KeTTHA
KEMENTERIAN TENAGA,
TEKNOLOGI HIJAU DAN AIR

NATIONAL RENEWABLE ENERGY POLICY & ACTION PLAN

This report has been prepared based on in-depth consultations and series of discussions with various stakeholders including the Members of Parliament, the Government authorities and agencies, the electricity supply industry, the power utilities, the RE industry, the professional bodies, the NGOs, the consumers associations, the national and international experts, and other relevant parties, as presented to and endorsed by the Jawatankuasa Perancangan Pelaksanaan Pembekalan Elektrik Dan Tarif (JPPPET) on 17th November 2008.

EXECUTIVE SUMMARY

Since 2001 Malaysia has made efforts towards renewable energy development where the principle adopted was using the market forces to deliver the intended outcomes towards electricity generation. The result of the last 8 years provides valuable lessons in identifying the issues arising from such an approach and the key lesson is that a 'business-as-usual' approach is not sustainable, appropriate nor productive.

In order to design a more effective policy, renewable energy policy must be recognised as a convergence of energy, industrial and environmental policies.

The reasons for the introduction of a new convergent and forward-looking RE policy are:

(1) Addressing the renewable energy market failure. The evidence shows that the market has failed to produce the desired outcome, particularly due to the lack of a proper and effective regulatory framework;

(2) Provision of long-term sustainability by avoiding stop-start strategies, having sufficient outcomes and securing the commitment of all stakeholders;

(3) Provision of a new growth industry in Malaysia;

(4) Recognising that the environment is an economic growth contributor, which can be leveraged to spur innovation (as compared to invention);

(5) Effectively diffuse RE technology, thereby improving on human capital and utilisation; and

(6) Avoidance of the incoherence of existing RE policy and the sending of mixed signals that affect business decisions.

The evidence gleaned from the last 8 years of the SREP programme, the Biogen and the MBIPV projects establish the existence of 8 issues which if not addressed would perpetuate the problems indefinitely. The issues are:

Table (i): RE Implementation Issues

Issues	Drawing Lessons
(1) Market failure exists: The RE market "fails" due to misuse of monopsony power and information asymmetries; the RE market is also constrained by financial and technological factors.	Market failure will be perpetuated unless the causes of such failure, *viz*. unequal bargaining position of the utility and RE project proponents, significant transaction costs in terms of the time needed to conclude a REPPA, and the monopsony power of the utility to agree to the requests of the RE project proponent, are properly addressed.
(2) Constraints: Inherent factors that constrain the performance of the market.	The market should not solely be relied upon to achieve the intended outcome as steps should be taken to ameliorate the economic, financial and technological constraints that are impeding market performance.
(3) Arbitrary price setting: RE prices set arbitrarily.	RE prices must be based on sound economic principles and allow for full cost recovery. Anything less will affect the viability of the RE project.
(4) Tensions and trade-offs: The predicament of expecting that the utility will bear the higher costs of RE power (due to the higher RE price).	The predicament can be addressed by the introduction of a mechanism for sharing the cost of RE amongst all members of society, as environmental improvement is a non-excludable public good.
(5) Absence of Regulatory Framework: Market failure compounded by absence of a proper regulatory framework, which prevents proper and legal action from being taken.	Regulatory frameworks provide the necessary foundation for achieving the desired outcome, and it sends a strong signal to the market of the Government's commitment. The existing ESA is inadequate, inappropriate and insufficient to be used as the legal basis to support RE businesses growth.
(6) Poor governance: Poor governance detrimentally affects the participation of stakeholders and legitimacy of the action.	Governance can be strengthened and improved through the introduction of the regulatory framework where governance principles are embedded.
(7) Limited Oversight: No concerted oversight of implementation problems.	Oversight and implemented function need to be in separate organisations for improved accountability.
(8) Lack of institutional measures: Lack of proper institutional measures to meet informational and technological needs.	Information asymmetry needs to be overcome through proper information dissemination, advocacy and awareness actions. Access to and the type of information should be made available expeditiously in order to assist in the private firm's decision making process with regards to investing in RE.

Renewable Energy (RE) Policy

Therefore the proposed forward-looking RE Policy comprises:

(1) **A Policy Statement with a vision** that provides long-term goals that all stakeholders should strive to realise.

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

(2) **5 Policy Objectives:** The forward-looking RE Policy has five objectives that embody elements of energy, industry and environmental policies, making it convergent in nature.

(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.

(3) **Policy Mission:** To achieve the policy objectives, a policy mission comprising five strategic thrusts have been identified:

Thrust 1: Introduce Appropriate Regulatory Framework

This requires the introduction of an appropriate, robust and efficient regulatory framework which would address market failures and provides incentives for firms to enter into the RE generation market.

The regulatory framework would be the primary vehicle for the introduction of the feed-in-tariff (FiT) mechanism which will act as a catalyst for the progressive entry of RE power generation businesses and other related aspects of RE development.

It is envisaged that with the reduced environmental pollution coming from increased RE usage, the society at large benefits. This would mean that society must play its part by contributing towards RE development through a fund to be used to pay for the RE power. Payment of this contribution, which can be embedded into the electricity tariff structure, must be made to a specific RE Fund and not become part of the receipts by Government (as such receipts must be paid into the Consolidated Fund).

There are consequently direct spill-over effects as such a regulatory framework would act as a catalyst for the emergence of RE industries, undertaking of R&D in RE technology and innovation (e.g. via improved boiler technologies etc.). The measurable outcomes of this thrust include the rate of increase in the use of RE, the decreasing (or plateaued) rate of fossil fuel consumption for conventional power generation and reduction of CO_2 emissions.

Thrust 2: Provide Conducive Environments for RE businesses

The 2nd Policy Objective identifies the importance of the growth of the RE industry. A definition of the "RE industry" provides clarity of this industrial sector. The 1st Policy Objective refers to RE generation, which would cover generation, distribution and sale of energy; while it is proposed that the term "RE industry" refer to the manufacturing of RE components or RE finished products (e.g. boilers, turbines, PV modules, etc.), support industries to the RE manufacturing sector, and RE service providers (e.g. technicians, consultants, engineers, builders) who support RE power generation. The focus of this thrust is on RE industry and RE power generation (which collectively are referred to as RE businesses or RE industry).

The conducive environment package would encompass the provision of fiscal incentives, and indirect assistance in the form of reducing the transaction costs for financing, using GLCs and MNCs to lead the charge, and providing assistance to SMEs to participate in the RE business. These are in addition to the feed-in tariff that of itself provides a stimulus for people to enter the RE power generation sector.

Thrust 3: Intensify Human Capital Development

RE is a new technology in Malaysia and there is an urgent need for human capital to be developed to support the emerging RE Industries. Yet there is a need for a short-term (stop-gap) measure to fill the human capital void in Malaysia by encouraging knowledge workers to relocate to Malaysia.

Thrust 4: Enhance RE Research And Development

The focus of the R&D is not on invention[1] but on innovation[2]. For example, the improvements in the microchip were due to innovation (i.e. the idea of "standing on the shoulders of giants").

Therefore the implementation of a systemic R&D programme that leads to innovative products and services is preferable as this can accelerate the growth of the RE Industry in the country. Innovation also enhances the diffusion of RE technology by making the technology cheaper and easier to use. This can strengthen businesses' competitive edge.

Thus, it is necessary to develop an R&D implementation plan that articulates the demand, identifies the use of regulation to spur innovation and provides appropriate support for R&D activities. All RE related R&D efforts coupled with effective innovations should result in robust downstream activities. This would in the end affect the industry tremendously and benefit the country in terms of economic gains.

Thrust 5: Design And Implement An RE Advocacy Programme

Advocacy programmes that are tailored with specific messages for specific audiences should be implemented. For example an advocacy programme targeted at investors and RE market entrants will need to convey a message that is subtly different from that of a general public advocacy programme designed to secure buy-in to the idea of societal payments for a clean environment. The common aim of all advocacy programmes is to increase the awareness of all stakeholders of the benefits and advantages of utilising RE and participation in RE businesses.

Thrust 1 is the most important foundation for the five (5) policy objectives, whilst Thrusts 2, 3 and 4 provide the stimulus and conducive environment for businesses to enter this market. Since the RE Policy is a forward-looking policy with new approaches it is important for its success that buy-in by relevant stakeholders and society at large is secured and this could be achieved through Thrust 5.

RE Action Plan

The specific actions needed to provide the most effective results should take one of two forms which are:
(i) Direct actions to create or establish the necessary institutional arrangements; and
(ii) Supporting measures to encourage and nurture the growth and development of the RE businesses.

The detailed report provides for the prioritisation of the main actions. The full scope of the action plan should be implemented within 2 months after the RE Law is passed. The estimated direct cost of implementing the RE Action Plan over a 5 year period using available data is RM 1.5 billion (this does not include the amount to be contributed to the RE Fund and the cost of indirect incentives).

RE Targets and Success Indicators

As the RE Policy is a new and forward-looking policy, it is important and necessary that evaluation be done periodically, to empirically ascertain whether these actions are bearing fruit or require change mid-stream, and by which the outcomes of the Policy Objectives be monitored and realised. Accordingly evaluation criteria have been drawn up for each Thrust, and planned base line assessments are to be undertaken to provide the basis for future evaluation. Details of the criteria are set out in Chapter 8.

1 Invention is defined as the creation of a new product or process.
2 Innovation is defined as the making of changes in existing products or services by introducing new methods, ideas or products.

Table (ii): RE Policy Planned Outcome

Year Ending	Cum. Total RE (MW)	Share of RE Capacity	Annual RE Generation (GWh)	RE Mix	Annual CO2 Avoidance (tonne)
2011	217	1%	1,228	1%	773,325
2015	975	6%	5,374	5%	3,385,406
2020	2,065	10%	11,227	9%	7,073,199
2030	3,484	13%	16,512	10%	10,402,484
2050	11,544	34%	25,579	13%	16,114,871

In conclusion this RE Policy is necessary for the development and growth of the RE businesses in Malaysia whilst at the same time one of the vital mitigation initiatives in reducing our green house gas emission from the continued burning of fossil fuels in electricity generation. The old ways of doing things no longer applies, and the country must move in a direction which is more progressive. The Action Plan shows that the policy objectives can be achieved on the condition the RE Law and Feed-in Tariff (FiT) which is supported by the RE Fund are introduced. These are the foundations on which the actions for the other thrusts are based upon.

Figure (i): Synergies of RE Action Plan (Strategic Thrusts) leading towards a successful RE Policy

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LIST OF ABBREVIATIONS USED

BCSDM	-	Business Council for Sustainable Development Malaysia
CDM	-	Clean Development Mechanisms
CRC	-	Cooperative Research Centre
DANCED	-	Danish Co-operation for the Environment and Development
DSD	-	Department of Skills Development in MOHR
EC	-	Energy Commission, the English language version of the Suruhanjaya Tenaga
EFB	-	Empty Fruit Bunches
EPU	-	Economic Planning Unit, Prime Minister's Department
ESA	-	Electricity Supply Act 1990 (Act 447)
IPC	-	International Procurement Centres
IPP	-	Independent Power Producers
JAS	-	Jabatan Alam Sekitar
KPKT	-	Kementerian Perumahan & Kerajaan Tempatan
KPPK	-	Kementerian Perusahan Perladangan dan Komoditi
KTAK	-	Kementerian Tenaga, Air dan Komunikasi, the former name of Kementerian Tenaga, Tenaga Hijau dan Air (KeTTHA)
KTKM	-	Kementerian Tenaga, Komunikasi dan Multimedia, the former name of KTAK
MBIPV	-	Malaysia Building Integrated Photovoltaic
MECM	-	Ministry of Energy, Communications and Multimedia, the former name of MEWC
MEWC	-	Ministry of Energy, Water and Communications, the former name of Ministry of Energy, Green Technology and Water (MEGTW)
MOHE	-	Ministry of Higher Education
MOHR	-	Ministry of Human Resource
MOSTI	-	Ministry of Science, Technology and Innovation
MPOB	-	Malaysia Palm Oil Board
NIMBY	-	Not In My Back Yard
OHQ	-	Operational Headquarters
POME	-	Palm Oil Mill Effluent
PPA	-	Power Purchase Agreements between IPPs and TNB
PTM	-	Pusat Tenaga Malaysia
R&D	-	Research and Development
RDC	-	Regional Distribution Centres
RE	-	Renewable Energy
RE	-	Representative Offices
REPPA	-	Renewable Energy Power Purchase Agreement
RO	-	Regional Offices
SCORE	-	Special Committee on Renewable Energy, established under the MECM
SESB	-	Sabah Electricity Sdn Bhd
SREP	-	Small Renewable Energy Power
ST	-	Suruhanjaya Tenaga
TNB	-	Tenaga Nasional Berhad, a Government-linked corporation that is primarily the single largest distributor and retailer in Peninsular Malaysia
UBBL	-	Uniform Building By-Laws

1. INTRODUCTION

This report identifies the need and rationale for a convergence of energy, industrial growth, environmental and information dissemination policies and proposes a new and forward-looking Renewable Energy (RE) Policy. The Report is structured as follows:

Chapter 2	**Key Facts** Sets out the chronology of the introduction and development of RE in Malaysia and the key facts gleaned from the various RE programmes.
Chapter 3	**Key Issues Affecting RE** Identifies the key issues and lessons that can be drawn from the facts.
Chapter 4	**Need for RE Policy and Action Plan** Develops the rationale for and objectives of a convergent RE policy, drawing on the lessons and key issues set out in Chapter 3.
Chapter 5	**The RE Resources and Smart Targets** Identify and analyse the technical potential of renewable energy resources and identify the SMART targets for the renewable energy.
Chapter 6	**The Renewable Energy Policy** Sets out the RE Policy vision, objectives and mission (strategic thrusts).
Chapter 7	**RE Action Plan: Implementation Approach** Details the implementation actions under each strategic thrust towards achieving the policy objectives.
Chapter 8	**Evaluation Criteria and Success Indicators** Identifies the evaluation criteria to gauge the successes and achievements of the RE Policy and Action Plan.
Chapter 9	**Conclusion** Concludes by showing the relationship of the various strategic thrusts to each other and the building blocks.

2. KEY FACTS

The design and formulation of a new and forward-looking RE Policy is guided by the relevant facts and lessons learnt from current efforts of renewable energy development in Malaysia.

2.1. Chronology of Events

Malaysia's RE policy and programmes have been in existence for almost 30 years and Table 2.1 below chronologically summarises the policies and programmes that have been introduced in Malaysia.

Table 2.1: Malaysian RE Studies, Policies and Programmes

No.	Date	Description Of Study, Policy Or Programme
1.	1980s	Stand alone solar photovoltaic systems for electricity supply to rural communities and remote areas in Malaysia.
2.	1999	Study on the development of a "Strategy for Renewable Energy as the Fifth Fuel" by KTKM (with the support of DANCED). This study assessed the RE potential in Malaysia and recommended the legal, regulatory and financial framework to encourage the utilisation of renewable resources.
		Prime Minister announced at the World Renewable Energy Congress in Kuala Lumpur that RE is the national fifth fuel.
3.	April 2001	RE utilisation as fifth fuel incorporated into the 8th Malaysia Plan, which identified the various tools to promote greater utilisation of RE (namely demonstration projects, commercialisation of research findings, extension of financial and fiscal incentives).
4.	May 2001	Small Renewable Energy Power (SREP) Program announced. The SREP Program encourages the production of RE by small power generation plants by allowing these producers to sell electricity generated to electricity distributors or retailers, such as TNB.
5.	2002	Biogen Full Scale Model (Biogen FSM) Demonstration Project was initiated.
		SREP Guidelines for the initial phase issued by the Special Approval Committee SREP Programme.
		Prices for electricity generated using RE and sold to TNB was to be negotiated on a "willing buyer-willing seller" and "take and pay" basis, and documented in a REPPA. REPPA terms were similarly open to negotiation.
6.	July 2005	MBIPV - a 5 year Programme financed by GOM-UNDP (GEF) that expires in 2010 was launched to promote use of PV technology in buildings.
7.	March 2006	9th Malaysia Plan states that *"the sources of fuel will be diversified through greater utilisation of renewable energy. A market-based approach will be promoted to ensure efficient allocation of resources. Emphasis will be given to further reduce the dependency on petroleum products by increasing the use of alternative fuels".*
8.	2006	Study on SREP Programme and RE development in Malaysia undertaken by DANIDA.
9.	July 2006	Increase of RE price to RM0.19/kWh for biomass and biogas[3].
10.	August 2007	Increase of RE price to RM0.21/kWh for biomass and biogas[3].

3 See TNB's 2008 Annual Report at p. 68

The outputs of the various studies conducted are summarized in the table below:

Table 2.2: RE Studies Conducted and Key Outputs

No.	Date of study	Description of Study	Key Outputs of Study
1.	1999	Study on the development of a "Strategy for Renewable Energy as the Fifth Fuel" by KTKM (with the support of DANCED).	(i) Identification of renewable energy potential from palm oil biomass wastes and effluents; (ii) The conceptualisation of the SREP programme with the expectation that the palm oil mill industry would be a key participant.
2.	2006	Study on SREP Programme and RE development in Malaysia by DANIDA	The main barriers to RE development: i. Tariff not meeting market IRR expectations; ii. Lack of long term fuel supply; iii. Lack of financing; and iv. Certain provisions in the REPPA were unacceptable to SREP developers. Specifically 3 categories of barriers which are: (i) Financial – insufficient incentives from Government, difficulty in sourcing of financing and uncertainty of fuel costs as biomass has alternative uses; (ii) Institutional/legal – limited interests, non-transparent way to connect to the grid, maximum limit discourages medium size RE projects as outside support scheme; and (iii) Technical – limited local expertise and technology, under-developed palm oil biomass boiler technology and localised biomass/biogas fuels (distance to load centre).

2.2. Status of RE Developments (2001 – 2009)

The period 2001 to 2008 spans two Malaysia Plans, i.e. the 8th and 9th Malaysia Plans which saw the introduction of three programmes – the SREP programme, the Biogen Full Scale Model (Biogen FSM) Demonstration Project and the MBIPV programme.

The main outcomes for RE development during the period are summarised below:

1. Small Renewable Energy Power Programme (SREP):
    - 50 projects approved by SCORE with total generation capacity of 288 MW;
    - 40% of projects have been cancelled;
    - 24% of projects have been issued with licences;
    - 36% of projects could not commence because licences have yet to be issued;
    - only 53 MW of RE generation capacity has been connected to the electricity grid (2001-2009);

2. In 2009, one Biogen FSM Demonstration Projects has been commissioned (i.e. the MHES Asia's 13 MW power plant) and the FELDA Serting 500 kW power plant is expected to be commissioned in the 1st half of 2010.

3. There are more than 400MW off-grid electricity capacity primarily produced by private palm oil millers;

4. About 1 MW of cumulative grid-connected PV installations in more than 100 buildings throughout Malaysia (mostly in Klang Valley).

As at December 2009, 53 MW RE power generations have been generated and connected to the grid. It is expected that by 2010 the generating capacity of SREP projects will reach 65MW.

2.2.1. SREP Programme

Nature

The SREP Programme is a fully private sector funded initiative. Private sector participants need to meet their own funding needs via the use of internally generated funds or borrowings from commercial financial institutions. Under the SREP Programme, small power generation plants (limited to not more than 10 MW capacity) which utilise RE resources sell (export) electricity to the utility company through the distribution grid system (usually at 11 kV).

All SREP Program projects must be submitted for approval by SCORE, a committee established under the Ministry of Energy, Green Technology and Water (KeTTHA). Members of the committee are appointed from various agencies and other stakeholders in the electricity sector. The SCORE Secretariat in the Suruhanjaya Tenaga (ST) processes and validates all SREP applications and the successful applicant would be granted a licence to operate by the ST which is the regulator of the Malaysian electricity industry.

Technologies and Fuel Supply

The most popular technologies under the SREP programme are biomass (using palm oil empty fruit bunches), biogas (from palm oil mills effluent), mini-hydro and municipal solid waste. The wider use of solar PV has recently gained prominence due to the implementation of the MBIPV programme but generally not considered as SREP.

Palm oil mills were considered inefficient biomass power plants because of the disproportionate RE input-output ratio of the existing mill technology, i.e. a disproportionately large volume of EFB has to be burnt to produce a given quantity of energy. Thus mills need to upgrade their plants to realise the full benefit of biomass. Furthermore for those technologies that rely on a fuel source such as EFB, rice husk, wood residue or POME, obtaining reliable fuel supply is a key factor to project viability.

> ***Example: Rice husk and wood residue as fuel***
> *Proposals to construct RE plants using wood residues and rice husk as fuel were received and approved by SCORE. Notwithstanding the approval, these proposals did not progress any further because (as noted by industry observers), the proposed capacity of 10MW for the rice husk power project was too ambitious and (as realised by the project proponents themselves) it was difficult and costly to collect the required quantity of fuel (i.e. rice husk and wood residue) to make the project feasible.*

It was observed that suppliers of EFBs for biomass power plants, upon recognising the economic value of an essential input to biomass power generation, could exercise its market power by introducing economic terms and conditions (where none existed before) for the supply of EFB.[4] Evidence of such circumstances was documented in the 2006 DANIDA Study which highlighted the difficulties faced by RE plant operators in obtaining long term biomass fuel supply agreements. Commonly the duration of most EFB supply agreements was no more than 3 years.

This situation has a direct effect of reducing the viability of the RE project as the buyer of energy (i.e. the utility) could not be assured of on-going long term supply given the RE plant is dependent on EFB fuel supply agreements of relatively short duration compared to the REPPA agreements which are for a longer period of time.

4 In economics, an essential input is one for which demand is price-inelastic. Buyers of an essential input have very limited recourse to lower their demand significantly when a seller increases the price of that input.

Energy Prices

The SREP Guidelines state the price of electricity generated using RE is to be agreed by the relevant parties through negotiations on a "willing buyer-willing seller" basis. This means the Regulator (ST) or the Government will not set the energy price the utility must pay to the RE power producer.

Another important issue to note is the price for electricity generated using RE according to the SREP Guidelines is on a "take and pay" basis. The utility company will only pay the RE power producer if the utility takes the electricity generated. Hence if the utility does not take any electricity in a given month, the RE power producer does not earn any revenue in that period.

Despite the SREP Guidelines stating that the price of RE electricity is to be negotiated, the price is evidently "declared" to be between 14 sen/kWh and 17 sen/kWh in the SREP Application Form 1/2002. The problems with the RE price levels being "declared" in the SREP Application Form 1/2002 are:

(a) They did not meet the RE project proponent's or the market's expected internal rate of return (IRR)[5]; and

(b) They did not reflect the full cost of RE supply.

These problems were not able to be mitigated when the level of RE price (for biomass and biogas power only) were revised upwards. The price increase was seen to be arbitrary because economic costing studies carried for the purpose were not made transparent. This may also create a market perception that the Government is preferring biomass and biogas as RE sources for electricity generation over other sources. The RE price of both biomass and biogas generated power has been revised twice recently as in Table 2.3 below.

- July 2006, KTAK increased the price to RM0.19/kWh following the 12% increase in the retail tariff for conventional power in mid 2006; and
- August 2007, the price was raised to RM0.21/kWh by the Minister following discussions with TNB[6].

Table 2.3: Summary of RE Prices for Various RE Sources (Malaysia)

RE prices	Biomass	Biogas	Mini-hydro	Solar PV
RM0.17/kWh	X	X	X	X
RM0.19/kWh (July 2006)	X	X	-	-
RM0.21/kWh (Aug 2007)	X	X	-	-

REPPA

In order for the legal relationship between the RE power producer and the utility to exist, a REPPA has to be entered into. This requires negotiations between the utility company and the RE power producer because currently there is no standard REPPA agreement mandated by the relevant authority or law.

As a result, REPPAs were developed using the PPAs between the conventional IPPs and the utility company as a precedent. It is observed that these REPPAs contained provisions that are unsuitable for RE power supply.

5 See the 2006 DANIDA Report at pages 12 and 15

6 It is understood that the direct intervention by the then Minister was necessary and resulted in agreement by TNB that such an increase was necessary in fulfilment of their corporate social responsibility.

Examples of unsuitable clauses in REPPA:

(i) Performance provisions (i.e. facilities must deliver at the "specified annual capacity factor calculated as an annual moving average"),

(ii) Penalty provisions (i.e. RE producers can be penalized 1 sen per kWh for every 2% shortfall in annual capacity factor, except for the first six months of billing when the project is still under testing stage), or

(iii) Saving sharing provisions (i.e. where RE developers were to pay TNB, 50% of any savings accrued from CAPEX or tax reduction which deviates from the former's original expectations when they submitted their financial models to TNB).

In negotiating the terms and conditions of a REPPA, RE project proponents are confronted with issues which are:

(a) Time and resource constraints

Most RE power producers are small players who neither have the resources nor capacity to negotiate for acceptable terms and conditions. Furthermore, the fiscal incentives for a RE project are subject to the condition that the project is implemented within 12 months. The combination of limited resources and time increased the pressures on RE power producers to capitulate and agree to terms favourable to the utility.

(b) Single buyer

The existence of a single buyer (i.e. the utility company) creates an unequal bargaining position, especially if the utility exercises its monopsony power to seek terms that are more favourable to itself or more onerous to the RE power producer[7]. This has the effect of pressuring the RE power producer to agree to terms it may not usually accept.
The Ministry of Energy, Water and Communications had in 2007 simplified and standardised the REPPA by removing some inappropriate and unsuitable clauses for RE projects of up to 2 MW capacities. Proponents of more than 2 MW projects will still have to negotiate the terms of REPPA with the utility.

(c) Interconnection

The cost to interconnect the RE power plant to the grid (including the cost of strengthening the system) according to the SREP Guidelines is to be borne by the RE project proponent. Sometimes the costs are quite substantial especially if the location of the RE power plant is quite a distance from the grid which would be burdensome to the RE project proponent.

7 Notes: The DANIDA Report identified the REPPA was unfavourable for RE project developers.

Participants Expectation

From the feedback obtained the expectations of interested participants in the SREP Programme can be summarised as follows:

(a) A pay-back period of between 3 to 5 years (especially by some palm oil millers[8]);

(b) A "high[9]" internal rate of return; and

(c) The SREP Program is not commercially attractive given the availability of alternative incentives in the form of CDM[10].

Most RE developers expected these are met when embarking on RE projects but to date its success is rather limited. However in 2007 the RE price for biomass and biogas was increased to RM0.21/kWh which improve the situation and able to counter-balance the incentive in the CDM programme (only for biogas) or meet the expectations.

Progress of SREP Projects

Several RE projects approved between 2007 to 2009 have made significant progress. These projects will supply a total of 65 MW when they are connected to the electricity grid by the end of 2010. It is worth noting these projects have progressed over a period during which changes were made to the key elements of the SREP Programme – namely an increase in the price of electricity sold to the utility by RE producers, and the standardisation of REPPA to reduce the negotiation time period for RE capacity below 2 MW. These changes addressed the two factors found by the 2006 study to have impeded the implementation of SREP projects.

2.2.2. Biogen Project

The Biogen Full Scale Model (Biogen FSM) Demonstration Project was initiated in 2002. Its main aim is to catalyse the development of RE projects through effective demonstration of the techno-economic viability of biomass and biogas grid connected power generation projects, as well as through the provision of soft-loans to facilitate the development.
The project is the cooperation between the Government of Malaysia and UNDP-GEF in which two full-scale model projects would be constructed and scheduled for commission in early 2009. The Biogen Full Scale Model projects are:

(a) MHES Asia's 13 MW RE power plant running on biomass using EFB as fuel; and

(b) FELDA Serting 500 kW RE power plant using biogas from palm oil mill effluents (POME).

During the implementation process there were initial interests of participants in the Biogen FSM Demonstration Project, however many withdrew from it citing the lack of adequate or sufficient returns on investments. The owner of MHES Asia RE power plant also faced many constraints while implementing the project such as:

(a) Delays in approval of borrowings from local financial institutions;

(b) The treatment of project proponents as independent power producers akin to the existing IPPs in the conventional energy generation market; and

(c) Loan conditions that disbursement occurs when a plant is 80% complete.

8 The 3-5 year payback period is a usual palm oil mill industry norm. Any period longer than that runs contrary to usual investment return horizons, thus making it a difficult to convince palm oil millers to participate.

9 Palm Oil Millers are used to high returns of their investments and a payback period of their investment of as low as 2 to 3 years. This provides for a high IRR. This acts as a disincentive for them to venture into the RE power generation, particularly when the payback period for their investment is about 10 years (from biomass fired SREP projects).

10 CDMs gave the palm oil millers adequate returns for merely flaring the methane rather than generating power.

2.2.3. MBIPV Project

The main goal of MBIPV Project is to reduce the long-term cost of solar photovoltaic technology through the development of a sustainable and widespread local market. The implementation of the MBIPV project is for 5 years from 2005 until 2010. The project is able to achieve the main objectives of increasing the capacity of PV technology applications in buildings by 330% and reducing the technology unit cost by 20% from the baseline. Through the Suria 1000 programme, the MBIPV Project provides grants which are awarded through a bidding system to homeowners and companies to partially finance the capital and installation costs of a PV system. The level of financial assistance provided in the early phases of the programme was higher than that provided in the later phases.

In all phases of the programme, successful bidders would contribute their own money to finance the purchase and installation of a solar PV system. Income from sale of electricity to the distribution grid is based on a ***net-metering*** scheme (in credit basis where the price for PV electricity is equivalent to the price of purchased electricity). The installed capacity of a PV system for a residential home is typically between 4kW to 10kW.

The following facts are some of the milestones that have been achieved under the MBIPV Project:

(a) Since 2006, on average the cost of a PV system has dropped from RM31,000/kWp to RM26,000/kWp. All other things being equal, consumers may have responded to the cheaper cost by increasing the quantity demanded of PV systems;

(b) Despite the lower level of financial assistance provided, the bidding for such assistance became more competitive which reflects:

i. The objectivity of both the bidding process and selection criteria;

ii. The willingness of consumers to bear a higher portion of the finances required to purchase and install a PV system; and

iii. Environmentally friendly or green technology is getting positive attention from the consumers.

2.3. Fiscal Incentives

The Government has introduced fiscal incentives to stimulate the growth and interests in the RE sector since 2000 which includes:

(a) The grant of pioneer status with tax exemption of 100% of statutory income, and an extension of the pioneer status from 5 years to 10 years[11];

(b) Investment tax allowance of 100% on qualifying capital expenditures incurred within a 5-year period, with the allowance offset against 100% of statutory income for each year of assessment[12]; and

(c) Import duty and sales tax exemptions.

All of the current fiscal incentives are provided with the condition of an expiry date 31st December 2010 which is the end of the ninth Malaysia Plan. These incentives would be evaluated for future fiscal incentives to be considered by the Government.

11 Note: This is an increase from the original exemption of 70% of statutory income.
12 Note: This is an increase from 60% of the qualifying capital expenditure.

3. KEY ISSUES AFFECTING RE DEVELOPMENT

Introducing a new policy requires clear identification and definition of the issues that need to be addressed, otherwise the policy may be misdirected or fail. The key issues and lessons in RE development in Malaysia are summarised in Table 3.1 below and elaborated in the proceeding sub-chapters 3.2.

