MALAYSIA'S ENERGY PLAN: THE WAY FORWARD

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BIODATA

Dr Mohd Zamzam Jaafar is the Chief Executive Officer of Pusat Tenaga Malaysia (MALAYSIA ENERGY CENTRE), a not-for-profit company, administered by the Ministry of Energy, Communications and Multimedia (MECM), Malaysia from 1st July 1998. He holds a B.Sc. and Ph.D in Nuclear Engineering from Queen Mary College, London. He is on secondment from Tenaga Nasional Berhad where he was involved in power station operation, development planning and R&D and corporate planning & business development since 1976. He coordinated several collaborative research with international organisations concerning nuclear power programme, energy planning & development and DSM, and presented numerous papers on energy issues in Malaysia and abroad.

As CEO of PTM, Dr. Zamzam is the current national project director of two major activities i.e. the 4-year RM 80 million Malaysian Industrial Energy Efficiency Improvement Project (MIEEIP) and the 30-month RM 8 million Capacity Building in Integrated Resource Planning (IRP) at Government and Related Agencies project. The former is co-funded by UNDP and Global Environment Facility and the latter receives co-funding support from DANCED.

He is also a member of the EU-ASEAN Energy Advisory Panel and the National IRPA (Experimental Applied Research) Panel under the Ministry of Science, Technology & the Environment. In the capacity of CEO of PTM, he is also the focal point for ASEAN Energy Efficiency & Conservation (EE&C) and the New and Renewable Sources of Energy (NRSE) sub-sector networks.

The latest high-value project at PTM is the Power Industry Cost Competitiveness Initiative (PICCI) to emulate the accomplishments and success of Cost Reduction Alliance (CORAL) by PETRONAS and its production sharing contractors in the oil & gas industry. As an “honest broker” PTM acts as the PICCI secretariat similar to the roles and functions of the “neutral” CORAL secretariat.

Malaysia Energy Plan

The Way Forward

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Ptm
Malaysia Energy Centre

Outline

- Energy Sector Overview
- Malaysia Energy Plan
- Future Challenges
  - Facilitate entry of RE&EE in mainstream energy development
  - Appropriate ‘self-sufficiency level” in energy supply and energy technology

Energy Sector Overview

The National Energy Policy (*1979*) covers three major objectives:

1. **SUPPLY – to ensure adequacy, security, cost-effectiveness of energy supply**

2. **UTILIZATION – to promote efficient utilization of energy and to discourage wasteful patterns of energy consumption**

3. **ENVIRONMENT – to minimize the negative environmental impacts in the energy supply chain**

Immediate Challenges

The Third Outline Perspective Plan (2001-2010) and Eighth Malaysia Plan (2001-2005) reports highlight:

1. Greater utilization of natural gas in power and non-power sectors

2. The development of renewable energy as the fifth fuel, particularly in power generation

3. Efficient utilization of energy through the introduction of new regulations and amendments to present laws.

4. Adequacy of electricity generating capacity to ensure reliable, affordable and quality energy supply

Energy Reserves

Energy Reserves & Potential in 2000

OIL	GAS	COAL	HYDRO ELECTRIC
3.39 billion barrels	82.5 trillion standard cubic feet	1,483 million tonnes	29,000 Megawatts (123,000 GWh/year)

data as at 1.1.2001 figure

Malaysia Energy Plan

1. Major Energy Investments (2001-05) already decided
   (Energy is not likely to be a constraint to economic progress)

2. Fuel Diversification to enhance Energy Security
   - *Utilization of domestic RE resources & cogeneration leading to complementary coexistence of Centralized and decentralized power plants*

3. Promote EE through implementation of Demand-side Management (DSM) and enforcement of Energy Efficiency Regulations i.e
   - *Retrofitting and district cooling programs*
   - *Establishment of new energy-efficient integrated complexes and townships*
   - *Appliance labelling*
   - *Changing the energy usage pattern*

Development Allocation / Investments and Expenditure for Energy Sector Programmes, 1995 –2005 (RM million)

