34th APEC Expert Group on New and Renewable Energy Technologies (EGNRET)

Renewable Energy Development in Malaysia

Badriyah Abdul Malek
Undersecretary
Sustainable Energy Division
Ministry of Energy, Green Technology and Water
Malaysia

26th April 2010
Presentation Outline

- Background: Development of Energy Policy & Related Policies in Malaysia
  - Current Program and Incentives in Malaysia
  - Current RE Targets & Growth in Malaysia

- Reasons for Slow RE Development & Need for RE Policy

- Global Scenario

- National RE Policy and Action Plan
  - RE support Mechanism (Feed-in Tariff)

- Conclusion
Background: Development of Energy Policies in Malaysia

- National Petroleum Policy (1975)
- National Energy Policy (1979)
- 4-Fuel Diversification Policy (1981)
- 5-Fuel Policy (2001)
Related Policies

- Other related policies includes
  - Science & Technology Policy, 1986 (MOSTI)
  - Environmental Policy, 2002 (NRE)
  - Bio-Fuel Policy, 2005 (KPPK)
  - Green Technology Policy, 2009 (KeTTHA)
  - Climate Change Policy, 2009 (NRE)
8th Malaysia Plan (2001 - 2005)
RE as the 5th Fuel
Implied 5% RE in energy mix

9th Malaysia Plan (2006 - 2010)
Targeted RE capacity to be connected to power utility grid:
300 MW in Peninsular Malaysia, 50 MW in Sabah
Targeted power generation mix:
56% NG, 36% coal, 6% hydro, 0.2% oil, 1.8% RE

RE capacity as of 31st December 2009:
Connected to power utility grid: **53 MW (15% of 9th Plan target)**
Off grid (private palm oil millers & solar hybrids): >430 MW
Malaysia: Current RE Programs

**Small Renewable Energy Power Programme**
- Launched in 2001 - small RE power producers (<10MW) eligible to sell electricity to utility
- December 2009 – 53MW of RE connected to the grid

**Malaysian Building Integrated Photovoltaic (MBIPV) Project (UNDP-GEF)**
- Launched in 2005 - reduce GHG emission by reducing long-term cost of BIPV
- December 2009 – reduce 1070 tCO₂ & produced 1884kWp of solar (PV) connected to grid

**Biomass-Based Power Generation and Cogeneration (BiOGEN) Project (UNDP-GEF)**
- Launched in 2002 - promote utilization of biomass (EFB) & biogas (POME) from Palm Oil Waste for power generation
- 2 Full scale model – 10 MW biomass and 0.5MW biogas
Fiscal Incentives to Promote RE

- **Pioneer Status (PS)** - Exemption from income tax (25% from 2009 onwards) on 100% of statutory income for 10 years

- **Investment Tax Allowance (ITA)** - 100% of qualifying capital expenditure incurred within a period of 5 years can be utilised against 100% of the statutory income for each year of assessment

- **Import Duty** - imported machinery, equipment, materials, spare parts and consumables

- **Sales Tax Exemption** - locally purchased machinery, equipment, materials, spare parts and consumables

- **Exemption of import duty and/or sales tax to “Third Party Distributors (TPD)”** - for Solar (PV or thermal) Systems products
Reasons for Slow RE Development
& Need for RE Policy
# Reasons for Slow RE Development

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<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>1. Market failure exists:</strong></td>
<td>The RE market “fails” as there is only one buyer which results in unequal bargaining position of the utility and RE project proponents. The RE market is also constrained by financial and technological factors.</td>
</tr>
<tr>
<td><strong>2. Constraints:</strong></td>
<td>Inherent factors that constrain the performance of the market: Economic, Financial, Technological.</td>
</tr>
<tr>
<td><strong>3. Absence of Legal Framework:</strong></td>
<td>Market failure compounded by absence of a proper regulatory framework, which prevents proper and legal action from being taken.</td>
</tr>
<tr>
<td><strong>4. Lack of institutional measures:</strong></td>
<td>Lack of proper institutional measures to meet informational and technological needs.</td>
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### Need for a National RE Policy