Table 3.1: Summary of Key Issues and Lessons

Issues	Issues
(1) Market failure exists: The RE market was not successful due to the monopsony power and information asymmetries; and also constrained by financial and technological factors.	Market failure will be perpetuated unless the causes of such failure, *viz*. unequal bargaining position of the utility and RE project proponents, significant transaction costs in terms of the time needed to conclude a REPPA, and the monopsony power of the utility to agree to the requests of the RE project proponent are properly addressed.
(2) Constraints: Inherent factors that constrain the performance of the market.	The market should be assisted to achieve the intended outcome (increase in RE power generation); steps should be taken to ameliorate the economic, financial and technological constraints that are impeding market performance.
(3) Arbitrary price setting: RE prices are set without transparent mechanism.	RE prices must be based on sound economic principles and allow for full cost recovery. Anything less than full cost recovery (or efficient prices) will affect the viability of the RE project.
(4) Tensions and trade-offs: The predicament of expecting the utility will bear the higher costs of RE power.	The predicament can be addressed by the introduction of a mechanism for sharing the cost of RE amongst all members of society, as environmental improvement is a non-excludable public good.
(5) Absence of Regulatory Framework: The absence of a proper regulatory framework, inhibits effective legal action from being taken.	Regulatory frameworks provide the necessary foundation for achieving the desired outcome, and it sends a strong signal to the market of the government's commitment. The existing ESA is inadequate and insufficient to be used as the legal basis to support RE Businesses growth.
(6) Poor governance: Limited and ineffective governance affects the participation of stakeholders and legitimacy of the action.	Governance can be strengthened and improved through the introduction of the regulatory framework where governance principles are embedded.
(7) Limited Oversight Limited concerted oversight of implementation problems.	Oversight and implemented functions need to be in separate organisations for improved accountability;
(8) Lack of institutional measures: Lack of systematic institutional measures to meet informational and technological needs.	Information asymmetry requirements which need to solved through proper information dissemination, advocacy and awareness actions. Access to and the type of information should be made available expeditiously to assist in the private firm's decision making process for investments in RE.

3.1. Existence of Market Failure

In a market economy like in Malaysia, the questions of *what, how* and for *whom* resources would be allocated are primarily resolved through the interplay of supply (by producers of goods and services) and demand (by consumers). A market works well in providing the sorts of goods and services people wish to buy and can do so at least cost, so long as certain conditions are present. The most important of these conditions are:

(a) There are no significant externalities. An externality is a significant cost of production (or consumption) that is not fully borne by the producer (or consumer); e.g. a producer who does not bear the costs of pollution will over-produce the good that is the source of the pollution.

(b) Firms in the market face competition from other existing firms, from imports, as well as the threat of new firms entering the market. A single-seller (monopolist) is likely to exploit the absence of competitive threats (e.g. by selling an essential product at a higher than competitive price), whereas a single-buyer (monopsonist) is likely to behave opportunistically (e.g. to only do business with firms that accept terms and conditions favourable to the buyer).

(c) Adequate information about the quality and characteristics of goods and services is provided or made available to buyers at reasonable cost; and a party in a transaction does not know substantially more than the other party.

Where and when one or a combination of such conditions is not met in the real-world, a market failure occurs and Government can and should intervene to prevent resources from being allocated inefficiently.

3.1.1. Evidence of Market Failure

The discussions in Chapter 2 show the existence of market failure in RE development of the country based on the facts which are:

(a) In the SREP Programme, leaving agreements to be reached between parties may allow the party with market power or more information to take advantage of its bargaining strength to the detriment of the other party. Examples are the very short term fuel (EFB) supply agreements or the long negotiation time for a REPPA.

(b) EFB is seen as an essential source of fuel for some technology-specific RE producers, the supplier of EFBs could and in fact did exercise its market position and power to the detriment of the buyers of EFB. As a result, the RE producers who are dependent on EFB are unable to secure long term supply contracts (of more than 3 years) with guaranteed availability at a price that is significantly higher than expected.

(c) An information asymmetry exists between RE project proponents and the utility (as the utility is more experienced in electricity supply) is able to justify the existence of certain clauses in a REPPA on technical grounds which cannot be rebutted by the RE project proponent. This could compel RE project proponents to accept unfavourable terms and conditions.

(d) It is well-known that CO_2 or GHG is emitted by the burning of fossil fuel. The costs of such pollutants (i.e. the externality) have yet to be taken into account in the production decisions and behaviour of the utility and IPPs. There may be over-production of electricity using fossil fuel and this is aggravated when the cost of the input to conventional power production is subsidised.

In Malaysia, the Government's role and involvement in the energy supply industry is well-established and can be expected to continue for some time in the future. The Government needs to recognise the conditions that cause market failure and address these issues.

3.2. Existence of Constraints

In the current environment of the energy sector, there are economic, financial and technological constraints which could undermine any form of RE Policy unless addressed specifically, either in the formulation or implementation of such policy.

The constraints are summarised in table 3.2 below:

Table 3.2: RE Implementation Constraints

No.	Type Of Constraint	Evidence Of The Constraint
1.	Economic	i. The existing tariffs act as a constraint on the part of the utility to agree to a higher energy purchase price due to the reason that no business will purchase an input to be sold at a lower price; ii. Competing incentives exist in the market that make it on a net benefit test, more favourable for businesses to utilise these competing incentives than participating in RE power generation; and iii. Preference for the least-cost fuel option by policy makers.
2.	Financial	Difficulties in obtaining commercial financing from local financial institutions by RE project proponents;
3.	Technological	i. Requirement for interconnection and costs burden on the RE power producer; and ii. Need to import RE technology.

3.2.1. Economic Constraints

(i) Controlled and Low Electricity Tariffs

The average electricity tariffs in Malaysia are generally low despite the increases in June 2006 by 12% and again in July 2008 by 23% (average). The government in March 2009 had reduced the average electricity tariffs by 5%. Notwithstanding the movement of tariffs over the past 3 years, a fundamental concern is that the tariffs are artificially low due to the fossil fuel subsidy the Government provides (directly or indirectly) and have not accounted the external costs. This means that the real costs of electricity is not passed to consumers which perpetuates consumer expectations of low retail tariffs.

This report takes as given the state of the current energy tariffs and assumes that it is the intention of Government to reduce over time, the existing subsidies and also include the external costs. Therefore in such a situation the low tariffs act as a disincentive (or even a commercial hindrance) for the utility to agree to a higher purchase price for RE. The utility being a public listed company with diverse shareholders owe the shareholders an obligation to meet financial targets and profit forecasts which it would not be able to do by buying RE at a price higher than the permitted retail energy tariffs.

Consequently there is a need for the policy to manage two opposite demands which are:

(a) The requirement for an efficient RE price which provides the necessary incentive for firms to enter the RE market; and

(b) The need for the utility to meet its financial responsibilities to its shareholders. This means the financial burden an efficient RE price places on the utility needs to be managed by alternative means.

(ii) Competing Incentives

The existence of different market choices can create competing incentives and private firms will choose the lowest cost to implement or produce the greatest benefit to them; i.e. a net benefit test. The available competing market choices are the CDM, which will improve energy efficiency or participation in RE generation. Based on a net-benefit test, firms will choose an approach that maximises the benefit to them at the lowest cost.

(iii) Least Cost Option

RE programmes or projects faced significant economic impediments because the economics of conventional energy using fossil fuels is less costly compared to renewable energy sources. With such an economic situation, it is not surprising that interest in RE projects is rather low. The lack of promotion of RE as a source of fuel for power generation by policy makers aggravates the marginalisation of RE from the mainstream because of the signals that are given to the market.

3.2.2. Financial Constraints

The approach of the current SREP programme relies on private capital and the availability of funds is a significant necessity. A review of the RE projects reveals that RE project proponents experienced difficulties in securing funding from local financial institutions. This occurs from a lack of knowledge or expertise amongst financial institutions to evaluate RE projects that seek funding, imposition of terms and conditions which treat RE funding as a conventional loan (and not similar to non-recourse project financing as adopted with IPP funding), greater risk mitigation measures to reduce the exposure of the financial institution to the risk of non-payment or a default. The latter resulted in reduced duration of the loan tenure to approximately 8 years, imposition of stringent conditions for drawdown particularly after an advanced stage of construction and higher interests rates.

As a consequence the availability of capital to fund RE projects is very much lacking, and this adds as a disincentive to private enterprise from developing any RE project. Only those with better access to capital (either ready capital via internally generated funds or with other assets to provide security to financial institutions) would be able to overcome the financial difficulties. This reduces the available pool of private sector participants and accordingly has a knock-on effect on the number of RE plants built and commissioned.

3.2.3. Technological Constraints

There are two technological constraints on the viability of RE projects which are:

(i) Interconnection

The cost to interconnect the RE power plant to the grid including strengthening of the system is according to the SREP Guidelines, to be borne by the RE project proponent. Such a requirement adds to the capital costs burden of RE project proponents, thereby increasing the capital requirement and affecting the financial viability of the RE project. However if such

costs are to be borne by the RE power producer then such costs must be reflected in the RE prices, so that the costs can be recovered. This would make the RE price an efficient price. However current RE prices were not transparent thus affecting the viability of the RE projects.

(ii) RE Technology

This burden is particularly significant because of the technology costs in RE projects. Advanced RE technologies (e.g. modern and efficient gasification boilers) that are imported could be very expensive and also subjected to significant technology costs (e.g. royalty payments for use of the intellectual property within the RE technology). Such costs would add to the capital burden of firms which in turn creates a feedback loop for higher RE tariffs. Consequently only firms with sufficient financial means could participate, but more significantly this has the potential to exclude small and medium, but equally if not more entrepreneurial enterprises from entering this market.

> ***Example: Technology Costs***
> *One of the approved RE power plant utilises a gasifier technology (referred to as "envirocycler") licensed from a Canadian patent. This technology would result in greater efficiency of energy conversion as compared to the conventional direct combustion of EFB.*
>
> *The capital cost of the gasifier amounted to RM14 million whilst the royalty payment amounted to 32% of the total project cost.*

The existing constraints mean any measures designed to implement the policy should address these constraints in a meaningful way without distorting the market (e.g. by providing subsidies). The opportunity is available for the proper management of these constraints in an effective and efficient manner which enables the policy to be sustainable over the long term.

3.3. Arbitrary RE Price Setting

The original intention as expressed in the SREP Guidelines was for the RE prices to be market-based. However there were instances of informal price settings made by the Government which lacked the adoption of economic principles. The RE prices for biomass and biogas were raised in 2006 and 2007 and not for other RE sources which reflects two key issues:

(a) The lack of the application of economic principles in price setting to ensure the basis is transparent and clear; and

(b) The substitution of a "principles-based" approach for an individual's perception or understanding of the "right" price (i.e. arbitrary setting of RE prices without regard to efficiency of the price).

3.4. Business Tensions and Trade-offs

Existence of business tensions necessitates a trade-off, where the business must make a choice. In the case of RE development in Malaysia, the demand on the utility (as the market for retail and distribution has not been liberalised) to fund RE by paying higher prices to RE power producers is the opposite of the demand on the same utility to improve its financial performance and the return on its assets.

This financial improvement is needed because:

(a) The utility is a publicly listed company, and

(b) Its majority shareholder is Khazanah Nasional which has introduced the "Rainbow Books" in the GLC Transformation programme[13].

These create tensions causing supremacy seeking in the utility, and the result is the utility will support the demand for financial improvement. Consequently there is little or no incentive for the utility to concede anything when dealing with RE power producers as it sees itself in a "lose-lose" situation.

13 Details of the GLC Transformation programme are available at http://www.pcg.gov.my/index.asp (accessed on 25 Feb 2009)

On the other hand, there is the expectation of RE power producers especially from the palm oil industry (i.e. biomass and biogas) of high IRRs and short pay-back periods, create a demand for higher RE prices. These demands have resulted in price changes and other actions viewed as being taken against the utility or not in the utility's interests but that of the palm oil industry.

However there is a need to recognise the use of RE produces a public good - i.e. improvement in the environmental condition through the reduction in GHG emissions. In Malaysia, the total GHG emissions for the year 2006 amounted to 169,829 $GgCO_2$ and the power sector is identified as one of the major and largest contributors with 56,203 $GgCO_2$ accounting for 33% of the emissions. Whilst it is recognised the various types of fossil fuels (e.g. coal) used in power generation contribute different amounts of GHG into the atmosphere, it must be noted that renewable energy such as biomass either release minimal amounts of GHG carbon-neutral, or the same amount of carbon dioxide as it absorbs, while wind and solar has zero emissions.

One of the outcomes of RE is a public good, which is non-rivalrous and non-excludable (i.e. other members of society cannot be excluded from enjoying it, nor does one's consumption of it reduces its availability). This means those who pay for this benefit cannot exclude others who do not pay (but who can still enjoy the good).

The current scenario would create a dilemma amongst consumers due to these factors:

(a) The expectation of a high price for RE especially for biomass and biogas by the RE power producers;

(b) The need by the utility for RE prices to be as low as energy generated from fossil fuels;

(c) The expectation of the associated costs of RE programme should be borne by someone other than the utility; and

(d) The outcome of RE power production is a non-rivalrous and non-excludable good.

The approach that could be adopted to date is to use political will to persuade the utility to bear these costs; but such an approach limits the growth of RE power plants. This also leads to the question of who should be made to bear the costs.

Cost Bearing

Placing the RE costs solely on the utility's shoulder (as is the case to date) creates tremendous tensions for the utility especially as it has to meet its key performance indicators set under the GLC Transformation programme, its public company status and treated as part of the government. The result is that the utility will find ways to minimise their cost exposure.

Alternatively if the RE producers bear the costs (i.e. being the difference between the actual cost to generate and the price they receive for selling it to the utility) they have no incentive to enter the market.

If the cost burden is placed on the Government, it means an opportunity costs and competition amongst other programmes for funding. However it must be recognised the Government revenue is not unlimited and must be used efficiently and effectively.

Therefore placing the RE cost burden on all levels of consumers whether they are households or businesses is an effective and efficient mechanism because:

(a) It is a consumption based burden, since the more one consumes the higher the amount to be contributed;

(b) It implicitly recognises the "polluter-pays" principle; and

(c) The existing collection mechanism can be used thereby minimising transaction costs.

3.5. Lack of an Efficient Regulatory Framework

It is observed current regulatory framework is inadequate to address the myriad issues pertaining to RE as a fifth fuel in electricity generation. For example under Section 26 of the Electricity Supply Act (ESA), the power to fix tariffs is in the hands of licensees with the proviso such tariffs are to be approved by the Minister before being applied. The ESA also requires

"installations" to have proper safety supervision undertaken by the resident engineer as prescribed in the Electricity Regulations. It is silent on the provision making available the rights of a power producer to require or demand interconnection of its power plant to the grid, nor is there any provision to deal with the risk of the grid operator behaving anti-competitively (since the grid is a natural monopoly and needs to be regulated as such).

The lack of mandatory requirement to enable access and interconnection means, any interconnection needs to be done voluntarily by the grid operator, through the use of contracts. These contracts could supplement the deficiency in the current regulatory framework, but their ability is dependent on the possibility of regulatory intervention to avoid abuse of market power. Further network access prices are not applicable in Malaysia since the transmission and distribution charges in the form of network access prices or use of system charges are not levied by the utility. The only form of such charges is the expenses that TNB as a licensee incurs in providing a supply line to a person requiring the supply of electricity, which is not a "network access price".

Without a robust, effective and efficient regulatory framework that provides clear rules (and minimises discretionary powers) the default mechanism is to rely on regulatory negotiations, i.e. negotiations to achieve an outcome which is similar had the outcome been specified in regulations. This consumes time and effort of all parties and may not necessarily produce the desired results.

The SREP programme evidenced that private capital will only be an effective means to introduce a new technology if there is a favourable and supportive regulatory environment and where sufficient and adequate return on investment exists. Without these elements, the market will not work to support the introduction and take up of new technology.

Additionally RE developers were also subjected to procedures and processes of other agencies such as the Department of Environment (DOE) for environmental impact assessments, State Authorities for land conversion approvals and for water abstraction rights and permissions (in mini-hydro) and planning permission from local authorities.

These requirements are nevertheless applicable to all parties intending to generate power in Malaysia; and are not unique to RE power producers only. However there is a compliance cost which needs to be managed or reduced; and an opportunity cost incurred because of administrative delays could be due to lack of awareness from the stakeholders of RE development in the country.

3.6. Governance Issues

Good governance is a system that is transparent, accountable, just and fair, participatory and responsive to people's needs. Governance is important because it provides a means, in which the institutional framework operates, clarifies the roles of interested parties and avoids or minimises conflicts of interests. Without proper governance, institutional structures may lack effectiveness to play an efficient and legitimate role in spear heading RE development.

Institutions are of two types – formal or informal. Formal institutions are set up within the ambit of legislation or regulations while informal institutions exist within the ambit of administrative actions which may be sanctioned, recognised or supported by the state. It is now recognised institutional systems may be one of the causes of sustainability problems and barriers to addressing policy problems. Systems which are not transparent or fully accountable are precisely those that are resilient, powerful and resistant to change.

3.6.1. The Roles and Responsibilities of SCORE

The creation of a special committee referred to as SCORE is a mechanism determined by the government to facilitate the development of RE projects in the country. Its main role is to approve the SREP projects which are processed and validated by ST who serves as the secretariat to the committee. However since the establishment of the SCORE in 2001, it is observed the members may have influenced the government in determining the policy direction of SREP projects.
The members of the SCORE include the MPOB and the utility (TNB) among others and the presence of these interested parties in the decision making process may create potential for conflicts of interests. Evidences of the possibility of such conflicts of interests are:

(a) The setting of RE prices at RM0.21/kWh for biomass and biogas which directly benefits palm oil mills represented by MPOB; and

(b) The standardisation of REPPA for under 2 MW RE plants which would benefit TNB as the company is still able to negotiate REPPAs for RE plants above 2 MW capacity.

Improving governance means avoiding situations where conflicts of interests may arise in instances where parties interested in the outcome of a decision are involved in the decision-making process. The inputs of both TNB and MPOB are valuable, yet the interplay of their respective vested interests may distort the decision-making process.

MPOB and TNB can and should be required to make transparent submissions to a public consultation held under the aegis of SCORE, whilst allowing the decision maker to arrive at an independent decision that is beneficial to the country as a whole.

3.6.2. No Oversight

Implementation of the SREP Programme or RE Policy should be systematic and may need a legally constituted implementing agency. It is noted that the SREP projects approvals are made by SCORE not by ST as the industry regulator. There are guidelines for potential investors or firms to follow however in the implementation process it seems SCORE has descended into the realms of implementation i.e. approving of RE projects. The consequence of this is that there is no institution performing an oversight role to ensure that policy goals are achieved.

It is noted that the increase of RE prices as well as getting the utility to agree to standardisation of the terms of REPPA are not based on transparent processes and procedures which may be open to question or challenge.

The lack of an oversight body to ensure the policy targets are met or at least to hold the implementing agency accountable reduces the effectiveness of the governance framework resulting in the limited success of RE development in the country.

3.7. Information Cost and Access

For any new technology to take root, having access to the appropriate information is essential. When firms do not have access to proper information, there is a greater likelihood of relying on their own perception or using proxies to draw conclusions and make decisions.

Access to information that facilitates proper decision making is also an essential element for the mobilisation of capital. Furthermore there is a cost to accessing and processing information for decision making, and this cost makes it prohibitive for small RE projects to undertake the information gathering, processing and assessing on their own.

There has been little assistance in provision of relevant information to interested parties, with the result of decisions being made largely on assumption basis.

> ***Examples of decisions made based on general assumption:***
> *(a) Biomass plant of 10 MW relying on assumption that wood and rice husk for fuel are available, while in reality the collection and quantity of such fuel is insufficient or the 10 MW plant intended is too ambitious;*
> *(b) Biomass plant using EFB which need to be purchased when it is believed it would be given away free.*

Minimisation of information costs could provide a direct assistance to firms interested in entering or participating in RE projects.

3.7.1. Access to Information

Whilst a lot of data and information about renewable energy is available both locally[14] and internationally, their accessibility is difficult either because the information is not published on the internet, not readily available in a form suited for business decision making or is classified as confidential and/or subject to secrecy laws.

Without easy access to information many firms or stakeholders are unaware of RE prospects, specific systems designs, application and approval processes and the benefits and risks of RE. This would affect decision making processes by potential RE developers. Consequently, potential developers would exercise a higher degree of caution in committing their financial and human capital to undertake RE projects.

3.7.2. Structure of Information

The information needed is not available in a single repository or in a format that is appropriate for the audience. There are many participants and stakeholders in RE (such as KeTTHA, EPU, ST, TNB, PTM, etc.) however there is no specific focal point if any data for RE is required. ST has published the SREP Guidelines, application forms, and process flowchart which are rather limited information.

Presently the responsibility of collecting and depositing relevant data for RE rests with PTM. The Energy Information Bureau in PTM provides information about RE but it requires time to be digested for relevance to business people in deciding to allocate their capital to an RE project or to another venture.

3.8. Lessons Drawn from Key Issues

The current RE policy development and scenario in the country provides real life evidence for changes that needed to be introduced. Without such proof, many detractors of RE policy would raise the same suggestions (i.e. let the market decide, Government should not intervene) that were tried without success.

The lessons which can be drawn from the facts and evidence are:

(a) Relying solely on market forces when clear constraints exist will not produce the desired outcome.

(b) There is a need to acknowledge the requirement for the introduction of proper RE price setting actions and the applicable principles to produce an efficient RE price, and its financial implication for both the utility and consumers.

(c) The cost of RE should be shared by all members of society. The utility will not agree to bear the costs of RE power (due to the higher RE price) without there being an increase in tariffs. Since tariff revisions occur infrequently and are politically sensitive, imposition of a higher RE price without a consequential increase in tariffs creates a "regulatory squeeze" on the utility. There is a need to address this predicament.

(d) The need for a proper regulatory framework equipped with the necessary tools and legitimacy to address specific market failures and constraints, whilst signalling a strong commitment by Government towards RE.

(e) Poor governance affects the participation of stakeholders and legitimacy of the action.

(f) Regulatory oversight and policy implementation should be undertaken by separate organisations that are both fully transparent and accountable. This separation provides an opportunity for proper monitoring of progress and to address problems early on.

(g) Information asymmetry needs to be addressed to minimise market failure.

(h) Access to and type of information should be made available expeditiously to assist the private firm's decision making process with regards to investing in RE.

14 Note: Several studies have been carried out in Malaysia through bilateral international assistance programmes. Many seminars and conferences have been held.

3.8.1. Actions Required for RE Development

Based on the aforementioned lessons, the actions need to be taken are:

(1) Introduce a regulatory framework which addresses the following key points:
   (a) Market failure issues pertaining to RE plants including information asymmetry and the existing constraints;
   (b) Provide certainty to investors;
   (c) Minimise regulatory or political capture by interested parties;
   (d) Setting of RE prices based on sound economic principles;
   (e) Establishment of an effective implementing agency for renewable energy development;
   (f) Provide for society to contribute towards the cost of RE (via a contribution system based on consumption of energy); and
   (g) Creation of a fund in which the contributions are to be paid into including the terms of operation and use of the fund.

(2) Develop a cost sharing mechanism and determine payment obligations;

(3) Introduce good governance system to ensure consistency of applications;

(4) Introduce clarity of roles between the implementing agency and the agency tasked with oversight functions to ensure full accountability; and

(5) Disseminate relevant and pertinent information to firms intending to participate in the RE industry, to minimise information costs.

Details of the action items are explored later in Chapter 7.

3.8.2. Summary

The actions identified in 3.8.1 above together with the lessons are summarised in Table 3.3 below:

Table 3.3: Summary of Lessons Drawn and Required Actions

Lessons drawn from real-life situation	Actions required
(1) Inappropriate to rely solely on market forces, when clear constraints exist, will not produce the desired outcome;	Introduce a new regulatory framework to address market failure issues pertaining to RE plants and the constraints.
(2) RE prices should be based on clear economic principles and to manage the financial implication for the utility;	RE prices must be based on sound economic principles for finally achieving full cost recovery. Anything less than full cost recovery or efficient prices will affect the viability of RE project. There is a need to introduce a new regulatory framework that: (i) Empower the regulator; (ii) Sets the applicable principles for RE price setting based on sound economic principles of efficiency; (iii) Provide for the cost of RE to be borne by society at large (via a contribution system based on consumption of energy).
(3) The cost of RE should be shared by all members of society, because it is unreasonable to expect the utility to bear the higher costs of RE power without an increase in tariffs. Since tariff revisions occur infrequently and are politically sensitive, imposition of a higher RE price without a consequential increase in tariffs creates a "regulatory squeeze" on the utility. There is a need to address this predicament.	For cost to be shared by society a mechanism needs to be provided in a law that: (i) Determines the manner of calculating the contribution; (ii) Obliges a person to pay; and (iii) Identifies the terms of operation and use of the fund. This can only be done through the introduction of an appropriate statute.
(4) The need for a proper regulatory framework	Develop the appropriate regulatory framework which is rule-based to provide certainty to investors and minimise regulatory or political capture by interested parties.
(5) Poor governance affects the participation of stakeholders and legitimacy of the action;	Prescribe a good governance system within the regulatory framework to ensure consistency of application and certainty to investors.
(6) Oversight and implementation function needs to be in separate organisations for accountability;	Introduce clarity of roles between the implementing agency and the agency tasked with oversight functions to ensure full accountability
(7) Information asymmetry needs to be addressed	Introduce a regulatory framework that address information asymmetry problems, such as by prescribing the terms and conditions of a REPPA without any limitation
(8) Access to and type of information should be made available expeditiously in order to assist in the private firm's decision making process with regards to investing in RE.	Disseminate relevant and pertinent information to firms intending to participate in the RE industry, to minimise information costs.

4. NEED FOR RE POLICY AND ACTION PLAN

4.1. Introduction

A Renewable Energy Policy is essentially a policy for change by sending a clear message to all stakeholders (including society at large) of the importance and necessity of sustainable development. Continuing with the old ways is no longer a viable and sustainable option for Malaysia, and all stakeholders must take on a contributory role. A business-as-usual approach is no longer tenable. There must firstly be recognition and acceptance that any RE policy is a convergence of energy, industry, environment, green technology and information dissemination policies. Such a convergence provides both tremendous challenge and opportunity in its design.

It must further be acknowledged that Government policy provides the market with proper signals which are translated into investment decisions by businesses. For example if Government were to introduce a policy on imposition of a carbon tax on firms which emit CO_2, then this signals to the firms to either exit the market, or to invest in CO_2 sequestration or storage systems or improve their production process to minimise the CO_2 emission to the permitted quantity if they wish to remain in the market. The choice of action in response to the signal sent by Government is left to the individual firm to select. Clear and robust government policy is necessary to push to overcome business inertia, which can act as an impediment to change. As a consequence the importance of policy to business decision cannot be understated.

There are six reasons for a Renewable Energy Policy:

Reason 1	To address current market failure;
Reason 2	To provide long term sustainability;
Reason 3	To stimulate a new growth industry;
Reason 4	To recognise the importance of the environment as an economic growth contributor;
Reason 5	To develop human capital resources particularly in the field of R&D in RE technologies; and
Reason 6	To improve the coherence of current policy.

4.2. National Green Technology Policy

The Federal Government having realised the important role of green technology has launched the National Green Technology Policy to spearhead green technology sector development in the country. The National Green Technology Policy has a strategic role which spans beyond achieving energy autonomy and mitigating climate change, which is one of the emerging drivers of economic growth for our country.

The government envision green technology is the choice made by most countries and would play a vital role in mapping out a low carbon economy for the country. The government had made a commitment to the global society that Malaysia would seek to reduce its emission of GHG thus apart from contributing to mitigation measures to combat climate change, green technology is to be the driver of the nation's economic growth.

Four Pillars of National Green Technology Policy[15]

The National Green Technology Policy is built on four pillars:

- Energy: Seek to attain energy independence and promote efficient utilisation;
- Environment: Conserve and seek to enhance the natural environment and promote mitigation measures;
- Economy: Enhance the national economic development through the use of technology; and
- Social: Improve the quality of life for all.

The RE Policy and Action Plan is an initial effort towards the progress of the National Green Technology Policy to ensure the government's effort would bear fruit and the vision become a reality.

4.3. Lessons Learnt from Germany: World Leader in Renewable Energy Technology Applications

Germany's renewable energy programme begun with the 250 MW windmill prototype programme in 1986. In 1989, it introduced the 100 MW demonstration programme and subsidy, which was increased to 250 MW two years later. In 1990, the government launched the 1,000 Roof PV Programme which was later upgraded to the 100,000 solar roofs programme in 1999.

15 Source: Green Technology Policy, 2009

In terms of RE pricing, Germany adopted the Electricity Feed-In Law in 1991, but replaced it with the Renewable Energy Sources Act (EEG) in 2000. The changes brought about by the EEG Law included different tariffs for different technologies. This law is particularly instrumental in increasing the solar PV tariffs by 6 times as well as a declining tariff or degression (-5% p.a.) over a defined period (based on the premise that cost of production of new technologies such as wind and solar PV would come down as the market grows and more vendors participate[16]).

Figure 4.1 illustrates the trend of electricity generation from RE sources among EU-27 member states. This 2006 data shows Germany is the leader in using renewable sources for electricity generation.

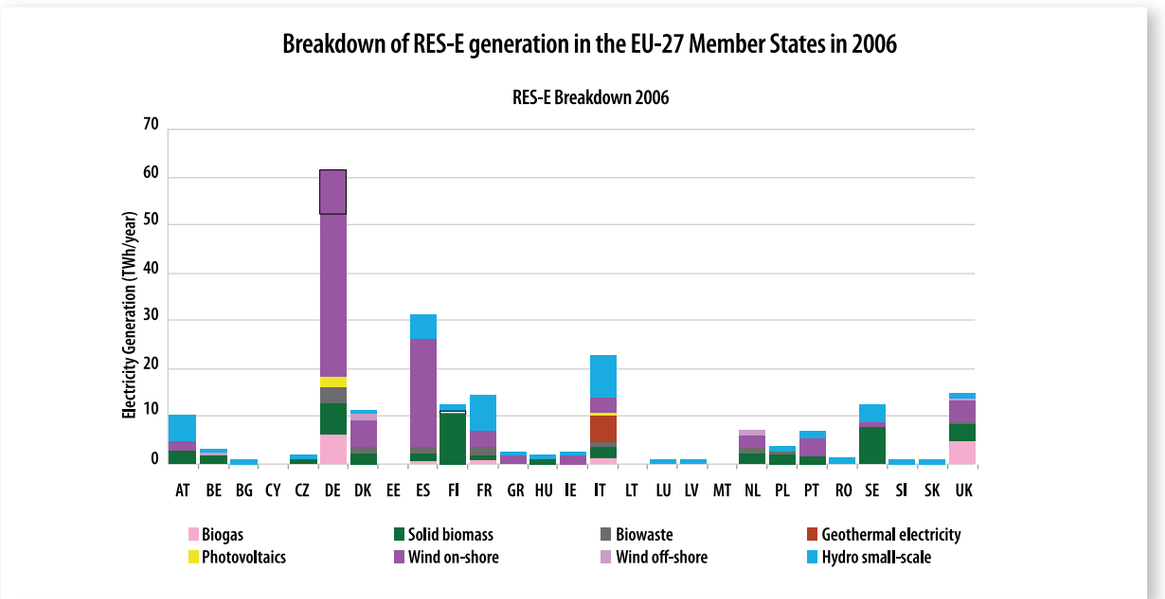

Figure 4.1: Electricity generation from RE sources among EU-27 Member States in 2006 shows Germany's leadership in renewable electricity generation

The rise in electricity generation from renewable sources is more significant after the introduction of the new EEG Law on 1st April 2000 as shown in Figure 4.2 below.

