Status of Renewable Energy (RE) in Malaysia

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EGNRET Meeting
2nd – 3rd April 2009, Honolulu Hawaii
Renewable Energy Policy

8th Malaysia Plan (2001 – 2005)
RE as the 5th
Implied 5% RE in energy mix

9th Malaysia Plan (2006 – 2010)
300 MW in Peninsular Malaysia
50 MW in Sabah

10th Malaysia Plan (2011 – 2015)
New RE Policy & Action Plan
RE Potential

- Potential: > 6,500 MW
  - Status: 1 MW
    - MBIPV Project (SURIA 1000, Demo, Showcase Incentives & SURIA for Developers)
    - Yearly average irradiance 1,400-1,900 kWh/m²

- Potential: 1,340 MW by 2030
  - Status: Total 53 MW under construction as of end Dec'08
  - 13 MW to be commissioned by end March.
  - BioGen Project
  - Palm oil waste (EFB), other agricultural waste (woodchips, paddy husks, etc)

- Potential: 410 MW by 2028
  - Status: Total 3.75 MW under construction as of end Dec'08
  - 500 kW to be commissioned by end March.
  - Run of the river with minimum impounding
  - Palm oil mill effluents (POME), cassava waste, livestock, agro, industrial waste water

- Potential: 490 MW by 2020
  - Status: Total 17.8 MW under construction as of end Dec'08
  - Run of the river with minimum impounding
  - Capacity < 30 MW

- Potential: 360 MW by 2022
  - Status: 8 MW (5 MW to be exported to grid) to be commissioned end Mar’09
  - Waste collected in Malaysia approximately 21,000 tonnes/day
RE Support & Promotion Mechanisms

Support Mechanism
- Approvals & licenses
- REPPA: RM/kWh 0.21 (biomass, biogas); 0.17 (hydro), net-meter (PV)

Promotion Mechanisms
- Pilot projects & case studies
- Capacity building & lessons
- Financing & policy developments

Fiscal incentives (<2011): Pioneer Status or Investment Tax Allowance; import duties and sales taxes exemption
Flowchart: RE application & grid interconnection

Notes:
1. The SREP Secretariat is hosted by the Energy Commission (EC).
Key Issues Affecting RE

1. Market failure exists
2. Constraints
3. Arbitrary price setting
4. Tensions & trade-offs
5. Absence of regulatory framework
6. Poor governance
7. Limited oversight
8. Lack of institutional measures
RE Status

- RE capacity (as of September 2008)
  - 50 SREP projects approved – 288 MW
  - 12 projects licensed – 75 MW
  - 18 projects approved but not yet licensed – 127 MW
  - 20 projects cancelled – 86 MW

- Connected to power utility grid – 13 MW
  - TSH 10 MW (EFB), Jana Landfill 2 MW (landfill gas)
  - Grid-connected solar PV systems – 1 MW

- Private millers – 700 MW (off-grid)

- 65.75 MW SREP projects under construction (2008 – 2010)
Stand Alone PV

  - Approx 3 MWp for rural electricity supply
- Solar streetlights, road safety devices, telecommunications
  - Fully accepted and considered by local authorities and private enterprises
- Garden solar lights and small solar devices
  - Annual production >1 MWp
Solar Hybrid Systems

- School-Net Project: to provide PC and internet to all schools.
  - Rural schools: PC and VSAT powered by solar PV-diesel hybrid systems
  - 4 kWp per school, total >1 MWp in 2007
- Island & rural electricity using solar PV-diesel hybrid systems:
  - About 7 projects (2006-2007), about 500 kWp
- 2008: 24 hours electricity supply to rural schools (Sabah)
  - Approx 17 kWp per school for >200 schools
MBIPV Project (2005 - 2010)
Objective: To reduce GHG emission by reducing long-term cost of BIPV technology via development of a sustainable BIPV market