Programme	7MP Expenditure			8MP Allocation		
	Federal Government	NFPEs	Total	Federal Government	NFPEs	Total
Electricity Sector	***2,543.6***	***23,563.6***	***26,107.2***	***2,601.6***	***22,565.1***	***25,166.7***
Generation (hydro and thermal)	1,389.9	5,937.4	7,327.3	986.5	6,943.7	7,930.2
Transmission	437.6	8,270.8	8,708.4	494.7	6,275.4	6,770.1
Distribution	246.2	9,325.2	9,517.8	239.3	9,346.0	9,585.3
Rural Electricity	463.6	-	463.6	856.6	-	856.6
Others	6.3	30.2	36.5	24.5	-	24.5
Oil & Gas Sector	***-***	***30,400.0***	***30,400.0***	***-***	***27,638.0***	***27,638.0***
Upstream	-	12,900.0	12,900.0	-	12,800.0	12,800.0
Downstream	-	11,000.0	11,000.0	-	10,600.0	10,600.0
Manufacturing	-	5,300.0	5,300.0	-	2,200.0	2,200.0
Others	-	1,200.0	1,200.0	-	2,038.0	2,038.0
Total	***2,543.6***	***53,963.6***	***56,507.2***	***2,601.6***	***50,203.1***	***52,804.7***

Source: Eighth Malaysia Plan

Energy Market Characteristics

- **Energy Industry in Malaysia can be divided into 3 major market categories**
  - a virtually domestic market with very limited cross-border trade i.e. electricity and piped gas supply. (Power utilities, PETRONAS and gas utilities are virtually monopolies in franchised areas while IPPs and incumbent utilities compete in power generation)
  - a combination of domestic and international market i.e. domestic supply, import/export of oil products and crude oil and coal (A number of oil companies compete in petroleum product retail business)
  - export of LNG

Natural Gas Production[1], 1995-2005 (mmscfd)

Exploration Area	1995	2000	2005
Off Peninsular*	1,440	2,100	2,800
Off Sabah	230	220	354
Off Sarawak**	1,881	2,631	3,888
Malaysia	***3,551***	***4,951***	***7,042***

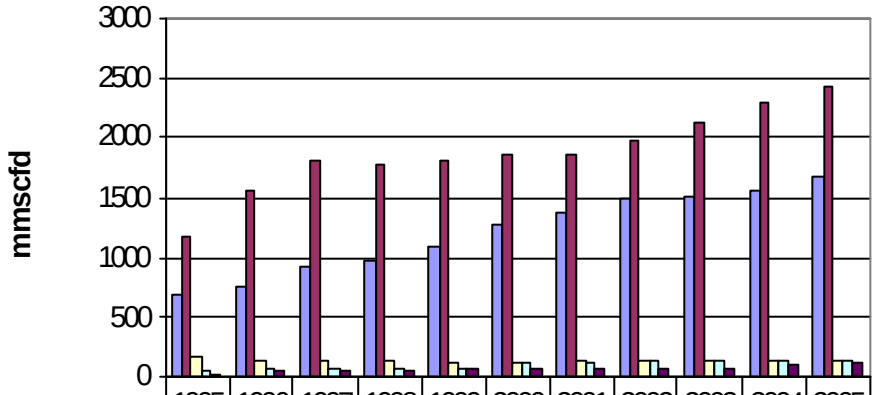
Note: [1] Total gas produced at wellhead

