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

2011

Prepared by

Dato' Hj. Badaruddin bin Mahyudin
Ministry of Energy, Green Technology & Water

Pn Badriyah Abdul Malek
Sustainable Energy Development Authority Malaysia

Date

May 2012

TABLE OF CONTENTS

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^{o}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 USD, based on exchange rate of USD 1 = MYR 3,0177 (http://www.bnm.gov.my, accessed on 31st December 2011).

PV support measures:

Enhanced 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 somewhat higher 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 balanced by their PV generation, to be charged the applicable retail tariff when electricity is imported from the grid and to receive some remuneration for PV 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 22 participating countries are Australia (AUS), Austria (AUT), 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.

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 2011. 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 year 2011 has been a significant year for Malaysia as the Ministry of Energy, Green Technology and Water inaugurate the achievement of a significant milestone in renewable energy development for the country. For the first time in the history, the Government has made a long term commitment towards renewable energy growth through the passing of the Renewable Energy (RE) Act 2011 and the Sustainable Energy Development Authority (SEDA) Act 2011. The RE Act 2011 and SEDA Act 2011 were passed by both houses of Parliament on 27th and 28th April 2011 respectively. Both Acts are the most important regulatory instruments needed after the approval of the National Renewable Energy Policy and Action Plan (NREPAP) by the Government of Malaysia in April 2010. The NREPAP outlines the Government's long term commitment towards renewable energy development in the country to increase its contribution in the fuel mix while mitigating the effects of climate change. Malaysia is blessed with abundant sunshine which allows her to capitalize on solar energy for electricity generation. Therefore, there are opportunities for Malaysia to tap the energy from the sun for clean electricity and encourage the growth of the solar PV industry.

1.1 Installed PV power

While the use of solar photovoltaic (PV) technology has been in the country for the past 20 years, the main applications are in the rural or off-grid areas. As end of 2011 the installed capacity for off grid PV is 11 MW while for grid-connected PV is 2,5 MW. The increase in PV capacity for off-grid in 2011 was negligible whereas for grid-connected PV, it was estimated to be 934 kW. The enforcement of the RE Act 2011 on the 1st December 2011 is a historic moment as it enables the implementation of the feed-in tariff mechanism. Among the RE sources listed under the Schedule of the Act is solar PV. The opening of quota for solar PV was 150 MW for 3 years (i.e. 50 MW each for 2012, 2013 and 2014). As of 31st March 2012, the total approved solar PV quota issued under the feed-in tariff programme for the 3 years had reached 159 MW.

1.2 Costs & prices

The average turnkey price of a grid-connected PV system as at end of 2011 was USD 3,65 per W. Average module pricing was USD 1,83 per W. In Malaysia, the average PV system priced has declined by 30 % from 2010 and 84 % from 1998 while PV module price has declined by 30 % compared to pricing from 2010

and 81 % from 1998. The year 1998 is the national baseline for reporting to the IEA PVPS in the country report.

1.3 PV production

On PV manufacturing front, Malaysia is one of the largest solar PV producers in the world with a total combined production capacity of 3 693 MW for wafers, solar cells and PV modules. This is largely due to concentrated Government efforts in providing attractive incentives such as the 15-year tax holiday for solar companies. Other attractive features that Malaysia offer include low loan interest rates, clear regulations and good infrastructures. As of June 2011, the total investment in Malaysia's solar energy industry has hit US$ 5,23 billion which translated to 14 300 jobs. Of the US$5,23 billion solar related investments, US$4,86 billion came from foreign direct investments.

1.4 Funding for PV

In 2011, a seed grant amounting to US$99,41 million was provided by the Government of Malaysia to launch the feed-in tariff mechanism on 1st December 2011. The seed grant was used to kick start the Renewable Energy Fund (RE Fund). The fund is utilized for the payment of the premium tariff based on individual renewable energy technology as listed in the schedule of the RE Act. As of 1st December 2011, a 1% contribution was imposed to all electricity consumers except for domestic consumers consuming less than 300 kWh per month. This contribution is the main source for the RE Fund and is estimated that the annual contribution to the RE fund is around US$ 100 million. From 2012 to 2014, solar PV is estimated to take up 47 % of the RE fund.