Component 1: BIPV information services, awareness and capacity building programme
Component 2: BIPV market enhancement & infrastructure development programme
Component 3: BIPV policies and financing mechanisms programme
Component 4: BIPV industry development and technology localisation programme

Targets:
330% increased of BIPV capacity against baseline
20% reduction of BIPV unit cost from baseline
BIPV Programme in 10th Malaysia Plan (10MP)

Post MBIPV Project: Sustainable & widespread BIPV applications, National BIPV programme with 30% annual BIPV growth and further cost reduction

- 2 LFA (Logical Framework Analysis) workshops
- 1 stakeholders seminar
- >200 participants total
- **Stakeholders:** Government, industry, finance, NGOs, R&D, universities, etc.
Stakeholder analysis - classification

Active
- Shell Solar, Poul (LEO Building), Building Council, UM, BP Solar, MAVCAP, Grenidea, MEPA, NGO, AES, MOSTE
- Petronas, Banks, Policy makers,
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Contra
- Passive
- Petronas, Banks, Policy makers,
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BIPV: Building-Integrated PV

- Using standard PV modules as building element / material (integrated or retrofitted)
- Cost effective and in-harmony with building architecture
PTM Zero Energy Office (ZEO) Building

- Passive design
- Daylighting (almost 100%)
- Double glazing
- Insulation
- EE lighting, task lights, office equipment, EE air conditioning & ventilation
- Floor slab cooling
- Thermal energy storage
- Controls & Sensors
- Solar PV and load shifting
Energy Indices ( kWh/m²/year)

- Normal Buildings
- LEO Building
- EC Building
- ZEO Building

Benchmark year:
- 2001
- 2006
- (2015)

Typical Consumption
200 – 300 kWh/m²/year
MBIPV Showcase: Office

PTM-ZEO (zero energy office)

System A: 47.28kWp (polycrystalline)

System B: 6.08kWp (amorphous)

System C: 11.6kWp (glass-glass, mono)

System D: 27kWp (monocrystalline)
Solar BIPV: Enhances functionality and aesthetic value of the building
MBIPV Showcase: School

SMK (P) Sri Aman, Petaling Jaya
MBIPV Showcase: School

SMK (P) Sri Aman, Petaling Jaya

4.4 kWp polycrystalline silicon

Source: ‘It’s a Solar Taxi’, STAR 13th April 2008
MBIPV Showcase: University

Monash University (Malaysia)

7.36 kWp amorphous thin-film
MBIPV Demonstration: Private Buildings
Normal Homes become Solar BIPV Homes

PV: retrofitted or integrated
SURIA for Developers
SURIA for Developers
SURIA 1000: Enhances Public Willingness

SURIA 1000: Average Willingness to Pay

Higher willingness
Status (31/10/2008): 1,526 kWp (inclusive awarded SURIA 1000)
Impact of Programme: Cost Reduction

Unit Cost of Grid Connected PV System in Malaysia

31/10/08: RM26/Wp
Competency Training

- ISP accredited training
- 10 days: theory, practical, exam
Quality Standards
Net-Metering

Note: A splitter (min 60A or same rating with cut out) is required unless TNB requests otherwise at the time of interconnection.
Approved Service Provider Scheme

- License valid for 1 year with annual review.
- Only for companies.
- Staff passed ISP training.
- Use certified electrician.
- Company shall be financially sound.
- Company shall have workers insurance and public liability insurance.
- Company shall follow APVSP Industry Best Practice Guidelines.
- Company shall abide by the APVSP Code of Conduct.

Complemented by Quality Assurance Scheme
Performance Monitoring

Introduction

Welcome to the website of the Photovoltaic Monitoring Centre (PVMC), Universiti Teknologi MARA, Malaysia (UiTM).

This website presents information on the performance of selected Building Integrated Photovoltaic (BIPV) systems under the Malaysian BIPV project.

