INTERNATIONAL ENERGY AGENCY

CO-OPERATIVE PROGRAMME ON PHOTOVOLTAIC POWER SYSTEMS

Task 1

Exchange and dissemination of information on PV power systems

National Survey Report of
PV Power Applications in Malaysia

2012

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Definitions, Symbols and Abbreviations

For the purposes of this and all IEA PVPS National Survey Reports, the following definitions apply:

PV power system market: The market for all nationally installed (terrestrial) PV applications with a PV power capacity of 40 W or more.

Installed PV power: Power delivered by a PV module or a PV array under standard test conditions (STC) – irradiance of 1 000 W/m^2, cell junction temperature of 25°C, AM 1,5 solar spectrum – (also see 'Rated power').

Rated power: Amount of power produced by a PV module or array under STC, written as W.

PV system: Set of interconnected elements such as PV modules, inverters that convert d.c. current of the modules into a.c. current, storage batteries and all installation and control components with a PV power capacity of 40 W or more.

CPV: Concentrating PV

Hybrid system: A system combining PV generation with another generation source, such as diesel, hydro, wind.

Module manufacturer: An organisation carrying out the encapsulation in the process of the production of PV modules.

Off-grid domestic PV power system: System installed to provide power mainly to a household or village not connected to the (main) utility grid(s). Often a means to store electricity is used (most commonly lead-acid batteries). Also referred to as 'stand-alone PV power system'. Can also provide power to domestic and community users (plus some other applications) via a 'mini-grid', often as a hybrid with another source of power.

Off-grid non-domestic PV power system: System used for a variety of industrial and agricultural applications such as water pumping, remote communications, telecommunication relays, safety and protection devices, etc. that are not connected to the utility grid. Usually a means to store electricity is used. Also referred to as 'stand-alone PV power system'.

Grid-connected distributed PV power system: System installed to provide power to a grid-connected customer or directly to the electricity grid (specifically where that part of the electricity grid is configured to supply power to a number of customers rather than to provide a bulk transport function). Such systems may be on or integrated into the customer's premises often on the demand side of the electricity meter, on public and commercial buildings, or simply in the built environment on motorway sound barriers etc. They may be specifically designed for support of the utility distribution grid. Size is not a determining feature – while a 1 MW PV system on a rooftop may be large by PV standards, this is not the case for other forms of distributed generation.

Grid-connected centralized PV power system: Power production system performing the function of a centralized power station. The power supplied by such a system is not associated with a particular electricity customer, and the system is not located to specifically perform functions on the electricity grid other than the supply of bulk power. Typically ground mounted and functioning independently of any nearby development.

Turnkey price: Price of an installed PV system excluding VAT/TVA/sales taxes, operation and maintenance costs but including installation costs. For an off-grid PV system, the prices associated

with storage battery maintenance/replacement are excluded. If additional costs are incurred for reasons not directly related to the PV system, these should be excluded. (E.g. If extra costs are incurred fitting PV modules to a factory roof because special precautions are required to avoid disrupting production, these extra costs should not be included. Equally the additional transport costs of installing a telecommunication system in a remote area are excluded).

Field Test Programme: A programme to test the performance of PV systems/components in real conditions.

Demonstration Programme: A programme to demonstrate the operation of PV systems and their application to potential users/owners.

Market deployment initiative: Initiatives to encourage the market deployment of PV through the use of market instruments such as green pricing, rate based incentives etc. These may be implemented by government, the finance industry, electricity utility businesses etc.

Final annual yield: Total PV energy delivered to the load during the year per kW of power installed.

Performance ratio: Ratio of the final annual (monthly, daily) yield to the reference annual (monthly, daily) yield, where the reference annual (monthly, daily) yield is the theoretical annual (monthly, daily) available energy per kW of installed PV power.