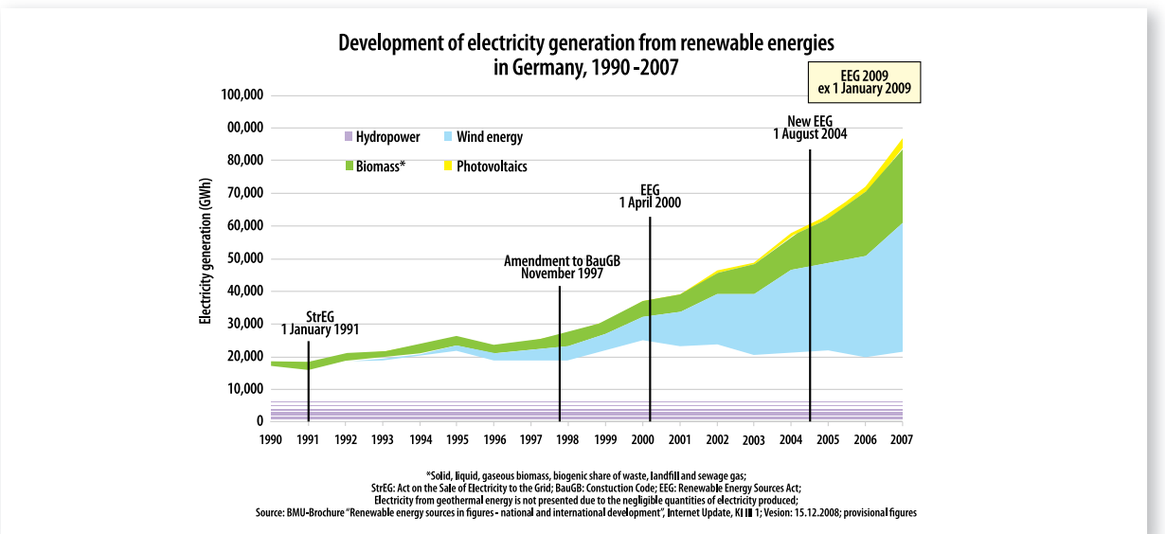

Figure 4.2: Rise of electricity generation from RE in Germany (1990-2007)

16 See, for example, Energy Information Administration (2005), *"Policies to promote non-hydro renewable energy in the United States and selected countries,"* U.S. Department of Energy.

The expansion of renewable energy sources in Germany has been an unprecedented success. Since the beginning of 2000, the share of the total final energy consumption from RE has more than doubled. The German Government had set the target of generating 12.5% of gross electricity consumption from RE by the year 2010. By 2007, this target had already been significantly exceeded at 14%.

The development status of renewable energy sources in Germany in 2007 are:

- 8.6% of total final energy consumption (electricity, heat, fuel; 2006: 7.5%).
- 14.2% of gross electricity consumption (2006: 11.7%).
- 6.6% of final energy consumption for heat (2006: 5.8%).
- 7.6% of fuel consumption (2006: 6.3%).
- 6.7% of primary energy consumption (2006: 5.6%).
- Wind energy: following a gross increase in installed capacity of 1,667 MW in 2007, a total of 22,247 MW was installed as at end of 2007, and around 39.5 TWh of electricity produced.
- Bio-energy: more than 17.4 TWh was produced from solid, liquid and gaseous biomass (the total figure including biogenic waste, landfill gas and sewage gas was 23.8 TWh).
- Hydro-power: Installed capacity remained more or less constant where 20.7 TWh of electricity produced.
- Solar power: With an additional 1,100 MW of capacity built in 2007, with 3.5 TWh of electricity produced. The installation of new solar thermal collector area has fallen but remains at a high level of around 940,000 m^2 with a total installed area of 9.6 million m2.
- Geothermal: Germany's second geothermal power plant has begun operation in 2007.

4.3.1. Economic benefits from EEG Law

In recent years, RE has developed into a significant economic contribution in Germany. Between 2003 and 2007, total turnover from RE sources increased from about 10 billion Euros to approximately 25 billion Euros, corresponding to an increase of 150% from the year 2003. The level of total turnover in 2007 (25 billion Euros) is equivalent to the tax revenues of the federal state of Baden-Wuerttemberg in 2006 (about 24 billion Euros).

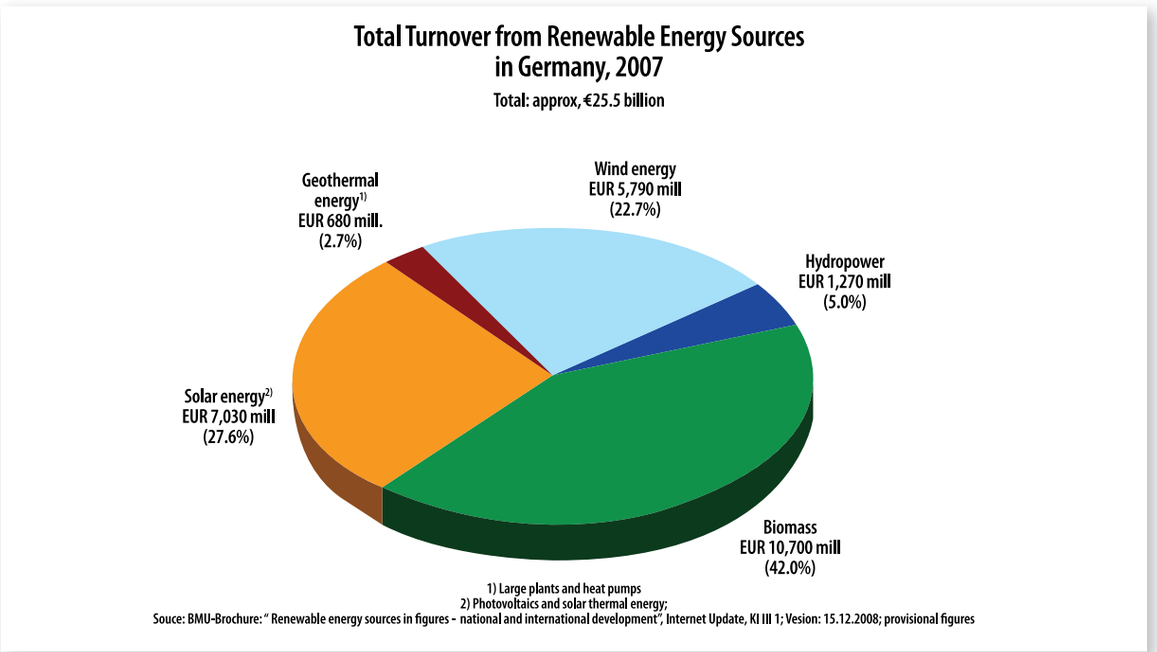

Figure 4.3: Total turnover from RE in Germany in 2007

Renewable energy is an important jobs creator for Germany and the continuous expansion in 2007 helped to create or secure numerous jobs as in Figure 4.4. In 2007, it is estimated nearly 250,000 jobs in Germany were attributed to the RE sector. This translates into an increase of about 55% compared to 2004 (approximately 160,000 jobs). At least 60% of the jobs are the direct effect of the EEG Law. This is supplemented by jobs associated with public and charitable funding to promote renewables including public sector employees.

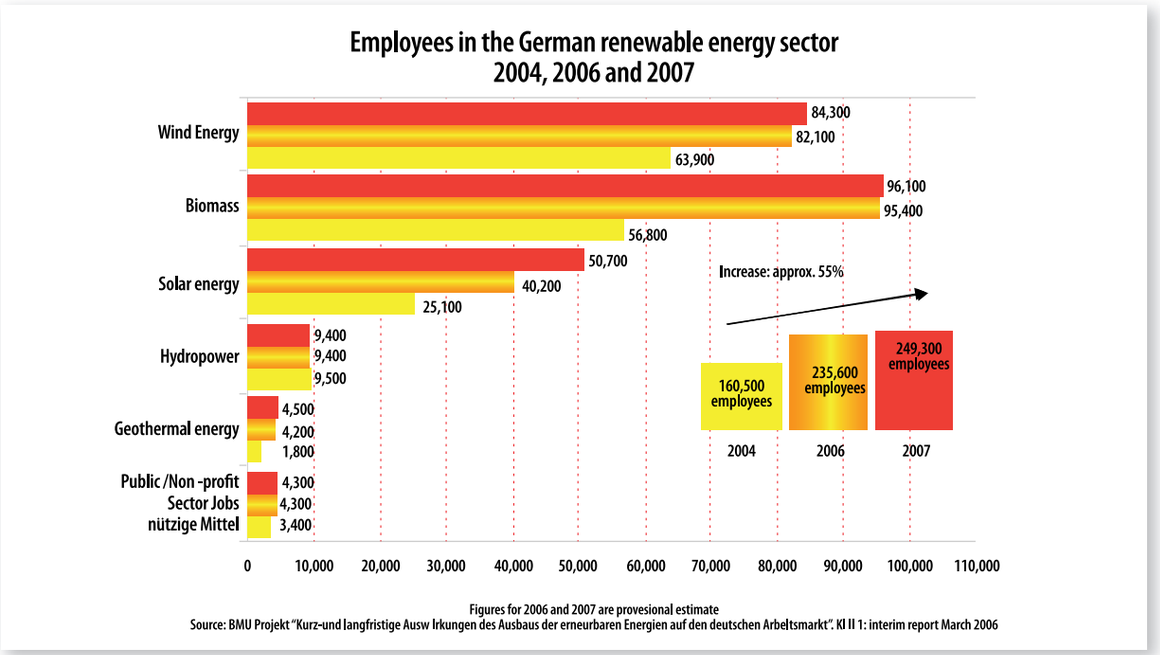

Figure 4.4: Job figures from RE in Germany (2004 – 2007)

4.3.2. Cost to Electricity Consumers

Electricity from renewable energy sources which is eligible for remuneration under the EEG Law (feed-in tariff) is still more expensive from conventional energy sources. To date, the resulting total costs have been calculated according to the following formula:

EEG apportionment = EEG quota x (EEG average fee - avoided electricity purchase price)

4.3.2. Cost to Electricity Consumers

The feed-in tariff (FiT) paid to plant operators are published by the Association of German Network Operators in an audited annual account. The electricity purchase costs avoided as a result of FiT can only be approximated, since these are trade secrets and there is no general database available.
The cost of FiT which is shared among the electricity consumers (including the special provision for electricity intensive companies), is equivalent to just under 5% of the costs for one kWh of household electricity in 2007 (an average of 20.7 cents/kWh). In 2007, the cost of the FiT to an average household with an electricity consumption of 3,500 kWh per annum was around 3 Euros per month.

4.3.3. Effects of RE on Electricity Prices

When assessing the economic effects of the promotion of RE by the EEG Law, as well as considering the market value of the FiT electricity, it is also necessary to take into account the impacts of electricity generation from RE on wholesale electricity

market prices. The fact that priority is given to the feed-in of renewables would in the short term, lead to a lowering of electricity prices on the wholesale market.

The market price of electricity is determined by the most expensive power station still needed to satisfy the demand for electricity (merit order). Because priority is given to RE via EEG Law, demand for conventional electricity is reduced. In accordance with the merit order, therefore, the most expensive power plants are no longer needed to meet the demand, and the market price falls accordingly. This effect is known as the merit order effect, as shown in Figure 4.5.

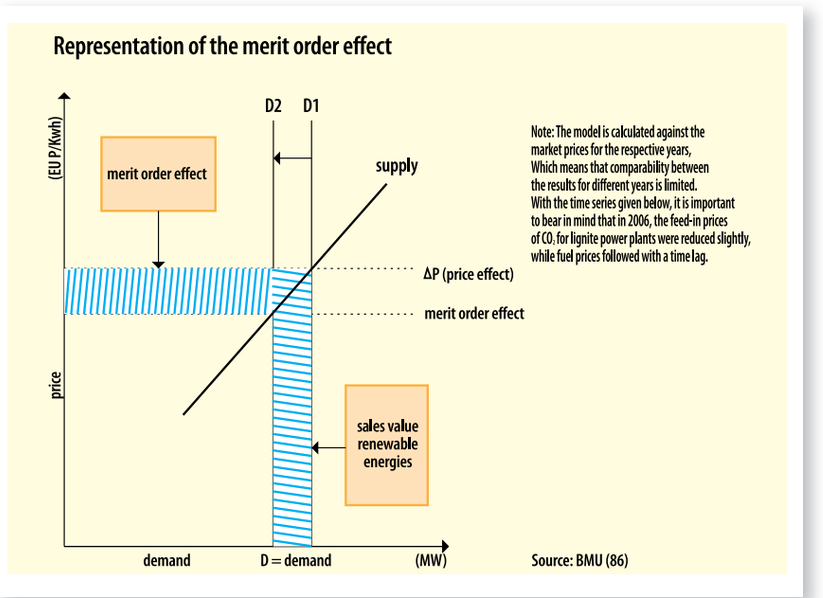

Figure 4.5: Merit order effect

Scientific studies commissioned by the BMU, prepared on the basis of a detailed electricity market model, suggested that over the past three years, the merit order effect has reduced the cost of electricity purchased via the spot market by between 2.5 and 7.8 Euros/MWh (see Figure 4.6 below). Hence, the merit order effect reduces the purchasing costs to electricity suppliers, which in turn tends to lower electricity prices.

	Simulated EEG electricity generation	Average Price reduction	Volume merit order effect	Specific effect	Average EEG feed-in fee
Year	(Twh)	(EUR/MWh)	(bn.EUR)	(EUR/MWH$_{EEG}$)	(EUR/MWH$_{EEG}$)
2004	41.5	2.50	1.65	40	92.9
2005	45.5	4.25	2.78	61	99.5
2006	52.2	7.83	4.98	95	109.0

Figure 4.6: Reduction of electricity cost due to merit order effect

4.3.4. R&D on RE Technologies

Research and development projects (R&D) on renewable energy sources are eligible for support under the Federal Government's Energy Research Programme. Investments in renewable energies help to conserve scarce resources, reduce dependency on energy imports, and protect the climate and environment. Technical innovations help to reduce the cost of renewable electricity. The German Environment Ministry (BMU) is responsible for application oriented project funding in the field of renewable energy sources (except biomass).

The BMU funds R&D in the field of renewable energies, also with a view to enhance job market policy. Research funding strengthens the leading international position and competitiveness of German companies and research institutions helping to create jobs in a growing world market.

The aims and main focus of research support by the German government are:

- To lower the cost of renewable energy systems;
- To ensure ecologically sound and nature-friendly advancement;
- To promote resource-conserving production methods;
- To optimise integration into the electricity grid;
- To ensure the rapid transfer of technology from research to market;
- To promote system-based integrated solutions, such as combinations of thermal insulation, house technology and renewable energies in the buildings sector;
- To encourage transboundary projects and technologies for use primarily in other countries;
- To strengthen the competitiveness of German companies and research institutes;
- To promote cross-sectoral research (economic issues, jobs, system studies etc.).

In 2007 a total of 177 new projects with a total volume of more than 100 million Euros were approved by the BMU in the fields of photovoltaics, geothermal energy, wind energy, low-temperature solar thermal energy, solar thermal power plants as well as overall strategy and overarching issues. The main share of newly approved funding went to photovoltaics and wind energy. There is a particularly pressing need for R&D work in the field of photovoltaics because the FiT rates show the highest degression in these areas, and it is vital suitable cost reductions are achieved. In addition there is still a huge potential for innovation in this field. Ultimately, it is also to safeguard Germany's leading international position in photovoltaics research and improving the competitiveness of German companies in a rapidly expanding global market.

In the area of wind energy research, the biggest challenges are in the offshore sector. In 2007, approval was granted for the first research projects in Germany's first offshore test field "alpha ventus". High-level support is also given to research in other areas.

4.3.5. Scenario for an Intensified Expansion of RE in Germany

The 2006 scenario in Germany illustrates the potential development of energy supply until the year 2050. Through the intensified expansion of renewable energy sources and more efficient use of energy, it is possible to reduce CO2 emissions by 80% compared to the 1990 levels. It is anticipated that as early as 2020, 18% of final energy consumption and around 27% of gross electricity generation can be met from RE sources.

By the year 2050, RE could account for approximately half of total primary energy consumption. Also by then 80% of electricity consumption could be derived from RE and approximately 48% of heat consumption. Thus renewables could potentially contribute 42% to fuel consumption.

4.4. Reasons for RE Policy and Action Plan RE

4.4.1. Reason 1: To Address Current Market Failure

The details of market failures have been discussed in Chapter 3.1. A new RE Policy is critically needed to devise strategies in addressing the RE-specific market failures to avoid perpetuating the associated inefficiencies into the future. This provides a clear signal to businesses on the importance of RE as a source of electricity to the country which can positively influence the investment decisions by these firms.

4.4.2. Reason 2: To Provide Long Term Sustainability

Long term sustainability is vital for the RE policy because of the length of time needed for the technology to become cost competitive (grid-parity). This means the policy designed needs to militate against stop-start strategies, have clarity of outcomes and secure the commitment of all stakeholders.

4.4.2.1. Avoid Stop and Start Strategies

Countries that adopted short-term strategies usually ended up with "start-stop" RE development efforts and lack long-term commitments in the utilisation of renewable energy resources. In these short-term targets, the contribution of RE in total fuel mix is considered insignificant and unpredictable for long-term dependability and electric utilities cannot be blamed for continuing to ignore RE and focussing instead on planning for large centralised conventional or nuclear power plants in future generation mix.

The German RE programme began in 1986 and the policies have been enhanced and improved over the last 23 years. The key lesson learnt in the German experience is that the significant increase in RE power plants and businesses was when an effective incentive mechanism was introduced i.e. the feed-in-tariff and supported by legislation (Renewable Energy Sources Act).

As a result of this strategy the policy was no longer subjected to the changes in the political office nor was there a concern the policies would take a stop-start approach. Successive governments did not change the course of the policy but learnt lessons and enhanced the policy which has been implemented.

4.4.2.2. Sufficiency of Outcomes

The outcomes of a policy need to be clearly identified, especially if public funds are needed to provide soft loans or other financial assistance. The need for specifying outcomes enables the policy to gather support from the stakeholders since they would recognise the policy is to produce a public value[17].

The current RE policy states that RE is to be used as a fifth fuel and targets (in terms of generation capacity to be installed) are stated in the Malaysia Plans. However, the convergent nature of RE means the generation capacity which is only one dimension of the policy and the industry growth or environmental improvements need to be identified, in order to complete the RE Policy.

4.4.2.3. Commitment by All Stakeholders

There is a need for long term commitment by all stakeholders with Government playing a leadership role. In Malaysia where the leadership role has been played by Government (with industry taking a "follow-the-leader" approach) the success or failure of any new policy requires the presence of clear political will, change champions and supportive regulatory framework.

Therefore revising the existing policy to secure such commitment is necessary. Currently the focus of the policy is on RE as a fuel. This immediately excludes the public who are key stakeholders from the purview of the policy. It becomes a specific industry policy, the value of which is not seen or recognised fully by stakeholders, particularly the public. Accordingly, it is necessary that a new RE policy be developed in order to secure the commitment of all stakeholders.

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17 Note: Public value is a concept introduced by Moore, to identify what citizens should expect of public managers. Thus public sector managers should be focusing on creating public value by their actions. See Moore, M.H. (1995) "Creating Public Value" Harvard University Press at p.27 *et seq*.

4.4.3. Reason 3: To Provide Focus for a New Growth Industry

Currently there is limited progress of RE development in the country. Apart from the SREP projects using the identified RE sources as fuel for electricity generation to date, there have been four foreign direct investments to set up solar PV manufacturing facilities providing employment opportunities. The companies are; First Solar (USA) in Kedah, Q-Cells (Germany) in Selangor, SunPower (USA) in Melaka, and Tokuyama (Japan) in Sarawak.

Various studies undertaken by REN21 and the UN have identified the different drivers which are able to spur market growth in renewable energy. The most notable drivers are:

(a) Investments in technology research, development, and demonstration (RD&D);
(b) A supportive policy and regulatory frameworks;
(c) Energy security issues;
(d) Environmental and climate change concerns; and
(e) Local and regional development opportunities these technologies offer.

Available data shows about 2.3 million people worldwide work either directly in renewables or indirectly in supplier industries; 230,000 jobs were created by the RE industry in Germany in 2006; whilst the Spanish RE industry now employs some 188,000 people directly and indirectly.

Worldwide spending in RE rose from USD55 billion for 2006 to USD71 billion in 2007. The two largest RE sub-sectors are wind and solar, whose combined growth significantly exceeds the other sub-sectors as illustrated in Figure 4.7 below.

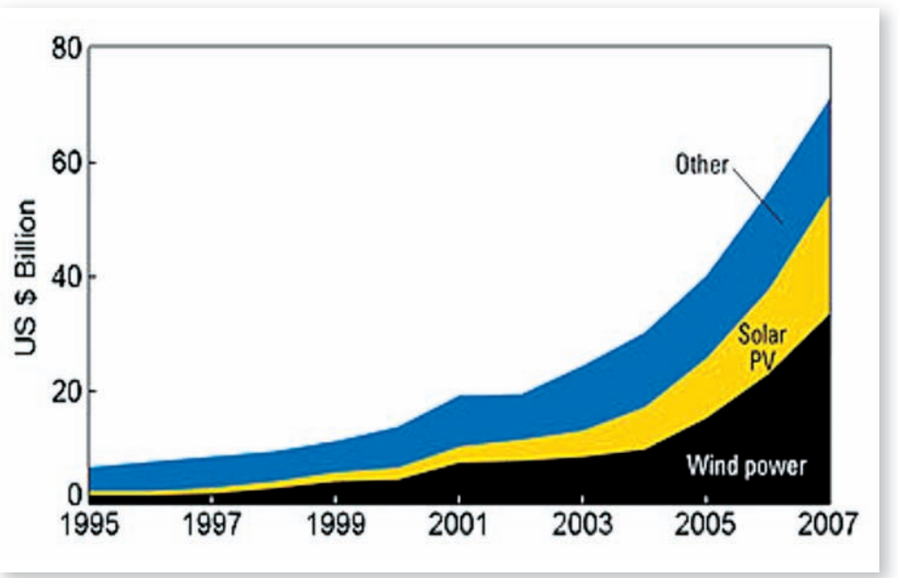

Figure 4.7: Global renewable energy investment growth (1995-2007)[18]

The growth of approximately 40% means there is tremendous opportunity for Malaysian businesses to participate in; particularly as a means to cushion the impact of the 2009 global economic crisis.

At the same time developing and under-developed countries are catching up in the RE industry; for example according to Worldwatch Institute ,[19]"Kenya has one of the largest and most dynamic solar markets in the developing world. There are 10 major solar PV import companies, and the Kenya has an estimated 1,000-2,000 solar technicians. In Bangladesh, Grameen Shakti has installed more than 100,000 solar home systems in rural communities in a few years – one of the fastest-growing solar PV programmes in the world – and is aiming for 1 million by 2015, along with the creation of some 100,000 jobs for local youth and women as solar technicians and repair and maintenance specialists".

18 Source: REN21 (2008) Renewables 2007 Global Status Report (Paris: REN21 Secretariat and Washington, DC: Worldwatch Institute) – available at http://www.ren21.net/pdf/RE2007_Global_Status_Report.pdf (accessed on 17 Feb 2009)
19 See Jobs in Renewable Energy Expanding by the WorldWatch Institute available at http://www.worldwatch.org/node/5821?utm_campaign=vsonline&utm_medium=email&utm_source=green_jobs#notes (accessed on 17 Feb 2009)

Opportunities in this sector lie in the manufacturing and export of RE components (e.g. turbines or components) or feed-stock (e.g. silicon) although currently undertaken by India and China[20]; the creation/emergence of support industries to manufacturing facilities (e.g. outsourcing R&D services); and the creation of specialized service providers, which can be exported to the region; need to be capitalised.

Therefore an RE policy which provides the impetus and incentives for both large enterprises and SMEs to invest in the RE sector will provide positive effects and outcomes, via export activities, job creation, foreign and domestic direct investments, emergence of support industries and services (e.g. solar technicians, maintenance specialist) and technology development; thereby pushing Malaysia up the knowledge value chain.

4.4.4. Reason 4: To Recognise the Importance of the Environment as an Economic Growth Contributor

According to a 2005 report[21], the world market for environmental goods and services is estimated to be worth 425 billion Euros and is likely to grow to 565 billion Euros by 2010. Michael Porter of Harvard University showed that countries with high environmental standards often have market-leading firms and record better economic performance compared to those with lower standards. This is because high standards can stimulate innovation both in firms selling environmental solutions and in those having to comply.

The conclusion is that there is now significant evidence from international research that good environmental management and regulation does not impede overall competitiveness and economic development; but can be beneficial by creating pressure which drives innovation and alerts businesses about resource inefficiencies and new opportunities.

4.4.4.1. Spurring Innovation and RE Take-up

Fossil fuel combustion and the corresponding increases in carbon emissions is identified as one the main contributor to the global warming problem. Malaysia ratified the Kyoto Protocol in 2002 thus can do its part under the United Nations Framework Convention on Climate Change (UNFCCC). The mitigation measures and response need to be taken to the threat of global warming by supporting RE projects which will reduce green house gas (GHG) emissions. In addition, RE projects can lead to very cost-effective emission abatement opportunities and represent choice opportunities for investments under the Clean Development Mechanism (CDM).

In Malaysia, the total CO_2-equivalent emissions for the year 2006 amounted to 169,829 $GgCO_2$. The power sector is the major and largest contributor with 56,203 $GgCO_2$ which accounted for 33% of the emissions. Whilst the various types of fossil fuels used in power generation, contribute various amounts of GHG into the atmosphere, biomass energy is carbon-neutral, releasing the same amount of carbon dioxide as it absorbs, while wind and solar has zero emissions.

> ***Percentage of CO_2-equivalent of different fossil fuels***
> *Natural gas based power generation contributed 57% of the total power sector emissions and coal based power generation contributed 40%. However, coal only accounted for 29% (5,743 ktoe) of the total fossil fuel consumed by the power sector as compared to 69% of natural gas (13,761 ktoe), as coal emits more CO_2-equivalent per MWh compared to natural gas.*

The current existence of CO_2-equivalent and GHG emissions from various economic sectors in the Malaysian environment provides an opportunity for the new RE policy to address ways and means by which such emissions can be mitigated. Evidence available shows that providing for stricter environmental standards will cause innovation to emerge within companies affected and at the same time result in environmental goods and services being provided. Such environmental standards can also spur the take up of RE as a clean energy source and as a counter-measure to the current emissions by conventional energy producers.

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20 Note: In China, the two primary domestic manufacturers were Goldwind and Sinovel Wind, with 33 percent and 6 percent of the Chinese market, respectively, in 2006. By 2007, there were more than 40 Chinese firms aspiring to manufacture wind turbines commercially, many of which were engaged in prototype development and testing, and a handful that were beginning to produce commercial turbines during 2006/2007 [see Renewables 2007 Global Status Report available at http://www.ren21.net/pdf/RE2007_Global_Status_Report.pdf (accessed on 17 Feb 2009)]

21 See "The Contribution of Good Environmental Regulation to Competitiveness", (Nov 2005) available from http://www.eea.europa.eu/about-us/documents/prague_statement/prague_statement-en.pdf (accessed on 18 Feb 2009).

Therefore an opportunity exist for an RE policy to recognise the importance of environmental management both as a source for a cleaner environment and as an economic contributor. This means the RE policy can and should introduce specific initiatives to provide a push to overcome business inertia, to alert and educate companies about resource efficiencies and the potential for technological improvement.

4.4.5. Reason 5: To Spur RE Technological Diffusion

Adoption of RE technology into the mainstream requires an effective diffusion process. The adoption of all forms of new technology follows an "S" curve, with the primary difference being their length of time. Shapira (1996)[22] points out that "technology can diffuse in multiple ways and with significant variations, depending on the particular technology, across time, over space, and between different industries and enterprise types. Moreover, the effective use of diffused technologies by firms frequently requires organizational, workforce, and follow-on technical changes".

Furthermore the economics of diffusion needs to be carefully considered since diffusion is not a trivial process, takes a long period of time to occur and is equally important as innovation. A new technology would not have an economic impact until it becomes widespread in the economy.

RE technology is experiencing the same diffusion process and the speed or pace of the diffusion domestically is reflected in the presence or absence of two key drivers namely:

(a) Significant technical hurdles (skills-driver); and

(b) Significant commercial hurdles (economic-driver).

Studies[23] have shown there is a positive correlation between skill and new technology adoption. The current policy focuses on RE only as fuel and it is not suited for promoting or accelerating RE technology diffusion. Thus new policy measures are needed to promote or accelerate the diffusion of technology and to address the impediments in technology diffusion by focussing on up-skilling and reducing the economic hurdle to technology adoption.

4.4.6. Reason 6: To Improve on the Coherence of Current Policy

A review of the existing renewable energy policies evidenced the lack of coherence amongst the various current policies. This has the unintended effect of sending mixed signals to the market on the importance of RE relating to commitment towards RE introduction, and the recognition of the cost of the environmental externalities produced by the business-as-usual approach.

The lack of coherence of the RE Policy with the other policies is shown below:

(a) In the 9th Malaysia Plan (9MP) emphasis is given to coal as a fuel for generating electricity as coal is decided as a fuel for generating electricity. The share of coal will be increased to 36.5% by 2010 to address the issue on the security of electricity supply together with minimising generation cost while the environmental objectives are taken into consideration. This has put less emphasis on the role of RE as the fifth fuel which is an indication that RE may not be high on the Government's policy agenda;

(b) Technology-specific supports for RE development are not actively pursued by the government. Malaysia may already have the advantage to certain technologies e. g. biomass and biogas which have managed to enjoy some incentives provided for by the government. However some technologies e.g. PV are still in the infancy stage and needs more facilities and incentives to be provided for so that the development could be fast tracked.

(c) The promotion of environmental self-discipline by the National Policy on the Environment 2002 via a "self-regulatory" framework is not consistent with the polluter-pays principle it preaches since there is no incentive for a polluter to want to achieve the next best situation (e.g. minimise pollution levels) without regulatory intervention.

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22 Shapria, P (1996) "An Overview of Technology Diffusion Policies and Programmes to Enhance the Technological Absorptive Capabilities of Small and Medium Enterprises", A background paper prepared for the Organization for Economic Cooperation and Development Directorate for Science, Technology and Industry, available at http://www.prism.gatech.edu/~jy5/pubs/oecdtech.htm (accessed on 18 Feb 2009).