Site Monitoring and Instructions
1. Move cursor over the red spot on the map
2. Select site and click

Map of Malaysia and List of Sites
PV Manufacturing

- First Solar
- Q-Cells
- Sunpower
- Renesola
- Tokuyama
Kulim High-Tech Park
- World no. 1 thin-film (CdTe) module manufacturer (704 MW in Kulim)
- FDI: RM 2 billion
- Provides 1,200 jobs
Q-Cells

Selangor Science Park 2
- World no. 1 solar cell manufacturer (300 MW in Sepang)
- FDI: RM 5 billion for ingot and cell manufacturing
- Provides 3,500 jobs
Rembia, Melaka
- Industry leading 22% cell efficiency
- Solar cell manufacturing (1,000 MW in Melaka)
- FDI: RM 5 billion
- To create about 5,000 jobs
Malaysia: Key Player by 2009

PV Modules (in MW)

- 2007
- 2008
- 2009 (Malaysia)
Oct 2008: Malaysia joins IEA PVPS

Malaysia has been an active observer since 2004. Effective 22 Oct 2008, Malaysia became a full member of IEA PVPS.

Malaysia’s representative at Executive Committee:

1. Main: Pn Badriyah Abdul Malek, Undersecretary, Sustainable Energy Development Division, MEWC

2. Alternate: Ir Ahmad Hadri Haris, National Project Leader, MBIPV Project, PTM

Malaysia participation in IEA-PVPS:

- Task 1: PTM
- Task 10: PTM
- Task 11: UiTM
- Task 13 (Task 2): UiTM, UTM
**Vision**

Enhancing the utilisation of indigenous renewable energy resources to contribute towards national electricity supply security and sustainable socio-economic development

**Objectives**

1. To increase RE contribution in the national power generation mix;
2. To facilitate the growth of the RE industry;
3. To ensure reasonable RE generation costs;
4. To conserve the environment for future generation; and
5. To enhance awareness on the role and importance of RE.

**Strategic Thrusts**

Thrust 1: Introduce and Implement Appropriate Regulatory Framework
Thrust 2: Introduce Conducive Stimulus Package for RE Businesses
Thrust 3: Intensify Human Capital Development
Thrust 4: Enhance RE Research and Development
Thrust 5: Design and Implement an RE Advocacy Programme
### Determining FiT Rates (Malaysia)

<table>
<thead>
<tr>
<th>Category</th>
<th>Costs and Calculation Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biomass</strong></td>
<td>Capex (investment cost)</td>
</tr>
<tr>
<td></td>
<td>Loan: rates (8.8%), period (15 years)</td>
</tr>
<tr>
<td></td>
<td>Fuel: requirement (250,000 t/yr), prices, transport charges</td>
</tr>
<tr>
<td></td>
<td>Costs: O&amp;M, depreciation, insurance</td>
</tr>
<tr>
<td></td>
<td>Revenue: FiT rates, duration (16 yrs), capacity factor (70%), other revenue</td>
</tr>
<tr>
<td></td>
<td>Annual cost increment (3%): fuel, transport, O&amp;M, insurance</td>
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<tr>
<td></td>
<td>IRR, SPB, cash-flow</td>
</tr>
<tr>
<td><strong>Solid waste</strong></td>
<td>Capex (investment cost)</td>
</tr>
<tr>
<td></td>
<td>Loan: rates (8.8%), period (15 years)</td>
</tr>
<tr>
<td></td>
<td>Fuel: requirement (1,000 t/day), prices, transport charges</td>
</tr>
<tr>
<td></td>
<td>Costs: O&amp;M, depreciation, insurance</td>
</tr>
<tr>
<td></td>
<td>Revenue: FiT rates, duration (21yrs), capacity factor (70%), other revenue (tipping fee, recycling)</td>
</tr>
<tr>
<td></td>
<td>Annual cost increment (4%): fuel, transport, O&amp;M, insurance</td>
</tr>
<tr>
<td></td>
<td>IRR, SPB, cash-flow</td>
</tr>
<tr>
<td><strong>Solar PV</strong></td>
<td>Capex (investment cost – RM22/Wp avg)</td>
</tr>
<tr>
<td></td>
<td>Loan (80%): rates (6%), period (15 years)</td>
</tr>
<tr>
<td></td>
<td>Costs: O&amp;M, depreciation, insurance</td>
</tr>
<tr>
<td></td>
<td>Revenue: FiT rates, duration (21yrs), capacity factor (13%)</td>
</tr>
<tr>
<td></td>
<td>Annual cost increment (3%): O&amp;M, insurance</td>
</tr>
<tr>
<td></td>
<td>SPB, (IRR), cash-flow</td>
</tr>
</tbody>
</table>
## FiT Rates: Comparison