Currency: The currency unit used throughout this report is **Malaysian Ringgit (MYR)**

PV support measures:

Feed-in tariff	an explicit monetary reward is provided for producing PV electricity; paid (usually by the electricity utility business) at a rate per kWh that may be higher or lower than the retail electricity rates being paid by the customer
Capital subsidies	direct financial subsidies aimed at tackling the up-front cost barrier, either for specific equipment or total installed PV system cost
Green electricity schemes	allows customers to purchase green electricity based on renewable energy from the electricity utility business, usually at a premium price
PV-specific green electricity schemes	allows customers to purchase green electricity based on PV electricity from the electricity utility business, usually at a premium price
Renewable portfolio standards (RPS)	a mandated requirement that the electricity utility business (often the electricity retailer) source a portion of their electricity supplies from renewable energies
PV requirement in RPS	a mandated requirement that a portion of the RPS be met by PV electricity supplies (often called a set-aside)
Investment funds for PV	share offerings in private PV investment funds plus other schemes that focus on wealth creation and business success using PV as a vehicle to achieve these ends

Income tax credits	allows some or all expenses associated with PV installation to be deducted from taxable income streams
Net metering	allows PV customers to incur a zero charge when their electricity consumption is exactly balanced by their PV generation, while being charged the applicable retail tariff when their consumption exceeds generation and receiving some remuneration for excess electricity exported to the grid
Net billing	the electricity taken from the grid and the electricity fed into the grid are tracked separately, and the electricity account is reconciled over a billing cycle
Commercial bank activities	includes activities such as preferential home mortgage terms for houses including PV systems and preferential green loans for the installation of PV systems
Activities of electricity utility businesses	includes 'green power' schemes allowing customers to purchase green electricity, operation of large-scale (utility-scale) PV plants, various PV ownership and financing options with select customers and PV electricity power purchase models
Sustainable building requirements	includes requirements on new building developments (residential and commercial) and also in some cases on properties for sale, where the PV may be included as one option for reducing the building's energy foot print or may be specifically mandated as an inclusion in the building development

Foreword

The International Energy Agency (IEA), founded in November 1974, is an autonomous body within the framework of the Organisation for Economic Co-operation and Development (OECD) which carries out a comprehensive programme of energy co-operation among its 23 member countries. The European Commission also participates in the work of the Agency.

The IEA Photovoltaic Power Systems Programme (IEA-PVPS) is one of the collaborative R & D agreements established within the IEA and, since 1993, its participants have been conducting a variety of joint projects in the applications of photovoltaic conversion of solar energy into electricity.

The 23 participating countries are Australia (AUS), Austria (AUT), Belgium (BEL), Canada (CAN), China (CHN), Denmark (DNK), France (FRA), Germany (DEU), Israel (ISR), Italy (ITA), Japan (JPN), Korea (KOR), Malaysia (MYS), Mexico (MEX), the Netherlands (NLD), Norway (NOR), Portugal (PRT), Spain (ESP), Sweden (SWE), Switzerland (CHE), Turkey (TUR), the United Kingdom (GBR) and the United States of America (USA). The European Commission, the European Photovoltaic Industry Association, the US Solar Electric Power Association and the US Solar Energy Industries Association are also members. Both Thailand and the International Copper Association are pending members.

The overall programme is headed by an Executive Committee composed of one representative from each participating country or organization, while the management of individual Tasks (research projects / activity areas) is the responsibility of Operating Agents. Information about the active and completed tasks can be found on the IEA-PVPS website www.iea-pvps.org

Introduction

The objective of Task 1 of the IEA Photovoltaic Power Systems Programme is to facilitate the exchange and dissemination of information on the technical, economic, environmental and social aspects of photovoltaic power systems. An important deliverable of Task 1 is the annual Trends in photovoltaic applications report. In parallel, National Survey Reports are produced annually by each Task 1 participant. This document is the Malaysia's National Survey Report for the year 2012. Information from this document will be used as input to the annual Trends in photovoltaic applications report.

The PVPS website www.iea-pvps.org also plays an important role in disseminating information arising from the programme, including national information.

1 EXECUTIVE SUMMARY

The Ministry of Energy, Green Technology and Water launched the National Renewable Energy Policy and Action Plan (NREPAP) to propel the deployment of Renewable Energy in Malaysia. The NREPAP provides long-term goals and commitment to enhance the utilisation of renewable energy resources in Malaysia. The main objectives of the NREPAP are:

- To increase RE contribution in the national power generation mix
- To facilitate the growth of the RE industry
- To ensure reasonable RE generation costs
- To conserve the environment for future generations
- To enhance awareness on the role and importance of RE

The NREPAP was followed by the enactment of two new laws, namely, the Renewable Energy (RE) Act 2011 and the Sustainable Energy Development Authority (SEDA) Act 2011. The Sustainable Energy Development Authority Malaysia or SEDA Malaysia was established on 1st September 2011 with the task of implementing and administering the Feed-in Tariff (FiT) mechanism. SEDA Malaysia also has to promote the widespread deployment of renewable energy resources via FiT.