** 150 mmscfd for Singapura Export*

*** Bulk of Sarawak Gas production for LNG export*

Source: Eighth Malaysia Plan

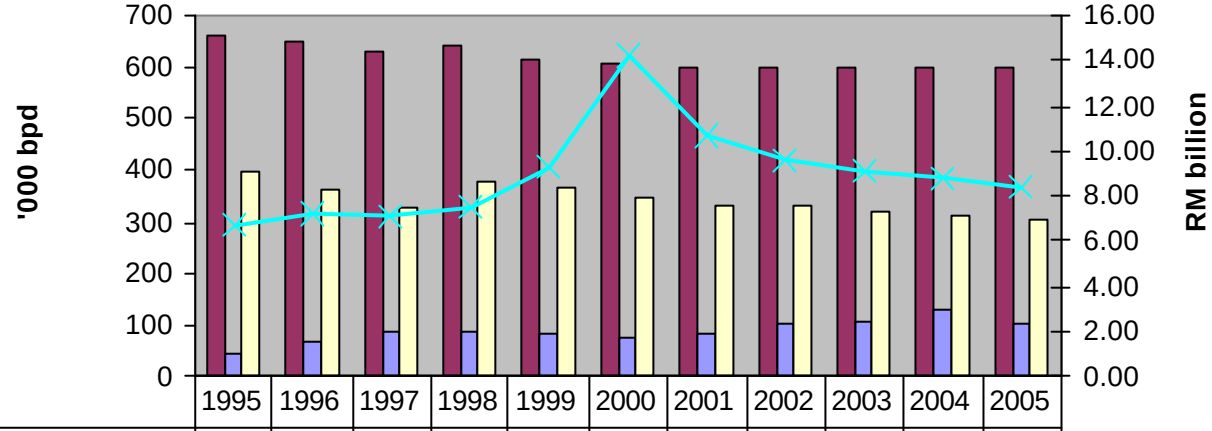
Gas Utilization, 1995 - 2005



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Electricity Generation	676	752	914	970	1097	1283	1365	1497	1515	1567	1687
LNG Export	1190	1550	1827	1767	1815	1863	1863	1995	2127	2284	2440
Export to Singapore	157	140	139	152	123	125	150	150	150	150	150
Industry	59	68	81	67	79	116	126	134	142	151	147
Reticulation	23	41	51	52	60	65	68	73	79	96	108

1. Supply of piped gas to the power sector will increase from 1,283 mmscfd in 2000 to 1,687 mmscfd in 2005.
2. Gas share in power generation mix to reduce from ~79% in 2000 to ~61% in 2005. It is reported that about 20 million tonnes of coal per year would be required when 3 planned coal plants (Janammanjung, Tanjung Bin and Jimah – 5600 MW) come on stream.

Crude Oil and Condensate[1] Production, Export Volume and Value, (1995 – 2005)



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Crude Oil ('000 bpd)	663	647	629	640	612	606	600	600	600	600	600
Condensate ('000 bpd)	42	70	85	85	83	74	82	105	110	128	102
Export Volume ('000 bpd)	399	364	330	375	369	345	332	331	319	313	302
Export Value (RM billion)	6.70	7.21	7.07	7.51	9.31	14.24	10.62	9.60	9.13	8.82	8.39

Note: [1] A crude oil component derived from natural gas streams, comprising pentane and heavier hydrocarbon

Source: Eighth Malaysia Plan

Installed Capacity, Peak Demand and Reserve Margin, (1995 – 2005)

Year	Generation by System [1]	Accumulated Installed Capacity (MW)	Peak Demand [3] (MW)	Reserve Margin [4] (%)
1995	TNB	9,655	6,572	46.9
	LLS [2]	590	298	98.0
	SESCO	590	342	72.5
	Total	***10,835***	***7,212***	***50.2***
2000	TNB	12,479	9,712	28.5
	LLS	785	410	91.5
	SESCO	846	551	53.5
	Total	***14,110***	***10,673***	***32.2***
2005	TNB	20,819	15,380	35.4
	LLS	880	615	43.1
	SESCO	1,046	839	24.7
	Total	***22,745***	***16,834***	***35.1***

Source: Eighth Malaysia Plan

Fuel Mix in Electricity Generation, 1995 – 2005 (%)

	Year	Oil	Coal	Gas	Hydro	Others	Total (gigawatthour)
Malaysia	1995	11.0	9.7	67.8	11.3	0.2	41,813
	2000	5.3	7.9	78.7	8.0	0.1	69,371
	2005	3.0	30.3	61.0	5.4	0.3	102,340
TNB	1995	9.2	10.7	70.3	9.6	0.2	38,091
	2000	3.3	7.8	81.4	7.4	0.1	63,684
	2005	1.3	32.6	61.0	5.0	0.1	93,649
LLS/SESB	1995	47.1	-	25.7	27.2	-	1,763
	2000	50.2	-	32.8	17.0	-	2,348
	2005	41.3	-	47.3	11.4	-	3,525
SESCO	1995	13.0	-	57.3	29.7	-	1,959
	2000	10.9	17.1	58.8	13.2	-	3,339
	2005	7.6	10.6	67.4	9.0	5.4	5,166