<table>
<thead>
<tr>
<th>Reason</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reason 1</td>
<td>To address current market failure</td>
</tr>
<tr>
<td>Reason 2</td>
<td>To provide long term sustainability (avoid start and stop policy)</td>
</tr>
<tr>
<td>Reason 3</td>
<td>To stimulate a new growth industry</td>
</tr>
<tr>
<td>Reason 4</td>
<td>To recognise the importance of the environment as an economic growth contributor</td>
</tr>
<tr>
<td>Reason 5</td>
<td>To develop human capital resources particularly in the field of R&amp;D in RE technologies</td>
</tr>
<tr>
<td>Reason 6</td>
<td>To improve the coherence of current policy</td>
</tr>
</tbody>
</table>
Global Scenario
Global Climate Change Scenario

- Global CO2 concentration increasing by the following trend:
  - Natural occurrence (650,000 years ago): 180ppm
  - Pre-industrial era: 280ppm
  - 2005 – 379ppm (increasing continuously)

- 4th Assessment Report, IPCC analysis - critical action needed:
  - Stabilise CO2 concentration in atmosphere at 450ppm
  - Control maximum increase of global temperature at 2ºC

- Major actions to be undertaken:
  - Annex I countries: reduction of GHG emission at rate 25%-40% by 2020
  - Non Annex I: significant reduction to baseline
Risks and Impacts of Global Warming

<table>
<thead>
<tr>
<th>Range of Future Scenarios and Uncertainties</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Risks to Unique and Threatened Systems</td>
<td>Frequency and Severity of Extreme Climate Events</td>
<td>Global Distribution and Balance of Impacts</td>
<td>Total Economic and Ecological Impact</td>
<td>Risk of Irreversible Large-Scale and Abrupt Transitions</td>
</tr>
</tbody>
</table>

Future Increase in Temperature (°C)

Sumber: Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC)
CO2 Mitigation

- E sector the highest contributor to GHG emission (60%)

## Global CO2 Emission Reduction Initiatives

<table>
<thead>
<tr>
<th>country</th>
<th>targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>GHG reduction : 20% to 1990 level by 2020</td>
</tr>
<tr>
<td></td>
<td>➢ 20% electricity mix from RE sources by 2020</td>
</tr>
<tr>
<td>USA</td>
<td>GHG reduction : 17% to 2005 level by 2020</td>
</tr>
<tr>
<td></td>
<td>➢ No national target- only state level</td>
</tr>
<tr>
<td>Australia</td>
<td>GHG reduction : 25% to 2000 level by 2020 (condition all parties agree to stabilise CO2 concentration below 450ppm)</td>
</tr>
<tr>
<td></td>
<td>➢ 20% electricity mix from RE sources by 2020</td>
</tr>
<tr>
<td>Japan</td>
<td>GHG reduction : 25% to 1990 level by 2020</td>
</tr>
<tr>
<td>Korea</td>
<td>GHG reduction : 30% from BAU by 2020</td>
</tr>
<tr>
<td></td>
<td>➢ 21% electricity mix from RE sources by 2050</td>
</tr>
<tr>
<td>Indonesia</td>
<td>GHG reduction : 26% to 2005 level by 2020</td>
</tr>
<tr>
<td>China</td>
<td>GHG reduction : 40%-45% to 2005 level by 2020</td>
</tr>
<tr>
<td>Malaysia</td>
<td>40% GHG intensity to GDP below 2005 by 2020 as per conditions</td>
</tr>
</tbody>
</table>
National RE Policy and Action Plan
Malaysian National RE Policy

Policy Statement:

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

Objectives:

- 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 generation; and
- To enhance awareness on the role and importance of RE.
Strategic Thrusts of National RE Policy

Strategic Thrust 1: Introduce Legal and Regulatory Framework

Strategic Thrust 2: Provide Conducive Business Environment for RE

Strategic Thrust 3: Intensify Human Capital Development

Strategic Thrust 4: Enhance RE Research and Development

Strategic Thrust 5: Create Public Awareness & RE Policy Advocacy Programmes
Synergies of RE Strategic Thrusts Towards Effective Implementation

Advocacy Programme

- Foundation: RE Act
- RE Policy & Goals
- Conducive RE Business Environment
- Human Capital Development
- RE R&D Action Plan

Foundation: RE Act
Strategic Thrust 1: Introduce Appropriate Legal Framework

- A new RE Act
- Feed-in Tariff (FiT)
- RE Fund (Professional Fund Manager)
- FiT Implementing Agency
- Responsibilities and obligations on power utilities and RE developers
Strategic Thrust 2: Create Conducive Business Environment for RE