In Malaysia, the FiT portfolio covers four types of renewable resources, namely biomass, biogas, small hydro and solar PV. Solar PV has the fastest take-up rate attributed largely to the ease of project implementation. As at end of December 2012, SEDA Malaysia had approved a total of 914 applications (168,98 MW) for PV and these constituted 95,2 % of the total applications approved under the FiT programme. Solar PV constituted 37,48 % from the total installed capacity approved under the Programme. The FiT Programme is funded by a Renewable Energy Fund (RE Fund) which is contributed by the electricity consumers via a 1 % collection from the consumers' monthly electricity bills. Domestic users with consumption of less than 300 kWh/month are exempted from contributing to the RE Fund. Due to the limited amount of the RE Fund, the FiT is designed with a cap for each renewable resource to ensure efficient management of the cash flow and sustainability of the fund.

1.1 Installed PV power

Total installed capacity in 2012 for on-grid centralised for category of more than 1MW is 5.441MW and for on-grid distributed for category of less than 1MW is 21.98MW.

1.2 Costs & prices

Based on the estimation of Malaysian Investment Development Authority (MIDA) cost per kilowatt for a PV system including all the components ranges from MYR 7,800/kW to MYR 11,000/kW. The price for PV module per kilowatt is between MYR 4,000 to MYR 4,500 and inverter is MYR 3,000 to MYR 4,200 per unit.

1.3 PV production

In 2012, Malaysia has a total combined production capacity of 3,464 MW for wafers, cells, and PV modules which has created employment for 7,262 people.

1.4 Budgets for PV under FiT

FiT in Malaysia is funded by the RE Fund comprising of MYR300 million seed grant from the Malaysian Government and a collection of 1% from electricity bills imposed on electricity consumers. Consumers utilising less than 300 kWh per month are exempted from the collection. This contribution is the main source for the RE Fund and in 2012 the FiT rates for Solar PV is MYR 1,23/kWh (up to and including 4kW) and MYR1,20/kWh (above 4kW and up to and including 24kW) with additional bonus of MYR0,26 for the usage of PV as part of a building installation and MYR0,25 for the usage of solar PV as a building material.

2 THE IMPLEMENTATION OF PV SYSTEMS

The PV power system market is defined as the market of all nationally installed (terrestrial) PV applications with a PV capacity of 40 W or more. A PV system consists of modules, inverters, batteries and all installation and control components for modules, inverters and batteries.

2.1 Applications for photovoltaics under FiT

As at 31st December 2012, SEDA Malaysia has received 1,254 applications of Solar PV for individual and 163 applications for non-individual. Out of this, 781 applications for individual with a total capacity of 12,33 MW were approved and 133 applications for non-individual with a total capacity of 156.65 MW were approved. Solar PV constituted 37.48% of the total RE resources under FiT which has Biomass, Biogas and Small Hydro under its portfolio.

2.2 Total photovoltaic power installed

The PV power installed in 4 sub-markets during 2012 should be entered in Table 1. If possible, please provide published figures or estimates concerning the role of PV in the broader national energy market in Table 1a.

Table 1: PV power installed during calendar year 2012 in 4 sub-markets

Sub-market/ application	off-grid domestic (MW)	off-grid non-domestic (MW)	grid-connected distributed (MW)	grid-connected centralized (MW)	Total (MW)
PV power installed in 2012 (MW)	8,03			26,82	34,85
Amount of CPV in the above (MW)		(…)	(…)	(…)	Na
Amount of PV in hybrid systems (MW)	(…)				

Table 2a: PV power and the broader national energy market

Total national (or regional) PV capacity (from Table 2) as a % of total national (or regional) electricity generation capacity	New (2012) PV capacity (from Table 1) as a % of new electricity generation capacity	Total PV electricity production as a % of total electricity consumption
<1%	Negligible	<1%

A summary of the cumulative installed PV Power, from 1992-2012, broken down into four sub-markets is shown in Table 3.