23 See Bartel and Lichtenberg (1987) "The Comparative Advantage of Educated Workers in Implementing New Technology," Review of Economics and Statistics 69 (1987), pp 1-11, Doms, Dunne, and Troske (1997) "Workers, Wages, and Technology," Quarterly Journal of Economics 112 (1997), 253 - 290, Caselli and Coleman (2001) "Cross-Country Technology Diffusion: The Case of Computers," American Economic Review 91 (2001), 328, all cited in Mukoyama, T. (2003) "A Theory of Technology Diffusion" available at http://129.3.20.41/eps/mac/papers/0303/0303010.pdf (accessed on 18 Feb 2009).

4.4.6.1. Effect of Mixed Signals

Government policies provide the market with signals for proper and sound investment decisions by businesses, with the choice of action left to the individual firm to select. When mixed signals are sent to the business sector the degree of uncertainty over Government's commitment towards RE is exacerbated thus affecting firms' investment decisions.

These mixed signals are:

(a) RE development is not an important agenda for the government compared to the conventional fuel source for electricity generation.

There is a strong emphasis on supply and diversification fossil fuel for power generation as set out in the National Energy Policy, Four-Fuel Diversification Policy, the National Depletion Policy and the 9MP. The introduction of the Fifth Fuel Policy provided the impetus for RE development; however there is no comprehensive and effective mechanism to spearhead the development in a systematic manner and the progress has been rather minimal after nine years of implementation.

(b) A "business-as-usual" approach is preferable to one that requires change.

There is insufficient policy support for managing environmental externalities because:

(1) The National Policy on the Environment 2002 emphasises polluter-pays principle, whilst on the other hand the Environmental Quality Act 1976 does not prescribe minimum standards of air or noise quality. The Act is seen without appropriate incentives and penalties, in which for firms to adopt the strategy of self-regulation are unlikely to act (voluntarily); and

(2) The National Energy Policy strongly advocates the supply objective with limited concern and emphasis on the environmental objective. However despite acknowledging emission form the energy sector constitutes one of the biggest contributors to the detriment of the environment, there is minimal effort from the government to address this critical issue. This provides the signal to the market that the importance of environmental protection in the country is of low priority.

There are currently different signals being conveyed to the market. The government needs to address this matter quickly and urgently. For the market to respond positively the government needs to undertake the necessary action and strategies to avert the current situation.

5. RENEWABLE ENERGY RESOURCES AND SMART TARGETS

5.1. Importance and Relevance of RE in Meeting Malaysia's Energy Requirements

In planning for the electricity requirements of the country, the Government, Regulator (ST) and the Utilities (TNB, SESB) presently do not consider RE to have any significant impact on power generation. Thus RE contribution is not factored into generation expansion analysis because:

(a) The growth of RE in Malaysia to date has been insignificant. Using historical growth data to project RE scenario into the future is a risky move as it puts the country's energy security in a precarious situation. Ensuring the nation's sufficient and affordable supply of energy is paramount to ensure its stability in pursuit of economic development and all these has put renewable energy at a disadvantage.

(b) The potential of renewable energy is still perceived to be small and insignificant and would not be able to serve as a long-term solution to the energy problem in this country.

(c) Energy from RE facilities is considered not dependable as compared to conventional energy sources as they are often subject to fluctuations in fuel availability or primary energy such as wind and sunlight.

(d) RE facilities could not compete with conventional energy in terms of scale on unit sizes.

(e) RE is expensive compared to conventional energy sources.

Commonly, for the electric utilities, the options for future energy supply are from traditional fuel sources such as large scale hydropower, coal and gas. The choices made usually reflect the strong influence of fuel costs and the lack of internalisation of the costs of the environmental damages or negative impacts on the environment.

Fuel such as coal is seen to be more economic because there are still large coal reserves available globally. However the demand for coal is rapidly rising especially with energy-hungry countries such as China and India. For example it is well known that China is building a coal power plant every two weeks. Thus in the future using coal means that Malaysia would have to compete with these countries for the fuel which may not be viable for Malaysia. The continuation of Malaysia's use of natural gas to provide the fuel for energy generation cannot be sustained for the long term due to limited reserves we currently have. Also the impact of using carbon-based fuels for energy generation leads to environmental degradation and climate change. Large scale hydropower systems which are the most common source of renewable energy could be the preferred choice but have significant long-term environmental impact because of the destruction to the forests due to impounding.

Thus looking at these scenarios, alternative fuels need to be explored. Nuclear power has seen a new revival, as more countries look to nuclear power as a means to address their energy demands. Compared to other conventional energy sources (other than hydropower), it does not emit any greenhouse gases; but there are long-term nuclear waste disposal issues, risk of misuse and nuclear proliferation issues arising from waste fuel re-processing; which raises national security issues. Also selecting nuclear as an option would require a considerable amount of lead time and a significant amount of investment to be made.

Thus the time is right for the government to consider RE as a choice for sources of fuel for future power generation. It is clean as there is no or limited amount of greenhouse gases emitted, sustainable (biomass is available from our palm oil plantations), readily available and has a positive socio-economic development for the country. Finally the development costs for RE is expected to decline whilst the development costs for conventional energy is expected to rise.

5.1.1. Grid Parity

Grid parity occurs when the cost of generating renewable electricity is equivalent or cheaper than the cost of generating electricity from conventional fossil fuel or nuclear energy. The time for this to happen varies between countries or locations, depending on specific cost of the fuel, the peak energy cost as well as the external cost to protect the environment.

Electricity from RE has a higher initial cost as it is a new technology and not directly subsidised, while the costs of fossil fuel and nuclear energy are expected to continuously rise. When grid-parity is achieved RE would then be applied primarily due to economic reason as it would be the cheaper choice.

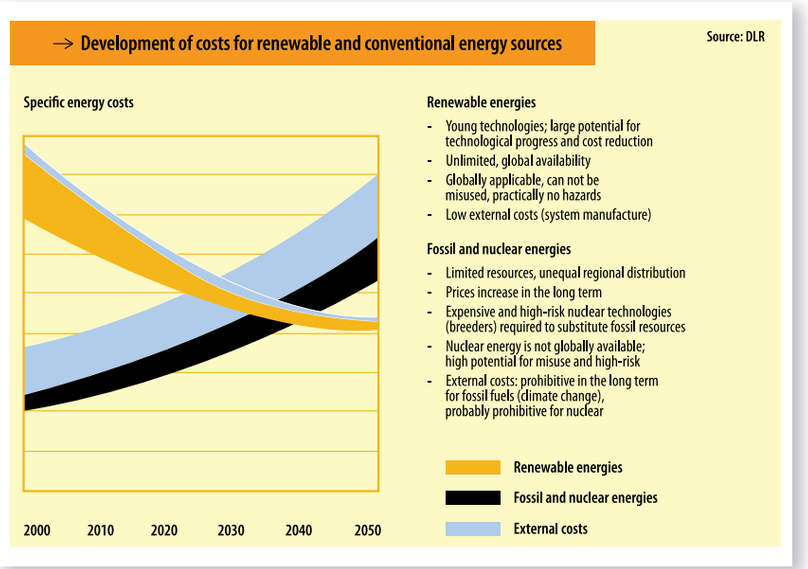

Figure 5.1: Costs of renewable and conventional energy sources[24]

5.2. Renewable Energy Resources in Malaysia

Malaysia is blessed with many indigenous RE sources. The RE sources identified are:

(a) Palm oil biomass wastes (usually EFB and PKS) and palm oil mill effluents;
(b) Mini-hydro;
(c) Solar power;
(d) Solid waste and land-fill gas;
(e) Wind energy* and geothermal*;
(f) Wastes and gases from agro-based* and farming industries*.

** Note: The detail resources potentials are yet to be fully examined and verified.*

The potential of some of these major RE resources are examined below to arrive at the targets set out in Chapter 5.7 of this report.

5.3. Biomass Wastes and Biogas Potential

Malaysia is the world's second largest producer of crude palm oil (CPO). The by-products from the mills processing palm oil include solid wastes from the empty fruit bunches (EFB), mesocarp fibres, palm kernel shells (PKS) and palm oil mill effluent (POME).

A study by PTM/SIRIM estimated that in 2002, 362 palm oil mills in the country processed about 59.8 million tonnes of fresh fruit bunches (FFB) and produced 11.9 million tonnes of CPO. From this a total of 22.6 million tonnes of solid biomass (EFB, fibres and PKS) and 41.9 million tonnes of POME were generated from the palm oil industry. The palm oil industry has since grown at an average rate of 7.5% p.a. and in 2006, more than 15.8 million tonnes of CPO were produced. In general, it can be concluded that all figures relating to EFB, POME and energy potential from wastes were all revised upwards by 33% from 2002 to 2006. By 2009, the numbers of palm oil mills in the country have grown to 417. Table 5.1 identifies the number of palm oil factories in Malaysia which can produce a quantity of biomass necessary for a 10 MW class EFB power generation plant. There are 17 factories located in Sabah and Sarawak, whilst 12 are in Peninsular Malaysia.

24 Source: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Germany

Table 5.1: Palm Oil Factories Producing >300,000 ton p.a. of FFB

State		Factory FFB Process Amount	
		more than 300,000 ton/yr	more than 250,000 ton/yr
Peninsular Malaysia	Kedah	1	2
	Pulau Pinang	0	0
	Perak	4	11
	Selangor	1	2
	N.Sembilan	0	1
	Melaka	0	2
	Johor	6	17
	Terengganu	0	0
	Kelantan	0	0
	Pahang	0	2
	Total	**12**	**37**
East Malaysia	Sabah	15	30
	Sarawak	2	9
Total		**29**	**76**

Source: Market Survey, Biomass Power Generation Industry in Thailand, Indonesia and Malaysia, Sumitomo Corp, 2009 (translated from Japanese to Bahasa Malaysia).

Based on the size of palm oil plantations in Malaysia, their annual production of biomass material is a maximum of 26 million tonnes per year. Of the total annual biomass production: EFB is 12.5 million tonnes, fibre 9 million tonne, and 5 million tonnes[26] palm kernel shells.

Regionally 60% of palm oil factories are from Peninsular Malaysia and 30% are from Sabah and Sarawak. The transport cost of biomass is estimated priced at USD 0.20/tonne/km; which needs to be considered when exploring the use of smaller plantations as fuel feeders, bearing in mind the location of the RE biomass plant.

The current utilisation of mesocarp fibres and palm kernel shells to generate steam and power for palm oil mills across the country because of their high quality as fuels and the ease in preparation, mean this source of biomass should be excluded in the estimation of biomass potential. PKS have a higher economic value as they have a market price of RM 120-140 per tonne for utilisation in the production of carbon black. This higher price (compared to RM 20 for EFB) also discourages the use of palm kernel shells as an RE fuel source.

Details of biomass potential in Malaysia are shown in Table 5.2 below.

Table 5.2: Total Amount of Biomass Released from Palm Factory

State		EFB	Fibre	Fibre (Palm Kernel Shell)	Total p.a. (tonne)
Peninsular Malaysia	Kedah	96,126	67,288	38,450	201,885
	Pulau Pinang	59,805	41,863	23,922	125,590
	Perak	1,494,341	1,046,038	597,736	3,138,115
	Selangor	688,414	481,890	275,366	1,445,115
	Negeri Sembilan	426,452	298,366	170,581	895,549
	Melaka	66,837	46,786	26,735	140,358
	Johor	2,687,200	1,881,040	1,074,880	5,643,119
	Terengganu	405,316	283,721	162,126	851,164
	Kelantan	199,209	139,446	79,684	418,339
	Pahang	2,252,946	1,576,433	900,819	4,729,298
	Sub-Total	**8,375,746**	**5,863,022**	**3,350,298**	**17,589,067**
East Malaysia	Sabah	3,477,723	2,434,406	1,391,089	7,303,217
	Sarawak	667,891	467,524	267,157	1,402,572
Total		**12,521,360**	**8,764,952**	**5,008,544**	**26,294,856**

A recent survey of 100 palm oil mills carried out by PTM in 2008 has shown that on average, about 22% (by weight of palm oil fresh fruit bunches (FFB) in the milling process were left over as EFB. Most of the mesocarp fibres from the fruits are utilized (98%) for energy generation for self-consumption, topped up by palm kernel shells (38%) as fuels. These figures confirm the commercial value of palm kernel shells which are being sold for other purposes.

The RE potential lies in the use of EFB and POME. However the EFB have multiple purposes and are used by the palm oil plantation as follows: 62% for mulching[25], 6% composting, 11% burned in incineration, 5% sold commercially and 16% being dumped somewhere in the plantation. Incineration without energy extraction is only allowed by the DOE for older plants from the time they were approved and constructed, but not for newer plants.

5.3.1. Biomass and Biogas Power Estimate

Based on 2008 data's, 20 million tonnes of EFB were produced where the total initial potential for power generation is 1,065 MW. Based on PTM's study, 20% of the EFB produced can be used for power generation amounting to 213 MW. For biogas, the potential is approximately 217 MW based on 58 million tonnes of POME (Source: MPOB, 2008). This estimate is based on an "as-is" basis.

However with a more conducive RE policy and action plan, improvements in existing combustion efficiency in palm oil mills (that can extract more energy from the mesocarp fibres and shells as well as from the EFB) can be expected[26]; the amount for mulching would be reduced to a more optimal level[27] and open incineration would be abolished; the estimate could be revised.

In 2008, the MPOB unveiled "The Roadmap for Palm Oil Industry and Latest Advances in the Industry" which will have a direct impact on the use of palm oil EFB as a biomass fuel for RE sources. This is because MPOB seeks to increase industry productivity, empower technology, expand investment, modernize infrastructure and ensure sustainability and advance the industry towards increased yield and oil extraction rate (OER), reduced wastes (reduced POME and zero discharge), increased conversion of wastes into non-energy products.

Taking into consideration these factors for purposes of target setting, a potential of 1,340 MW connected to grid from palm oil biomass by 2030 is therefore considered realistic and achievable. This is a very conservative estimate as it is expected the palm oil industry is forecasted to continue growing and increasing in output despite decreasing rate of new acreage being converted to palm oil plantations.

The reliance on EFB and other agriculture waste as fuel for biomass plants means that the size of the land used for palm oil plantations and agriculture is limited. The acreage of palm oil plantations is expected not to exceed 4,000 hectares. Therefore the inherent limitations of biomass mean that a reliable maximum capacity that can be made available is 1,340 MW by 2030.

5.4. Mini-Hydro Potential

Although Malaysia has had the experience and expertise in mini-hydro systems since the 1970s, these have not been exploited for added advantage to the country. At the same time data on mini-hydro potential sites, their respective power potentials, etc. are not easily available because rivers are under the jurisdiction of the state authorities.

Table 5.3: Installed Capacity of Mini-Hydro Power Stations in Malaysia

State		Installed Capacity (MW)
Peninsular Malaysia	Kedah	1.556
	Perak	3.207
	Terengganu	1.936
	Kelantan	3.158
	Pahang	3.504
	Sub-Total	13.361
East Malaysia	Sabah	8.335
	Sarawak	7.297
Total		**28.993**

Source: National Energy Balance 2007

25 Mulching is a process where the EFB were used to cover the soil surrounding young palm trees in replanting so as to retain water in the soil and eventually decomposing to act as organic fertilizer.
26 Currently, on average, 7% of fibres and 16% or shells are still discarded.
27 Currently 62% of EFB is used for mulching.

In general, the suitable mini-hydro projects would be those based on the run-off-the-river schemes of sizes of up to 10 MW to 30 MW in capacity. Exemption to the requirement that eligible mini-hydro projects should be run-off-river types should be given to dam-toe projects from water supply schemes.

A common issue in mini-hydro development is their remote locations. Although the potential can be quite high, feasible projects should be those within reasonable distance of around 10 km or less from the nearest points of interconnection. Therefore the scarcity of available data means there is a need to collect sufficient data to undertake an evaluation of the potential. Taking into account the paucity of data, and making an extremely conservative guesstimate of the potential, mini-hydro target of 490 MW is capable of being achieved by 2020.

5.5. Solar Power Potential

Solar photovoltaic (PV) cells convert sunlight directly into electricity. They are made of semi conducting materials similar to those used in computer chips. When sunlight is absorbed by these materials, the solar energy knocks electrons loose from their atoms, allowing the electrons to flow through the material to produce electricity. This process of converting light (photons) to electricity (voltage) is called the photovoltaic (PV) effect.

Solar cells are typically combined into modules which hold about 40 cells; a number of these modules are mounted in PV arrays which can measure up to several meters on a side. These flat-plate PV arrays can be mounted at a fixed angle facing south, or they can be mounted on a tracking device that follows the sun, allowing them to capture the most sunlight over the course of a day. Several connected PV arrays can provide enough power for a household; for large electric utility or industrial applications hundreds of arrays can be interconnected to form a single large PV system.

Thin film solar cells use layers of semiconductor materials only a few micrometers thick. Thin film technology has made it possible for solar cells to now double as rooftop shingles, roof tiles, building facades or the glazing for skylights or atria. The solar cell version of items such as shingles offer the same protection and durability as ordinary asphalt shingles.

The performance of a solar cell is measured in terms of its efficiency at turning sunlight into electricity. Only sunlight of certain energies will work efficiently to create electricity, and much of it is reflected or absorbed by the material that makes up the cell. Because of this, a typical commercial solar cell has an efficiency of 15%, about one-sixth of the sunlight striking the cell generates electricity. Low efficiencies mean that larger arrays are needed, which means higher cost. Improving solar cell efficiencies while holding down the cost per cell is an important goal of the PV industry.

Malaysia being an equatorial country has sunshine throughout the year coupled with a high irradiance level is well suited for PV generation. The investigations of PV applications in Malaysia demonstrated that a modified tilt angle at 30° is not optimum for locations around the Equator. Near horizontal tilt is more favourable and installations will normally have about 5° to 15° tilt angle to be efficient and still allow the PV system to follow the roof slope. Figure 5.2 shows the irradiance level in Malaysia.

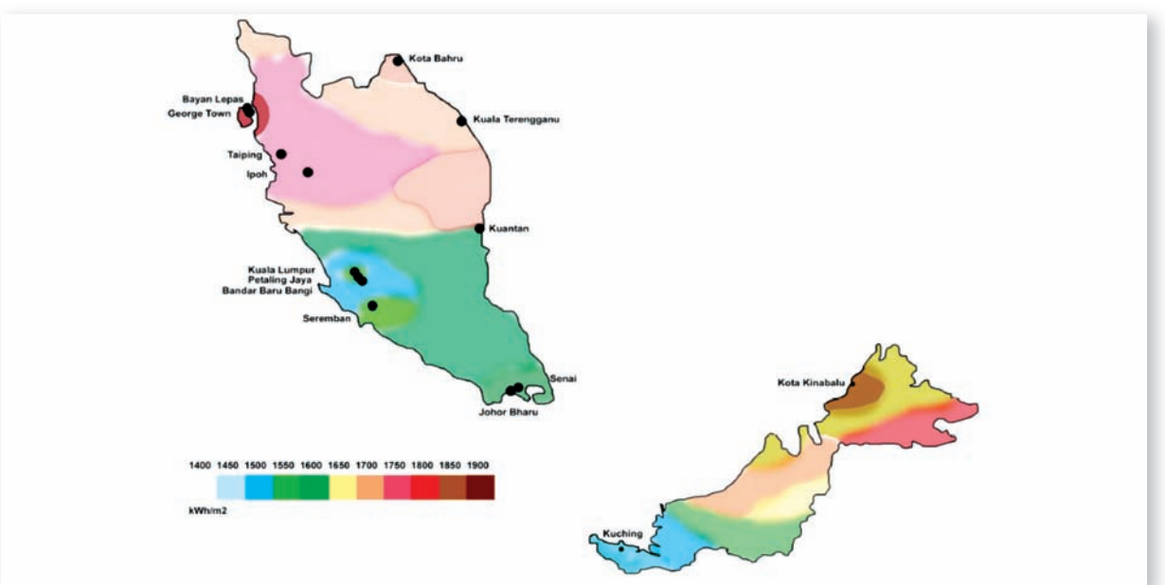

Figure 5.2: Solar irradiance levels in Malaysia

The details yearly average values of solar irradiance are set out in Table 5.4.

Table 5.4: Irradiance (Yearly Average Value) by Towns in Malaysia

Towns in Malaysia	kWh/m²
Kuching	1470
Bandar Baru Bangi	1487
Petaling Jaya	1571
Kuala Lumpur	1571
Seremban	1572
Kuantan	1601
Johor Bahru	1625
Senai	1629
Kota Bharu	1705
Kuala Terengganu	1714
Ipoh	1739
Taiping	1768
Kota Kinabalu	1900
Bayan Lepas	1809
George Town	1785

Looking at the yearly average values of solar irradiance in Malaysia it is foreseen that we need to take advantage of this situation as many European countries with lower irradiance already have an aggressive solar PV promotional policy which includes Germany and Spain.

PV technology appears to offer the most suitable long-term prospect for RE. Worldwide trends in the development and use of solar PV are significant, as shown in Table 5.5.

Table 5.5: Growth Trends in PV

Country	Installed PV in 2007	PV in 2008 (E)	PV in 2009 (E)
Germany	1,150	1,700	2,500
Spain	512	2,600	500
USA	240	330	800
Japan	210	250	500
Italy	70	160	550
Korea	50	90	150
France	45	130	220
China	20	40	65
India	22	28	50
Portugal	15	30	50
Australia	12	15	40
Greece	2	20	200
Rest of Europe	40	60	129
Rest of World	120	160	210
Total(approximately)	**2,508 MW**	**5,613 MW**	**5,964 MW**
CAGR	≈ 36%	≈ 60%	≈ 40%
Growth year to year	≈ 60%	≈ 124%	≈ 6%

Latest news show that this trend is accelerating even faster than earlier anticipated as many nations around the world are jumping on the bandwagon of solar technology. The technology would soon reach technical maturity, as conversion efficiency is near the peak, and reliability in terms of lifetime cycle reaching more than 25 years.

As can be seen in Figure 5.3 below, global growth in solar PV panel production was estimated to grow at 53% per annum while prices per kW have come down by 3% to 4% per annum

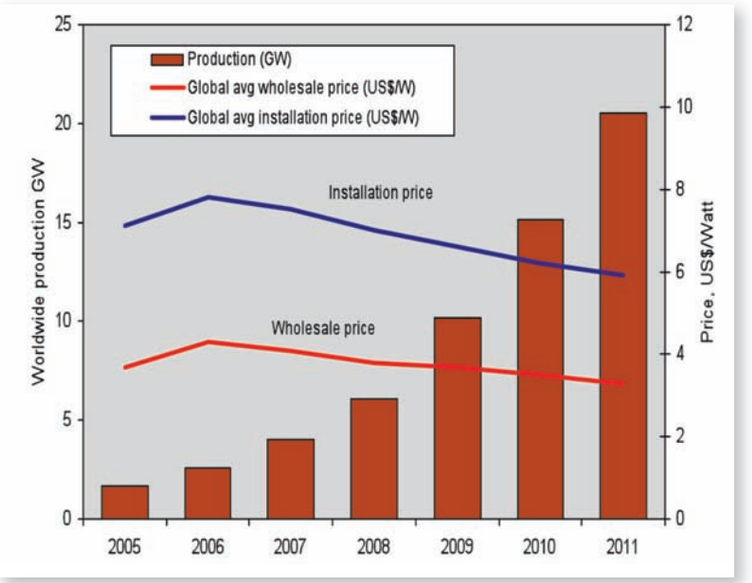

Figure 5.3: World costs and price trends for solar photovoltaic[28]

Development efforts are no longer focused so much at improving conversion efficiency (e.g. kW output per square meter surface area),[29] but more in bringing production costs and prices down per kW of photovoltaic capacity. In Malaysia this move is to ensure the price of solar technology would soon be affordable to all levels of society.

5.5.1. Solar Power Estimate

As a rule of thumb, a three storey energy efficient building in Malaysia installed with solar PV panels on its 1,000 m^2 roof may be able to generate all the electricity that it needs[30]. Taller urban buildings have higher density of occupancy but not a large volume per square meter of roof area, hence roof-top solar PV modules cannot provide all the energy needs for these types of buildings[31].

The real opportunity for solar PV lies in homes (residential areas), warehouses, and other low-rise commercial buildings. Factories, however, typically consume high levels of energy due to production machineries or similar equipment, and will never be expected to be energy self-sufficient through solar PV but can provide the large roof spaces for solar PV.

In estimating the solar power potential in Malaysia and the setting of targets, it is recognised that the constraint is not so much on the availability of solar irradiation, but more on the availability of funding and the domestic and international production facilities to cope with demand. Currently the Malaysian solar PV module market is subjected to and focuses on the global market, and even current local production outputs are directed towards export to high growth demand in Europe, USA and Japan.

28 Source: Photon International, September and October 2007 issues
29 Of course, there is still scope for further technical improvements, as it was reported that increased energy outputs from newer PV modules can be achieved because of better sensitivity to a wider spectrum in the solar radiation.
30 Design of the PTM Zero-Energy Building in PTM's Energy Smart, Issue 0017, Quarter 1.
31 Thin-film PV panels fitted on building façades can increase energy outputs, but again they are only applicable at the higher floors to avoid shadow areas.

Therefore a reasonable target for grid-connected solar PV as building integrated (BIPV) application is 850 MW by 2030 (and more than 8,000 MW by 2050) that can grow unlimitedly as it is not constraint by land availability. This is arrived at by the following assumptions:

(a) Using 2003 data and suitable building roof surfaces the estimated amount of energy PV can produce is approximately 6,500 MW (i.e. ≈ 65 million m^2 x 100 W/m^2);

(b) The building roof surfaces are from 40% of total number of households (i.e. 2.5 million houses) and 5% of total commercial buildings (i.e. about 40,000 commercial buildings)[32];

(c) Solar BIPV energy opportunity ≈ 7.8 TWh, about 21% of residential and commercial electricity demand in 2005 (1 kW = 1200 kWh/year)

5.6. Solid Wastes Potential

Traditionally in Malaysia the most economic option of solid waste disposal is through landfills or dumpsites. The state governments upon recognising that ineffective solid waste management would result in catastrophic environmental problems such as water resource pollution from leachate and also health reasons have adopted using sanitary landfills instead. However some municipalities are still using open dumpsites to manage their solid waste.

Current data from the Ministry of Housing and Local Government suggest that the total waste collected and disposed per day in Malaysia is approximately 21,000 tonnes. From Table 5.6 below it is seen that the states of Selangor, Johor and Sarawak produce the most amount of solid waste, while Perak, Pahang, Sabah and Sarawak have high numbers of dumping sites in the states.

5.6.1. Solid Wastes Power Estimate

Based on the current data it is estimated from solid wastes (RDF, incineration, sanitary landfills): 378 MW can be installed by 2024. This is based on the assumption that 30,000 tonnes/day of solid wastes would be produced as projected by KPKT, followed by 3% annual growth post 2024 according to increase of the population.

Additionally there are already many solid waste dumping sites that have been closed as shown in Table 5.6 previously. These sites have potential to generate electricity from landfill gases[33] that is already available.

Table 5.6: Total Waste Generation in Malaysia[34]

State	Waste collected and dumped per day (MT/d)	Number of operating dumping sites	Number of closed dumping sites
Perlis	120	1	1
Kedah	1,504	12	3
Penang	1,800	1	2
Perak	1,864	21	9
Pahang	1,094	20	12
Selangor	3,240	7	11
Kuala Lumpur	1,950	1	7
Negeri Sembilan	1,162	8	10
Melaka	906	2	5
Johor	2,439	13	21
Kelantan	729	13	5
Terengganu	651	9	12
Sabah	1,174	20	1
Sarawak	2,001	51	12
Total per day	**20,633**	**179**	**111**

32 Source: TNB statistics based on their customer information
33 See the existing TNB's 2MW Jana Landfill power plant in Puchong, Selangor.
34 Source: Jabatan Sisa Pepejal, Ministry of Housing and Local Government (2008)

Currently, an integrated waste management plant owned by *Core Competency/Recycle Energy* is already operating in Semenyih, Selangor managing the solid waste of the Kajang municipality. This plant with a capacity of sorting and treating a maximum 1,000 tonnes per day also has a power generation plant. From the normal intake of 700 tonnes/day of wastes, the plant can sort the combustible waste and generate a gross power of 8 MW of which 5.5 MW are available for export to the utility.

If all future waste-to-energy plants are based on this integrated concept involving recycling initiative, etc, the power potential for target setting would naturally be reduced as other waste products are either recycled or directed towards more value-added products.

5.7. Targets for Renewable Energy Development

5.7.1. "SMART" Targets for Renewable Energy

Based on the detailed analysis above and taking into consideration the technical limitations (particularly of the availability of fuel sources) and the need for sustainability, the suitable targets for renewable energy must be specific, measurable, achievable, realistic and time-specific (i.e. SMART). These SMART targets are a conservative assessment of Malaysia's RE resources, with a sensitivity of ± 10%.

Given the present low actual capacity of RE projects, the development of RE has to be accelerated to grow at 18% of compounded annual growth rate (CAGR) from 2010 to 2030. For the CAGR to be achieved many strategies need to be employed. The overall SMART targets for short, medium and long term are as follows:

Electricity Capacity Mix: By 2015, total capacity from RE is targeted to reach 975MW or 6% of total peak electricity demand capacity by 2015;

Electricity (Energy) Mix: By 2015, total electricity mix from RE is targeted to reach 5.3 TWh/year or 5% of total electricity generated.

Electricity Capacity Mix: By 2020, total capacity from RE is targeted to reach 2,065 MW or 11% of total peak electricity demand capacity by 2020;

Electricity (Energy) Mix: By 2020, total electricity mix from RE is targeted to reach 11.2 TWh/year or 9% of total electricity generated.

Electricity Capacity Mix: By 2030, total capacity from RE is targeted to reach 3,484 MW or 14% of total peak electricity demand capacity by 2030;

Electricity (Energy) Mix: By 2030, total electricity mix from RE is targeted to reach 16.5 TWh/year or 11% of total electricity generated.

Table 5.7 indicates the projected SMART targets for RE development in Malaysia. The targets are projected until year 2050 when RE would constitute 11.5GW or 36% of total peak electricity demand capacity and 29.3 TWh/year or 15% of total electricity generated.

Table 5.7: SMART targets

Year Ending	Cum. Biomass (MW)	Cum. Biogas (MW)	Cum. Mini-Hydro (MW)	Cum. Solar PV (MW)	Cum. Solid Wastes (MW)	Cum. Total RE (MW)
2011	110	20	60	7	20	217
2015	330	100	290	55	200	975
2020	800	240	490	175	360	2,065
2025	1,190	350	490	399	380	2,809
2030	1,340(1)	410(2)	490(3)	854	390	3,484
2035	1,340(1)	410(2)	490(3)	1,677	400	4,317
2040	1,340(1)	410(2)	490(3)	3,079	410	5,729
2045	1,340(1)	410(2)	490(3)	5,374	420	8,034
2050	1,340(1)	410(2)	490(3)	8,874	430	11,544

Notes to Table 5.7:

(1) The maximum potential can be realised from palm oil EFB and agro-based industry;

(2) The maximum potential can be realised from POME, agro-based and farming industries;

(3) The maximum potential can be realised from mini-hydro.
The assumptions used in Table 5.7 are:

(1) RE plant lifespan is 25-30 years, whereby old plants will be replaced or upgraded.