2 THE IMPLEMENTATION OF PV SYSTEMS

As of 2011, grid-connected PV systems grew by another 934 kW while the off-grid PV systems remained unchanged. Although the capital subsidy from the Malaysia Building Integrated Photovoltaic (MBIPV) Project ended in 2010, the increase in the installed grid-connected PV systems was largely due to the remaining projects of which, was financially supported by the MBIPV Project.

2.1 Applications for Photovoltaics

As of 2011, more than 60 % of the grid-connected PV systems consists of households and the remaining consists commercials and schools. As of 31st March 2012, the number of solar PV applications approved under the feed-in tariff for households were 269 while for commercials, 130. However, these systems will only be commissioned between 2012 to 2014. Households are permitted to apply up to 12 kW whereas commercials are allowed to apply up to 5 MW per application.

2.2 Total Photovoltaic Power Installed

Table 1 below summarizes the total PV capacity in the country. CPV is not available in the market and is under taken by a local university as a research study.

Table 1: PV Power Installed During Calendar Year 2011 In 4 Sub-Markets

Sub-market/ application	**off-grid domestic**	**off-grid non-domestic**	**grid-connected distributed**	**grid-connected centralized**	**Total**
PV power installed in 2011 (MW)			(…)		2,5
Amount of CPV in the above (MW)		(…)	(…)	(…)	Na
Amount of PV in hybrid systems (MW)	11				11

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 (2011) 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 1992-2011, categorically divided into four sub-markets is shown in Table 3.

Table 3: The Cumulative Installed PV Power In 4 Sub-Markets

As of 2011, both installed grid-connected and stand-alone PV systems capacity remain insignificant. However from 2012 onwards, Malaysia will see a steady growth of PV.

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

The feed-in tariff in Malaysia has been designed to promote local content by giving bonus tariff for roof-top and integrated applications on top of the FiT. This is to discourage land use and to promote more efficient use of available roof spaces especially for factories (see Exhibit 1)

Exhibit 1: 646 kWp, Robert Bosch (M) Sdn Bhd, Penang, Malaysia (February 2012)

However, despite the bonus tariff for roof-top applications, most of the approved PV installations were ground mounted. (see Exhibit 2).

Exhibit 2: 8 MW PV power plant at Pajam, Malaysia by Cypark Resources Berhad (March 2012)

2.3 PV Implementation Highlights, Major Projects, Demonstration And Field Test Programmes

The highlight for 2011 for solar PV implementation was the launch of feed-in tariff mechanism on 1st December 2011 through the enforcement of the RE Act 2011. The feed-in tariff is administered and monitored by Sustainable Energy Development Authority Malaysia (www.seda.gov.my). SEDA Malaysia was

established on 1st September 2011 as a statutory body which reports directly to the Ministry of Energy, Green Technology and Water.

Three years (2012-2014) of solar PV quota in the FiT system was released (50 MW per year) of which 90 % was allocated for commercials while only 10 % for home owners. Within less than 3 hours after the launch, quotas for the commercials was fully taken. One of the unique achievements for Malaysian FiT is the e-FiT Online System which serve an online feed-in tariff processing system. This system allows the public to submit their applications via the web.

The e-FiT online system embeds the complex rules and regulations from the subsidiary legislations, technical computations and administrative requirements. The system will dynamically allocate the RE quota available based on successful submission of completed application and quota availability. This system promotes transparency and fairness in operating the feed-in tariff mechanism. Quota allocation is a major concern to the public due to the limited quota especially for solar PV. The use of e-FiT ensures good governance and protects the integrity of SEDA Malaysia as the implementing agency.

2.4 Highlights of R&D

One of SEDA Malaysia's responsibilities is to execute the five (5) strategic thrusts outlined under the NREPAP. Strategic thrust 4 entails the programmes and activities within the renewable energy technologies R&D framework. Initial activities have been taken by SEDA Malaysia to address this strategic thrust. In 2012 the focus for SEDA Malaysia is to work with the Ministry of Science Technology and Innovation (MOSTI) to formulate a systematic R&D strategy for RE Technology development in Malaysia.

SEDA Malaysia has also initiated discussions with financial institutions for attractive financing schemes especially for home owners (strategic thrust 2), human capacity development (strategic thrust 3) and promote greater awareness of feed-in tariff (strategic thrust 5).