- Promote RE businesses – SME and manufacturing
- Long term low interest financing
- Standard evaluation process
- Fiscal Incentives
- Special Incentives for Locally Developed R&D
- Incentives to Promote Local Content
- RE Centre for SMEs
Strategic Thrust 3: Intensify Human Capital Development

- RE in Technical and Tertiary Curricula
- RE Training Institutes and Centres of Excellence
- Pool of experts to fulfil local and overseas market
- Fiscal relief for RE courses
- Financial incentives for training programmes
Strategic Thrust 4: Enhance RE Research and Development

- RE Research & Development Action Plan – reduce cost of technology & promote wider application
- Coordination & co-operation in technology & economic research bet Government & private sector
- Strong linkages bet local & international research institutes
- Development of RE innovations
Strategic Thrust 5: Create Public and Stakeholder Awareness & RE Policy Advocacy Programmes

- Effective & continuous information dissemination
- Relationship with media, NGOs & private entities
- Demonstration & awareness programmes in primary & secondary schools
- Periodic monitoring & evaluation of RE
# National RE Targets

<table>
<thead>
<tr>
<th>Year</th>
<th>Cumulative RE Capacity</th>
<th>RE Power Mix (vs Peak Demand)</th>
<th>Cumulative CO2 avoided</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>73 MW</td>
<td>0.5%</td>
<td>0.3 mt</td>
</tr>
<tr>
<td>2015</td>
<td>985 MW</td>
<td>6%</td>
<td>11.1 mt</td>
</tr>
<tr>
<td>2020</td>
<td>2,080 MW</td>
<td>11%</td>
<td>42.2 mt</td>
</tr>
<tr>
<td>2030</td>
<td>4,000 MW</td>
<td>17%</td>
<td>145.1 mt</td>
</tr>
</tbody>
</table>

Notes: RE capacity achievements are dependent on the size of RE fund

- **Assumptions:**
  - Feed-in Tariff (FiT) in place
  - 15.6% compound annual growth rate (CAGR) of RE power capacity from 2011 to 2030.
RE Policy & Action Plan: Targets

Cumulative RE Installed Capacity (& Ratio to Peak Demand)

- 2015: 985 MW (6%)
- 2020: 2,080 MW (11%)
- 2030: 4,000 MW (17%)
- 2050: < 2,000 MW

BAU 2050: < 2,000 MW

1090% increase of BAU
RE Targets

Cumulative RE Installed Capacity

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

2015: 985 MW (6%)
2020: 2,080 MW (11%)
2030: 4,000 MW (17%)
2050: 21.4 GW (73%)

BAU 2050: < 2,000 MW
RE SUPPORT MECHANISM
FEED IN TARIFF
Feed-in Tariff (FiT)

- A mechanism that allows electricity that is produced from indigenous RE resources to be sold to power utilities at a fixed premium price and for specific duration.

- Provides a conducive and secured investment environment which will make financial institutions to be comfortable in providing loan with longer period (>15 years).
  - Provides fixed revenue stream for installed system
  - Only pays for electricity produced: promotes system owner to install good quality and maintain the system
  - With suitable degression rate, manufacturers and installers are promoted to reduce prices while enhancing quality
<table>
<thead>
<tr>
<th>Policy</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net metering</td>
<td>Any amount above what is consumed in the building is exported to the grid. Any amount below what is consumed in the building is imported from the grid (usually for PV produced electricity in home/building)</td>
</tr>
<tr>
<td>Direct capital support</td>
<td>Cash rebate on a portion of grid-connected RE system costs</td>
</tr>
<tr>
<td>Feed-in tariffs (FIT)</td>
<td>Premium price for electricity grid-connected paid to system owners by utility or regulatory body. Price typically guaranteed for 20 years.</td>
</tr>
<tr>
<td>Renewable Portfolio Standard (RPS)</td>
<td>Mandatory portion of grid-connected RE power in the generation mix. Tradable certificates represents power that is produced.</td>
</tr>
<tr>
<td>Green Pricing</td>
<td>Voluntary schemes where consumers pay a premium for grid-connected power from utility or other electricity retailers.</td>
</tr>
<tr>
<td>Tax Incentives</td>
<td>Reduction or elimination of tax paid in purchase of RE systems, deduction of total cost of portion of system cost from business or personal tax</td>
</tr>
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</table>
## FiT Advantages:
- To address local barriers

