ENERGY EFFICIENCY & DEMAND SIDE MANAGEMENT

(EE/DSM) in Malaysia

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This article attempts to highlight some implications of electricity demand growth for Malaysia, with and without the adoption of EE/ DSM concepts. The engineering community can help to propagate these concepts and encourage their clients to embrace EE/ DSM initiatives.

SYNOPSIS

Malaysia has recorded its intention of promoting Energy Efficiency and Renewable Energy as policy initiatives under the 8th Malaysia Plan, reinforcing its initial mention in the 7th Malaysian Plan. The Energy Commission Act of 2001, charges the Energy Commission (or Suruhanjaya Tenaga – ST), with implementing these policy initiatives.

Malaysia also obtained Danish Government assistance under DANIDA (Danish International Development Assistance) for a "Capacity Building in the Energy Commission and Key Related Institutions on EE/DSM" project, which started in February 2002, at the ST.

EE/DSM has been promoted over many years in Malaysia, and specific fiscal incentives have been given by the government of Malaysia in the budgets for the years 2001 and 2003 to encourage energy users to adopt these concepts. Nevertheless, there seems to be a "reluctance" by the users to embrace these concepts and implement the relevant projects to use energy more efficiently.

Although these EE alternatives may involve higher capital expenditure up-front, their energy use savings more than justify the capital cost premium over the life of the equipment concerned. This will translate into lower cost of production and better business competitiveness for Malaysian industrial and commercial entrepreneurs in the regional market under the implementation of AFTA and in the future as well AFTA & after.

ENERGY EFFICIENCY & DEMAND SIDE MANAGEMENT (EE/DSM) IN MALAYSIA

EE/DSM – Basic Concepts

Energy Efficiency and Demand Side Management (EE/DSM) is one of the energy management strategies widely used internationally, to help assure sustainable energy supply and use for national development.

EE/DSM is an economically viable option as an alternative to generation capacity addition and associated infrastructure development, to meet growing electricity demand of a nation. It is also a necessary initiative to sustain economic growth, and optimise capital expenditure required for developing the necessary energy supply infrastructure for the nation.

The EE/DSM initiatives complement the supply side development plans as they are economically viable options as alternatives to generation capacity addition and associated infrastructure development, to meet growing electricity demand. EE/DSM concepts have some-times been wrongly equated to "energy conservation" which has negative connotations. EE/DSM is using energy efficiently, not doing without energy. EE/DSM initiatives do not constrain energy consumption; they simply endeavour to eliminate

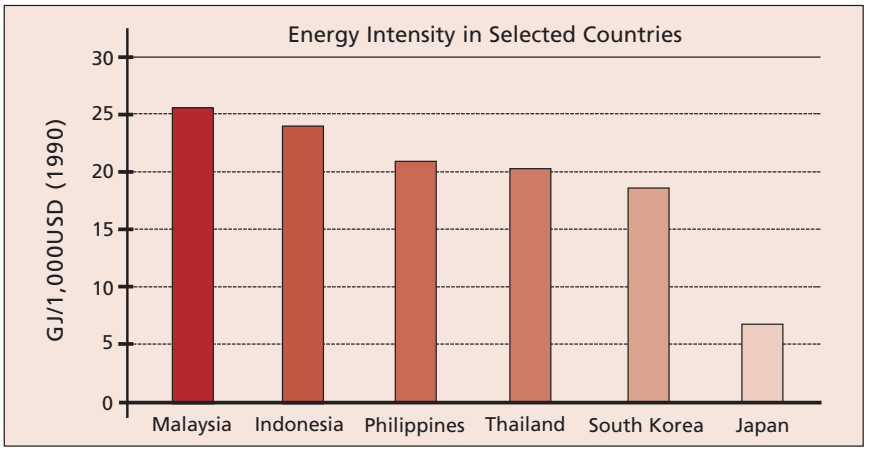

Figure 1 – Relative Energy Intensity for Selected Countries
Source: DOE/EIA International Energy Annual 1998 including all sectors