Source: Eighth Malaysia Plan

Planned Generation 2001 - 2008

Planned Projects	Capacity (MW)	Total Capacity (MW)	Estimated Cost (RM billion)
Gas Combined Cycles			
1. SJ Tuanku Jaafar, Negeri Sembilan	2 X 750	1500	4.0
2. Powertek, Melaka	2 X 240 + 240	720	1.6
3. Segari, Perak	3 X 142 + 240	666	1.6
4. Sepang, Selangor	2 X 235 + 240	710	2.0
5. Perlis Power	2 X 330	660	1.8
6. Pulau Bunting, Kedah	2 x 700	1400	4.0
Sub Total		***5656***	**15.0**
Coal Plants			
7. Janamanjung, Perak	3 X 700	2100	7.2
8. Tanjung Bin, Johor	3 X 700	2100	7.2
9. Jimah, Negeri Sembilan	2 X 700	1400	5.0
Sub Total		***5600***	**19.4**
Hydro			
10. Bakun Hydroelectric, Sarawak		2400	9.0
11. Kenyir II		300	0.7
12. Ulu Terengganu		300	0.7
Sub Total		***3000***	**10.4**

Renewable Energy

A New Source of Grid Electricity

- Small Renewable Energy Power (SREP) program was officially launched on 11 May 2001
- About 5% of total electricity generation or 500 – 700 MW of installed capacity will be from RE by the end of 2005.
- Two landmark power purchase agreements were signed on 16 Oct 2001 to facilitate the entry of renewable energy (biomass and biogas) into mainstream energy development in Malaysia.
- Malaysia has also secured co-funding support from the United Nations Development Programme (UNDP) and Global Environment Facility (GEF) to embark on a 5-year biomass-based Power Generation and Cogeneration project in the Palm Oil Industry.

A New Source of Grid Electricity (cont')

- Use of biogas from landfill and those generated from Palm Oil Mill Effluents (POME) as well as other waste-derived fuel will be encouraged

- Grid connected PV systems are also under research, development and demonstration (R,D & D) stages and one 3 kW PV system is already installed in a private home.

- Mini-hydro and Municipal Solid Wastes are included as RE (A private company already operates and maintains about 16 MW of mini-hydro plants. Incinerators planned to burn MSW in some major urban centres could be converted to MSW power plants)

Available Energy by Types of Palm Oil Mill Residues in 2000

Year	Total planted area* (mil. hectares)	FFB yield (mil. tonnes)	Dry Weight (mil. tonnes)			Energy from residues (dry weight basis) (TJ)			Total available energy from mill residues (TJ)
			EFB	Fibre	Shell	EFB	Fibre	Shell	
2000	2.045	39.46	3.04	3.09	2.02	31,657	51,037	41,352	124,046

*Note: * Preliminary Forecast Figures based on 0.04% growth per annum of total planted area*

Available Energy from Oil Palm Trunks and Fronds in 2000

Year	Replanting area	Trunks		Fronds					Available energy from trunks and fronds
		Felled trunks based on 100% availability	Potential energy[1]	Felled fronds[2]	Pruned fronds[3]	Total available	Based on 20% availability	Potential energy[1]	
	(mil. ha)	(mil. tonnes)	(PJ)	(mil.tonnes)	(mil. tonnes)	(mil. tonnes)	(mil. tonnes)	(PJ)	(PJ)
2000	0.0784	5.92	**68.97**	1.13	21.41	22.54	4.51	**75.23**	**144.20**

Source: MPOB (2001), Gurmit Singh (1994), Hamami (1989)

Note:

1. *Calorofic values are based on the moisture content.*
2. *Amount of felled fronds is based on a forecast assuming a replanting rate of 1.7% per annum and a plantation growth rate of 0.04% per annum.*
3. *Amount of pruned fronds is based on the total planted area.*

Estimated Excess Generation Capacity Available from Oil Palm Residues

Oil Palm Residues	Excess Generation Capacity (MW)
Shells & Fruit Fibre	802
Empty Fruit Bunches	315
Trunks & Fronds	1,433
Total	***2,550***

1. **All of the shells, fruit fibre, empty fruit bunches, trunks and 20% of fronds are available for fuel purposes (the remaining 80% of fronds are currently used for mulching purposes).**
2. **The conversion efficiency is assumed at 21% (compared to ~ 3.5% in current Palm oil mill self generation plants). The energy required to process the trunks and fronds has not been determined.**