Table 3: The cumulative installed PV power in 4 sub-markets

	Cumulative installed capacity as at 31 December														
Sub-market	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Stand-alone domestic	5									6,375	8	10	11	11	8,03
Stand-alone non-domestic	Na														
Grid-connected distributed	0,486									0,640	0,775	1,063	1,556	2,5	26,82
Grid-connected centralized	Na														
TOTAL (MW)	5,486									7,015	8,775	11,063	12,566	13,5	34,85

2.3 PV implementation highlights, major projects, demonstration and field test programmes

In a bid to increase public participation in the deployment of RE in Malaysia, SEDA Malaysia has launched the Solar Home Rooftop Programme on 24th September 2012. Under this programme, 2 MW of solar PV quota was released in the second half (H2) of 2012. Each individual is allowed up to a maximum of two (2) applications capped at 12 kW per application. SEDA Malaysia has promoted this programme through the mass media and stakeholder engagement programmes which gained very good response from the public. This has resulted in spurring a significant amount of new applications for the individual Solar PV quotas.

Apart from that, SEDA Malaysia has also released the e-FiT Online System version 2.0 which is an enhanced version of the e-Fit Online System. The enhanced version is more robust and user-friendly compared to the previous version.

2.4 Highlights of R&D

SEDA Malaysia is actively working with the Ministry of Science, Technology and Innovation (MOSTI) to chart the path of RE R&D in the country. A number of RE projects are being undertaken under the flagship of Techno Fund and Science Fund.

For solar PV, there are two (2) notable projects which are the Development of Pilot Plant Advanced solar Dryer Systems for Malaysian Export Based Agricultural and Marine Products and also the Large Scale Solar Assisted Hot Water Heating System for Hospitals.

Apart from that, a local university (Universiti Putra Malaysia) have also embarked on the Solar Concentrated Photovoltaic (CPV) Pilot Plant to study the potential of CPV in Malaysia.

2.5 Public budgets for market stimulation, demonstration / field test programmes and R&D

Table 4: Public budgets for R&D, demonstration/field test programmes and market incentives.

	R & D	Demo/Field test	Market incentives
National/federal	unknown	unknown	MYR 300mil
State/regional	unknown	unknown	unknown

INDUSTRY AND GROWTH

2.6 Production of feedstocks, ingots and wafers

Table 5: Production information for the year for silicon feedstock, ingot and wafer producers

Manufacturers (or total national production)	Process & technology	Total Production	Product destination (if known)	Price (if known)
MEMC	Solar wafering	300 MW	unknown	unknown

2.7 Production of photovoltaic cells and modules

Total PV cell and module manufacture together with production capacity information is summarised in Table 5 below.

Table 6: Production and production capacity information for 2012

Cell/Module manufacturer (or total national production)	Technology (sc-Si, mc-Si, a-Si, CdTe)	Total Production (MW)		Maximum production capacity (MW/yr)	
		Cell	Module	Cell	Module
Wafer-based PV manufactures					
1 AUO-Sunpower				505	
2 Q-Cells				800	
3 Flextronics					282
4 Domestic PV Assemblers					177
Total					
Thin film manufacturers					
1 First Solar					1400
2					
Cells for concentration					
1				NA	
TOTALS				**1305**	**1859**

2.8 Module prices

Table 7: Typical module prices for a number of years (MYR/ Wp) [1USD= MYR 3.06(2012)]

Year	2006	2007	2008	2009	2010	2011	2012
Standard module price(s): Typical	23,71	19,80	17,94	14,35	8,06	5,80	4,00
Best price	Na						

2.9 Manufacturers and suppliers of other components

Malaysia currently does not commercially produce any PV inverters or DC switchgear. There are productions for storage batteries and battery charge controllers. However, the data on production volume is not readily available. Locally made mounting structures are constructed on project basis.

2.10 System prices

A summary of typical system prices is provided in the following tables.