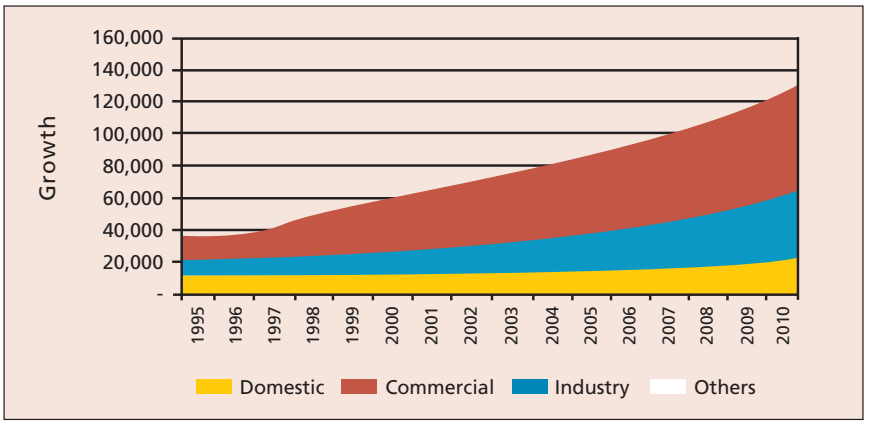

Figure 2 – Electricity Consumption in selected sectors
Source: NEB 2000

avoidable waste of energy.

Supply & Demand Perceptions and Their Implications

The national energy policy has traditionally concentrated on planning to ensure adequate, reliable, and quality energy supply to meet the projected demand. The projected demand is driven by the national development policies and strategies to achieve the desired development goals, as seen in the form of GDP growth rates.

Malaysia, in common with other developing countries, has endeavoured to ensure adequate energy supply for the growing national needs. Adequate, secure and quality supply is essential for the needs of a nation that is promoting industrial development as it aims for a "developed nation" status.

A well entrenched perception in the developing world is that national economic growth demands increasing energy use. In fact, the rate of increase in energy use is often mistakenly equated to the rate of national economic growth. This is patently untrue, as examples from the East and the West show that economic growth rates can be decoupled from energy use growth rates. Two such examples are Denmark and South Korea, whose details are listed later.

The rate of economic development does not necessarily depend directly on the rate of energy use growth. This has been proven conclusively by a number of developed countries, which have managed to achieve high economic growth with negligible, or even negative energy use growth through successful EE/ DSM initiatives.

Investment in EE/DSM can give attractive benefit to cost ratios (BCR), and their benefits continue for the life of the initiatives that are implemented.

MALAYSIAN ENERGY USE

PERFORMANCE & TRENDS

The electricity to GDP growth rate elasticity in Malaysia is about 1.5, meaning that every one percent of GDP growth requires 1.5% of electricity demand growth.

The high, unrestrained demand growth called for a total investment of about RM 25.1 billion for the infrastructure development for the electricity sector during the 8th Malaysia Plan period. This could increase to an estimated RM 35 to 40 billion for the 9th Malaysia Plan.

The chart in Figure 1 shows the relative energy intensity for selected countries, where even several ASEAN nations appear to use energy more efficiently than Malaysia.

The following chart (Figure 2) shows the electricity use growth trend, and projections over the period 1995 to 2010.

Consumption for the years 2001 to 2005 is projected on an annual growth rate of 9.3% according to the projections in 8MP and 8% p.a. in 2006-2010 (based on 8MP until 2005).

The electricity use share and projected growth rates between the various sectors is as shown in

TABLE 1 – ELECTRICITY USE SHARE & GROWTH RATE FORECAST

NO.	SECTOR	CURRENT SHARE %	GROWTH RATE %
1	Industrial	53	8.5
2	Commercial	27	7.6
3	Residential	18	7.6
4	Others	2	N/R

Source: 8th Malaysia plan

TABLE 2 – COMPARISON BETWEEN 4TH & 5TH ECONOMIC DEVELOPMENT PLANS – S. KOREA

	Average GNP growth (%)	Average growth rate of energy consumption (%)	GNP elasticity to Energy Demand
4th Plan (1977 - 1981)	5.8	8.7	1.5
5th Plan (1982 - 1986)	8.6	6.1	0.71