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Barriers Removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viability of investment</td>
<td>Fixed tariff prices for specific duration (contract &amp; license)</td>
</tr>
<tr>
<td>Security for investment</td>
<td>Access and obligation to purchase (priority) by utility</td>
</tr>
<tr>
<td>Improves cash flow</td>
<td>Long loan period ($\geq 15$ years) at commercial interest rate</td>
</tr>
<tr>
<td>Less requirement for other fiscal incentive and soft loan</td>
<td>FIT revenue pays for bank loan &amp; investment</td>
</tr>
<tr>
<td>Encourages energy production and quality system</td>
<td>Revenue derives from FIT: requires system to continuously operate</td>
</tr>
<tr>
<td>Reduces cost of (new) technology</td>
<td>Degression rate encourages system cost reduction</td>
</tr>
</tbody>
</table>
Verifications of FiT Effectiveness (selected)

- Stern Review Report:
  - Sir Nicholas Stern stated that “Comparisons between deployment support through tradable quotas and feed-in tariff price support suggest that feed-in mechanisms achieve larger deployment at lower costs.”

- UNDP-GEF Report: Promotion of Wind Energy - Lessons Learned From International Experience and UNDP-GEF Projects
  - “Feed-In tariff policies have been very effective in Germany, Spain and Denmark, leading to the world’s first, second and fifth installed wind energy capacities.”

- International Energy Agency: Deploying Renewables - Principles for Effective Policies
  - “Feed-in Tariffs are more effective and cheaper than quotas for RE”

- Ernst & Young Report: Renewable Energy Country Attractiveness Indices:
  - “Feed-in Tariffs are cheaper than Trading System”

- Traditional RPS country/state moving towards Feed-in Tariff:
Comparison between FiT and Quota System

<table>
<thead>
<tr>
<th>Feed-in Tariff (FIT)</th>
<th>Renewable Portfolio Standards (RPS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Proven to be the cheaper option</td>
<td>▪ Less successful in achieving targets (e.g. UK, Sweden)</td>
</tr>
<tr>
<td>▪ Performance based incentive - encourages reliable operation</td>
<td>▪ Involves tradable green certificates which are unpredictable in prices</td>
</tr>
<tr>
<td>▪ Provides long-term investment security and returns</td>
<td>▪ Must have a penalty system</td>
</tr>
<tr>
<td>▪ Creates stable and predictable revenue to pay for cost of investment</td>
<td>▪ Requires strong enforcement mechanisms</td>
</tr>
<tr>
<td>▪ Degression and periodic reviews allow and stimulate price reductions due to technological advances (e.g. solar PV)</td>
<td>▪ No clear identification of source of funds to meet additional costs</td>
</tr>
<tr>
<td>▪ Simple to implement – specific RE developments and FiT costs can be pre-determined and planned in advance</td>
<td>▪ Unpredictable RE prices and costs because of bidding and trade</td>
</tr>
<tr>
<td>▪ Encourage smaller and distributed power producers and new industries – greater number of jobs</td>
<td>▪ Usually only one RE technology would be promoted</td>
</tr>
<tr>
<td></td>
<td>▪ Usually only bigger company (with resources) would be interested to become developers</td>
</tr>
</tbody>
</table>
Critical Elements for Effective FiT Mechanism Legal Framework

FiT must be guaranteed via the RE Act, whereby:

- Access to the grid is **guaranteed** – utilities legally obliged to accept all electricity generated by RE private producers.
- Local approval procedures are **streamlined and clear**.
- FiT rates must be **high enough** to produce a ROI plus reasonable profit (not excessively) to act as an incentive.
- FiT rates will be **fixed for a period** (typically 20 years) to give certainty and provide businesses with clear investment environment.
- Adequate "**degression**" for the FiT rates to promote cost reduction to achieve “grid parity”
- Adequate **fund** is created to pay for the FiT rates (incremental cost) and guarantee the payment for the whole FiT contract period.
- Implementation by a competent agency in a professional manner that includes constant **monitoring, progress reporting and transparency**.
Key Success Factors for National RE Policy

