# FIT for MALAYSIA

## Assessment of the proposed Malaysian feed-in tariff in comparison with international best practise

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# I. Abstract

This report was compiled by David Jacobs, Distinguished Visitor under the Brain Gain Malaysia program. It deals with the proposed feed-in tariff mechanisms for Malaysia, comparing international best practise with the proposed design for Malaysia. The feed-in tariff mechanism, as it was elaborated by the responsible Ministry KeTTHA and the MBIPV project over the last years, contains all design aspects that have been indentified as international best practise by researchers of the last five years (see chapter II). Therefore, the draft feed-in tariff is ready to be debated in parliament and will hopefully become effective in July 2011.

However, this report is making some suggesting for FUTURE modifications. The international experience has shown that feed-in tariff mechanisms need to be amended after a certain number of years (for instance, in 2013 or 2014 in Malaysia), since the share of renewable electricity can be expected to increase. Therefore, some new design options, such as additional plant-size categories, additional financing options and others, should be taken into consideration once the law has been passed for the first time (see chapter III).

In addition, the report includes some suggestions for research that needs to be done in the coming years. Based on the experience other countries that have started to support renewable energy, researcher of staff from KeTTHA need to analyse the international market development, the costs and benefits of renewable energy support, the impact of renewable energy sources on the national electricity grid, etc. These research opportunities will be presented in Chapter IV.

## II. Analysis of current FIT proposal in Malaysia in comparison with international best practise

At the time of writing the information available on the details of the regulation were still limited, as the actual law has not yet been debated in parliament. Therefore, this report can only be considered a preliminary assessment of the proposed feed-in tariff based on some disclosed information by the Ministry of Energy, Green Technology and Water (KeTTHA).

The study will be divided into three sections. First, we will analyse the proposed feed-in tariff in Malaysia and compare it with international best practise design options as they have been elaborated in a number of studies (Couture et al., 2010; DBCCA, 2009; Grace et al., 2008; Klein et al., 2008; Mendonça et al., 2009a).[1] Second, the report will make certain suggestions for modifications of the law in a few years time, after the feed-in tariff mechanisms has been in operation for a number of years. In Chapter 4 the author will present some future research opportunities.

### A. Introduction

The Malaysian government has announced its plan to increase the share of renewable energies in the coming years. In the electricity sector, the share of renewable energy sources will be increased from less than one percent today to 5.5 percent in 2015. Setting target has proven to be crucial for the development of renewable energy sources in many countries – irrespective of the support instrument that is applied. In order to reach this target, the government is planning to implement a feed-in tariff. Feed-in tariffs are long-term, guaranteed purchase agreements for green electricity at a price that can provide project developers a reasonable return on investment.

Feed-in tariffs have driven a considerable share of global renewable energy capacity. By 2008, it was estimated that 45% wind capacity worldwide was installed under feed-in tariff regimes (DBCCA 2010). In the case of photovoltaic (PV) solar energy, the share installed under feed-in tariffs is even higher: 75% in 2008 and at least 86% in 2009 (DBCCA 2010; Mints 2010). A number of recent studies have shown that feed-in tariffs are more effective and more efficient than other policies (EU Commission 2005, 2008; DB Climate Change Advisors, 2009; Ölz, 2008; Stern Review, 2006). The effectiveness and efficiency of feed-in tariffs is attributed to the high degree of investment security that the policies can create.

As of

| European Union | Non-EU Europe and Middle East | Africa | Americas | Asia and Australasia |
|---|---|---|---|---|

[1] The sections on international best practise largely draw on previous publications of the author, namely the feed-in tariff handbook „Powering the Green Economy“ (Mendonca et al. 2009) and the forthcoming PhD “Renewable energy policy convergence in the EU”.

| | | | | |
|---|---|---|---|---|
| Austria, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, France, Finland, Germany, Greece, Hungary, Ireland, Italy, Latvia Lithuania, Luxembourg Malta, Netherlands Portugal, Slovak Republic, Slovenia, Spain, United Kingdom | Croatia Israel Macedonia Serbia Switzerland Turkey Ukraine | Algeria Kenya Mauritius South Africa Tanzania Uganda | Argentina Canada* Ecuador Nicaragua United States* Dominican Rep. Honduras Peru | Australia* China India* Mongolia Pakistan Philippines South Korea Sri Lanka Taiwan Thailand |