Energy Efficiency and DSM

EE and DSM

- **Malaysia has established a special organization to spearhead education and training in RE&EE i.e. the Centre for Education and Traning in Renewable Energy and Energy Efficiency (CETREE) in Universiti Sains Malaysia.**

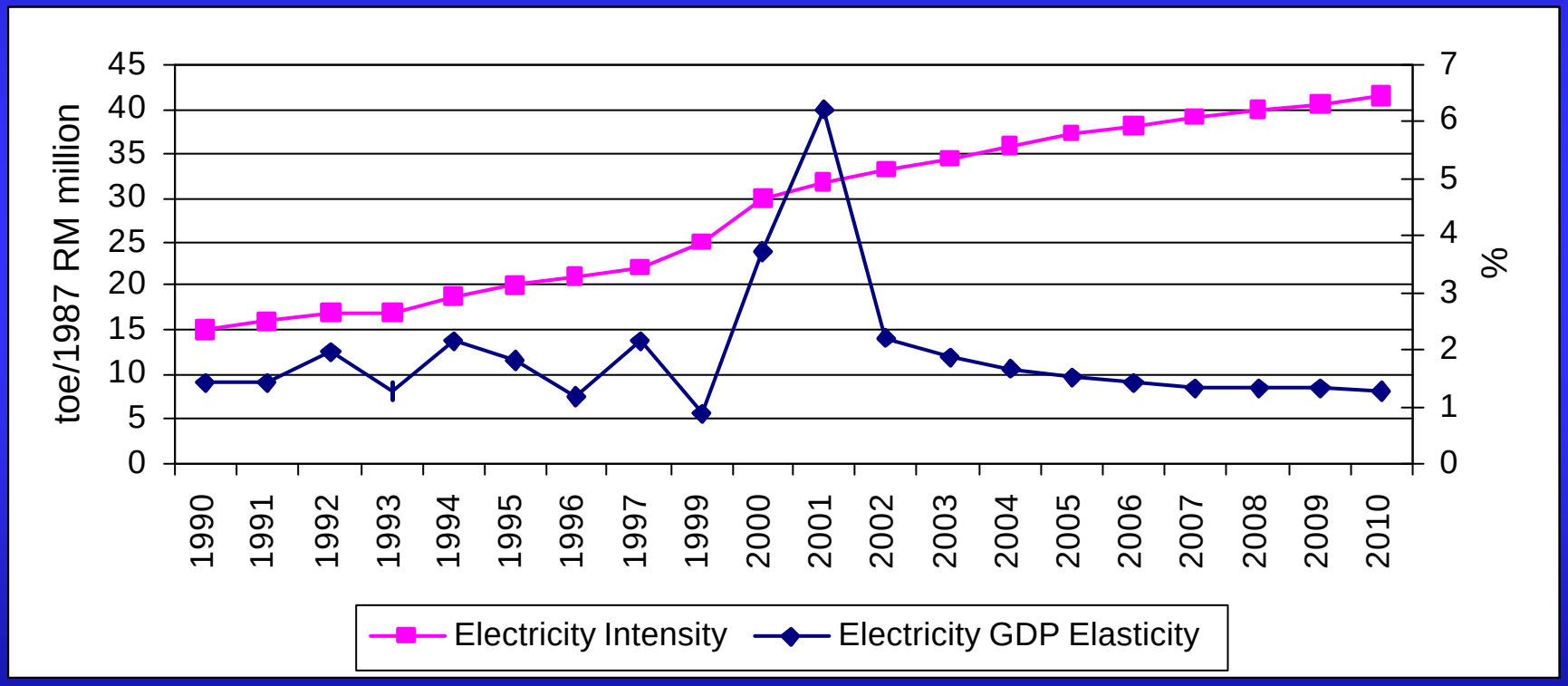
- **The focus of the EE program is industrial and building energy efficiency with two on-going voluntary programs executed by Pusat Tenaga Malaysia:**
  - Malaysian Industrial Energy Efficiency Improvement Project (2001 –2004)
  - Building Energy Audits in Government and related agencies within the overall Malaysian Energy Management Programme (MEMP)

EE and DSM

- **DANCED (... now DANIDA) of Denmark has agreed to support a DSM project to identify and recommend appropriate strategies for adoption by the electricity regulator.**

- **This regulator-led DSM program will focus on**
  - EE regulations
  - performance standards and
  - equipment labeling.