Table 8: **Turnkey Prices of Typical Applications**

Category/Size	Typical applications and brief details	Current prices per W
OFF-GRID Up to 1 kW		
OFF-GRID >1 kW		
GRID-CONNECTED Specific case		
GRID-CONNECTED up to 10 kW	Residential	MYR9.00 – MYR12.00
GRID-CONNECTED >10 kW	Solar Farm	MYR7.00-MYR9.00
GRID – CONNECTED (utility-scale plant, if relevant)		

Table 7a: National trends in system prices (current) for distributed Grid-Connected PV Systems

YEAR	2005	2006	2007	2008	2009	2010	2011	2012
Price /W:	29.60	31.45	27.54	27.36	23.14	16.32	11.42	9.00

2.11 Business value

Sub-market	**Capacity installed *in 2012* (MW)**	**Price per W** *(from table 7)*	**Value**	**Totals**
Off-grid domestic				
Off-grid non-domestic				
Grid-connected distributed				
Grid-connected centralized				
Export of PV products *(including information from Tables 4 & 5)*				
Change in stocks held *(including information from Tables 4 & 5)*				
Import of PV products *(including information from Tables 4 & 5)*				
Value of PV business				

3 FRAMEWORK FOR DEPLOYMENT (NON-TECHNICAL FACTORS)

Table 9: PV support measures

	On-going measures	Measures that commenced during 2012
Feed-in tariffs (gross / net?)	Gross	FiT Implemented on 1st December 2011
Capital subsidies for equipment or total cost	Nationwide programme for capital incentive since 2006 and concluding in 2010 for grid-connected PV systems for urban applications.	
Green electricity schemes		
PV-specific green electricity schemes		
Renewable portfolio standards (RPS)		
PV requirement in RPS		
Investment funds for PV		
Income tax credits	Waiver of import duty & sales tax at national level under Budget 2011 extended to 31st December 2012. Investment Tax Allowance & Capital Allowance for PV systems at national level under Budget 2011 extended to 31st December 2015.	
Net metering	Introduced at national level since 2007.	
Net billing		
Commercial bank activities e.g. green mortgages promoting PV		
Activities of electricity utility businesses		
Sustainable building requirements		

3.1 Indirect policy issues

NA

3.2 Interest from electricity utility businesses

The country's major national electricity utility, Tenaga Nasional Berhad (TNB) is one of the key stakeholders in feed-in tariff implementation. TNB has been tasked to collect the 1 % surcharge on top of the electricity bill of consumers who uses more than 300 kWh of electricity per month. The sum will then be deposited into the RE Fund which is administered by SEDA Malaysia. The sum collected will be used to pay for the premium feed-in tariff. The distribution licensees (e.g TNB) in Peninsular Malaysia are obliged under the law to prioritize renewable energy systems to connect to the grid for feed-in approval holders.

Rules and regulations governing the technical requirements for FiT implementation can be found in the subsidiary legislations in the following webpage http://www.seda.gov.my. In addition to the prioritized interconnection, TNB is also planning to build a 2 MW PV power plant as demonstration project. However, participation from utility businesses which are also the Distribution Licensee is capped at 49% to avoid conflict of interests.

TNB also plan to spearhead the smart grid roadmap in the country. TNB's smart grid development plan has three phases between 2011 and 2015. The focus of the first phase is reliability and involves distribution automation, deployment of DMS, customer information system and integration with other enterprise systems. TNB decided to begin with three smart grid demonstration programs in 3 states which are in Bayan Lepas, Penang (industrial centre), Bukit Bintang, Kuala Lumpur (commercial centre), and Medini, Johore (rural).

Phase 2 targets customer empowerment and energy efficiency through smart meters and AMI, bidirectional communications, improved billing, remote connection management, dynamic voltage/VAR Control, demand management, consumer power management and reduced T&D losses.

Phase 3 focusses on reducing CO_2 emissions, through renewable energy, energy storage, electric vehicles, and energy efficient street lighting.

3.3 Interest from Municipalities and Local Governments

The administrative barriers for installing a solar PV system from the municipalities and local governments are minimal compared to other renewable resources such as small hydro, biomass and biogas. Some State Governments has shown keen interests and have made investments through the state owned companies obtaining feed in approvals and setting up PV power plants. The Government encourages State Governments, Municipalities and Local Governments to participate in renewable energy development road map. In 2012 SEDA Malaysia had planned road shows throughout the country to provide information and awareness about the feed-in tariff mechanism and their roles to grow the RE industry. It is expected that the road shows will enhance their

understanding and thus procedures concerning approvals of PV systems can be expedited with greater efficiency.