(2) RE Technical potential:

i. Biomass (EFB, agro-based): 1,340 MW will be reached by 2028.

ii. Biogas (POME, agro-based, farming): 410 MW will be reached by 2028.

iii. Mini-hydro (not exceeding 30 MW): 490 MW will be reached by 2020.

iv. Solar PV (grid-connected): unlimited.

v. 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).

Figures 5.4 and 5.5 indicate modestly the potential of RE in terms of national installed power capacity and electricity generation under the SMART target. It is critical to recognise this scenario is only possible when the proposed National RE Policy and Action Plan is implemented, in particular the Strategic Thrust 1. The thrust which is on introducing an appropriate regulatory framework (RE Law which facilitates the feed-in tariff and funding mechanisms) are instituted and effectively implemented.

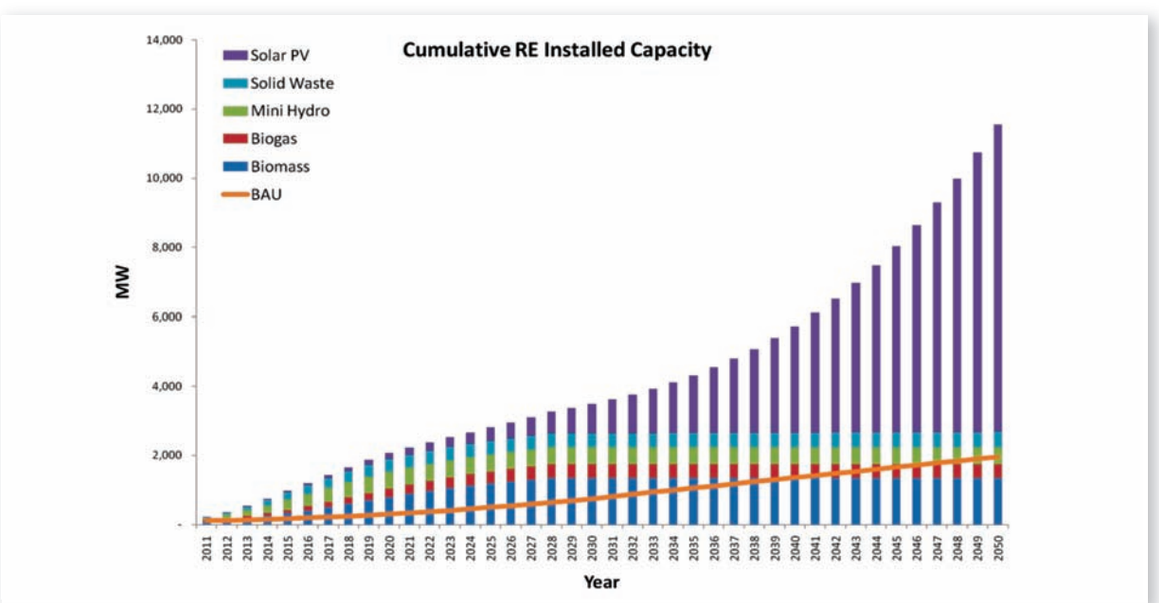

Figure 5.4: Cumulative RE installed capacity

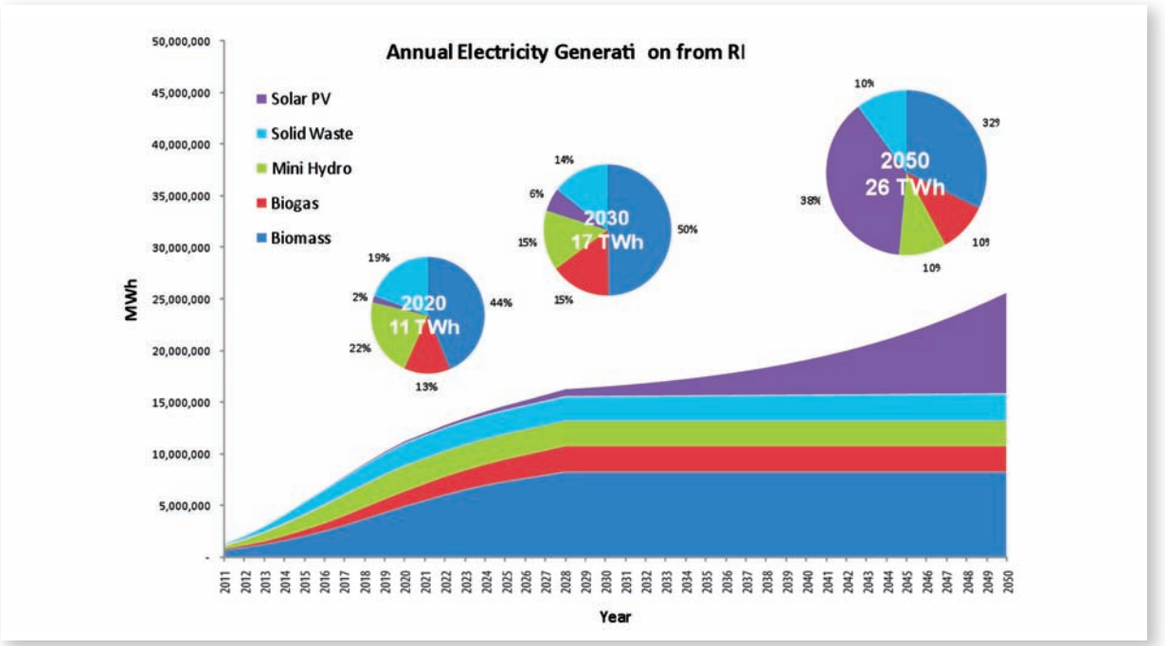

Figure 5.5: Annual electricity production from RE resources

Under the umbrella of the RE Law, it is expected that for the first 15 to 20 years, biomass energy would have a significant role to play until it reaches the limitation of the plantations. Solar energy is anticipated to play a very important role in the long-term, as it is the only unlimited source of energy with significant capacity available in the country. The impact of electricity production from solar energy is expected to greatly increase because solar technology is progressing fast whereby its efficiency would leap over the coming years.

5.7.2 GHG Emission Reduction

Malaysia has ratified the Kyoto Protocol in 2002 a move to show the government's seriousness and commitment to reduce our *carbon footprints* through escalating green technology applications in all sectors of the economy. Thus effective mitigation measures to reduce GHG need to be taken with special focus given to main sectors emitting GHG which are electricity generation and transport.

It is well known fact that using renewable energy is an effective measure to reduce GHG emission from the electricity sector. Generating electricity using RE is environment friendly because it has minimal or zero emission. Many countries around the globe are embarking on serious RE development as initial measures to the global warming phenomenon which has become the focus of the global society.

Malaysia has made the voluntary commitment at the United Nations Climate Change Conference 2009 (COP 15) to reduce 40% of its emission intensity of GDP by the year 2020 compared to 2005 levels. Based on the SMART targets, by 2020, RE will be 11% or 2,065MW from the electricity peak demand mix. It is projected that 60,584GWh electricity will be generated from RE sources contributing towards the reduction of 42 million tonne CO_2 from the power sector.

The detailed targets for energy (by RE resources) and environmental CO_2 avoidance are shown in Table 5.8.

Table 5.8: Energy and Environmental Target from 2011 to 2050

Year	Annual Biomass GWh	Annual Biogas GWh	Annual Mini-Hydro GWh	Annual Solar PV GWh	Annual SW GWh	Annual RE Electricity (GWh)	Annual CO2 Avoidance (tonne/yr)	Cumulative CO2 Avoidance (tonne)	Cum RE (MW)
2011	675	123	300	7.7	123	**1,228**	**846,975**	**846,975**	**217**
2015	2,024	613	1,450	61	1,223	**5,374**	**3,707,825**	**10,816,136**	**975**
2020	4,906	1,472	2,450	194	2,208	**11,229**	**7,747,900**	**41,803,181**	**2,065**
2025	7,297	2,146	2,450	456	2,330	**14,680**	**10,128,817**	**88,071,821**	**2,809**
2030	8,217	2,514	2,450	1,019	2,392	**16,592**	**11,448,339**	**143,444,366**	**3,484**
2035	8,217	2,514	2,450	2,128	2,453	**17,762**	**12,255,721**	**202,908,742**	**4,317**
2040	8,217	2,514	2,450	4,170	2,514	**19,865**	**13,707,192**	**268,207,951**	**5,729**
2045	8,217	2,514	2,450	7,765	2,575	**23,522**	**16,229,914**	**343,765,293**	**8,034**
2050	8,217	2,514	2,450	13,540	2,637	**29,358**	**20,256,975**	**436,426,797**	**11,544**

The applicable assumptions to Table 5.8 are:

(1) No loss of RE plant capacity (old plants are replaced or upgraded).

(2) RE electricity generation:

i. 1 MW of biogas and biomass (consumes 25,000 tonne/year/MW of wastes) generate 6,132 MWh/year (70% capacity factor);

ii. 1 MW of mini-hydro generates 5,000 MWh/year (57% capacity factor);

iii. 1 MW solar PV generates 1,100 MWh/year (13% capacity factor, but is expected to significantly increase in the future);

iv. 1 MW of solid wastes (consumes 100 tonne/day/MW) generate 6,132 MWh/year (70% capacity factor).

(3) 1 MWh of RE electricity avoids 0.63 tonne of CO_2.

6. THE RENEWABLE ENERGY POLICY

This Chapter sets out a proposed vision statement and the set of objectives and related strategic thrusts of a forward-looking RE Policy.

The new RE policy is intended to transform Malaysia to become a leader in renewable energy and also in green technology applications. This will ensure that Malaysia will develop into a nation that is able to satisfy its own energy needs from indigenous RE resources, be independent from fuel imports, a leader in green technology development while able to conserve its natural environment so that it can also be enjoyed by the future generation. A sustainable local RE industry could ensure the green house gas emission due to power generation from fossil fuel be mitigated while creating a new source of economic activity for the country. It is envisaged the new RE Policy would be able to put Malaysia on the forefront amongst ASEAN countries to pursue green technology aggressively towards a more sustainable future for the country.

6.1. Policy Vision

A policy vision for RE development in Malaysia provides for the long-term goal that all stakeholders should strive towards realisation. The policy statement is crafted to be all encompassing addressing the aspects role and the importance of RE in national development as stated below:

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

6.2. Policy Objectives

A forward-looking RE Policy embodies elements of energy, industry and environmental policies making it convergent in nature and is reflected in the five objectives which have been set for RE:

(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.

6.3. RE Strategic Thrusts

To achieve these policy objectives, five strategic thrusts have been identified which would enable Malaysia to pursue RE development more aggressively. The strategic thrusts are:

Thrust 1: ***Introduce Appropriate Regulatory Framework***

This requires an appropriate, robust and efficient regulatory framework which would address market failures and provide incentives for firms to enter into the RE generation market be introduced and implemented.

The regulatory framework should provide for the introduction of a feed-in-tariff (FiT), a catalyst for the entry of RE power generation businesses, RE industries and R&D in RE. Furthermore with the reduction of environmental pollution means the society must also play its part by making a contribution to a fund that would be used to pay for the RE power. This is especially important as the retail tariffs contain subsidies and have today been reduced and exclude the external costs. A mechanism could be employed by embedding into the electricity tariff structure a certain cost which must be made to a specific RE Fund.

There are consequently direct spill-over effects from a regulatory framework which would act as a catalyst for the emergence of RE industries, undertaking of R&D in RE technology and innovation (e.g. via improved boiler technologies etc.). The measurable outcomes of this thrust include the rate of increase in the use of RE, the gradual decreasing (or constant) rate of fossil fuel consumption for conventional power generation and reduction of the CO_2 emissions.

Thrust 2: ***Provide Conducive Environments for RE Businesses***

The 2nd Policy Objective identifies the need for the growth of the RE industry. A definition of the "RE industry" provides clarity of the ambit of this industrial sector. Since the 1st Policy Objective refers to RE generation, which would cover generation, distribution and sale of energy. It is proposed that the term "RE industry" refers to the manufacturing of RE components or RE finished products (e.g. boilers, turbines, PV modules, etc.), support industries to the RE manufacturing sector, and RE service providers (e.g. technicians, consultants, engineers, builders) who support RE power generation. The focus of this thrust is on RE industry and RE power generation (which collectively are referred to as RE businesses).

The stimulus package would encompass the provision of fiscal incentives, and indirect assistance in the form of reducing the transaction costs for financing, using GLCs and MNCs to lead the charge, and providing assistance to SMEs to participate in the RE business. These are in addition to the feed-in-tariff which provides an incentive for people to enter the RE power generation sector.

Thrust 3: ***Intensify Human Capital Development***

RE is a new technology in Malaysia and there is a need for human capital to be developed in order to support the emerging RE Industries. Yet there is a need for a short-term (stop-gap) measure to fill the human capital void in Malaysia by encouraging knowledge workers to relocate to Malaysia.

Thrust 4: ***Enhance RE Research and Development***

The focus of the R&D is not on invention[35] but on innovation[36]. For example, the improvements in the microchip were due to innovation (i.e. the idea of "standing on the shoulders of giants").

Therefore the implementation of a systemic R&D programme which leads to innovative products and services to accelerate the growth of the RE Industry is required. Innovation also enhances the diffusion of RE by making the technology cheaper and easier to use and strengthen businesses competitive edge.

Thus it is necessary to develop an R&D implementation plan which articulates the demand, identifies the use of regulation to spur innovation and provides appropriate support for R&D activities.

Thrust 5: ***Design and Implement an RE Advocacy Programme***

Advocacy programmes are tailored with specific messages for specific audiences should be implemented. For example an advocacy programme targeted at investors and RE market entrants will need to convey a message that is subtly different from a general public advocacy programme designed to secure buy-in to the idea of societal payments for clean environment. The common aim of all advocacy programmes is to increase the awareness of all stakeholders of the benefits and advantages of utilising RE and participation in RE businesses.

Policy mission should be reviewed and (as necessary) embellished over time, once the foundation has been laid. For example when the policy is reviewed in five years time, the original mission of Thrust 1 would have been accomplished with the implementation of an appropriate regulatory framework. Nonetheless, it may need to be improved further or as necessary, replaced by a new thrust as part of the ongoing mission to realise the Policy Vision.

35 Invention is defined as the creation of a new product or process.
36 Innovation is defined as the making of changes in existing products or services by introducing new methods, ideas or products.

The contributory role of the respective thrust in achieving the policy objectives are summarised in the matrix below:

Year	POLICY OBJECTIVES				
	1 – Increase RE contribution in power generation	2 – Grow the RE industry	3 – Ensure reasonable RE generation costs	4 – Provide environmental conservation	5 – Enhance awareness
T1: Introduce appropriate regulatory framework	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
T2: Provide conducive environments for RE businesses	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
T3: Intensify human capital development	**Yes**	**Yes**	**-**	**Yes**	**Yes**
T4: Enhance RE research and technology	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
T5: Design and implement an RE advocacy programme	**Yes**	**Yes**	**-**	**Yes**	**Yes**

7. RE ACTION PLAN: IMPLEMENTATION APPROACH

To achieve the objectives of the new RE Policy, specific actions to provide the most effective results must be identified. The specific actions need to be taken are of two forms:

(a) Direct actions to create or establish the necessary institutional arrangements; and

(b) Supporting measures to encourage and nurture the growth and development of the RE businesses.

The nature of the direct actions needs to be taken, reflecting three guiding principles, namely:

(a) Focusing on activities rather than a sector (as much as possible);

(b) The actions must be measurable, thus there must be appropriate criteria to evaluate success or failure; and

(c) RE is a technology which needs to be diffused.

7.1. Strategic Thrust 1: Introduce Appropriate Regulatory Framework

For RE to achieve the desired progress, a new Renewable Energy Law is critical to provide the clarity and certainty to the regulatory framework which has the effect of encouraging firms to enter the RE power generation business[37]; and correct the existing market failures.

To implement Thrust 1 effectively and efficiently, a new RE Law should be enacted to introduce a regulatory framework which addresses the specific market failures caused by information asymmetries and the potential negative impacts of prevalent market power.

The introduction of a new statute is required because analysis of the ESA shows the law is inadequate to address issues relating to RE development, and does not provide for a clear framework for the energy industry specifying obligations and rights of firms undertaking generation, transmission, distribution and retail[38]. The ESA also does not obligate interconnection to the grid nor specifies the access charges that can be charged (if any). It only identifies persons who build and operate "installations", which can encompass all of the above segments, and requires them to be subject to licensing, safety requirements and provision of employment or business to specifically licensed class of people whose actions are strictly controlled. In such a case a special legal framework is required if RE is to make the necessary and effective head start.

7.1.1. RE Law

Responsive regulation is an approach which values trust, transparency and professionalism. To achieve the aims of Thrust 1, the structure of the proposed RE Law must take cognisance of the design principles set out in Table 7.1. It is also important the proposed RE Law provides for a regulatory framework which is consistent with the aim of business stimulus in Thrust 2.

Table 7.1: RE Law design principles

No.	Design Principle	Rationale & Explanation
1.	Proportionality	Intervention only when it is necessary. Remedies should be appropriate to the risk posed. The cost of compliance must be identified and minimised. Avoid disproportionate effect on small businesses. There must be a balance between risks, costs and benefits.
2.	Accountability	Regulators must be able to justify their decisions and be subject to public scrutiny. This requires a consultative approach to decision making before decisions are actually made. This necessitates the establishment of: (a) Clear standards and criteria; (b) Well-publicised, accessible, fair and effective complaints procedures and appeals; (c) Clear lines of accountability to Minister and/or Parliament and the public.
3.	Consistency	Application of rules should be consistent. Consistency of application provides clarity to regulatees to enable them to make better decisions in undertaking their business. However this may cause a tension with Principle 6 (Flexibility) as tensions may exist.

37 From the facts there is evidence that sufficient interests exists in participating in RE power generation (see pages 4 *et seq* of this report).

38 For example under the ESA there is no power for the Minister to set prices, his power is to approve prices if submitted by a licensee. Therefore the Minister cannot legitimately set prices for which the licensees must comply.

No.	Design Principle	Rationale & Explanation
4.	Transparency	Regulations should be simple, clear and user-friendly. Transparency promotes clarity and regulatees are made aware of what they need to do to comply.
5.	Targeting	Focus on the problem itself and minimise side-effects. This may require "goals-based" approach with enforcers and regulatees given flexibility to decide how the goals are to be achieved. Those activities which give rise to the most serious risk should be the target of regulation.
6.	Flexibility	Regulation should be sufficiently flexible to minimise overly prescriptive regulation, which increases cost to Government to enforce those types of rules. Flexibility allows rules to be changed to suit changing needs of the regulatees.
7.	Avoid unintended consequences	It is necessary to avoid or minimise potential unintended consequences which arises as a result of the regulation in one area.
8.	Regulation must be enforceable in a practical sense.	Effective regulation means it must be practical to enforce. If the rule causes an increase in enforcement demand then the practicality is diminished. With diminishing enforcement, the compliance of regulation would similarly diminish.
9.	Periodic review	Regulation cannot be static and should be reviewed periodically, in order to stay relevant and applicable.
10.	Clarity	Regulatory goals and outcomes must be clear. This enables the outcomes of regulatory action based on the regulation to be measured against those outcomes. Thus, avoiding uncertainty and inconsistency of application.

These design principles are a guide by which the legislation and regulation can be designed and do not provide a means by which legislative provisions can be drawn up.

More importantly, the RE Law will allow the Feed-in Tariff (FiT) and RE Fund mechanisms to be introduced and implemented.

Feed-in Tariff (FiT)

Feed-in Tariff (FiT) is a mechanism that allows electricity produced from RE resources to be sold to power utilities at a fixed premium price and for a specific duration. This will provide a conducive and secured investment environment which will make financial institutions more comfortable in providing loans with longer period (at least 15 years tenure) to finance the renewable energy projects.

As a result, RE projects become bankable and could grow unhindered. It is anticipated the FiT mechanism will:

(a) Provide fixed revenue stream for the installed and operated RE systems;

(b) Only pay the for electricity produced, i.e. promoting RE system owner to install only quality RE systems and maintain the systems properly to generate more revenue;

(c) With a suitable degression rate, the RE manufacturers and installers are motivated to reduce the technology costs while maintaining or improving the quality and efficiency.

The disadvantage of FiT mechanism is that it does not address the first cost barrier of high incremental cost. However, this can be addressed through soft loan support or financial packages. As proven in some countries, this barrier will be removed by itself once the financial institutions get involved in RE projects under the secured environment which FiT mechanism provides.

Independent evaluations undertaken between 2006 and 2008 reveal and confirm that a Feed-in Tariff (FiT) mechanism is very effective in introducing and growing the number of RE power plants, spurring innovation and spearheading the growth of the economy through the emergence of new RE Industry compared to the quota system or renewable portfolio standard (RPS). A summary of these reports findings are set out in the table below.

Table 7.2: Verifications of Feed-in Tariff (FiT) Effectiveness

Report	Year	Findings
United Nations Development Programme (2008): Promotion of Wind Energy – Lessons Learned From International Experience and UNDP-GEF Projects, Chapter 1: Public Policies	2008	The report stated "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. France and Portugal have also used Feed-In tariffs to become fast growing wind energy countries with 810 MW and 695 MW installed in 2006, bringing them to 10th and 9th place in terms of installed capacity" (pg. 16).
International Energy Agency (2008): Deploying Renewables – Principles for Effective Policies	2008	The report summarised "feed-in tariffs are more effective and cheaper than quotas for renewable energy".
Ernst & Young (2008): Renewable Energy Country Attractiveness Indices	2008	The report concluded "feed-in Tariffs are cheaper than trading system" whereby comparing the cost to consumer in delivering renewable electricity, "the Germany's EEG is cheaper at 2.6 p/kWh as compared to United Kingdom's Renewable Obligation (RO) at 3.2 p/kWh" (pg. 13). The report also summarised "feed-in tariffs have the benefit of curbing the cost to the energy consumer of renewable in the context of rising oil prices" (pg. 4).
Stern, N. (2007): The Economics of Climate Change - Stern Review, Part IV: Policy Responses for Mitigation	2007	The Stern Report (2007) on the financial costs of global climate change was published by the former chief economist of the World Bank, Nicolas Stern. Part IV of the report (Policy Responses for Mitigation) gives a short overview of the existing of incentives for renewable energy projects and differentiates between price based (e.g. FiT Laws) and quantity based (e.g. Tradable Green Certificates) support mechanisms. It points out based on existing experience price-based support mechanisms (i.e. FiT) achieves a "larger deployment at lower costs" as compared to tradable quotas (see pg.366)."
Federal Environmental Agency (2006): Monitoring and evaluation of policy instruments to support renewable electricity in EU Member States - Final Report	2006	The report compares FiT and quota systems (Tradable Green Certificates (TGCs) / Renewable Portfolio Standards (RPS)). The report concludes that "feed-in tariffs (FiTs) have been more successful in triggering a considerable increase of RE technologies in almost all the countries in which they have been introduced and where their effectiveness was not significantly hampered by major barriers (administrative barriers, grid access, etc.)" (pg. 88). The report states "the risk premium required by investors can be minimised by the high level of price security given by feed-in tariffs, thus lowering the overall costs for consumers and assuring relatively homogenous premium costs for society over time" (pg. 88).

Prior to the year 2004, the quota system (also known as renewable portfolio standard or RPS) was a popular mechanism adopted by various Governments to promote RE deployment. Under the quota systems (RPS), the Government sets a target for renewable electricity production which increases over time. Most quota systems allow the target to be met by producing the renewable energy directly and the RE investments are recovered via tradable 'Green Certificates'.

Nonetheless, the success of Germany's RE market and subsequent replications by 20 European countries of the German's EEG (Renewable Energy Sources Act) proved that FiT mechanism is more effective. This shows FiT is a more effective mechanism deployed to achieve renewable energy targets.

A comparison between feed-in tariff and quota system mechanisms are described in Table 7.3 below.

Table 7.3: Comparison between Feed-in Tariff (FiT) and Quota System (RPS)

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

Feed-in tariff needs to be introduced through a legal instrument to guarantee success and effective implementation. Therefore a new law usually a Renewable Energy Law will have to be introduced which contain specific details of the feed-in tariff prices, degression, the duration, obligations of various parties, and the review process.

Setting up high feed-in tariff rates for the RE technology at the first instance will not guarantee a success without incorporating the other critical success factors which are described below. In almost all cases, the feed-in tariff rates are empirical values and need to be reviewed or adjusted (of the degression) to suit the growth of RE market. Most importantly, the growth of the RE market is dependent on the available RE fund to pay for the incremental cost of the higher feed-in tariff rates, and this will then limit the achievable RE capacities. Nonetheless, this limitation (if not too small) will provide a realistic opportunity for the local RE industry to grow and mature, and not 'booming' out of hand. This relationship is shown Figure 7.1

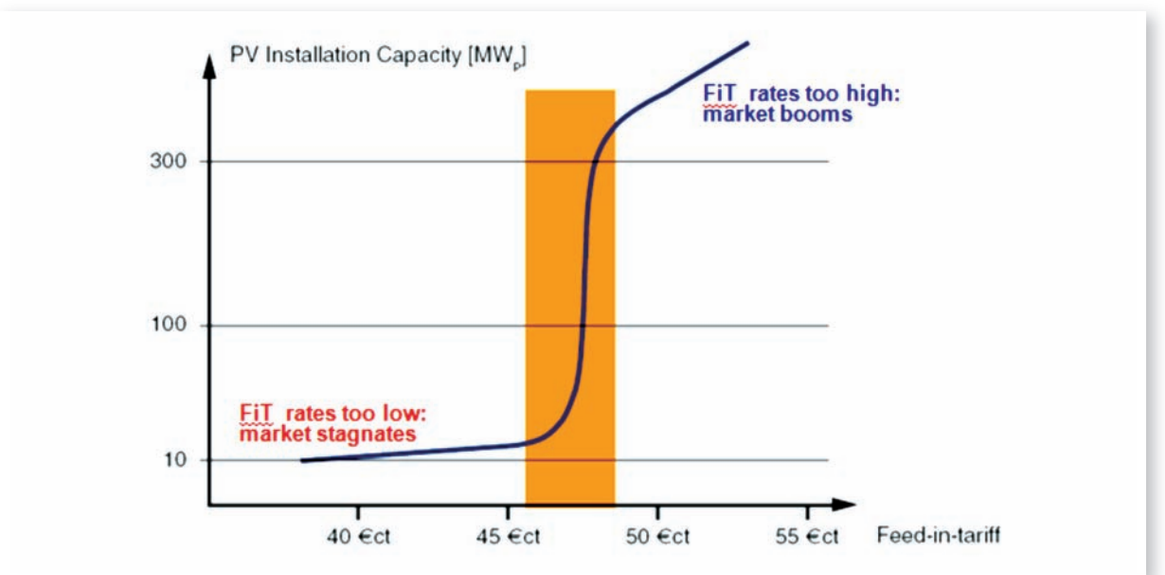

Figure 7.1: Example of relationship between PV market growth and feed-in tariff rates

Outline of RE Law

For an RE Law to be effective it must address the following key points:

(1) RE prices (FiT) – creation of a price (i.e. FiT) setting mechanism anchored on economic principles of efficiency and full-cost recovery. The FiT should be designated a regulated price for which negotiations between parties are neither necessary nor allowed. Different levels of FiT, together with a degression rate should be set for different types of RE technologies. These prices and degression rates should be reviewed at least tri-annually. A detailed explanation of Feed-in-Tariff (FiT) is set out in Annex B of this Report and a more detail information is available from http://www.onlinepact.org;

(2) Details relating to the setting up and operation of the RE Fund and specifying the contribution obligations of consumers must be made. The simplest approach is to set a contribution rate applied to the quantity of conventional electricity consumed, as the more one consumes the more one should be responsible for the pollution emitted by conventional generators;

(3) Obligation to interconnect – the power utilities (grid operators or distributors) must be obliged to interconnect with priority access for transmission and distribution. The cost of interconnection must be borne fairly and reasonably on the basis of shallow connection charging, i.e.:
- The RE producers will pay for the costs of the equipment needed to connect their plant physically to the nearest point of the electricity distribution grid;
- The power utilities will pay any cost for reinforcement of the network, costs which are passed to the final consumers by including them in the system charges (as rate base) upon the next tariff review.

(4) REPPA – the standardisation of terms and conditions of the REPPA to minimise negotiations between the utility and the RE producer.

Consequential amendments to other statutes may be needed to avoid inconsistencies with this new law.

Critical Success Factors for the RE Law

The critical success factors identified for RE Law are:

(1) Access to the grid must be guaranteed. Utilities must be legally obliged to accept all electricity generated by private RE producers;

(2) Tariffs for RE (FiT) must be high enough to produce a return on investment plus a profit (not excessively) to act as an incentive for firms to enter the market[39];

(3) Tariffs for RE (FiT) must be fixed for a long enough period (REPPA is typically 20 years) to give certainty. In addition, it will also provide businesses with the security for market development and project financing[40];

(4) There must be a "degression" for the FiT to promote cost reduction to achieve "grid parity", where an annual stepwise reduction in tariffs by a certain percentage is mandated .

A degression encourages would be RE system purchasers to invest early rather than later (leading to increase in planting of RE power generation systems). It can also add pressure on manufacturers of RE power systems to innovate, so that they continually reduce their production costs, which in turn increases the affordability of the RE power system for subsequent installation of RE systems[41];

(5) Adequate fund is created to pay for the feed-in tariff (or the incremental cost between higher FiT and the displaced electricity cost) and guarantee the payment for the whole contract period. The size of the fund will significantly determine the amount of RE capacity (limit) that can be generated.

39 Notes: The current German tariff is 49 euro cents per kilowatt-hour (roughly RM2.50), about two and a half times the retail price of electricity.
40 Notes: In Germany the degression was 5% in 2008, increasing to 8% by 2009.
41 An intending RE power producer will only buy PV if the cost of the system is less than the sale price. This means that PV suppliers need to ensure that their prices are reasonable.

(a) The Malaysian RE Law Must Be Specific and Clear

The law must be clear as to the obligations it imposes, the duties it creates and the rights of the relevant parties. The RE Law must address specific issues and shortcomings such as:

(1) Remove the need to negotiate REPPA by creating a standard agreement to be adopted and for which changes are not permitted;

(2) Mandate interconnection within a stated time frame, thereby removing the potency of strategic refusals or delays by utilities to frustrate RE power generation firms;

(3) Contribution by all consumers and a collection mechanism that works (e.g. the current collection mechanism);

(4) Specifying the feed-in tariffs for different RE technologies, the degression rate and the duration of the FiT; and

(5) Requiring an annual periodic review and public reporting of the progress by the appointed Government agency.

(b) Proposed Feed-In Tariff (FiT) Mechanism

The FiT rates were determined through extensive consultative discussions with relevant stakeholders and RE players based on the following factors:

- Capital and investment cost;
- Equity and financing (rates and tenure);
- Costs of O&M, fuel, transport, insurance and depreciation;
- Annual cost increment;
- IRR, simple payback calculation, cash-flow;
- RE plant capacity factor and other revenues.