2.5 Public Budgets For Market Stimulation, Demonstration / Field Test Programmes And R&D

The Federal Government provide market incentives to promote solar PV growth which include the feed-in tariff programme and tax exemption for

import duty and sales for PV goods. Companies are eligible to claim for investment tax allowance in addition to the capital allowance for purchasing PV equipment. The Government of Malaysia has provided seed grant of US$99,41 for the RE Fund which is utilized to pay the feed-in tariff for grid connected projects.

Table 4: Public Budgets For R&D, Demonstration/Field Test Programmes And Market Incentives

	R & D	Demo/Field test	Market incentives
National/Federal	Not known	Not known	US$99,41m
State/Regional	Not known	Not known	Not known

3 INDUSTRY AND GROWTH

3.1 Production Of Feedstocks, Ingots And Wafers

Tokuyama Malaysia Sdn Bhd which is located in Sarawak will start their operation in 2013 to produce polysilicon (which is normally utilised as feed stock for ingot casting) with an estimated production capacity of 6.000 tonnes per annum. Apart from Tokuyama, MEMC Kuching Sdn Bhd, also located in the Sarawak has been producing wafer with production capacity of 670 MW per annum. However, due to global restructuring, MEMC will size down its plant to 300 MW as at year ending 2011.

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	600 MW	Unknown	unknown

Production Of Photovoltaic Cells And Modules

Table 6: Production And Production Capacity Information For 2011

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				350	
2. Q-Cells				670	
3. Flextronics					469
4. Domestic PV assemblers					90
Total				**1.020**	**559**
Thin film manufacturers					
1 First Solar					1.514
TOTALS					**2.073**

As the local PV market is still negligible, the productions in 2011 were mostly exported to countries such as Europe and the USA.

3.2 Module prices

In Malaysia the PV market is very small and thus there is not much difference between the prices of thin film and crystalline technologies. Prices of PV module have dropped 81 % compared to the 1998 baseline and 30% to the year 2010.

Table 7: Typical Module Prices Trend (198-2011)

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
US$ per Wp	9.40	5.01	5.58	6.40	6.91	6.25	8.63	5.42	6.24	5.21	4.72	4.10	2.61	1.83

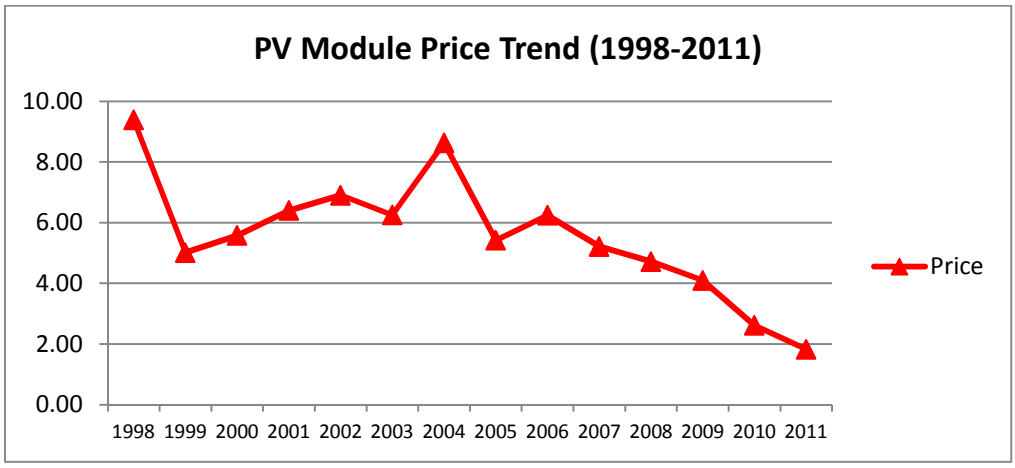

Exhibit 3: Chart Showing PV Module Price Trend (1998-2011)

3.3 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.