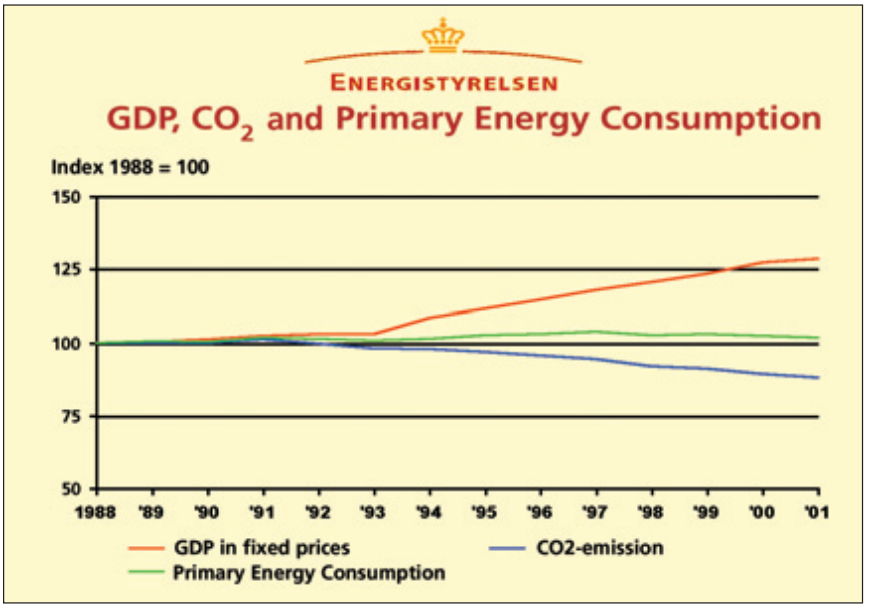

Figure 3 – GDP, CO_2 and Primary Energy Consumption

Table 1.

Energy Consumption & Management Examples

Denmark and South Korea are examples of countries that have consciously managed to control their energy use efficiency, and thus "decouple" their energy and economic growth rates.

South Korea managed to improve its energy use efficiency through dedicated efforts for the "Achievement of Energy Conservation" by reducing its elasticity between energy consumption growth and GNP growth rates over two of their 4-year development plan periods as shown in Table 2.

South Korea currently envisages its energy demand to grow by about 3.2% to support an average eceonomic growth rate of about 6% (Korea Energy Management Corp., Energy Efficiency & Conservation Training Program 2003).

On the other hand Denmark has managed to maintain its energy use (including transport energy use), substantially constant over a period of about 20 years, while its GDP growth has grown by over 25% as shown in Figure 3.

Need for EE/DSM

EE/DSM focuses on the efficiency and effectiveness of energy utilisation from the user side (in this article covering only electricity), and refers to the management and use of electricity.

EE/DSM initiatives help to optimise the total investment in the electricity supply system development, and help to reduce the cost of electricity used in the relevant business activities. This reduces the cost of doing business, and helps improve the competitive edge for the business community in the international market, since electricity use constitutes about 3% to as high as over 15% of the production cost for various industries.

With worldwide emphasis on protecting the environment, and Malaysia's ratification of the Kyoto Protocol, it is obviously desirable for Malaysia to demonstrate its commitment by practical deeds in reducing wasteful use of energy.

EE/DSM measures are known to have a cost impact, and this has often been offered as the reason why electricity users are reluctant to implement them. Another reason, not often voiced openly, is that electricity rates in Malaysia are relatively low. Can Malaysia afford such unrestrained investment, and the associated environmental pollution?

Potential Impact of EE/DSM

EE/DSM programmes and projects can contribute to reducing the rate of growth of energy demand for the same economic development. This means that the existing infrastructure investment would satisfy the energy demand for the "immediate future" beyond the projected period of supply adequacy, and reduce the magnitude of future investment in energy supply infrastructure development.

If the electricity demand growth ratio of 1.5 times the GDP growth ratio could be reduced to 1.0 (as has been achieved by other countries), it would mean that Malaysia could "save" up to one-third the investment in the electricity sector development. This would have amounted to investment savings of about RM8 billion for the 8th Malaysia Plan and about RM13 billion for the 9th Malaysia Plan on infrastructure development alone.

In addition, the electricity users themselves would also save money on the unused energy, and this could amount to about 60% of the investment cost over the same period.

EE/DSM initiatives will not give savings in the investment required for the 8MP (mid term stage), but significant savings could be obtained for the investment planned for the 9MP, provided the electricity users can be encouraged to adopt the

required EE initiatives.

It is not possible to achieve such a change in the elasticity "overnight", or without effective EE/DSM strategies. Such efforts will also require some investment in promotion programmes, or the provision of attractive incentives for the users to adopt the concepts.

The currently available incentives do not appear to have generated the pace desired of EE/DSM project imple-mentation desired. One reason appears to be that they have not been adequately publicised, and potential beneficiaries of such incentives have not been aware of them. This means that more effective and widespread awareness building is a prerequisite for the successful promotion of the EE/DSM initiaitves and projects.

Additionally, it appears that the electricity tariffs for the major users are too low to encourage them to invest capital towards improving their electricity use.