The proposed FiT rates are followed by the degression rates each specific for the renewable source used. Referring to the type of RE sources used it is projected that the degression for solar PV would be the highest. This is because for solar PV the technologies are anticipated to improve tremendously bringing down the prices. Other sources would also have degression however it would not be as substantial as solar PV.

The proposed FiT and degression for the promotion of RE technologies in Malaysia are as in the following table:

Table 7.4: FiT Rates and Degression

RE Technologies/ Resources	FiT Duration	Range of FiT Rates * (RM/kWh) Min – Max	Annual Degression *
Biomass (palm oil, agro-based)	16 years	0.24 - 0.35	0.2%
Biogas (palm oil, agro-based, farming)	16 years	0.28 - 0.35	0.2%
Mini-hydro	21 years	0.23 - 0.24	0%
Solar PV	21 years	1.25 - 1.75	6%
Solid waste & sewage	21 years	0.30 - 0.46	1.5%
Wind	21 years	0.23 – 0.35	1%
Geothermal	21 years	0.28 – 0.46	1%

**Note: Subject to final confirmation upon enactment of the RE Law.*

(c) Contribution Mechanism of the RE Fund

The principle adopted here is all electricity consumers would be required to contribute to the RE Fund and this obligation must be specified, including the mechanism by which the contribution amount is ascertained. There should be no difficulty in ascertaining the amount and a simple mechanism is best, such as a contribution system based on consumption.

Thus, it is recommended that a minimum contribution rate of 2% (equivalent to not more than 0.65 cents/kWh) to be embedded into the tariff pricing upon the next electricity tariff review and it would remain until the year 2030. The collection of the RE Fund could be retained for implementation until 2050 or when the tariff for electricity from RE sources is equal to the tariff from fossil sources a period when it is said to achieve grid parity. When grid parity is achieved, electricity from renewable sources would be the preferred choice because it is environment friendly and competitive compared to fossil sources.

(d) Setting Up of the RE Fund

The Fund needed for FiT implementation must be prescribed by the RE Law in order that contributions can be paid to it legally. If the fund is not specified in the RE Law then any such payments if received by Government must be paid to the Consolidated Fund or if received by the utility risked being mixed with its own funds. This can affect the legitimacy of the fund and jeopardise public's trust in the system. The availability and size of the fund will directly determine the overall RE capacity that can be installed in each year, as well as guarantee the payment for FiT throughout the contract period.

The fund is to be managed by a professional fund manager appointed by the Government, where the fund's governance structure, role and responsibilities must be set out in the RE Law with no room for discretion which could be misused. The payment to the power utilities for the cost of FiT (less the value of displaced electricity) shall be efficiently and expeditiously disbursed.

The RE Fund in the first year of collection would amount to RM 580 million. The projected collection is for a 20 year period (until 2030) about RM 20.1 billion. The structure, governance and responsibilities of the Fund Manager would be stipulated in the RE Law to ensure transparency and integrity. The total FiT cost and RE Fund is illustrated in **Table 7.5.**

Table 7.5: FiT Cost and RE Fund

Year	Average Retail Electricity Tariff (with projected increment)	Annual Electricity Sales (TNB)	Annual 2% Contribution Fee	Cumulative Size of RE Fund	Cumulative FiT Cost (less Displaced Electricity Cost, borne by TNB)	Annual RE Fund Balance (less FiT Cost & Fees)
2009	31.31 sen/kWh	RM 26 Billion	RM 0	RM 0	RM 0	RM 0
2011	33.50 sen/kWh	RM 30 Billion	RM 580 Million	RM 580 Million	RM 160 Million	RM 412 Million
2015	36.85 sen/kWh	RM 38 Billion	RM 730 Million	RM 3.2 Billion	RM 2 Billion	RM 1.21Billion
2020	40.53 sen/kWh	RM 48 Billion	RM 940 Million	RM 7.4 Billion	RM 6.7 Billion	RM 282 Million
2025	49.05 sen/kWh	RM 68 Billion	RM 1.2 Billion	RM 12.8 Billion	RM 12.1 Billion	RM 153 Million
2030	53.95 sen/kWh	RM 84 Billion	RM 1.6Billion	RM 20.1 Billion	RM 15.6 Billion	RM 3.7 Billion
2035	53.95 sen/kWh	RM 91 Billion	RM 0	-	RM 17.7 Billion	RM 1.6 Billion
2040	53.95 sen/kWh	RM 96 Billion	RM 0	-	RM 18.7 Billion	RM 519 Million
2045	53.95 sen/kWh	RM 101 Billion	RM 0	-	RM 19.1 Billion	RM 87 Million
2050	53.95 sen/kWh	RM 106 Billion	RM 0	-	RM 19.2 Billion	RM 6 Million
TOTAL				**RM 20.1Billion**	**RM 19.72 Billion**	**N/a**

Assumptions: Electricity tariff is increased by 6% in 2010 (4% for TNB and 2% for the RE Fund).

(e) Institutional Clarity Provided

It is important that institutional clarity be specified so all the agencies especially government stakeholders are aware of their respective roles. Institutional structure must provide for clarity of functions of the various interacting agencies. Amongst the functions of the relevant stakeholders for RE development are suggested below:

Table 7.6: RE Stakeholders and Functions

Organisation	Function
KeTTHA	• Policy setting and decision making on policy matters • Reporting to Parliament • Coordinating the CORE (committee for oversight of RE) team
ST	• Licensing of RE power producers • Safety of installations • Registration of competent personnel to undertake electrical works
RE Implementing Agency	• Management and approval of FiT application • Determining the applicable FiT based on commercial operation data for RE power producer • Evaluating technical competency of RE power producer for license recommendation to ST • Evaluating technical competency of RE equipment for fiscal incentives recommendation to MIDA • Providing the facilities for the SME-RE Centre • Providing the facilities for the RE Fund • RE data collection • RE reporting • RE advocacy
Professional Fund Manager	• Managing the RE Fund • Disbursing the fund to power utilities upon claim on efficient and expeditious manner
MIDA	• Approving fiscal incentives

Institutional clarity provides the basis for organisations to act, identify their boundaries and the scope of their responsibilities; without which the risk of institutional failure is high. The introduction of a RE Law which provides for the introduction of FiT is critical to the success of the new forward-looking RE Policy. Such a law will not only contribute to realisation of Thrust 1, it will also have the effect of stimulating the RE Industry, R&D and human capital development.

7.1.2. Supporting Measures

After the enactment of the RE Law, supporting measures need to be implemented are as follows (additional measures that may be considered are described in Annex C):

(a) Enter A "Delegation Agreement" In Lieu Of Amending Laws That Affect State Rights

To facilitate the growth of RE generation, a one-stop centre for approvals of ancillary matters should be set up to address the regulatory concern of the additional compliance costs with respect to planning permission and land use approvals at the state level. This one-stop centre is to be the Government appointed FiT Implementing Agency. The agency plays a coordinating role between the State Authorities whereby they should agree to delegate their approving function to the agency if certain specified conditions are met; in return all revenue collected from the processes are to be paid to them and not retained by the agency *("delegation agreement").*

Conceptually therefore the delegation agreement would provide for:

(1) Scope of agreement: Delegate authority to the Government appointed agency grant the planning permissions and land use approvals if specified conditions are met;

(2) Conditions for approval: A common set of conditions must be agreed with the State Authorities against which the agency can exercise the delegated authority to approve an application on behalf of the State Authority. These conditions must be documented in the agreement;

(3) Fees: State Authority is to specify the amount of fees the agency should collect from applicants, and such sums are to be paid over to the relevant State Authority. The agency's administrative costs in undertaking this is to be provided by the Federal Government;

(4) Duration: The agreement is for a finite period (say 5 years);

(5) Renewal: State Authorities must consent to renewal, not automatic;

(6) Governance: The agreement must provide for proper governance and accountability of the agency to the State Authorities.

The use of an agreement to facilitate the emergence of a new industry is a new and novel concept in Malaysia. It is anticipated to provide a better and more efficient means to undertake the activity without the need to amend the relevant laws.

The agreement requires the appointed agency to "negotiate" with all State Authorities on a common set of conditions for the grant of approvals for RE generation only. For example – the conditions of land use conversion if a planning permission is required for an RE facility within a residential area. For any matters beyond the specified conditions, the agency must refer to the relevant State Authority for approvals.

Such an approach does not require any amendments to the laws affecting land use and planning, thereby minimising (if not totally eliminating) any concerns of State Authorities' with federalisation or reduction of state rights.

(b) Improve environmental standards to spur innovation

Studies in the EU have shown increasing environmental standards do not decrease economic activity but instead improves economic activity (in general) and innovation (in particular)[42]. Malaysia's current environmental standards can be improved because:

(1) The applicable principal legislation (Environmental Quality Act 1974), preserves and supports the externalising of cost of environmental damage, as there is no need for firms to adopt cost-effective technologies to ensure compliance is minimised thereby reinforcing a "business-as-usual" thinking;

(2) Despite providing for the licensing of noise and air polluters, there are no prescribed regulations which specify the acceptable noise levels or ambient air quality standards. The Department of the Environment (DOE) in 1988[43] has provided guidelines to the air quality with respect to CO_2, SOx, NOx, particulate and suspended particulate and noise planning guideline issued on 2004[44] only.

The lack of appropriate environmental regulations has the exact opposite effect as firms and businesses in Malaysia adopt least-cost options, continue to pollute (unless higher standard countries demand action) and generally consider compliance with environmental standards as unimportant (i.e. NIMBY syndrome).

Once the RE Law is introduced, a support measure is to improve the environmental standards. This would have the effect of improving technology use (i.e. more efficient boilers in palm oil mills) which in turn will spur the need for R&D and business growth. KeTTHA may need to work with the DOE to secure the introduction of these new standards.

42 See "The Contribution of Good Environmental Regulation to Competitiveness" by the Network of Heads of European Environment Protection Agencies (November 2005)
43 See DOE's Air Quality Guideline available at http://www.doe.gov.my/dmdocuments/Udara/3%20RMAQG.pdf (accessed on 8 May 2008)
44 DOE's Noise Pollution Guidelines (2004) available at http://www.doe.gov.my/dmdocuments/guidelineBunyiBising.pdf (accessed on 8 May 2008)

7.2. Strategic Thrust 2: Provide Conducive Environments for RE Businesses

Malaysia has been successful in attracting foreign direct investment through the provision of a package of incentives tied to performance (i.e. export). Existing FDI policy which encourages the setting up of manufacturing related services sector[45] in RE should continue. According to Grant Thornton's 2008 International Business Report, the primary constraints faced by Malaysian businesses compared to East Asian businesses and Global businesses are skilled workers, demand or orders for their products or services, working capital and financing costs, as shown in Figure 7.2 below.

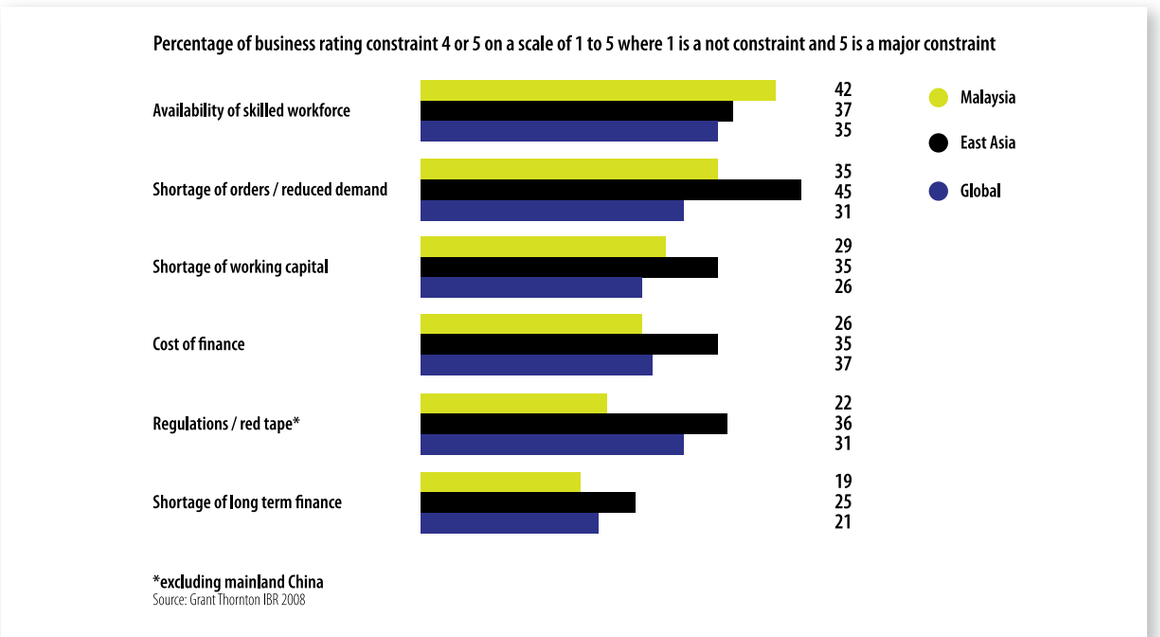

Figure7.2: Business constraints[46]

The institutional arrangement to implement this thrust effectively requires the intervention of Economic Planning Unit (EPU) to coordinate the actions of various Government ministries and agencies to develop RE as one of the new areas for national economic growth, and Ministry of Finance and Bank Negara Malaysia for financing and fiscal related actions.

Direct actions need to be taken to encourage entry into the RE market, with supporting actions aimed at stimulating demand for RE goods or services. The main actions are summarised and described in Table 7.7 below.

Table 7.7: Summary of Thrust 2 Main Actions

Type		Description of Main Action
Financial	(i)	Creation of an evaluation process for lending to RE power producers
Fiscal	(ii)	Continuation of existing fiscal incentives
	(iii)	Special incentives to use locally created/developed R&D (this can also stimulate T4)
	(iv)	Local content incentives
SMEs	(v)	Create an RE Centre for SMEs (this can support T5)
Corporate	(vi)	Involve GLCs and specifying their RE contribution
	(vii)	Involve existing MNCs in RE activities

45 Note: This sector covers the establishments of OHQ, IPC, RDC, RO and RE and other support services such as integrated logistics services, integrated market support services, integrated central utility facilities, cold chain facilities for food products, research and development (R&D), and renewable energy

46 Source: International Business Report 2008 – Malaysia, produced by Grant Thornton

7.2.1. Creation of Evaluation Process for Lending to RE Power Producers

This action is to smoothen the entry into either RE power generation or the RE Industry sector by addressing the financial difficulties currently faced. RE producers have found it difficult to secure loans because the financial institutions were unaware of the nature of RE business activity. Such difficulties can be overcome by creating a RE funding evaluation process which existing financial institutions must subscribe to and apply.

This is not new as there exist similar approaches for example the simplified lending process to small and medium scale industries backed by a guarantee from the Credit Corporation of Malaysia or in the provision of micro-credit.

The problem faced by RE producers is not that there are insufficient funds in the capital market but the lack of skills of the financial institution to evaluate the applications and provide the funds expeditiously. The treatment of RE borrowers as a normal corporate debtor ignores the nature of the RE project; particularly with the introduction of a feed-in-tariff in the new RE Law. This provides added security to the financial institutions in lending to RE power generation projects.

Through the creation of a standard evaluation process by the financial institutions, the provision of working capital to RE producers in a timely and appropriate fashion can be realised. This allows for the unlocking of the capital market for RE producers instead of Government having to provide funds for them.

To create the standard evaluation process, the Government should use leading banks (at least two banks in which the Government is a shareholder) to lead the way by setting up RE financing teams who are trained in RE and can draw up the standard evaluation criteria and process to be implemented. Mandating the evaluation process can be undertaken by BNM. Additionally the banks should be given specific RE loan targets by the Government for which they are to be held accountable for failing to meet those targets.

As a stand-by provision, the Government can offer financial assistance to RE power generation firms that are unable to secure funding despite there being an agreed and understood evaluation process. This financial assistance fund is estimated to be RM 500 million to be used over 5 years.

7.2.2. Continue Existing Fiscal Incentives

The set of Government fiscal incentives is not a long term or sustainable policy tool. It does have the immediate effect of encouraging the establishment of a new sector, and can have positive direct impacts[47] on the viability of RE projects by increasing the IRR and cash-flow. On the other hand, the incentive effect of some fiscal measures may be marginal, e.g. the benefits of tax relief may be considered marginal by an investor, especially when the existing corporate tax rate is sufficiently low.

Therefore for the short-term the existing fiscal incentives offered should be continued. An evaluation of their relevance and usefulness to firms should be undertaken in Year 4 after the RE Law has been brought into force, to determine if any revisions are required. However it is projected by 2019 the fiscal incentives should be permanently discontinued.

7.2.3. Special Incentives to Use Locally Created/Developed R&D

This action is related to Thrust 4. Firms which adopt and use locally created or developed R&D for RE should be granted special fiscal reliefs by the Government in order to stimulate the innovation system to produce local RE technology (of comparable quality and cost to international benchmark). This would enable to create a demand for local RE technology by RE power generation firms. The special fiscal reliefs are:

(a) Group tax relief - so losses in one subsidiary can be used to offset the profits in another; and

(b) Double deduction of the costs of the local innovation or R&D in RE technology used.

47 Note: The positive direct impacts are on internal rates of return (IRR) and payback periods for implementing RE projects by (i) increasing IRR by as much as 2% and (ii) reducing the payback period by as much as 3 years. The indirect effect is to lower the burden of a company's annual taxes between 32% to 53% via investment tax allowance, thus increasing the bank-ability of RE and cash flow.

The grant of group tax relief provides the ability of a group of companies to benefit from the investment by a member of the group in RE. Hence if a member incurs a loss, such loss can be used by a profitable member of the group to reduce its tax liability. That loss can arise from low sales in a market which is still not sufficiently mature; or from the double deduction of the cost of acquiring the local innovation which changes the profit to a loss. This incentive is proposed for a period of 10 years.

7.2.4. Local Content Incentives

Manufacturers of RE finished products and components for export should be encouraged to use local material in their finished products and components. This can help develop a supply chain for the large RE manufacturers.
The incentives would be:

(a) The provision of double deduction of the costs of local material as an allowable expense (for domestic manufacturers only) if the local content is in excess of 50% with a proviso this deduction is for a maximum period of 4 years;

(b) For foreign manufacturers investing in Malaysia, the incentive is to either extend their tax holiday by a further 2 years or if they have adopted an investment tax allowance, the grant of a 2 year tax holiday. This incentive is only available when the local content has exceeded 50%. The incentive is a one-time provision. Hence when the foreign manufacturer has reached 50.1% local content it can apply for the 2 year tax holiday, and upon the expiry of the 2nd year, this tax holiday incentive is no longer available.

The local content requirement and incentive should be extended to utilisation of local services, and firms who use in excess of 50% local service providers would be eligible to a waiver or refund of all service tax paid.

7.2.5. Create an RE Centre for SMEs

This action is related to Thrust 5. The SME sector in Malaysia is a significant group accounting for 32% GDP (2005), 56.34% jobs created (2005) and employing 5.6 million workers[48]. However the SME sector lacks informational assistance to venture into new areas despite having the necessary entrepreneurialism. SMEs often find it difficult to select and apply the most appropriate science and technology to grow their business or to venture into new areas such as RE generation or RE Industry.

To assist the SME sector to participate in this new market, Government should consider establishing a RE Centre in the RE Implementation Agency. The establishment of a RE Centre with clear objectives will help SMEs to engage effectively with the relevant parties in the National RE Innovation System. The Centre should focus on providing information to SMEs about RE technologies, opportunities and risks; and assist them to participate in incentive programmes, and match their interests with possible partners or providers.

Such a RE Centre should be able to secure advices from a government appointed agency with cooperation from SMIDEC. This agency would have the expertise and competency to advise and assist SMEs with RE specific matters while SMIDEC will have an overall responsibility for all sectors in which SMEs are involved in and not the RE expertise.

The illustrative cost estimates for the establishment and operations of the RE Centre based on 10 personnel renting appropriate premises and having the necessary facilities is RM 20 million over five years.

7.2.6. Involve GLCs and Specifying Their RE Contributions

This action calls for Government Linked Companies (GLC) to support and participate in RE generation because they either have suitable RE resources, for example Sime Darby is in the palm oil plantation businesses thus can use the palm oil waste (EFB or POME) for power generation or that they have assets which can be shown as demonstration projects.

48 SME Annual Report 2007 published by Bank Negara Malaysia and available at http://www.smeinfo.com.my/index.php?&pg=286&ch=2&ac=727&lang=en (accessed on 20 Feb 2009)

Furthermore according to the Putrajaya Committee[49] on GLC Transformation, the role that GLCs are to have is to be high-performing entities which are critical for the future prosperity of Malaysia. The GLC Transformation programme covers 2 additional areas, namely delivery of significant benefits to stakeholders and a strong corporate social responsibility.

The rationale for getting the GLCs involved is to enable the Government to leverage these external assets to kick-start the growth of the RE generation sector, which in turn will spur the development and growth of RE Businesses. The leveraging takes the form of direct participation in RE generation either as a viable business or as a demonstration project. Such leveraging by Government of these assets is consistent with the GLC Transformation programme to deliver significant benefits to stakeholders (not just shareholders) and for GLCs to have a strong corporate social responsibility (which can be evidenced by GLCs participation in Government's socially beneficial programme). From their efforts of helping to improve the environment through the reduction of CO2-equivalent emissions, introduction of clean technologies and creation of new job opportunities, the GLCs would provide significant benefits to the people of Malaysia.

The role of the Government is also important as an incentive for the GLCs to be involved, it is necessary for Government to:

(a) Identify those who can contribute directly since not all GLCs are suitable for the undertaking of RE generation; and

(b) Specify the RE contribution by specified GLCs which should be monitored by KeTTHA and could be made mandatory.

The suggested approach of Government identifying GLCs and specifying the RE targets by them is consistent with a leveraging of these assets by government for the benefit of the people as a whole. The possible identifications and targets for GLCs role are summarised below:

Table 7.8: RE Target for GLCs

GLC Identity	RE Contribution to meet SMART Target	Min. RE allocation target in 2020
Malaysia Airports	BIPV when refurbish airports in and around Malaysia	10%
Sime Darby, Felda, Golden Hope Plantations etc	Biomass and biogas	10% + 5% (respectively)
UEM	Solid waste	30%
Regional Development Authority	BIPV for new buildings	5%
Sykt Prasarana Negara Berhad	BIPV at rail and bus stations	3%
Sykt. Perumahan Kerajaan	BIPV + new residential areas	20%

7.2.7. Involve Existing MNCs in RE Activities

Malaysia has a significant number of MNCs that are not only environmentally conscious (such as IKEA, INTEL, Western Digital, Daimler and many others), but have their long standing relationships with local suppliers. In a sense, this is a 'natural asset' in the country which could be exploited positively by Government. The MNCs should be encouraged to engage in RE generation for themselves and/or to exert their positive influence on local suppliers to encourage them to do likewise. This requires KeTTHA or the Government appointed agency to engage with MNCs to discuss ways by which they can help and what Government can offer as incentives. The incentive scheme will be formulated upon the adoption of the RE Policy.

7.2.8. Additional Measures

Other additional measures are specifically targeted at building refurbishment, to help stimulate the emergence of RE Power Generation and further development of RE Industries.

49 Putrajaya Committee on GLC High Performance (PCG) (http://www.pcg.gov.my) was formed in January 2005 to follow through and catalyse the GLC Transformation Program. PCG is chaired by the Second Finance Minister, with participation from the heads of the Government-Linked Investment Companies (GLIC.'s) namely Khazanah Nasional Bhd (KNB), Permodalan Nasional Bhd (PNB), Employees Provident Fund (EPF), Lembaga Tabung Amanah Tentera (LTAT), Lembaga Urusan Tabung Haji (LTH), and representatives from the Ministry of Finance Inc. (MOF) and the Prime Minister's Office, to work together to monitor developments and to recommend further measures of improvements.

(i) Strategic use of public procurement

Government should use its public procurement power strategically to spur RE generation and industry growth. Government should, in upgrading its federal buildings include the use of building integrated RE as a requirement. This will create the demand for RE materials and skills which in turn will encourage market entry of related businesses. The strategic use of Government's procurement power can demonstrate Government's commitment to RE, which will in turn motivate the participation of the private sector. This can be achieved by incorporating design elements for RE technology, in particular BIPV, into the Government's (EPU) Standard and Cost guidelines and procedures. This also requires the respective Government agency implementing the construction or renovation tenders to provide preference for RE technologies and tolerance for the additional cost incurred which could be partially off-set by the displaced building materials.

(ii) Rewards for new buildings (including refurbishment) that incorporate BIPV

Special rewards should be provided to commercial and agriculture building owners that integrate RE technologies (e.g. PV in building claddings) into their new or refurbishment buildings, such as:

(a) Group tax relief – so losses in one subsidiary can be used to offset the profits in another;

(b) Special expenditure relief in the form of a 125% deduction of allowable expense or as part of the investment tax allowance; and

(c) Reduction of import duties and/or sales tax for RE related equipment for a 3 year period.

Whilst in an economic downturn, it is possible for building owners to take the opportunity to refurbish their buildings to be prepared when the economy improves. Those who are prepared to do so would benefit from the availability of these rewards. The possible loss in revenue by the Government may, however, be small in comparison to the effect of stimulating the growth of RE businesses.

7.2.9. Alternative Choice of Implementing Mechanism

Instead of the usual mechanisms by which incentives are provided by Governments (i.e. where incentives are prescribed and available to those who apply), offering incentives in unique ways may be considered as the mechanism itself may provide an incentive to interested parties to be first or choose Malaysia as their investment destination. Details of the proposed alternative mechanisms are set out in Annex C of the report. Obviously more in-depth analyses of these alternative mechanisms are needed before they can be implemented.

7.3. Strategic Thrust 3: Intensify Human Capital Development

Human capital development is a key thrust because it has the potential to create the greatest impact on the country. Malaysia's Knowledge Economy Master Plan identifies the importance of human resource development as it can increase the overall productivity and adaptability of the Malaysian economy which is fundamental for the transition to the K-economy, and calls on the Government to build the necessary infrastructure[50]. The focus on human capital development in Thrust 3 is in line with the K-economy master plan. Recognising this, there is unfortunately a current lack of available courses which are of use and relevant to RE businesses.

However as the percentage of those with tertiary education in the country is small (about 13.9% as at 2001), encouraging individuals to enter tertiary colleges is a necessary step to increasing this percentage. This requires a determination of what motivates a person to have a tertiary education; and how the Government can provide incentives for such individuals.

The proposed actions are designed to simultaneously build up the local expertise and skilled workers in RE, and to provide the right incentives for ordinary individuals to acquire new skills and expertise. However these actions are subject to a 'sunset' condition. The institutional arrangement to implement this thrust effectively requires the intervention of Ministry of Finance, Ministry of Higher Education, Ministry of Human Resources and other relevant Government agencies to coordinate the actions in intensifying the human capital development to meet the requirement of the RE industry.

50 Additionally the Government is called to improve the function of the markets in order to unleash the creative power of markets, while the private sector should be proactive in increasing its knowledge capability and knowledge content of its activities as well as raise its international competitiveness to a new threshold.

7.3.1. Incorporate RE in Technical and Tertiary Curricula

The availability of RE technology courses in local IHLs and training centres would need to be increased. This can be done through the collaboration with relevant ministries in designing an RE course curriculum which meets the need of RE. Certifying training courses according to the National Skills Development Act 2006 and the Malaysian Qualifying Board should also be pursued. Discussions would be required with DSD and MOHE on the course structure. This move is anticipated to produce graduates and technical personnel who would be ready to work in the RE industry.

7.3.2. Development of Training Institutes and Centre of Excellence

The availability of adequate and quality training facilities would need to be enhanced to meet the expected demand for RE courses. Such facilities also need to meet certain international standards for quality RE education and cater for technical competency and professional as well as management levels. Centre of Excellence (CoE) for RE should also be created at universities to further promote high class facility which will produce quality graduates and researches.

7.3.3. Provision of a Subsidy and Fiscal Reliefs

Providing the necessary courses at institutions of higher learning and technical training centres may of themselves not necessarily produce the necessary skills. Since most Malaysians prize education, providing an education incentive would not only stimulate demand, it will also expedite the take up of these courses. The direct action calls for the provision of a subsidy for RE technical training and/or fiscal reliefs to individuals who pay the course fees for graduate courses in RE at institutes of higher learning, as detailed below.

(i) Technical training subsidy

The technical training, for which the fees for RE courses are subsidised (e.g. RE technician's courses), must be certified under the National Skills Development Act 2006. There are potentially 232 technical training centres in and around Malaysia[51] which could provide such RE courses, and provides easier accessibility for intending trainees. An advocacy programme targeted at training centres would be used to encourage them to introduce RE technical training courses.

Those individuals who wish to improve themselves will benefit from the subsidy and payment to the training institution should only be made upon confirmation the individuals have completed the course. Timing for the payment of the subsidy is after the eligible individuals completes the course within the time limit set by the college and are awarded the appropriate certificate, and not before. This is to avoid subsidising individuals who drop-out of the course and fraud by the centre. However the centres receipt of this subsidy is still subject to income tax.

It is necessary to engage with the Department of Skills Development ("DSD"), Ministry of Human Resource to secure the introduction of the RE curriculum at these training centres. The illustrative cost estimate of the subsidy is projected at RM100 million over 5 years.

(ii) Fiscal reliefs for higher education

Fiscal reliefs for the costs of graduate courses should be given to individuals who undertake graduate courses in RE with local institutes of higher learning (IHLs). The total fee payable in a tax year to the IHL would be treated as an allowable expense from the individual total income.

Such a fiscal relief will encourage individuals to undertake RE course, which will encourage IHLs to offer courses involving RE. The likely impact on Government is minimal since the number of individuals prepared to undertake RE courses may be small, yet the benefits of such incentive would outweigh its costs to Government.

Currently the field of engineering and architecture is not a popular choice of course among students. This is attributed to the fact that these courses are difficult to gain entrance to and the coursework are very demanding. Table 7.9 below shows in 2007, only 14,574 or 18% out of 83,119 graduates are from the field of the engineering and architecture. The same trend is also seen in the post-graduate (non-doctoral) and students who undertook doctoral courses in engineering and architecture in local universities (public and private) are 12% and 15% respectively.

51 See Department of Skill Development, Ministry of Human Resources, at http://espkm.nvtc.gov.my/Modules/2.4_MIS/2.4.3_SearchEngine/frmSearchACCentres.aspx (accessed on 24 February 2009)

Table 7.9: Number of Graduates in 2007 from Local Universities[52]

	All faculties	Engineering & Architecture	Engineering & Architecture as % of all faculties
Total number of graduates	83119	14574	18%
Post graduate (non-doctoral)	9313	1155	12%
Ph.D	719	108	15%

Usually only 8% of all graduates went to pursue a post-graduate course. Therefore if an optimistic assumption of 20% on all engineering and architecture graduates who would pursue a post-graduate degree due to the fiscal relief, the likely number of individuals who would benefit would be 3,000. This will have a significant impact on the availability of RE skill sets in Malaysia, but not necessarily on the amount of tax collected.