Historical and Forecast Electricity Intensity & Elasticity (1990 –2010)



Source: EASES Model for data year 2000 – 2010

National Energy Balance data for year 1990 - 1999

Self-sufficiency and Technology Transfer

The Self-sufficiency Challenges

- Malaysia will become a net oil importer around 2010 but "net imports" of coal and gas in Pen Malaysia will be earlier than this date – PETRONAS is negotiating to import gas from Indonesia (West and East Natuna and Sumatra) and coal import will reach 20 million tonnes per year

- It is necessary to sustain a reasonable energy self-sufficiency level by minimising imports and maximise use of domestic energy resources, including distributed RE&EE sources.

The Self-sufficiency Challenges (cont')

- **Encouraging use of Made-in-Malaysia components and services to reduce technology imports could justify a Malaysia First strategy**

- **Energy sector must be willing to act as test-bed or development catalyst**

The Self-sufficiency Challenges (cont')

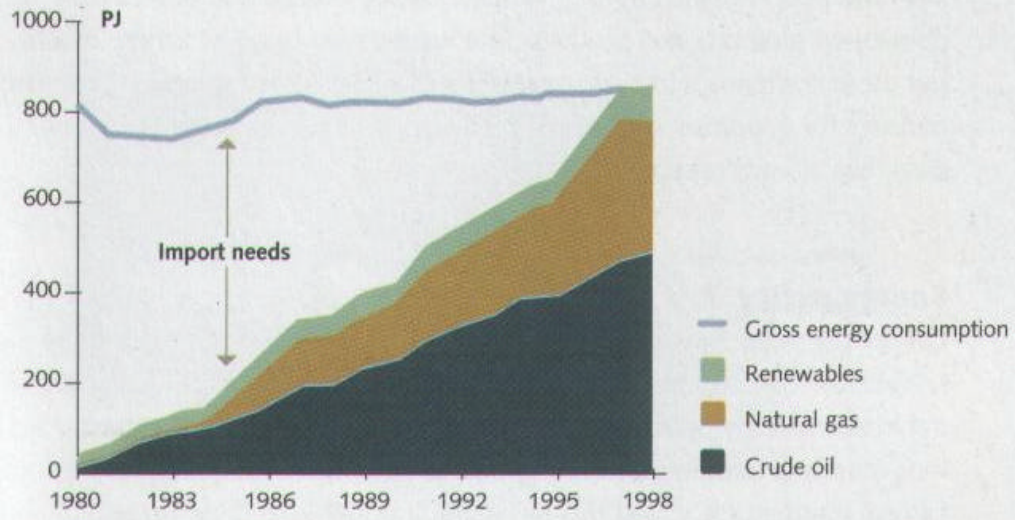
- **Success can be accelerated and four mechanisms have previously been used to implement technology transfer**
  - **Private Joint Venture with technology suppliers to set up operations in Malaysia**
  - **Licensing arrangement between a private foreign technology supplier and Malaysian recipient, sometime facilitated by government to government cooperation e.g. Volund-Enco Engineering cooperation**
  - **Government-led industrial offset programme to facilitate technology transfer (e.g. leveraging purchase of defense equipment)**
  - **Private sector technology acquisition, as encouraged by the government e.g. Proton acquisition of Lotus**

The Self-sufficiency Challenges (cont')

- **Energy technology self-sufficiency challenges were successfully implemented in Denmark and Finland to become a net exporter of energy technology.**
  - **Denmark : stable primary energy consumption and famous for wind turbine export**
  - **Finland : remote and automatic operation of cogeneration facilities using low CV fuel (peat and biomass waste).**

