar, Principal Assistant Secretary, Aviation Division

Mr. Nazri Armar, Assistant Director, Marine Department

Mr. Azizul Abdul Aziz, Mechanical Engineer, Road Transport Department

Dr. Wong Shaw Voon, Director, Malaysian Institute of Road Safety Research

Suruhanjaya Tenaga (The Energy Commission)

Ir. Francis Xavier Jacob, Director, Energy management and Industrial development Department

Mr. Zaini bin Abdul Wahab, Demand-Side Management Unit

Malaysian Green Technology Corporation

Mr. Steve Anthony Lojuntin, Principal Engineer

Tenaga Nasional Berhad

Mr. Ismail Abd Rahman, General Manager

Dr. Amir Hisham Hashim, Assistant General Manager

University Tenaga Nasional (UNITEN)

Dr. Adlansyah Abd Rahman, Senior Lecturer

[Ir. Dr. Tuan Ab Rashid Bin Tuan Abdullah](#), Principal Lecturer

Universiti Teknologi Mara (UiTM)

Prof. Dr. Azni Zain-Ahmed, TNCA / Head RISE Center

Dr. Nor Zaini Zakaria, Senior Lecturer

Mrs. Salmah Ahmad, Senior Lecturer

Federations of Malaysia Consumers Association (FOMCA)

Mr. Foon Weng Lian

Mrs. Mages

Centre for Environment, Technology and Development, Malaysia (CETDEM)

Mr. Anthony Tan, Executive Director

Malaysia Association of Energy Services Companies (MAESCO)

Ar. Zulkifli Zahari, President

Perusahaan Otomobil Nasional Sdn Bhd

Mrs. Nordiana Noordin, Deputy Director, Green Technology Department

APPENDIX C: REFERENCES

- EPU (Economic Planning Unit, Prime Minister's Department) (2010). *Tenth Malaysia Plan 2011–2015*.
- U.S. EIA (Energy Information Administration). International Energy Outlook 2010. See <http://www.eia.doe.gov/oiaf/ieo/transportation.html>
- MEGTW (Ministry of Energy, Green Technology and Water) (2008). *Malaysia Energy Balance 2008*.
—(2010). Draft Final Report of National Energy Efficiency Master Plan.
- PEMANDU (Performance Management and Delivery Unit, Prime Minister's Department) (2010). Government Transformation Programme.
- PETRONAS (Petroleum Nasional Berhad) (2009). *Annual Report 2009*.
- Phylipsen, GJM, K. Block and E. Worrel. (1998). *Handbook on International Comparisons of Energy Efficiency in the Manufacturing Industry*. Department of Science, Technology and Society. Utrecht University.
- TNB(Tenaga Nasional Berhad)(2009). Annual Report 2010.