Both the training subsidy and fiscal reliefs should sunset over time to avoid entrenching a human capital development program which is subsidy-laden. The proposed duration of the incentives is 4 years for applications and once granted will be applicable for the duration of the course.

7.3.4. Additional Measure

Permit withdrawal from the HRDF
Firms in Malaysia have been obliged to contribute a percentage of their employees' salary to the Human Resource Development Fund (HRDF). Withdrawal from the HRDF is permitted to pay for training at approved training facilities. Therefore if there are firms who are willing to or have entered the RE generation or RE Industry markets, these firms should be permitted to withdraw their contribution from the HRDF to pay for the cost of retraining of their personnel. This requires the facilities which provide RE skills training have prior approval by HRDF. Discussions with HRDF are needed for there to be a smooth and simple approval process for the training facility. This would reduce the financial burden on firms who are willing to enter this industry but require appropriately trained personnel.

7.4. Strategic Thrust 4: Enhance RE Research and Technology

It must be recognised and acknowledged whilst there are positive economic benefits to Malaysia from greater private sector investment in R&D, the principal limit to the amount of businesses outlay is the perceived returns in the marketplace. If there is no or low returns, the private sector is unlikely to make an investment. This raises the question on the role which the Government can play to stimulate R&D in RE in Malaysia, and what strategies could employed to accomplish the mission.

The state of the art of RE technology has progressed significantly when clear incentives were introduced by Government policy. However the current state of plants and equipments using biomass as a combustion fuel is inefficient. At the same time there are some RE technologies which require indigenous R&D to be undertaken to make them viable domestically.

This situation provides an opportunity for firms to enter and develop indigenous RE technology to be offered for biomass plant upgrading to improve efficiencies. R&D incentives targeting this action (rather than the sub-sector RE-biomass) would bear more positive fruits.

7.4.1. R&D Issues and Innovation System

An innovation system comprises actors, networks and institutions (including regulation), and their interaction with each other. Walz *et al*[53] conclude that innovation processes are shaped by the following factors:-

(a) Innovation is not a linear process, but consists of many feedback loops between invention, technology development and diffusion;

52 Source: MOHE at http://www.mohe.gov.my/web_statistik/index.htm?navcode=NAV038?m=3&navcode=NAV038&subcode=SUB001&lang=ENG (accessed on 24 Feb. 09)
53 Walz R., Ragwitz R., and Schleich J., "Regulation and innovation: the case of renewable energy technologies" Fraunhofer Institute Innovation and System Research, Germany

(b) Innovation is embedded in production of knowledge and socio-economic development and institution leading to path dependency;

(c) Producer-user interaction and learning in the market makes early diffusion important;

(d) There is a need to differentiate between diversification of solutions and selection towards dominant designs;

(e) Stability of framework conditions which in general enhances innovation processes; and

(f) Communication between actors on various levels is essential to disseminate knowledge and to gain new insights.

The interaction of the various actors in RE, as illustrated by Walz *et al,* is illustrated in Figure 7.3 below. It begins with (1) the demand for RE technologies, which leads to (2) the supplier of the technology and (3) investors in RE technology. RE technology demand leads to (4) transmission and distribution of electricity. The interactions are not one-way but bi-directional indicating each could influence the other. Along each of these interactions, policy could have an influence.

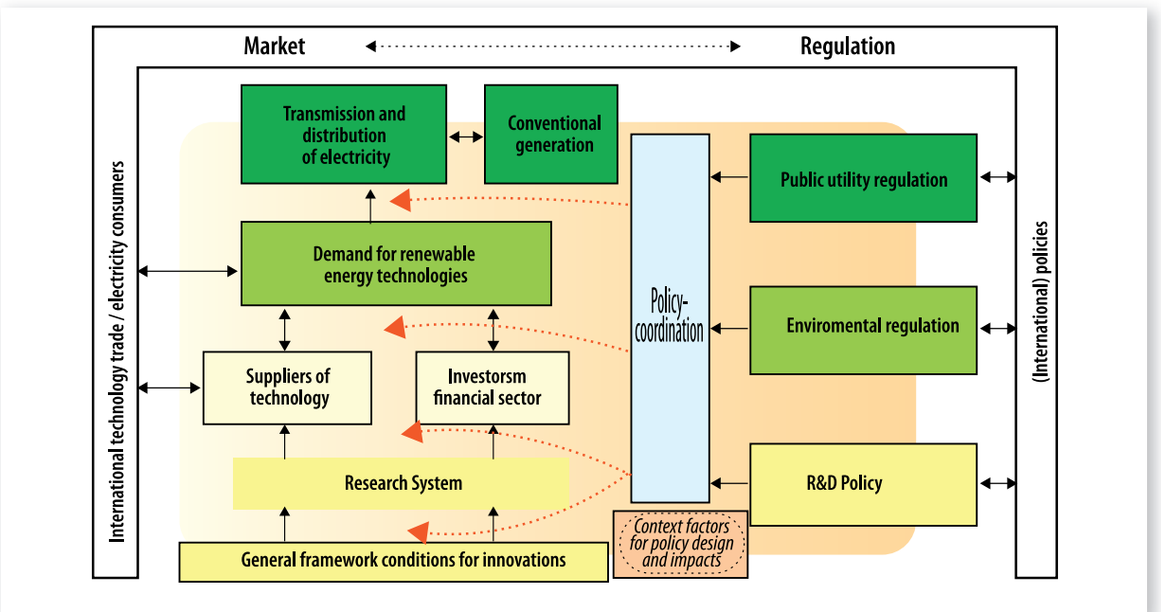

Figure 7.3: The triple role of regulation within the system of innovation of wind energy

The diffusion for the technology becomes an important aspect which influences various functions of an innovation system. Innovations in RE technologies, according to Walz et al are shaped by regulation. Further high level of regulation is needed to foster diffusion of the technologies.

7.4.2. State of R&D in Malaysia

Research and development are essential for the emergence of inventions and innovations in society. Malaysia's 2005 R&D expenditure as a percentage of GDP as reported by MOSTI is 0.64%[54]. In comparison, the R&D expenditures of Singapore, Taiwan and Japan are 3, 4 and 5 times respectively compared to that of Malaysia.

However R&D activities are held back by insufficient funding, lack of expertise and poor co-ordination of R&D among research institutions. Duplication of R&D efforts is not uncommon. The lack of commercialisation of R&D in RE technologies reduces the support which R&D firms need.

Effective research activity is also a pre-requisite to attracting R&D investment. Local research institutions have a poor track record of commercialisation of R&D activities, specifically RE technology. There is also a lack of coordinated research activity undertaken in RE technology by these research institutions.

54 Source: National Survey of Research and Development 2008 Report – Data for Year 2006 from Ministry of Science, Technology and Innovation available at http://www.mosti.gov.my/mosti/failpdf/fact&figure.pdf (accessed on 13 Feb 2009).

Research Funding Focus

Government has allocated RM 4.4 billion in the 9th Malaysia Plan to fund R&D activities as shown in Table 7.10[55] below.

Table 7.10: Amount of Funds Allocated for R&D

Research focus area	Amount in RM million (9MP allocation)
Biotechnology sector	550
ICT sector	878
Research funding (Science Fund)	966.5
Pre-commercialisation of research (Techno & Inno Funds)	1,275.8
Commercialisation of R&D	115
STI	40.5
Human capital	550

Of the total RM 4.4 billion, RM 1.4 billion has been allocated for pre-commercialisation and commercialisation funding in five areas i.e. biotechnology, ICT, industry, sea to space and S&T Core with the 3 following areas having sub-focus areas.

Table 7.11: Pre-commercialisation and Commercialisation R&D Focus Areas

Technology Cluster	Sub-Areas within the Technology Cluster
i) Information and Communication Technology (ICT)	• Information System • ICT Infrastructure • Software • Emerging Information Technology • Communication • Security System • Signal Processing • Database Technology • ICT Application
ii) Biotechnology	• Plant • Animal • Food • Biopharmacy • Molecular Biology • Medical Biotechnology • Industrial/ Environmental Biotechnology
iii) Industry	• Advanced Materials • Advanced Manufacturing • Nanotechnology • Alternative Energy • Radiation Technology • Waste to Wealth • Processing Technology • Engineering Development • Environment

There is inherently a strong focus on the funding of ICT and biotechnology R&D (as can be clearly seen by the total amount of both specific and general funds made available to these two sectors). This naturally edges out RE as it must compete for both recognition and funding with other technology areas which already have a high degree of Government support.

R&D Policy Actions in RE

Currently there is no specific policy or roadmap for R&D specifically focussing on RE. Most research institutions and universities map out their own path for R&D based on the priority and interests of their management. In the government sector the responsibility of charting the path for R&D for any particular area is under the jurisdiction of MOSTI.

55 Available from MOSTI.

MOSTI has made some initial efforts to increase R&D in RE. The steps that have been taken to support R&D in RE technologies include:

(a) Establishing two committees in recognition of the need for a systematic national R&D for RE, namely the RE Task Force chaired by the Deputy Minister MOSTI and RE Technical Working Group chaired by SIRIM;

(b) Identifying the focus areas of the RE technology research and R&D - namely biomass, biogas and solar;

(c) Utilising the Techno and Science Funds to provide grants for R&D activities in new RE technologies; and

(d) Developing a specific budget for research in RE technologies.

Current Status of R&D in Malaysia

The current public sector funding for R&D has a strong focus on the biotechnology and ICT sectors. These two sectors account for 33% of the total available funds for R&D (without taking into account the focus areas of the general funds). The pre-commercialisation and commercialisation funding is available for only five specific technology clusters.

RE is not identified as one of the focus areas for R&D thus it has to compete with other subjects for research funds. As a result, RE research is subject to a high degree of competition amongst the various technology clusters funded (i.e. inter competition) as well as competition amongst technologies within the ambit of "Alternative Energy" (which includes nuclear as well as renewable energy, i.e. intra competition). As a result it is unlikely generic funding of RE research would be successful, when such a clear preference towards ICT and biotechnology sectors exists.

The current status of R&D whilst is a positive move towards supporting the Strategic Thrust 4, is inadequate because the actions are geared towards provision of money, instead of developing a conducive environment which encourages R&D activities in RE technologies. The Australian approach provides valuable lessons as they have reported the creation of conducive environment is an important element. R&D focus should be on the activities which will help the sector, i.e. activity based focus and monitored and performance specific.

Further, the gaps in the current approach should be addressed. The Government needs to play a leadership role to guide the private sector involved in R&D as the private sector:

(a) Is very conscious about costs (about 70% of Malaysian businesses think cost management is a main source of competitive advantage); and

(b) Is not sufficiently putting focus on innovation as a source of competitive advantage (only 44% of Malaysian businesses consider innovation as a source of competitive advantage)[56].

In Malaysia the provision of public money by the Government may be insufficient however the Government can play a key role to help identify the research needs (i.e. the problem to be solved) and which research funding could be made available.

56 International Business Report 2008 – country focus (Malaysia), Grant Thorton available at www.internationalbusinessreport.com

7.4.3. Develop an RE R&D Action Plan

Government should not expect the R&D activity to produce inventions but the thrust should be considered a success if R&D activity produces innovation. The difference between the two words "invention" and "innovation" needs to be clearly appreciated, in order that expectations are clear[57] and funding could also be made available for innovative processes or actions.

The key features of the RE R&D Action Plan are as listed in Table 7.12 below:

Table 7.12: Key Features of RE R&D Action Plan

Features of R&D action plan	Feature Details
Demand articulation	The problem requires research to be done – e.g. improving the efficiency of biomass boilers will be identified. This is called "demand articulation": • Demand articulation - defines the problem to be solved by the research, identification of the technology and market availability; • Should be prescribed in RE Research Flagship which has specific objectives framed by a good understanding of the needs of researches, users, customers and the community; • The role could be played by Government as private sector does not see innovation source of competitive advantage. Sunset clause: Demand articulation should be for a specific duration of 5 years and if it needs to be extended, a debate in Parliament is necessary to amend the enabling law.
Market information	Whilst initially using demand articulation will help local firms identify the market but over time the government should refrain from doing so. Therefore the R&D Action Plan should provide for the availability of market information so firms will be able to identify market potential of research areas.
Resources – Availability of skilled people	Without adequate skilled workers R&D programmes have a low chance to succeed. Therefore: (i) Permit the importation of high quality foreign skilled workers (i.e. knowledge workers) to address the immediate shortage. (ii) Encourage local individuals to undertake post-graduate courses via the incentive programme (in Thrust 3).
Resources – Facilities	Requirement of establishment of an RE research lab/ Centre of Excellence which the research cooperatives can use.
Resources – Financial	Provide funds by the Government; and continue with the R&D fiscal incentives is required. Funds would be subject to the performance and monitoring framework.
Institutional features	Design an effective institutional framework, where the joint venture of public and private sectors is reflected in a cooperative research centre, with these features (i) Close interaction between researchers and users of research; (ii) Industry contribution to the centre's education programmes to produce industry-ready graduates; and (iii) As a place where higher degree programmes can be undertaken.

57 R&D funding is not about patent filing only. Availability of invention is a small arena of R&D activity. Innovation is the primary action of R&D. Not all innovation can be patented because of legal requirements in Patent Laws which may not be met. This does not mean that there is no protection or that there is no value to the innovation. Governments should realise this difference and R&D activities should be supported if they are to innovate the RE technologies.

Features of R&D action plan	Feature Details
Monitoring and evaluation framework	The recipient of the funds must be subject to a proper monitoring and evaluation mechanism which is fair, transparent and accountable. A fair and proper monitoring and evaluation mechanism is transparent and accountable without any risks of bias or a conflict of interests.
Governance	Clear and transparent rules for awarding funds to bidders, avoidance of conflicts of interests, proper and legally binding undertakings to preserve intellectual property of bidders; accountability process and grievance mechanism.
Feed-in-Tariff law	Introduce a feed-in-tariff law with the specified degression which will encourage technological innovation to reduce the RE technology cost.
Roles and Responsibilities	Clearly identifying the roles and responsibilities of the parties and their accountability.

The illustrative estimates of the cost of Thrust 4 is about RM 600million to be spent on capital and operational expenditure as well as funding of R&D activities.

The institutional arrangement to implement this thrust effectively requires the intervention of Ministry of Science, Technology and Innovation, Ministry of Higher Education and other relevant Government agencies to develop and implement the RE R&D Action Plan.

7.5. Strategic Thrust 5: Design and Implement an RE Advocacy Programme

The RE Policy must continue to build or acquire political capital because of the long term nature of policy to bear fruits. Malaysia is unfortunately fond of showing immediate success "through harvesting low hanging fruits" (i.e. easy targets or more visible ones). However RE Policy is not a short term policy nor can a short term approach produce positive results. Without long term political capital the sustainability of the RE Policy may diminish as it would not be able to attract authority and funds from the political authority. Consequently a policy advocacy programme is needed which helps build political capital for the sustainability of the RE policy.

What is a Policy Advocacy Programme

A policy advocacy programme (sometimes referred to as social marketing) is a programme designed to provide information of the policy, its objectives and its outcomes to the stakeholders to achieve and sustain on-going public support. Furthermore advocacy programmes provide results to the public and political authority.

The objective of a policy advocacy programme is not just about providing factual information but the provision of information which helps build political sustainability of the policy (i.e. buy-in) and minimise policy resistance.

Rationale

The introduction of RE Policy is a significant change from the "business-as-usual" approach which requires different stakeholders' contribution and support. Civil society as the contributor of the public fund, needs to be convinced that the idea of the fund and the contribution is sound and there is no risk the fund will be abused.

Thus different stakeholders have different interests and it is important these are addressed by way of tailored messages to target audiences. Nonetheless the soundness of policy is and should be advocated as the common theme. If there is no clear advocacy programme the stakeholders on whom the success of the policy depends on will turn against it, and the policy is doomed no matter how suitable, appropriate or effective it may have been.

Therefore the rationale for the advocacy programme is to win the cooperation and support of various stakeholders to secure their willing participation for the future success of the RE policy which will bring benefits to the society.

Types of Advocacy Programmes

Awareness programmes are one type of the range of advocacy programmes which should be adopted. Another approach is the commissioning of independent evaluations published locally or engaging third party public sector bodies to organise workshops, discussion forums, seminars or case studies or even public hearings, briefings or consultations. Social marketing is another form of advocacy programme.

However all advocacy programmes are designed to achieve two objectives which are to provide information and secure support for a new action by Government.

7.5.1. Design an Advocacy Programme

A pre-requisite of successful advocacy is a programme design which takes into account the target audience, the timing of the programme and the message to be given. This means the implementation of the advocacy programme has to be carried out in phases.

Table 7.13 provides an indication of the target audience and the possible message in each phase of the advocacy programme.

Table 7.13: Phases of RE advocacy programme

Target audience	Phase 1 (Understanding) Message	Phase 2 (Participation) Message
Public-at-large	1. Environmental awareness and overcome the NIMBY syndrome, and commitment to environmental sustainability; 2. RE Law, its purpose and how it benefits them; 3. How RE benefits people; 4. Importance of the contribution mechanism and the RE Fund.	5. Report to the people the status of RE initiatives; 6. Inform of the training incentives to encourage them to take up the courses; 7. Identify the R&D programmes they may want to participate.
Schools	1. Environmental awareness, commitment to environmental sustainability 2. How RE benefits people	3. Environmental awareness strengthening 4. How RE benefits people
Banks	1. Viability of funding RE projects	2. Viability of funding RE projects 3. Solicit feedback on ways to improve process 4. lending process evaluation with banks
GLCs MNCs Publicly Listed Companies & other large enterprises	1. Environmental awareness, overcome the NIMBY syndrome and commitment to environmental sustainability; 2. RE Law, its purpose and how it benefits them; 3. How RE benefits people; 4. Importance of the contribution mechanism & the fund. 5. Incentives on offer for improved involvement; 6. Their involvement – what can they do; 7. Incentives on offer for improved involvement.	8. Make them the messenger of the various initiatives that Government is introducing. 9. Get them to encourage their suppliers to look at RE businesses as an option. 10. Showcase their RE activity
SMEs	1. Environmental awareness, overcome the NIMBY syndrome & commitment to environmental sustainability; 2. RE Law, its purpose and how it benefits them; 3. How RE benefits people; 4. Importance of the contribution mechanism and the RE Fund. 5. How can they become RE Businesses	6. Inform them of specific investment opportunities 7. How and why they should become RE businesses
Regulatory bodies	1. The role that they can play to help achieve the Thrusts	2. Ensure that their policies and regulatory instruments are consistent with the RE Policy.
The Third Sector[58]	1. The role that they can play to help achieve the Thrusts 2. Be the champion for the RE Law, contribution and RE Fund	3. Make them the messenger of the various initiatives that Government is introducing.
Government agencies (e.g. DOE, MOHR, MIDA, EPU etc)	1. Environmental awareness & overcome the NIMBY syndrome; 2. RE Law, its purpose and how it benefits them; 3. How RE benefits people; 4. Be the champion for the RE Law, contribution and RE Fund	5. Environmental awareness and overcome the NIMBY syndrome; 6. RE Law, its purpose and how it benefits them; 7. How RE benefits people; 8. Be the champion for the RE Law, contribution and RE Fund; 9. Promote RE Businesses.

Note: The regulatory bodies would encompass such as BNM, SC, MCMC, SPAN, Cooperative Commission, CCM, BURSA.

58 The Third Sector is the sector that is neither the public sector nor the private sector. It encompasses civil society and NGOs or any organization not within the first two.

The key features of the Advocacy Programme are:

Table 7.14: Key Features of the RE Advocacy Programme

Features of Advocacy Programme	Detail explanation
Specifying champions within and outside KeTTHA	These champions are people who believe in the new RE Policy and are the spokesperson on all matters relating to the RE Policy. Their enthusiasm can be harnessed to secure other supporters.
Methods to use all media and the new media	A proper media usage plan is needed to maximise the reach of the message to all stakeholders. This way the cost of face to face meetings can be avoided completely.
Indentify all stakeholders	All stakeholders should be identified (not just be category but by name if possible).
Sufficient flexibility	The programme must be sufficiently flexible to adapt to changes in the social, business, economic and political climate of the country.
Periodic monitoring & evaluation	Periodic monitoring and evaluation of the results produced by the programme is necessary in order to continue, change or revise the detailed activities of the Advocacy Programme.

The estimated cost of the advocacy programme over a 5 year period is RM 120 million.

The institutional arrangement to implement this thrust effectively requires the intervention of Ministry of Information, Communication and Culture, Ministry of Education and other relevant Government agencies to design and implement the RE advocacy programme.

7.6. Summary

7.6.1. Impact on Policy Objectives

The direct main actions of each Thrust and their impact and influence on realising the five Policy Objectives are summarised in the matrix in Table 7.15.

Table 7.15: Actions under each Thrust and their impact on Policy Objectives

Thrusts	Direct Main Action to be taken	Policy Objectives				
		1	2	3	4	5
T1	Introduce RE Law	√	√	√	√	√
T2	Create lending evaluation process	√	√			√
	Continue with current fiscal incentives	√	√	√		
	Special incentives for using local R&D tech.	√	√		√	√
	Local content incentives		√			√
	Market entry for SMEs via SME RE Centre	√	√			√
	RE Contribution by GLCs	√	√		√	√
	Involving MNCs		√		√	√
T3	Technical and tertiary curricula	√	√		√	√
	RE training institutes and Centre of Excellence	√	√		√	√
	Financial and fiscal incentives for technical and tertiary education	√	√		√	√
T4	Develop a RE R&D Action Plan	√	√	√	√	√
T5	Design an Advocacy Programme that promotes understanding	√	√		√	√

The direct main actions of each Thrust also addressed the key issues affecting RE as identified and discussed in Chapter 3, as shown in Table 7.16 below. Thus, with the effective implementation of each of the Strategic Thrust the barriers to RE deployment would be removed.

Table 7.16: Actions under Thrust and Impact on Key Issues Affecting RE

Thrusts	Direct Main Action to be taken	Key Issue Identified							
		Market failure exists	Constraints	Arbitrary price setting	Tensions & trade-offs	Absence of regulatory framework	Poor governance	Limited oversight	Lack of institutional measures
T1	Introduce RE Law	√		√	√	√	√	√	√
T2	Create lending evaluation process		√						
	Continue with current fiscal incentives		√						
	Special incentives for using local R&D tech.		√						√
	Local content incentives								√
	Market entry for SMEs via SME RE Centre								√
	RE Contribution by GLCs		√						√
	Involving MNCs		√						√
T3	Technical and tertiary curricula								√
	RE training institutes and Centre of Excellence								√
	Financial & fiscal incentives for technical and tertiary education								√
T4	Develop a RE R&D Action Plan		√						√
T5	Design an Advocacy Programme that promotes understanding	√	√	√	√	√	√	√	√

Table 7.17: RE Action Plan Implementation Timeline

Strategic Thrusts	Direct Main Action to be taken	Time Period				
		Q1	Q2	Q3	Q4	Q5
T1 (Law)	RE Law introduce	Design & start implementation				
T2 (Biz)	Create lending evaluation process		Start			
	Continue with current fiscal incentives	Start				
	Special incentives for using local R&D tech.				Start	
	Local content incentives				Start	
	Market entry for SMEs via SME RE Centre		Start			
	RE allocation by GLCs			Start		
	Involving MNCs				Start	
T3 (Skills)	Technical and tertiary curricula				Start	
	RE training institutes and Centre of Excellence			Start		
	Financial and fiscal incentives for technical and tertiary education				Start	
T4 (R&D)	Develop a RE R&D Action Plan					Start
T5 (Advocacy)	Design an Advocacy Programme that promotes understanding					Start

7.6.3. Direct Cost and Development Budget

The estimates of the funds the Government will have to spend over the next 5 years in implementing the various Thrusts of the RE Action Plan, being moneys the Government will actually pay out (but excluding moneys not received e.g. tax revenue because of tax breaks or reliefs) is approximately (2011-2015) RM 1.5 billion.

Table 7.18: Direct Costs to the Government

Thrusts	Direct Costs	Period & Purpose
T2	RM 500 million	Over 5 years to provide financial assistance to RE developers/companies.
T2	RM 20 million	Over 5 years for the setup and operational cost of RE centre for SMEs.
T3	RM 100 million	Over 5 years for subsidy towards RE technical trainings.
T4	RM 600 million	Over 5 years for RE R&D fund and action plan.
T5	RM 120 million	Over 5 years for RE advocacy programme.
All	Up to RM 100 million	Over 5 years to develop the RE programmes and for annual baseline studies.

Note: The 2% collection from electricity revenues for the RE Fund is not included as developmental budget. The O&M cost and service fees for the utilities and implementing agencies in implementing the feed-in tariff are covered by the RE Fund. However, the cost of designing the detail of the RE Act, feed-in tariff and RE Fund mechanisms should be included as the developmental budget.

Table 7.19: Costs to Development Programmes and Mechanisms of RE Action Plan

Development cost for the detail programmes	RM million
1. Feed-in tariff and RE Fund mechanisms	1
2. Financial assistance mechanism to RE developers	2
3. SME centre and mechanism	0.5
4. Technical training subsidy mechanism	3
5. RE R&D action plan	2
Sub-total	**8.5**

Table 7.20: Detail Activities and Corresponding Budget for RE Advocacy Programme (Thrust 4)

Stakeholders	General print media (newspapers/ magazines)	TV/ radio	Web info	Local seminar/ workshop	Roadshow/ exhibition	Technology demonstrations	Local study visits	International missions/ business meetings	International seminar/ workshop	International cooperation	Focused local media/ activities	
MNCs	X		X	X		X	X	X			X	publications
Public listed companies & large enterprises	X		X	X		X	X	X			X	publications
SMEs	X		X	X		X	X	X	X		X	publications, awards
The Third sector	X		X	X		X	X	X				
Regulatory bodies	X		X	X		X	X	X	X	X		
Gov agencies	X		X	X		X	X	X	X	X		
Members of Parliament	X		X			X	X				X	publications
Implementing agencies and RE experts			X	X			X	X	X	X		
Year												**Total RM million**	**%**
2011	5	4	2	3	4	8	1	2	1	1	4	**35**	**29%**
2012	5	3.5	1	3	2	1	1	2	1	1	3	**23.5**	**20%**
2013	4	3	1	2.5	4	1	1	2	1	1	5	**25.5**	**21%**
2014	3.5	2	1	2.5	2	1	0.5	1.5	1	1	3	**19**	**16%**
2015	3	2	1	2	2.5	1	0.5	1	1	1	2	**17**	**14%**
TOTAL	**20.5**	**14.5**	**6**	**13**	**14.5**	**12**	**4**	**8.5**	**5**	**5**	**17**	**120**	**100%**
%	**17%**	**12%**	**5%**	**11%**	**12%**	**10%**	**3%**	**7%**	**4%**	**4%**	**14%**		

8. EVALUATION CRITERIA AND SUCCESS INDICATORS

In determining the effectiveness of the implementation of the RE strategic thrusts to achieve both the RE Policy Objectives and the Policy Vision, it is necessary to develop the evaluation criteria and identify the success indicators. This would allow for the creation of a base-line against which evidence can be obtained to determine if any improvement or positive progress has been achieved; and proposals for changes without relying on emotional response to a situation or personal intuition made.

The data obtained in subsequent years will help determine if there has been improvement from the baseline or otherwise. This provides the empirical evidence necessary for the continued support of the policy. Detractors will be hard-pressed to argue against empirical data showing positive results.

As the RE Policy is a new and forward-looking policy it is important the evaluation be done periodically. The success indicators may be reviewed from time to time to determine its relevance and ambition of the Government. Without such evaluation, policy makers will not be able to empirically ascertain whether the actions identified for each Thrust are bearing fruit or require change mid-stream. Only through evaluation can the outcomes of the Policy Objectives be realised.

8.1. Base Lining

There is a need to undertake a baseline assessment of Malaysia position with regards to RE power generation, RE Industry, R&D in RE technology, public awareness of RE and skill levels. This provides the basis for future assessments and evaluation to determine whether an action is to continue, revised or removed altogether. Developing a base line helps identify the data requirements for current and future assessments as well as data collection issues. For most of the thrusts a base line needs to be established.

The initial amount funding required breakdown of costs for determining the various baselines identifies would be RM 11.5 million as in Table 8.1.

Table 8.1: Baseline Costs (per Annum)

Baseline studies	RM million per annum
1. Detail RE resources and targets (capacity and energy mix)	2
2. RE technology cost	1
3. Number and types of RE businesses (developers) in the country	0.5
4. Number of RE jobs and types	0.5
5. Number of SMEs in RE business and sector	0.5
6. Number of banks providing RE financing, rates and terms	0.5
7. Number of RE licenses and REPPAs	0
8. Local resources and contents in applied RE technologies/ systems	3
9. Number of RE importer and technology	0.5
10. Number of institutes of higher learning offering RE courses and types	0.5
11. Number of technical colleges with RE courses and types	0
12. Number of RE students enrolled and passed (and quality)	0
13. Number of locals employed in RE business	1
14. Number of local RE R&D applied in the RE industry (local/ international)	0.5
15. Number of R&D collaboration and joint-ventures	0
16. Public awareness of RE	1
17. Public acceptance of RE	0
18. Public's willingness to invest in RE	0
Sub-total	**11.5**

Undertaking a comprehensive baseline work would cost approximately RM 50 million to RM 100 million depending on the number of baselines to be done, the extent of the baseline and the availability of data to develop the baseline.

8.2. Thrust 1 Criteria

The criteria for a successful regulatory framework are as follows.

8.2.1. RE SMART Targets

Based on the detailed analysis set out in Chapter 5, the SMART targets to be achieved at different points of time form the basis of the key success indicators for the RE Action Plan as set out below. The SMART target is a very important aspiration to be achieved but room must be given for it to be achieved. A tolerance of 10% of the target is allowable and the targets also need to be reviewed periodically every 3 year period.

Table 8.2: SMART Targets

Year Ending	Cum. Total RE Capacity (MW)	Share of RE Capacity	Annual RE Generation (GWh)	RE Mix	Annual CO2 Avoidance (tonne)
2011	217	1%	1,228	1%	773,325
2015	975	6%	5,374	5%	3,385,406
2020	2,065	10%	11,227	9%	7,073,199
2025	2,809	12%	14,662	10%	9,237,274
2030	3,484	13%	16,512	10%	10,402,484
2035	4,317	15%	17,479	10%	11,011,455
2040	5,729	19%	19,082	10%	12,021,673
2045	8,034	25%	21,668	11%	13,650,739
2050	11,544	34%	25,579	13%	16,114,871

8.2.2. Number of RE Businesses

Another success criterion is the number of RE Businesses which have entered the RE power generation and RE industry markets. An increased in number of RE businesses mean the regulatory framework is providing the necessary incentive, clarity and support needed for their entry. Therefore data of this RE businesses needs to be collected.

8.3. Thrust 2 Criteria

8.3.1. Performance Factors

Table 8.3 identifies the performance factors to be used to evaluate strategic Thrust 2, the weightage and their reasons.