Potential Savings From EE/DSM

The potential savings are substantial, as shown in Table 3. The potential savings from EE/DSM depend on the intensity and successful adoption of the respective programmes to be implemented, the duration of the programmes, and the successful "selling" of the promoted options.

Figure A and Table 3 show the impact of EE/DSM initiatives if the following performance improvements can be achieved:

- *Reduction of existing demand by 0.1% per annum, and*
- *Reduction in the elasticity by 0.01 per annum.*

The above assumptions imply rather minimal energy efficiency improvement efforts (e.g., compared to the example of S. Korea) towards inculcating a culture of using energy efficiently, and showing some concern for our environment.

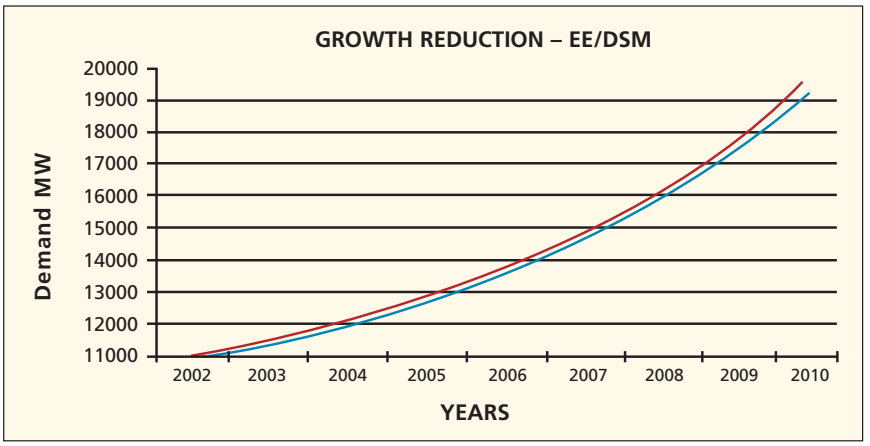

Figure 4 - Electricity Demand Growth Projection Alternatives

TABLE 3 - POTENTIAL SAVINGS FROM ABOVE ALTERNATIVE SCENARIOS

POTENTIAL SAVINGS FROM EE/DSM INITIATIVES 2003 - 2010				
	Reduction in MD (MW)	Investment cost involved (million RM)	Reduction in energy used used (MWh)	Cost of energy unused (million RM)
Savings through declining elasticity	198	1,029	2,842	568
Savings through reducing demand	117	606	2,184	437
Combined savings - demand & energy	315		5,026	
Combined savings (million RM)		1,635		1,005

From Table 3 also shows the magnitude of potential benefits from EE/ DSM initiatives that can be accrued if the specified rate of energy use efficiency is efficiently achieved.

The question remains as to why have EE/DSM initiatives not taken off in Malaysia, even though our neighbours (Thailand and Singapore) have embraced these concepts and are now benefitting from their results.

Most business enterprises would consider investments viable if they generate high returns that result in short payback periods of not more than 2 (or at most 3) years. Hence, any EE/DSM investment that can give a pay back period of less than 3 years could be an attractive investment.

This may require the provision of fiscal or financial incentives, as have already been made available through the Budget 2003 (and Budget 2001 earlier). Or perhaps there has not been adequate dissemination of the relevant information (or dissemination to the right targets), to achieve the desired results.

EE/DSM Options

TABLE 4 - SAVINGS FROM LIGHTING

TYPE OF LAMP	LAMP LIFE HOURS	LAMP POWER WATTS	LAMP COST RM	LIFE-TIME ENERGY COST (PER UNIT)	TOTAL COST (EQUIVALENT RM)	LIFE-TIME SAVINGS RM
Incandescent	1,000	60	1.70	15.00	167.00	-
CFL	10,000	18	25.00	45.00	70.00	97.00

Various EE/DSM options are available to reduce the energy demand required for economic development. Many options have already been used by other developing and developed countries to enhance their competitive edge in international business activities.

Since Malaysia is virtually at the start of a concerted EE/DSM campaign, the potential options are what can be termed the "low hanging fruits", i.e., options that are easy to implement and have attractive returns for low investment and effort.