The success of the National RE Policy and goals can be achieved when the following factors are put in place:

- RE Act which implements the Feed-in Tariff mechanism
- RE Fund to cover the cost of Feed-in Tariff (FiT) mechanism
- Source of RE Fund which is derived from electricity consumers at a nominal percentage
- Establishment of a dedicated Implementation agency
Grid Parity

Driver: Environment & Energy Security

Cost of electricity from RE

Cost of electricity from fossil fuels & nuclear

GRID PARITY

Source: BP, REC

Europe, USA, Japan

Asia
FiT Degression: Towards Grid Parity

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

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

Grid Parity
Proposed Source of Fund for FiT

- A small percentage of one-off inclusion into electricity tariff
  - Will not affect low income consumers (<200 kWh/mth)
  - Polluters pay concept
  - Encourages EE and DSM

- RE fund only covers for incremental cost of FiT where TNB will bear the value of displaced cost of electricity supply.

- The **size of RE fund** will determine the **RE target** for Malaysia.
RE Implementing Agency:

- Implementation and managing of RE Feed-in Tariff and reviews to be undertaken by a **Government agency with proper expertise and strong understanding of the FiT**
- The structure of Agency will be determined by the Government
  - Proposed statutory body with legal powers

RE Fund Manager:

- RE Fund is to be managed by a **professional fund manager** according to a procedure as determined by Government
- The administrative cost in managing the fund and other related transactional cost shall be paid from the interest generated from the RE Fund as determined by the Government
- The disbursement from the fund shall be efficiently and expeditiously managed
FiT Mechanism for Malaysia

Electricity Bills 100%

Power Utilities
{revenue = (100% – x%)}

RE Implementing Agency

RE developers

Bank

Residential sector

Commercial sector

Industrial sector

Solar BIPV buildings

License + Fee

Electricity Supply Cost at Interconnection Point

Receivables

FiT payment

REPPA

License + Fee

License + Fee

Government enacts RE Act

{FiT payment}

{FiT application}

FiT fee

{(FiT – displaced cost) + admin fee}

“displaced cost” = electricity supply cost at interconnection point

{FiT payment}

{FiT payment}

40

{FiT payment

{FiT application}

{FiT payment}

{(FiT – displaced cost) + admin fee}

“displaced cost” = electricity supply cost at interconnection point
Potential Impact of National RE Policy by Year 2020

- Minimum **RM 2.1 billion savings of external cost** to mitigate CO2 emissions (total 42 million tonnes avoided from 2011 to 2020, on the basis of RM 50 per tonne of external cost);

- Minimum **RM 19 billion of loan values** for RE projects, which will provide local banks with new sources of revenues (at 80% debt financing for RE projects);

- Minimum **RM 70 billion of RE business revenues** generated from RE power plants operation, which can generate **tax income of minimum RM 1.75 billion** to Government;

- > 50,000 **jobs created** to construct, operate and maintain RE power plants (on the basis of 15-30 job per MW).
Conclusion

The success of the National Renewable Energy Policy and goals can be achieved when the following factors are put in place:

- **RE Act** which implements the Feed-in Tariff mechanism
- **RE Fund** to cover the cost of Feed-in Tariff (FiT) mechanism
  - source of RE Fund which is derived from electricity consumers at a nominal percentage
- Establishment of a dedicated **Implementation agency**
- Malaysia to roll-out FiT in 10\(^{th}\) Malaysia Plan - Q1 of 2011
Thank You
## RE Policy: Projected RE Growth