Table 8.3: Performance Factors for Thrust 2

No	Performance factors	Weight	Reason
1.	Turnover from the construction of renewable energy powered installations	0.5	The nature of constructing RE power plants is not sufficiently unique to be easily identifiable. Therefore to avoid over-stating the benefit, turnover from construction industry is reduced by 50%.
2.	Jobs created	1	Key outcome is socio-economic development which is shown by these criteria. This has direct relationship with the actions
3.	New firms entering the RE business	1	
4.	SMEs entering the RE industry	1	
5.	Loans provided by commercial banks	0.5	Lending per se may not be attributable solely to the Actions, as firms with strong balance sheets and assets may be able to secure financing regardless of the use of the funds. Hence a 50% discount is to be applied.
6.	Turnover of the RE industry	1	Key outcome is socio-economic development which is shown by these criteria. This has direct relationship with the actions
7.	Number of REPPAs signed within a specified time period (say 1 month, 3 months etc).	1	This is indicative of the effectiveness of the RE Law
8.	Local content in RE industrial products	1	Key outcome is socio-economic development which is shown by these criteria. This has direct relationship with the Actions
9.	Number of distributors of imported RE products	1	This is a counter-measure to local content and R&D. If more businesses are distributors then the stimuli needs to be change.

8.3.2. Develop Baseline

Identifying the performance baseline provides the basis for improvements. Increase in percentage terms of performance factors would evidence the actions taken to implement Thrust 2 are bearing positive results.

Therefore it is necessary to firstly determine the performance baseline of the RE industry as at 2009. The baseline should obtain data for the same evaluation points as identified in sub-chapter 8.3.1 above. The development of this baseline and obtaining appropriate data from relevant agencies or surveys would provide the empirical basis for determining whether the Thrust 2 main actions are producing the outcome (i.e. Policy Objective). This is realised when there is evidence of an increase from the baseline. If there is no increase or a decrease, two follow up actions may be required:

(a) Change the advocacy programme; or

(b) Review and revise the actions in this Thrust.

8.4. Thrusts 3, 4 and 5 Criteria

8.4.1. Evaluation of Thrust 3

Based on the main action for Thrust 3, the performance criteria should be:

(a) Number of Institutes of Higher Learning that offer courses where RE is included as the main focus;

(b) Number of technical training colleges that offer quality and recognised technical training courses in RE;

(c) The number of students graduating from the technical and tertiary colleges in the specified course (including post-graduate courses); and

(d) The number of trained graduates hired by the private sector.

8.4.2. Baseline and Periodic Surveys

To evaluate Thrust 3, a base line is to be undertaken to determine the current situation to ascertain whether the introduction of technical and tertiary incentives have produced the required results. It also provides a defence to any allegation the data is not legitimate. If the result is zero (as expected) it is the base from which the programme starts.

Periodic surveys

Periodically (i.e. bi-annually) undertake a survey of the same target group (of randomly selected subjects) to determine if the programme is showing improvement. If there has been no movement or a reduction the programme needs to be revised.

8.4.3. Evaluation for Thrust 4

The RE R&D implementation plan should develop its own evaluative measures. However one measure which should not be used is the number of patent filings because the R&D is focused on innovation (rather than invention) and patenting contains legal restrictions such as the concept of prior art.

8.4.4. Evaluation for Thrust 5

The method by which success of this Thrust is to be measured is through public surveys. What is analysed is the increase between survey years. If the awareness survey shows there has been an increase of awareness in the public from the previous year, the advocacy programme should continue.

Base lining

A base-line of the target group should be determined. This group is surveyed to determine the level of awareness of RE Policy in general and Government's initiatives. The information obtained from Phase 1 can inform the design of survey questions in subsequent years. Base lining provides a basis for determining the level of awareness, which can be compared by subsequent surveys to see if the level of awareness is rising. This would indicate that the advocacy programme is working.

Periodic surveys

Periodically (i.e. bi-annually) undertake a survey of the same group to determine if the advocacy programme has improved the awareness, buy-in and participation of the target group. If there has been no movement or a reduction the advocacy programme needs to be revised.

9. CONCLUSION

The SREP programme introduced by the Government of Malaysia has been implemented for almost eight years. However the progress of RE development in the country has been quite minimal. Studies and reviews have been done with the expectation the palm oil mills would be a key participant of the programme because they had the raw materials (EFB) to be used as a fuel source to generate electricity. There were many who were enamoured by this good idea – it was logical, attractive and leveraged national strengths. However what appeared to be a good idea has been frustrated by the market, evidencing that Government cannot predict how markets will work or perform.

It was believed the palm oil industry would have been very attracted at the opportunity to use their waste to produce electricity however they were cautious. In fact post-implementation studies showed the palm oil mills had been utilising their EFBs and other oil palm wastes for fuel to generate power for their own use. Interests however unexpectedly came from third party developers who made the assumption that the EFB had little or no value and palm oil mills would readily give it away for free. The scenario which has developed was these third party developers created a market for the EFB by introducing a demand which resulted in the suppliers knowing they could sell their EFBs rather than give it away for free. This led to fuel supply agreements being needed and with severe limitations.

Initially the government has made the decision that electricity generated from using biomass and biogas were given a higher tariff (i.e. 21 sen/kWh) as compared to mini-hydro (17 sen/kWh) when it was perceived the target SREP participants would be the palm oil industry. This however does not result in the anticipated rapid growth of RE generation from biomass sources.

There are many different technologies which can be used to generate renewable energy-such as mini-hydro, solar PV, geothermal and wind. R&D activities in these areas are generating newer, cost-effective and innovative solutions and technologies. The RE industry is an area which Malaysia can actively participate in and could become a world leader.

We are approaching the end of the 9th Malaysia Plan and preparations need to be made for the 10th Malaysia Plan. The timing is right for the government to make available a new RE Policy as a continuing effort after the launching of the National Green Technology Policy last July 2009. This opportunity provides the avenue for a complete overhaul of the existing RE Policy in order to promote a sustainable and forward-looking renewable energy development in the country and pursue green technology development in a systematic and aggressive manner. Sufficient policy experiences exist today in many countries such as Germany, Spain, Italy, Japan, Korea and even developing countries such as Thailand compared to the situation a few years ago.

The recommended RE Policy is clear, robust and forward-looking. With the policy and the introduction of the renewable energy law which includes the provision of a mandatory feed-in tariff, RE Fund and an implementing agency, it is anticipated that there will be significant and positive impacts on the economy of the country, as evidence from the case studies from other countries who have introduced such measures.

The Renewable Energy Law requires an Act of Parliament to be introduced. This is a key and fundamental thrust of the RE Policy. It is the foundation upon which the success of the entire policy rests. If such an Act of Parliament is not introduced or is delayed, then there would be no conducive regulatory environment that is needed to spur the growth of RE in Malaysia. In fact the environment would be no different than the one that exist currently.

The RE Law is the foundation upon which Thrusts 2, 3 and 4 sit, indicating that without the RE Law it would be very difficult for these Thrusts to produce results, be successful or gain traction amongst stakeholders. Whilst the overlay of the advocacy programme shows that Thrust 5 is necessary to bring on board all stakeholders to support the changes introduced the RE Policy. This is graphically represented as follows:

Figure 9.1: Synergies of RE Action Plan (Strategic Thrusts) leading towards a successful RE Policy

The policy requires effective and reasonable evaluation criteria which provide a basis for determining whether the policy has been successful or not. Therefore detailed SMART targets are proposed for both energy and capacity targets that RE is to achieve at various intervals. It is anticipated that 13% power capacity and 10% energy generation will come from RE by 2030. This would avoid 131 million tones of CO_2 being produced by the conventional power generation sector.

The proposed estimate of the direct cost of implementing the various thrusts including developing the baselines for proper evaluation is RM1.5 billion over a 5 year period (this cost does not include the contribution to the RE Fund).

In addition, there are other criterion that have been designed to be used to assess the success or failure of the other thrusts, including undertaking of a baseline assessment, so there is appropriate evidence of the state of play today.

There are however, other policy areas, such as conventional energy price subsidies, the energy market in Malaysia, mass and public transport systems, vehicle taxes, biofuels and environmental standards and pollution, that should be addressed if renewable energy is to be promoted wholeheartedly and as a main-stream energy source for Malaysia. These areas are under the purview of many Ministries and agencies and are outside the scope of this Report.

In conclusion the success of the forward-looking RE Policy and Action Plan is dependent not only on the actions and support of the Government but also of the private-sector and the Third sector (i.e. NGOs etc.). The RE Policy and Action Plan must be seen by all stakeholders as producing public value, sustainable from a political and legal standpoint and must be administratively feasible. Only when all of these elements are in place can and will the policy be successful. Consequently it is forecasted the RE Policy and Action Plan would enable new businesses to emerge, new jobs to be created and new growth areas to be developed, paving the way for Malaysia to become the leading country in this region for green technologies and low carbon economic growth.

ACKNOWLEDGEMENT & REFERENCES

[1] Allocation under 9MP available at Ministry of Science, Technology and Innovation

[2] Bartel and Lichtenberg (1987) *"The Comparative Advantage of Educated Workers in Implementing New Technology,"* Review of Economics and Statistics 69 (1987), pp 1-11,

[3] Caselli and Coleman (2001) *"Cross-Country Technology Diffusion: The Case of Computers,"* American Economic Review 91 (2001), 328,

[4] Chapter 4 *Prevention and Control of Pollution and Environmental Degradation of the National Policy* on the Environment 2002, available at http://www.doe.gov.my/dmdocuments/natonal%20policy/National%20Policy%20on%20the%20Environment%20on%2010.19.151.21/dasar.pdf (accessed on 8 May 2008)

[5] Department of Skill Development, Ministry of Human Resources, at http://espkm.nvtc.gov.my/Modules/2.4_MIS/2.4.3_SearchEngine/frmSearchACCentres.aspx (accessed on 24 February 2009)

[6] *Design of the PTM Zero-Energy Building* in PTM's Energy Smart, Issue 0017, Quarter 1.

[7] DOE's *Air Quality Guidelines* available at http://www.doe.gov.my/dmdocuments/Udara/3%20RMAQG.pdf (accessed on 8 May 2008)

[8] DOE's *Noise Pollution Guidelines* (2004) available at http://www.doe.gov.my/dmdocuments/guidelineBunyiBising.pdf (accessed on 8 May 2008)

[9] Doms, Dunne, and Troske (1997) *"Workers, Wages, and Technology,"* Quarterly Journal of Economics 112 (1997), 253 - 290,

[10] Energy Information Administration (2005), *"Policies to promote non-hydro renewable energy in the United States and selected countries,"* U.S. Department of Energy

[11] Ernst & Young (2008): *Renewable Energy Country Attractiveness Indices*

[12] Federal Environmental Agency (2006): *Monitoring and evaluation of policy instruments to support renewable electricity in EU Member States* - Final Report

[13] Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Germany

[14] GLC Transformation programme are available at http://www.pcg.gov.my/index.asp (accessed on 25 Feb 2009)

[15] Graduates from private and public tertiary centres (2007) published by Ministry of Higher Education, Malaysia available at http://www.mohe.gov.my/web_statistik/index.htm?navcode=NAV038?m=3&navcode=NAV038&subcode=SUB001&lang=ENG (accessed on 24 Feb. 09)

[16] Information on landfill etc provided by Jabatan Sisa Pepejal, Ministry of Housing and Local Government (2008)

[17] International Business Report 2008 – Malaysia, produced by Grant Thornton

[18] International Energy Agency (2008): *Deploying Renewables – Principles for Effective Policies*

[19] *Jobs in Renewable Energy Expanding* by the WorldWatch Institute available at http://www.worldwatch.org/node/5821?utm_campaign=vsonline&utm_medium=email&utm_source=green_jobs#notes (accessed on 17 Feb 2009)

[20] Koridor Utara at http://www.ncer.com.my/?q=manufacturing/develop_new_subsectors (accessed on 19 Feb 2009)

[21] Moore, M.H. (1995) *"Creating Public Value"* Harvard University Press

[22] Mukoyama, T. (2003) *"A Theory of Technology Diffusion"* available at http://129.3.20.41/eps/mac/papers/0303/0303010.pdf (accessed on 1

[23] *National Survey of Research and Development 2008 Report* – Data For Year 2006 from Ministry of Science, Technology and Innovation available at http://www.mosti.gov.my/mosti/failpdf/fact&figure.pdf (accessed on 13 Feb 2009)

[24] Network of Heads of European Environment Protection Agencies (November 2005) *"The Contribution of Good Environmental Regulation to Competitiveness,* (Nov 2005) available from http://www.eea.europa.eu/about-us/documents/prague_statement/prague_statement-en.pdf (accessed on 18 Feb 2009)

[25] *Renewables 2007 Global Status Report* (Paris: REN21 Secretariat and Washington, DC:Worldwatch Institute) – available at http://www.ren21.net/pdf/RE2007_Global_Status_Report.pdf (accessed on 17 Feb 2009))

[26] Shapria, P (1996) *"An Overview of Technology Diffusion Policies and Programmes to Enhance the Technological Absorptive Capabilities of Small and Medium Enterprises"*, A background paper prepared for the Organization for Economic Cooperation and Development Directorate for Science, Technology and Industry, available at http://www.prism.gatech.edu/~jy5/pubs/oecdtech.htm (accessed on 18 Feb 2009)

[27] *SME Annual Report 2007* published by Bank Negara Malaysia and available at http://www.smeinfo.com.my/index.php?&pg=286&ch=2&ac=727&lang=en (accessed on 20 Feb 2009)

[28] *SREP Guidelines* available from MEWC's website at http://www.ktak.gov.my/template01.asp?contentid=252&tt=1&parentid=13 (accessed on 11 February 2009)

[29] Stern, N. (2007): *The Economics of Climate Change - Stern Review,* Part IV: Policy Responses for Mitigation

[30] TNB's 2008 Annual Report

[31] TNB's customer information data

[32] United Nations Development Programme (2008): *Promotion of Wind Energy – Lessons Learned From International Experience And UNDP-GEF Projects,* Chapter 1: Public Policies

[33] Walz R., Ragwitz R., and Schleich J., *"Regulation and innovation: the case of renewable energy technologies"* Fraunhofer Institute Innovation and System Research, Germany

[34] World costs and price trends for solar PV available at Photon International, Issue September and October 2007

[35] Policy Action on Climate Change Toolkit (PACT) http://www.onlinepact.org (World Future Council)

[36] *Supporting Solar Photovoltaic Electricity: An Argument for Feed-in Tariffs,* European Photovoltaic Industry Association

[37] *Evaluation of different feed-in tariff design options – Best practice paper for the International Feed-In Cooperation,* A. Klein, B. Pfluger, A.Held, M. Ragwitz, G. Resch, T. Faber

[38] *Feed-in Tariffs: Accelerating the Deployment of Renewable Energy,* Miguel Mendoca

[39] EEG – THE RENEWABLE ENERGY SOURCES ACT, *The success story of sustainable policies for Germany,* Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)

[40] *Renewable energy sources in figures – national and international development,* Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)

[41] Australian Policy Online http://www.apo.org.au

[42] *National Energy Balance 2007,* Pusat Tenaga Malaysia

Annex A: Current SREP Programme Guidelines

"During this initial phase, SCORE will adopt the following Guidelines in promoting the development of grid-connected small RE power plants:

1. SREP shall apply to all types of renewable sources of energy, including biomass, biogas, municipal waste, solar, mini-hydro and wind.

2. Project developers will have to negotiate the Renewable Electricity Purchase Agreement with the relevant Utility, including the selling price on a willing-seller, willing buyer basis, based on take and pay.

3. The RE electricity producer shall be given a licence for a period of 21 years, to be effective from the date of commissioning of the plant.

4. RE electricity producers will be responsible for all the costs of the grid-connection, the relevant Utility system reinforcement (electric cables, transformer, switchgears and other protection equipment) and the necessary metering installation. The distribution grid interconnection shall be made at a voltage between 11 – 33 kV.

5. The small RE power plant shall be located within a distance of 10km from the nearest interconnection point. Exception is given for hydro power generation project.

6. No stand-by charges shall be levied. However, if back energy is requested by project developers, it will be charged accordingly with the prevailing tariff.

7. Power generation through co-generation technology shall be given special preference.

8. Maximum capacity of a small RE power plant designed for sale of power to the grid shall be 10 MW. A power plant can be more than 10 MW in size, but the maximum capacity that will be allowed for power export to the distribution grid will be no more than 10 MW.

9. The small RE power plant must be ready for grid-connection within 12 months from the date of approval for such grid connection. This is applicable for existing plant that wishes to connect to the grid. However, in the case of proposals for setting up new RE power plants (or where "re-powering" is proposed) that require the installation of new boilers or turbo-generator systems, the plant shall be commissioned within 24 months. The stipulated period of construction until commissioning shall be counted from the date of signing of the Renewable Electricity Purchase Agreement (REPA) between the developer and the utility.

10. The RE power plant must meet all environmental regulations set by the Department of Environment (DoE), and the developer of the project is responsible for obtaining the necessary approval of DoE, and any other statutory approvals required.

11. The minimum of 30% equity in an RE power plant project must be by Bumiputera shareholder(s). Foreign agency/company is allowed to participate in SREP project with maximum participation equity of 30%."

Source: Extract from the KTAK's website[59]

59 KTAK's website available at http://www.ktak.gov.my/template01.asp?contentid=252&tt=1&parentid=13 (accessed on 11 February 2009)

Annex B: Renewable Energy Feed-in Tariff (RE-FiT) Law

B.1. What is a Feed-in Tariff (FiT) Law

Renewable energy (RE) Feed-in Tariff (FiT) is a mechanism that allows electricity that is produced from RE resources to be sold to power utilities at a fixed premium price and for a specific duration. A Feed-in Tariff Law has proven to be the best available mechanism for accelerating the uptake of renewable energy in grid-connected areas. Furthermore, a good FiT system is a truly democratic policy because:

- It is cost-effective for the public to generate their own clean electricity;
- It returns the control to generate electricity to the people.

B.2. What is not a FiT Law

There are many kinds of support mechanisms promoting electricity supply from renewable sources, with various names, all over the world. Whilst they can be combined with FiTs, it is important to distinguish FiT Laws from these other mechanisms e.g. quota systems and tender schemes (see B.9 for further details).

B.3. How do FiTs work

FiTs oblige energy utilities to buy renewable energy from producers, at a mandated price. By guaranteeing access to the grid and setting a favourable price per unit of power, FiTs ensure that renewable energy is a sound long-term investment, for companies, for industry, and for individuals, thereby creating a strong economic incentive for investing in renewable energy.

B.4. Who pays for the FiTs

The most common method for funding the FiT involves sharing the costs amongst all end-users (electricity consumers). The result being that the increase in price per household is very small among the users.

B.5. What are the benefits of a FiT Law

When designed effectively, FITs are proven to:

- Reduce CO_2 emissions by replacing fossil fuel-based power production with clean, renewable sources of energy.
- Create jobs, for example in 2006 the German renewables industry employs around 234,000 people. Almost 60% of which were employed as a direct result of the German FiT Law.
- Help secure domestic energy supply, enabling countries to reduce their reliance on imported fossil fuels.
- Guarantee investment security for renewable energy investors.
- Drive technological innovation.
- Provide fair market conditions for renewables, which without this renewables would be unable to fairly compete with heavily subsidised conventional energy.

B.6. Impact of Feed-in Tariff: Example of Germany

The German Government pioneered in the year 2000 an effective FiT mechanism that is now replicated in many countries around the world (e.g. Spain, Greece, France, Italy, Portugal, South Korea, Switzerland, etc, for the full list please refer to B.8 post). An evaluation in 2007 by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) identified the main impacts of FiT are as follows:

(1) By 2006, Germany achieved 12% (30,924 MW) of RE share in the gross energy consumption as compared to only 6.3% (11,448 MW) in year 2000 (see Figure B.1).

(2) In 2006, more than 230,000 people have been employed in the RE sector due to the rapid development of the RE industry.

(3) By 2006, the German RE businesses are leading the world with 15% of global market share with trading values equivalent to €22.9 billion.

(4) In 2006, the German Government has avoided the external cost to manage green house gas (GHG) emissions by as much as €3.4 billion due to the electricity generation from RE.

(5) By 2005, the average electricity production cost for RE has reduced to €0.1 per kWh and expected to reduce further to €0.07 per kWh by 2020.

(6) Between 2000 to 2006, €9.4 billion of economic benefits have been derived from the FiT policy against the cost of €3.3 billion to implement the FiT.

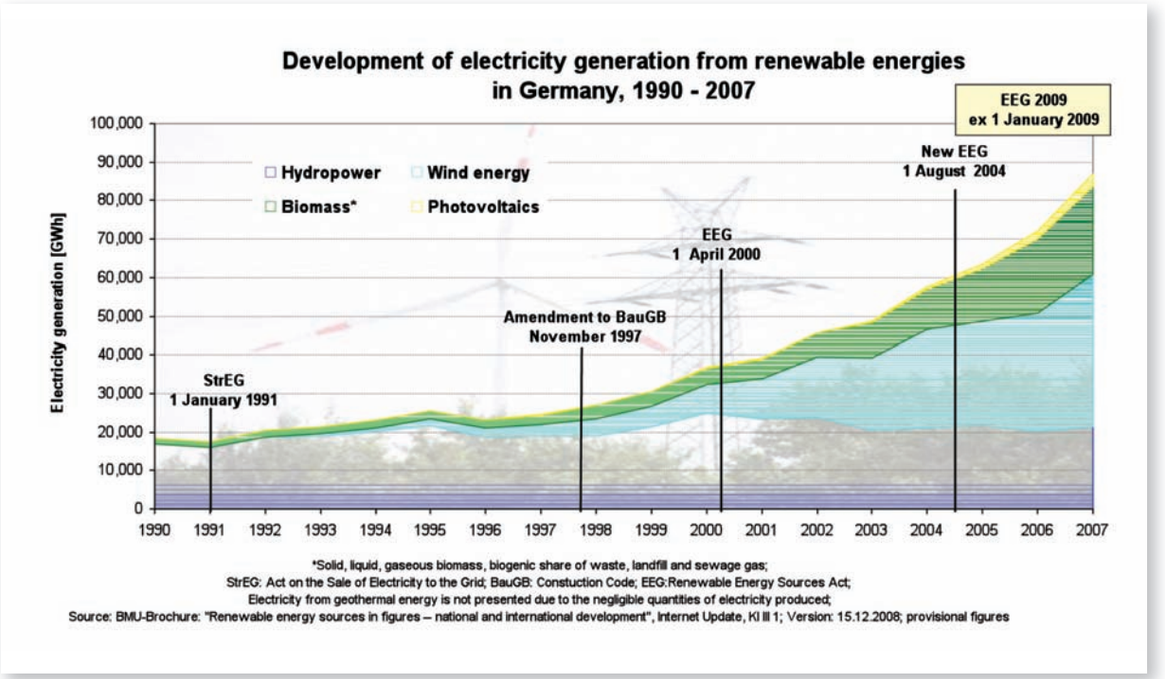

Figure B.1 Development of electricity generation from RE in Germany

B.7. Common Criticisms towards FiTs

FiTs are often rejected for being 'interventionist', for interfering in the free market, and for being inefficient or ineffective as a result. In reality, all renewable energy support mechanisms are interventions in the market. What makes FiTs unique is that they have proven to be the most effective mechanism for increasing the uptake in renewable energy, and the best at creating market growth. It is also worth noting that those who argue that FITs are 'interventionist' frequently advocate some form of quota system or 'renewable portfolio standard'. However, quota systems are just as interventionist: while FiTs fix the amount to be paid for the electricity, and allow the market to determine the amount of electricity generated; quota systems fix the latter, and allow the market to determine the former.

B.8. Where has FiT been introduced?

The table below identifies the various countries that have introduced FITs Laws as at the end of 2008.

Africa	Americas	Asia	Australasia	Europe
Algeria Kenya Mauritius	Argentina Brazil Canada* Costa Rica Ecuador Nicaragua United States*	India* Indonesia Israel Japan* Korea (South) Pakistan Philippines Sri Lanka Thailand Turkey Ukraine	Australia*	Austria Croatia Cyprus Czech Republic Denmark Estonia France Germany Greece Hungary Ireland Italy Latvia Lithuania Luxembourg Macedonia Malta Netherlands Portugal Slovak Republic Slovenia Spain Switzerland

B.9. Alternative Non-FiT Mechanisms

Quota Systems (Renewable Portfolio Standard) and Tradable Green Certificates

Under Quota Systems, the Government sets a target for renewable electricity production that increases over time, building a market for renewable electricity. Most Quota Systems allow the target to be met by producing the renewable energy directly or by purchasing 'credits'. For the trade of those 'credits' an additional mechanism called 'Tradable Green Certificates' or 'Renewable Energy Certificates' or 'Credits' is usually established.

> ***Examples of Quota Systems in the United States:*** *In the United States, Quota Systems are called Renewable Portfolio Standards (RPS). For example, California's RPS requires 20% of electricity for retail sales to be produced from renewable sources by 2010, and increases the requirement to 33% by 2020. [California Energy Commission website: http://www.energy.ca.gov]. Texas's RPS required 2,000 MW of additional energy from renewable sources by 2009. When Texas met that goal, the RPS then increased to require 5,880 MW of electricity from renewable sources by 2015 (of which, 500 MW must come from non-wind resources) and 10,000 MW in renewable energy capacity by 2025. [Texas State Energy Conservation Office website: http://www.seco.cpa.state.tx.us].*

> ***Examples of Quota Systems in Europe:*** *In Europe, the systems are called Quotas, and are usually combined with a mechanism for trading renewable energy certificates (Tradable Green Certificates). For example, the Renewable Obligation for England and Wales requires all licensed electricity suppliers to provide a percentage of their electricity from renewable sources. It sets an escalating target, increasing to 10% by 2010, and 20% by 2020. Electricity suppliers can buy Renewable Obligation Certificates (ROCs) to meet the required percentage or pay a 'buy-out price' for each MWh of non-compliance (£34.30 per MWh for 1st April 2007 to 31st March 2008). [UK's Renewables Obligation website: http://www.ofgem.gov.uk].*

Tradable Green Certificates (TGCs), known as Renewable Energy Certificates or Credits (RECs) in the United States, are a tradable verification that a certain amount of electricity was produced from renewable sources. Renewable electricity producers are given certificates for renewable electricity they produce. Producers sell these certificates separately from the electricity that is produced. Buyers of these certificates most often use them to meet a required target under a Quota System, but can also purchase them to be 'green'.

The terms TGC, RPS, and Quota are sometimes used interchangeably in Europe to refer to systems with a quota target and tradable certificates available to help meet that target.

Tender Schemes

Tender schemes (or competitive bidding) are offers (or 'tenders') for renewable electricity producers to supply renewable electricity up to a target predefined by the Government. Producers put forth bids and those with the lowest prices are awarded long term contracts or power purchase agreements. Tendering can be used to meet any target, such as those under a Quota System.

Annex C: Additional Measures to Support Strategic Thrust 1

C.1. Amend building codes and UBBL to include use of building integrated RE systems

A review of existing building codes and in particular the UBBL is necessary to determine what changes (if any) should be made so that building owners will integrate renewable energy systems (e.g. use of PV for cladding) into their building designs. For the non-residential buildings, this can be achieved through the inclusion of MS 1525 (Malaysian Standard: Code of Practice on Energy Efficiency and Renewable Energy for Non-Residential Buildings) into the UBBL, and subsequently can be extended to the new residential buildings. By including such design requirements into regulation, future designs of new buildings (or even refurbished buildings) will take into account the integration of renewable energy systems, which can spur introduction of RE power generation systems (thereby supporting the achievement of the SMART RE targets) and further stimulate the entry of new support and service businesses in the RE Industry.

C.2. Introduce a building rating system (Green Building)

Regulation can be used to require that buildings be subject to a rating system[60] and certified. Hence buildings which are certified can claim to use energy more efficiently when compared to conventional buildings, contribute directly to the introduction of RE, have healthier work and living environments (which contribute to higher productivity) and improved employee health and comfort. The demand for healthier work and living environments can provide strong incentives to developers to comply.

Countries such as Singapore, USA, Australia, and Hong Kong have introduced a national building rating system along the lines of LEED.

The introduction of a building rating system can help the realisation of "green" buildings in the country and specifically the utilisation of renewable energy systems within the building or the use of renewable energy itself.
This building rating system can be made mandatory at a later stage for new and refurbished buildings, so that the owners will have their buildings rated. No criminal penalty should be imposed for failure to meet the standards, but instead incentives should be given for achieving a "green" rating.

60 A common building rating system is the Leadership in Energy and Environmental Design (LEED) Green Building Rating System. In Malaysia, the Green Building Index (GBI) is being developed by PAM and ACEM and would be launched in first half of 2009.

Annex D: Alternative Incentive Offering Mechanisms

D. Annex D

These are details of the 2 conceptual proposals referred to in sub-chapter 7.2.9 of the Report (relating to Thrust 2), which may quicken the pace of investment or increase the attractiveness of investing in Malaysia.

D.1. Offering Mechanism 1: Declining Incentives

This mechanism is referred to as the "1st Mover Advantage Mechanism". In this mechanism, the type of benefits or incentives are specified by Government and fully made available to applicants through a specific time window. After the lapse of the specified time-window, the benefits or incentives are still made available but the scope is reduced (by value or by type of incentives offered) to all "latecomers". Such a programme is designed to motivate firms to compete to be first-movers in order to receive the full range of benefits. Coupled with a sound and proper evaluation of applicants, such a programme could result in specified RE policy targets (e.g. MW capacity or job creation) being met by efficient "first movers". Some of the conceptual details of the 1st MAM are:

No	Key Details	Details
1.	Package of benefits or incentives	Scope of benefits: Fiscal; financial, people, land and construction of RE plant (part of climate protection initiation). These incentives can be combined for the incentive package to the 1st movers.
2.	Time period to apply before reduction	2 years
3.	Incentives for 2nd and subsequent movers	Incentives reduced – e.g. fiscal benefits reduced from say 100% tax exemption to 60% tax exemption; financial assistance withdrawn
4.	Programme lifespan	Limited to 8 years (4 cycles of 2 years each)

D.2. Offering Mechanism 2: Personalised Incentives Mechanism

This mechanism is referred to as the "Personalised Incentive Mechanism". This mechanism works on the basis that as it cannot be ascertained ex ante as to the exact package of incentives or benefits that firms may want, it may be more efficient to allow interested firms to bid for a package of incentives that they would need in return for meeting Government's targets in RE or the Policy Objectives.

Successful bidders do not receive the grant of the incentives or benefits unless they start to show that the required performance and specified outcomes are being achieved.

Key details of bidding system for the PIM are:

No	Key Details	Details
1.	Frequency of offer of incentives	at least bi-annually or tri-annually
2.	Bidding rules	Investors submit closed bids for incentives to be provided (where they specify the incentives); incentives are tied to performance; performance must achieve the outcome; outcome specified by KTAK which is tied to RE Policy, and incentives granted when evidence of performance is made available (ex post)
3.	Governance of bidding	Necessary to ensure trust in the process; need transparency to build trust
4.	Evaluation of the bidding	Evaluation process made transparent, without any party politics being involved;
5.	Empowerment	KeTTHA must be empowered to provide the incentives asked for by winning bidders. This requires legislative provision.
6.	Sunset	The incentive programme is to be sunset after a defined period or when a particular outcome is achieved (e.g. number of jobs) where the private sector will continue with the investment regardless of the incentives
7.	Benefits	Only genuine players who can contribute will participate.