<table>
<thead>
<tr>
<th>RE Technologies</th>
<th>FiT Rates</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Germany 2007</td>
<td>Italy 2009</td>
<td>Malaysia 2009/2010</td>
</tr>
<tr>
<td>Retail Electricity Tariff (average)</td>
<td>0.28 US$/kWh</td>
<td>0.24 US$/kWh</td>
<td>0.08 US$/kWh (Subsidised)</td>
</tr>
<tr>
<td>Solar PV</td>
<td>2.4 x retail</td>
<td>2.7 x retail</td>
<td>5.5 x retail</td>
</tr>
<tr>
<td>Wind</td>
<td>0.4 x retail</td>
<td>1.7 x retail</td>
<td>1.1 x retail</td>
</tr>
<tr>
<td>Biomas</td>
<td>0.5 x retail</td>
<td>1.2 x retail</td>
<td>1.1 x retail</td>
</tr>
<tr>
<td>Biogas</td>
<td>0.4 x retail</td>
<td>1.0 x retail</td>
<td>1.1 x retail</td>
</tr>
<tr>
<td>Mini-hydro</td>
<td>0.5 x retail</td>
<td>1.2 x retail</td>
<td>0.8 x retail</td>
</tr>
<tr>
<td>Cost to consumers (% of retail tariff)</td>
<td>4.8%</td>
<td>7.8%</td>
<td>2% (proposed)</td>
</tr>
</tbody>
</table>

Source: BMU, GSE
Grid Parity

RE-FiT Rate vs Average Retail Electricity Tariff & Displaced Cost

- Retail Tariff
- Displaced Cost
- FiT Biomas
- FiT Biogas
- FiT Mini Hydro
- FiT Solid Waste
- FiT Solar PV

Grid Parity
RE Fund for FiT

Residential sector

Commercial sector

Industrial sector

Electricity bills 102%

Power Utilities {Revenue 100%}

{RE Fund 2%}

{(FiT – displaced cost) + fee}

RE Fund Manager

FiT Manager

{FiT payments}

Solar BIPV buildings

SREP developers

RE Fund Manager

FiT Manager

SREP developers
FiT Cost VS RE Fund

Annual RE Fund vs Annual FiT Cost

- Annual RE Fund
- Annual FIT Cost
Cumulative RE Installed Capacity

- Solar PV
- Solid Waste
- Mini Hydro
- Biogas
- Biomass

Year

2015:
- 975 MW (6%)
- 5.4 TWh (5%)

2020:
- 2,065 MW (10%)
- 11.2 TWh (9%)

2030:
- 3,484 MW (13%)
- 16.5 TWh (10%)

2050:
- 11.5 GW (34%)
- 25.6 TWh (13%)

FIT Reviews
RE Generation Mix:

Annual Electricity Generation from RE

- Solar PV
- Solid Waste
- Mini Hydro
- Biogas
- Biomass

2020: 11 TWh
- 44% Solar PV
- 22% Solid Waste
- 19% Mini Hydro
- 13% Biogas
- 2% Biomass

2030: 17 TWh
- 50% Solar PV
- 14% Solid Waste
- 15% Mini Hydro
- 6% Biogas
- 6% Biomass

2050: 26 TWh
- 32% Solar PV
- 38% Solid Waste
- 10% Mini Hydro
- 10% Biogas
- 10% Biomass

Year
Thank you

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