Energy Self-Sufficiency in Denmark after Enduring 18 Years of National Efforts

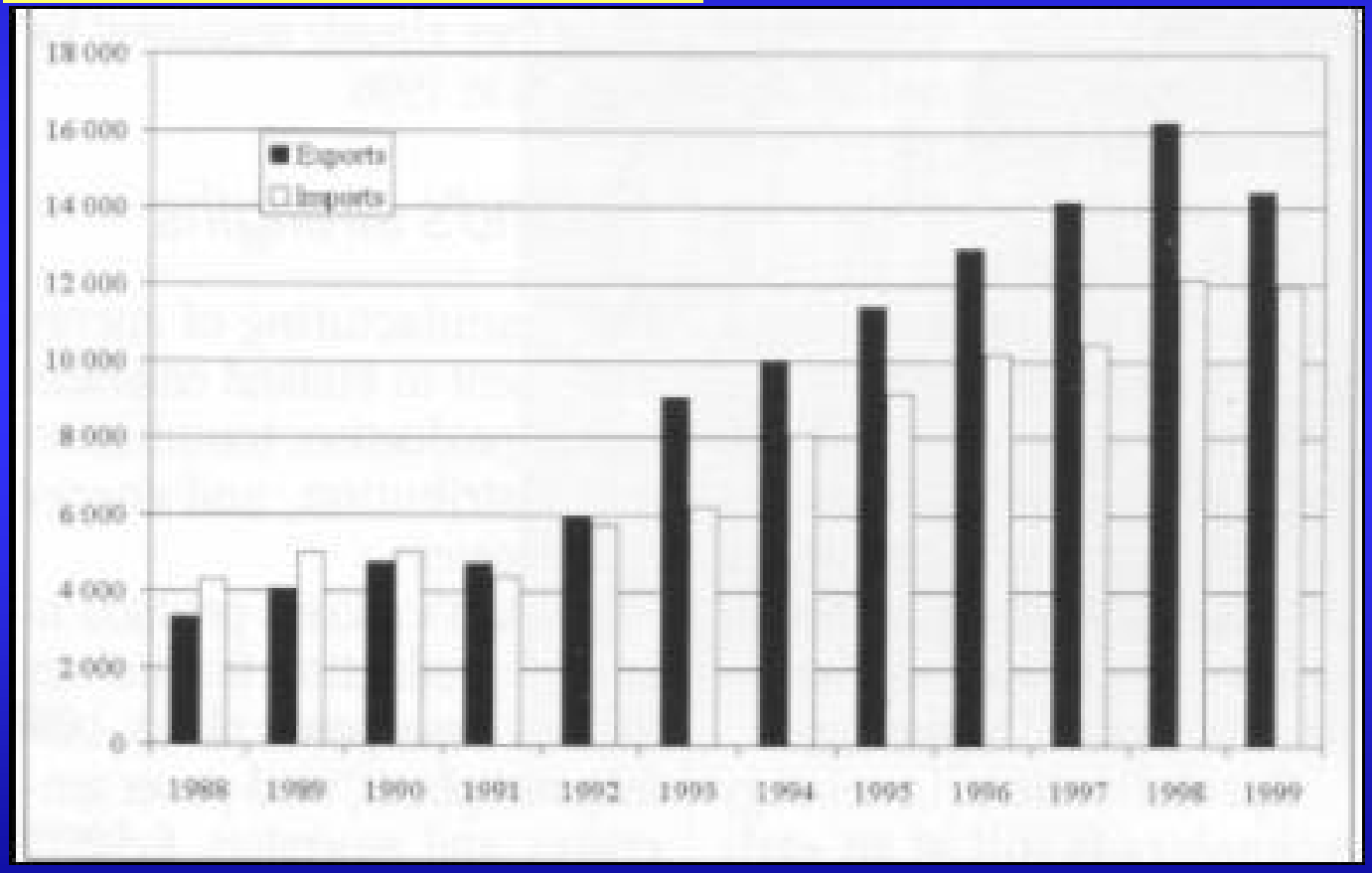
FIGURE 2. ENERGY PRODUCTION AND GROSS ENERGY CONSUMPTION 1980-1998



It will be seen from FIGURE 2 that total energy consumption has remained stable, while Denmark's own production of energy has increased. Since 1991, Denmark has been self-sufficient in oil and natural gas. Source: *Energy Statistics 1996*, Danish Energy Agency, Ministry of Environment and Energy.

Source:Danish Energy Agency, Danish Energy-Sector Exports - Products & Cosnulting Services, 2000

Import/Export of Energy Technology in Finland



Source: Energy in Finland, 2000

The Self-sufficiency Challenges (cont')

- **Malaysia could emulate these two "small" Nordic economies to achieve its desired self-sufficiency level (perhaps ~ 70%) in future energy supply and energy technology requirements**

Electricity Market Restructuring

Electricity Market Restructuring

"WE HAVE DIFFERENT IDEAS ABOUT PRIVATISATION NOW. PREVIOUSLY, THERE WAS THIS IDEA THAT THE DISTRIBUTION AND POWER GENERATION WOULD BE SPLIT. BUT WHAT HAPPENED IN CALIFORNIA IS A BIG LESSON TO US. IN MALAYSIA, WE WILL BALANCE THE ROLE OF THE PRIVATE AND PUBLIC SECTORS."