3.4 System Prices

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

Table 8: **Turnkey Prices of a Typical Application**

Category/Size	Typical application and brief details	Current prices per W
OFF-GRID Up to 1 kW		Not available
OFF-GRID >1 kW		
Distributed GRID-CONNECTED	Ranges from residential applications up to 5 MW power plant	US$ 3.65

Table 7a: National Trends In System Prices (Current) For Distributed Grid-Connected PV Systems

The prices of PV systems have dropped by 84 % compared with the baseline established in 1998 and 30 % compared to the year 2010

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
US $ per W	22.68	11.50	11.20	9.98	12.21	8.45	12.77	8.04	8.54	8.11	7.60	6.50	5.22	3.65

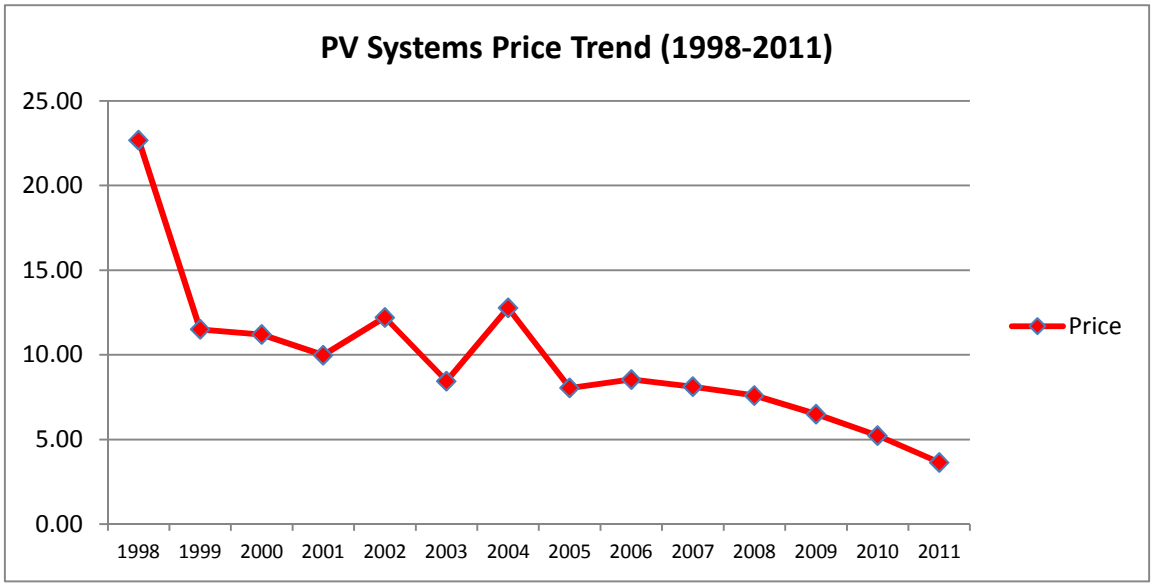

Exhibit 4: *Chart Showing PV Systems Price Trend (1998-2011)*

3.5 Labour Places

The number of labour places in 2011 has increased by 2080 (22 %) compared to 2010. The increase is largely contributed by the manufacturing sector with a small increase in the distributors and system installation companies.

Table 9: Estimated PV-Related Labour Places In 2011

Research and development (not including companies)	30
Manufacturing of products throughout the PV value chain from feedstock to systems, including company R&D	8 751
Distributors of PV products	235
System and installation companies	
Electricity utility businesses and government	60
Other	
Total	9 076

3.6 Business Value

The value of PV business in Malaysia contributed to the Gross Domestic Product for 2011 remains insignificant as the installed capacity grew by only 934 kW (estimated total of US$ 3,4 million). The GDP for 2010 for Malaysia was US$ 256 billion and thus PV business ratio to the total GDP is negligible.

Table 10: Value of PV business

Sub-market	**Capacity installed *in 2011* (MW)**	**Price per W** *(from table 7)*	**Value**	**Totals**
Off-grid domestic				*na*
Grid-connected distributed	**0,934**	**US$3.65**		*US$3,4 million*
Export of PV products *(including information from Tables 4 & 5)*				*Export value is not known*
Change in stocks held *(including information from Tables 4 & 5)*				*na*
Import of PV products *(including information from Tables 4 & 5)*				*Most PV installed are imported.*
Value of PV business				*US$3,4 million*

In Malaysia, much of the PV business lies in the manufacturing of PV components such as wafer, solar cells, assembling of PV modules and manufacturing of PV thin films through foreign company (FDIs). As of 2011, the PV business contributed by the local market is not so significant. According to a recent study[1] carried out by the Malaysian Government with the World Bank