<table>
<thead>
<tr>
<th>Year</th>
<th>Cum Biomass (MW)</th>
<th>Cum Biogas (MW)</th>
<th>Cum Mini-Hydro (MW)</th>
<th>Cum Solar PV (MW)</th>
<th>Cum SW (MW)</th>
<th>Cum Total RE, Grid-Connected (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>110</td>
<td>20</td>
<td>60</td>
<td>7</td>
<td>20</td>
<td>217</td>
</tr>
<tr>
<td>2012</td>
<td>150</td>
<td>35</td>
<td>110</td>
<td>15</td>
<td>50</td>
<td>360</td>
</tr>
<tr>
<td>2015</td>
<td>330</td>
<td>100</td>
<td>290</td>
<td>55</td>
<td>200</td>
<td>975</td>
</tr>
<tr>
<td>2020</td>
<td>800</td>
<td>240</td>
<td>490</td>
<td>175</td>
<td>360</td>
<td>2,065</td>
</tr>
<tr>
<td>2025</td>
<td>1,190</td>
<td>350</td>
<td>490</td>
<td>399</td>
<td>380</td>
<td>2,809</td>
</tr>
<tr>
<td>2030</td>
<td>1,340</td>
<td>410</td>
<td>490</td>
<td>854</td>
<td>390</td>
<td>3,484</td>
</tr>
<tr>
<td>2035</td>
<td>1,340</td>
<td>410</td>
<td>490</td>
<td>1,677</td>
<td>400</td>
<td>4,317</td>
</tr>
<tr>
<td>2040</td>
<td>1,340</td>
<td>410</td>
<td>490</td>
<td>3,079</td>
<td>410</td>
<td>5,729</td>
</tr>
<tr>
<td>2045</td>
<td>1,340</td>
<td>410</td>
<td>490</td>
<td>5,374</td>
<td>420</td>
<td>8,034</td>
</tr>
<tr>
<td>2050</td>
<td>1,340</td>
<td>410</td>
<td>490</td>
<td>8,874</td>
<td>430</td>
<td>11,544</td>
</tr>
</tbody>
</table>

**Assumptions:**

1. **RE Technical potential:**
   - Biomass (EFB, agriculture): **1,340 MW** will be reached by 2028.
   - Biogas (POME, agriculture, farm): **410 MW** will be reached by 2028.
   - Mini-hydro (not exceeding 30 MW): **490 MW** will be reached by 2020.
   - Solar PV (grid-connected): **unlimited**.
   - Solid waste (RDF, incineration, sanitary landfill): **378 MW** will be reached by 2024 (at 30,000 tonne/day of Solid Waste as projected by KPKT, followed by 3% annual growth post 2024).
Assumptions:
1. No loss of RE plant capacity (old plants are replaced or upgraded).
2. RE electricity generation:
   1. MW Biomass (25,000 tonne/year/MW), Biogas generates 6,132 MWh/year (70% capacity factor).
   1. MW mini-hydro generates 5,000 MWh/year (57% capacity factor).
   1. MW PV generates 1,100 MWh/year (13% capacity factor – expected to significantly improve in future).
   1. JW SW (100 tonne/day/MW) generates 6,132 MWh/year (70% capacity factor).
3. 1 MWh RE avoids **0.69** tonne CO2.

<table>
<thead>
<tr>
<th>Year</th>
<th>Annual Biomass GWh</th>
<th>Annual Biogas GWh</th>
<th>Annual Mini-Hydro GWh</th>
<th>Annual Solar PV GWh</th>
<th>Annual SW GWh</th>
<th>Annual RE Electricity (GWh)</th>
<th>Annual CO2 Avoidance (tonne/yr)</th>
<th>Cum Total RE (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>675</td>
<td>123</td>
<td>300</td>
<td>7.7</td>
<td>123</td>
<td>1,228</td>
<td>846,975</td>
<td>217</td>
</tr>
<tr>
<td>2015</td>
<td>2,024</td>
<td>613</td>
<td>1,450</td>
<td>60.5</td>
<td>1,223</td>
<td>5,374</td>
<td>3,707,825</td>
<td>975</td>
</tr>
<tr>
<td>2020</td>
<td>4,906</td>
<td>1,472</td>
<td>2,450</td>
<td>192.5</td>
<td>2,208</td>
<td>11,227</td>
<td>7,746,837</td>
<td>2,065</td>
</tr>
<tr>
<td>2025</td>
<td>7,297</td>
<td>2,146</td>
<td>2,450</td>
<td>438.9</td>
<td>2,330</td>
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Growth of RE (Solar PV) Industry in Malaysia

- First Solar
- Q-Cells
- Sunpower
- TCT/Red Solar
- Solartiff
- TT Vision, Ire-tex, PIE, Pentamaster
- Tokuyama
- PV High-Tech

- Impact of FDIs: RM 13.8 billion (in 2 years), 10000 jobs, indirect values to transport and infrastructure sectors, port and shipping industries, etc.
- FDIs provide ‘next door’ business opportunities to local industry.