Amongst such options are the following:

- *Avoidance of energy waste due to "bad energy use habits" (e.g., "switching off" appliances when not in use, or switching on only when needed),*
- *Minimising use of "stand-by" features of electronic appliances (which consume energy continuously),*
- *Sustenance of appropriate comfort environment where energy is used to create the working environment, e.g, in lighting intensity to suit the purpose, a comfortably cool environment (temperature neither too low nor too high), avoidance of cooled air waste through leakages, etc.,*
- *Use of compact fluorescent lights (CFL) instead of incandescent lights (conventional bulbs),*
- *Use of fluorescebt lights with low loss, or electronic ballasts,*
- *Use of energy efficient refrigerators and other household appliances,*
- *Use of high efficiency motors (HEM) in applications where prolonged continuous operation requires large energy use (energy use is often many times the purchase cost), as well as use of VSDs (variable speed drives) where appropriate,*
- *Use of energy efficient air conditioners, and reduction of unnecessary heat gain through the use of suitable insulation for air conditioned buildings,*
- *Implementation of effective maintenance of energy consuming equipment, and replacement rather than repair of less efficient equipment,*
- *Use of daylighting in offices, hospitals, and similar facilities, where possible (daylight has been known to have significant physiological benefits on human behaviour).*

Government Support for EE/DSM

In spite of the "low hanging fruits" available from EE initiatives, the industrial and commercial electricity consumers have shown little interest in adopting such EE initiatives.

The Malaysian Government had introduced incentives to promote EE and RE from the budget for the year 2001, for the incentives to be available up to the end of year 2002. The incentives have been enhanced in the budget for the year 2003, while the period of validity for the incentives has also been extended to 2005.

The currently available incentives do not appear to have generated the pace of EE/DSM project implementation desired. One reason appears to be that they have not been adequately publicised, and potential beneficiaries of such incentives have not been aware of them. This means that more effective and widespread awareness building is a prerequisite for the successful promotion of the EE/DSM initiaitves and projects.

Additionally, the target con-

TABLE 5 - SAVINGS FROM HIGH EFFICIENCY MOTORS

ANNUAL ELECTRICITY COST AT L.V. INDUSTRIAL TARIFF RM 0.258/KWH						OP DAYS	
	Efficiency	Hours of operation per day, at 80% load.				266	
Motor of 10 kW		2	4	6	8	10	12
Motor A	0.88	1,248	2,496	3,743	4,991	6,239	7,487
Motor B	0.91	1,207	2,413	3,620	4,827	6,033	7,240
ELECTRICITY COST DIFFERENCE RM AT L.V. INDUSTRIAL TARIFF, FOR:							
1 year	1	41	82	123	165	206	247
5 years	5	206	411	617	823	1,028	1,234
10 years	10	411	823	1,234	1,645	2,057	2,468

sumers may not be aware of the significance of the benefits that can be derived from the adoption of EE practices.

Significance of Savings From EE/DSM

Simple examples are the best means of showing the potential savings from EE initiatives.

Table 4 shows that the use of a CFL (18 Watts, equivalent to a 60 watt incandescent lamp) can give an average life-time saving of up to RM 97.00 even though its purchase cost is high at RM 25.00. (CFL lamps of 4 Watts to 20 Watts are available at RM18.00 at a well known "mega-store" while some are offerred on special sales at prices as low as RM12.00).

Similarly, an 18 Watt conventional fluorescent lamp also gives a significant saving (although it has additional energy cost for the losses from its ballast if a magnetic ballast is used), when compared with an incandescent lamp.

Similar calculation for a HEM is shown in Table 5. This shows that even for an efficiency difference of only 3%, the electricity cost difference can be substantial, enough to more than cover the cost premium for such motors (although the cost premium for HEMs in Malaysia is currently high due the lack of a market for such products). Similar calculations can also be applied to other industrial, commercial and domestic appliances that use electricity.

These calculations show that the electricity use cost of an appliance is many times higher than the purchase cost of the appliance. This is true for most electricity using appliances. However, such implications of energy cost do not appear to receive due consideration when equipment purchase is made.

FINAL COMMENTS

This article has not touched the concept of energy efficient building design, as embodied in the Ministry of Energy, Communications and Multimedia's new Low Energy Office (LEO) building in Putrajaya. LEO buildings can obviously contribute significantly to overall energy use savings, but involve many diverse aspects.

This article has made no reference to savings that can be attributed to environmental degradation costs. Heavy penalties are imposed in many countries in the form of taxes on energy to cover environmental pollution mitigation efforts.

It seems rather incongruous for Malaysians to continue to waste energy through inefficient use and inconsideration for the environment just because energy, especially electricty, is cheap and affordable.

Engineers can, and should, champion the cause for energy efficiency in Malaysia, for a more competitive business community, and a better environment for our future generations. ■