[1] *Moving up the Value Chain: A study of Malaysia's Solar and Medical Device Industries*, July 2011 a joint study by the Economic Planning Unit, Prime Minister's Department Malaysia and the World Bank (online) http://www.epu.gov.my/html/themes/epu/images/common/pdf/19122011rev1Dec2011.pdf

on moving up the solar PV value chain in the country, mentioned that "the greatest opportunity to extract greater value added lies in downstream applications to install and use solar energy" (page 6) and this can be achieved via an "aggressive new feed-in tariff (FiT) programme" (page 7). Besides generating a local PV industry via the FiT programme, other avenues of moving up the solar PV value chain in the country include supply of local components (such as glass, cables), enhanced human capital labour, provide affordable capital financing for local PV manufacturers and domestic PV market.

4 FRAMEWORK FOR DEPLOYMENT (NON-TECHNICAL FACTORS)

Table 11: PV support measures

	On-going measures	**Measures that commenced during 2011**
Feed-in Tariff		Implemented on 1st December 2011
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.	none
Net metering Net billing	Introduced at national level since 2007.	none
Green Technology Financing Scheme	Started in 1st January 2010, the Government will bear 2% of the interest rate. Value of	none

	buy-down of interest amounted to an estimate of US$500 million.	
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.	none

4.1 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 1 % 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 managed 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 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. TNB also plan to spearhead the smart grid roadmap in the country. To-date, TNB has identified 3 pilot sites for the smart grid project and has completed a call for tender for the procurement of 5 000 units of smart meters.

4.2 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. Municipalities and local governments are encouraged to participate in renewable energy and 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.

4.3 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.

5 HIGHLIGHTS AND PROSPECTS

The highlight of 2011 for solar PV development in Malaysia is the passing of the RE Act 2011 and SEDA Act 2011 by the Parliament, the preparation of Subsidiary legislations, development of the e-FiT online system leading to the successful implementation of the feed-in tariff on 1 December 2011. The chronology of events leading to the implementation of the FiT mechanism are as follows:

- 27th April 2011 – Passing of the Renewable Energy (RE) Act 2011
- 28th April 2011 - Passing of the Sustainable Energy Development Authority (SEDA) Act 2011
- 23rd May 2011 – Royal assent received for the RE Act 2011 and SEDA Act 2011
- 2nd June 2011 – Gazette of the RE Act 2011 and SEDA Act 2011
- 1st September 2011 – Official establishment of SEDA Malaysia
- 3-4th November 2011 – Tutorial classes for e-FiT Online System
- 5-8th November 2011 – Gamma testing of e-FiT Online System open to public
- 22nd November 2011 – Official launching of SEDA Malaysia's office
- 1st December 2011 – e-FiT Online System for the FiT mechanism goes live
- 30th December 2011 – 2nd opening of RE quota for the e-FiT Online System

ANNEX A: COUNTRY INFORMATION

This information is to give the reader some background about the national situation in which PV is being deployed. Whilst every attempt has been made to ensure the accuracy and relevance of the facts and figures given, users are advised to check and verify the application of any information and data herein with respect to their particular situation and environment.

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.mida.gov.my/env3/index.php?page=electricity-rates.

2) Typical Household Electricity Consumption (kWh)

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

3) Typical Metering Arrangements And Tariff Structures For Electricity Customers.

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) Typical Household Income

The per capita gross national income for 2011 had increased by 28 % compared to previous year to USD 9 278. The per capita gross national income was USD 7 230 in 2010.

5) Typical Mortgage Interest Rate (http://www.blr.my/)

Effective 11th May 2011, the base lending rate (BLR) has increased to 6,60 % (compared to 6,30 % in 2010).

6) Voltage (household, typical electricity distribution network)

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) Electricity Industry Structure And Ownership

In 1993 Malaysia initiated deregulation of the Electricity Supply Industry (ESI) with the 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 of 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 the power generation component of the industry. Further planned deregulation was frozen after the California Power Crisis.

8) Price of Diesel Fuel

Price of diesel fuel as of 31st December 2011 was USD 0,68 per litre (retail).

9) Typical Values Of Kwh / Kw For PV Systems In Parts Of Your Country

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