Dato Seri Dr Mahathir bin Mohamad
Prime Minister, Malaysia
New Straits Times, 5 May 2001
(in TNB 2001 Annual Report)
Website at http://www.tnb.com.my

Electricity Market Restructuring (cont')

- A healthy excess reserve (18% in Pennsylvania, New Jersey and Maryland - PJM, 30% in Malaysia) and effective demand elasticity are important considerations for a well-functioning electricity market.

- Some form of price regulation or mitigation mechanism similar to that introduced by the US Federal Energy Regulatory Commission (FERC) in June 2001 must be in place to avoid a win-lose market situation.

Electricity Market Restructuring (cont')

- **Malaysia decided to postpone its plan to establish a power exchange or power pool and retain or prolong the monopsony model with a credit worthy incumbent utility as sole bulk buyer using cost-based instead of market-based pricing.**

- **Competition and choice could still be achieved without having to establish a dedicated power pool and investment in hardware, software and upgrading human skills could be saved and put to better use.**

Electricity Market Restructuring (cont')

- The collapse and accounting "breach of trust" at ENRON, the world largest energy trader, is another invaluable lesson

- Malaysia could take advantage of the decision to slow down the electricity market restructuring and instead, use the competitive bidding process as a means for the sole purchasing agency (TNB) to solicit proposals for a combination of centralized and decentralized solutions. This would be a true test of how the on-going DANCED assisted Integrated Resource Planning (IRP) "tool" should work in the marketplace.

Centralized and decentralized multi-year projects/programs

- Centralized Energy Options
  - Build new centralized power plants
  - Repower derated power stations

- Decentralised Energy Options
  - Build gas cogeneration plants (in view of expected ceiling/quota of ~ 70% of total gas supply for the power sector)
  - Build district cooling system to reduce electricity-based air-conditioning system
  - Build RE power plants
  - Embark on cost-effective EE&DSM programs to moderate growth of energy demand instead of adding new supply capacities and taking advantage of cheaper off-peak electricity tariff

RE&EE promotion & support

1. Budget 2001 announcement (Oct 2000) – fiscal incentives given to RE&EE projects to support RE as 5th fuel
   (e.g. no import duty and sales tax; accelerated depreciation for EE projects and tax allowance for RE projects)

2. Announcement of Small RE power (SREP) program on 11 May 2001 by MECM

3. First two RE (Power) Purchase Agreement (REPA) were signed between TNB and project developers on 16 Oct 2001 allowing grid connection of < 10 MW RE power plants. More REPAs are in the pipeline

4. On-going GEF co-funded MIEEIP and planned biomass-based power generation & cogeneration project in the palm oil industry focusing on demonstration projects

Concluding Remarks

Concluding Remarks

1. For past 2 decades and perhaps another 5 – 10 years more, Malaysia is shielded from volatility in international energy markets. Malaysia is still a **net energy exporter**.

2. This favourable position can no longer be tenable because Malaysia will become a **net energy importer**. Coal is already imported and soon gas too. Malaysia will also become a net oil importer around 2010.

3. RE is the fifth fuel option but large scale **RE&EE programs** must first be successfully demonstrated. RE&EE are unique domestic resources occurring in small isolated pockets and are therefore small-scale distributed energy resources unlike the familiar centralized large-scale power stations. Their complementary co-existence is desirable and being pursued.

Concluding Remarks (cont')

4. Effective transfer of appropriate energy technologies will enable Malaysia to manufacture affordable energy technologies to harness unique domestic RE&EE sources and later to export these energy technologies.

5. Upgrading of local technological skills and competencies is encouraged to transform Malaysia into a regional centre for energy-related engineering and services. Terms of UNFCCC and Kyoto Protocol CDM could assist these efforts.

Final words !

On-going efforts towards a clean energy future is Malaysia is being <u>intensified</u> in the 8MP period

"Action speaks louder than words"

Thank you

http://www.ptm.org.my