3.4 Standards and codes

In February 2012, a new Malaysian Standard, on "Design, installation, maintenance and inspection of PV mounting system – Code of practice" - MS2440:2012 was published for PV integrated and retrofitted applications. The objective of this standard is to provide system installers good engineering practice for mounting PV structures on roof top. Besides MS 2440, Malaysia also had the "Installation of Grid Connected Photovoltaic (PV) System"- MS1837:2010 which was developed as guidelines to PV service providers on requirements for PV systems. Both standards are available on Malaysian Standards Online web portal, http://www.msonline.gov.my/default.php.

4 HIGHLIGHTS AND PROSPECTS

NA

ANNEX A: COUNTRY INFORMATION

This information is simply to give the reader some background about the national environment in which PV is being deployed. It is not guaranteed to be 100 % accurate nor intended for analysis, and the reader should do their own research if they require more detailed data.

Please provide the following, including a short reference as to the source of the information (for example, author's estimate, electricity supply association etc etc):

1) retail electricity prices - household, commercial, public institution

The last electricity tariff was revised on 1st June 2011 and the latest electricity tariff can be viewed at http://www.tnb.com.my/residential/pricing-and-tariff.html

2)

Estimated per capita electricity consumption was 7.500 kWh per annum (in 2011)

3)

The utility tariffs comprise the following types:

- Low voltage (LV) block tariffs for residential customers, with varying blocks rates;
- LV tariffs for industrial, commercial and mining customers, with fixed block rates;
- Two-part tariffs for industrial, commercial and mining customers with MV (medium voltage, i.e. 6,6 kV to 33 kV) and HV (high voltage, i.e. above 33 kV) supply. In Sarawak, the two-part tariff also applies to LV supply customers but with a designated minimum monthly consumption limit;
- ToU (time of use) tariffs with Peak and Off-peak rates for energy, coupled with an MD (maximum demand) charge for the MD imposed on the supply system during the peak period only (0800 to 2200 for TNB, and 0700 to 2400 for SESCO) are available to industrial, commercial and mining customers;

Metering facilities employed cover different arrangements to suit the tariff category and consumption magnitude and include:

- Whole current (Class 2) meters for LV, single and 3 phase supply of up to

  100 Amps, with CT (current transformer) metering for higher capacity LV supplies (and can include precision meters (of Class 0,5) for the highest consumption customers;
- CT metering for MV and HV supply customers, with single meters (for up to specified monthly consumption) and with two meters (main and check meters) for customers with higher monthly consumption.

The meter accuracy class varies according to consumption and includes Class 0,5 and Class 0,2 for the largest customers

Except for residential and public lighting use, other customers are subject to power factor (PF) penalties (if their average PF during the billing period falls below 0,85), and their metering incorporates kVAr metering to determine the average PF.

4) In 2012, the per capita national income is MYR30,956, an increase of 10% from 2011(MYR28,000)

5) typical mortgage interest rate (http://www.blr.my/)

   Effective 11th May 2011, the base lending rate (BLR) is 6,60 %.

6) The typical household electricity supply is via a 3 phase 400/230 volt system with 230 volt single phase supply for the smaller customers (up to about 12 kW load) and 3 phase supply for the larger customers. A few of the largest residential customers, whose load demand exceeds about 40 kW, are metered via CT meters. The LV supply is distributed through 11/0,4 kV substations equipped with transformers, predominantly of 1.000 kVA capacity, and with several LV feeders extending several 100 meters form the substations. The 11/0,4 kV substations are themselves fed from 33/11 kV or 132/11 kV substations of varying capacities to suit the load demand for the area concerned.

7) In 1993 Malaysia initiated deregulation of the Electricity Supply Industry (ESI) by granting of licences for Independent Power Producers (IPPs). Currently, the IPPs control about 50% of the total generating plant in Malaysia, while the three main utilities control about 50% of the generation capacity. Malaysia has also granted licences to “Independent Distribution Companies” for distribution of electricity to consumers in selected areas, mainly for industrial areas, and large commercial facilities with captive customers (usually their tenants and sub-tenants). The overall transmission grid in Peninsular Malaysia is under the control and management of TNB the main utility, which also supplies electricity to the bulk of consumers in Peninsular Malaysia, including some consumers who have been granted licences as independent distributors. In the states of Sabah and Sarawak, the utilities are vertically integrated with IPPs playing a part in power generation sector.

8) price of diesel fuel

   Price of diesel fuel as of 31st December 2011 was MYR1.80 per litre (retail).

9) The typical values of kWh/kW ranges from 1.000 – 1.400 kWh/kW per annum