Source: REN21 and author's research

## B. Eligible Technologies

In order to establish a feed-in tariff, policy makers will have to decide which renewable energy technologies they want to support, that is, which technologies will be eligible for tariff payment under the feed-in tariff. In order to make this decision there should be good knowledge about the potential and resource availability of each technology in a given region or country. Assessing the resource potential and drafting wind and solar maps is a pre-requisite.

It is usually recommended to support a variety of renewable energy technologies, instead of focusing on just one or two technologies which are currently the most cost-effective. This way, the share of renewable electricity can be increased more rapidly then by just focusing on one or two technologies. One of the primary advantages of feed-in tariffs over other support instruments is the opportunity for technology-specific support. It is also recommended to support both fluctuating technologies, e.g. wind energy and solar, and technologies that can provide firm power, e.g. biomass, solar thermal, geothermal, and hydroelectric. This way, the latter technologies can provide back-up capacity for the fluctuating sources of energy once the share of renewable electricity reaches a certain level.

In Malaysia, five of technologies will be eligible for tariff payment once the law enters into force, namely waste, biomass, biogas, small hydro and solar photovoltaics. The resource potential of other technologies, such as wind power, geothermal and tidal power, has not yet been fully assessed. However, those technologies might become eligible for tariff payment at a latter stage, once the policy maker has the necessary information regarding the resource availability at hand. In the case of biomass, it might also be necessary at a later stage to determine which type of biomass resources can be used for generating electricity in order to secure a sustainable use of the available resources. The German legislator has done this in 2001

http://www.bmu.de/files/erneuerbare_energien/downloads/application/pdf/electicity_biomass.pdf.

## C. Tariff calculation methodology

In the past, some feed-in tariff mechanisms included tariff levels that reflected the avoided costs of conventionally produced electricity. In the case of the “avoided cost” approach, policymakers refer the cost that would have occurred when the renewable electricity would have been produced by other, conventional generation technologies such as gas-fired power plants or nuclear power plants. In many cases, renewable electricity producers received an additional top-up payment because renewable electricity is “cleaner” than conventionally produced power. However, this approach often did not allow for sufficiently high tariffs for less mature technologies. While the tariffs under this approach might be high enough – or even too high – for rather cost-effective technologies such as wind energy, technologies like solar PV will most likely not benefit.

However, in the last decade most legislators switched towards are cost-based tariff calculation approach. In this case, the legislator sets the tariff level in order to allow for a certain internal rate of return, usually between a five and ten percent return on investment per year (project based). In some cases the rate will have to be higher as the profitability of renewable energy projects should be comparable with the expected profit from conventional electricity generation. The following cost components are usually taken into account when calculating tariffs:

- Investment costs for each plant (including material and capital costs);
- Grid-related and administrative costs (including grid connection cost, costs for the licensing procedure, etc.);
- Operation and maintenance costs;
- Fuel costs (in the case of biomass and biogas);
- Decommissioning costs (where applicable).

In line with international best practise, the Malaysian legislator has also used a cost-based tariff calculation methodology. A comparison with feed-in rates in other countries reveals that the proposed tariff levels are in line with feed-in tariffs in other countries.

| | Malaysia (2011) | Taiwan (2009) | Germany (2010) | Kenya (2008) | Ontario (2008) | Ecuador (2007) |
|---|---|---|---|---|---|---|
| **Biogas** | **28-35** | 21 | 34-50 | 22 | 30-59 | 30 |
| **Biomass** | **27-35** | 21 | 34-50 | 22 | 39-42 | 30 |
| **Small hydro** | **23-24** | 21 | 27-54 | 25-37 | 37-40 | 16-18 |
| **Solar PV** | **85-178** | 112-130 | 103-142 | --- | 193- | 162 |

## D. Size specific tariffs

Feed-in tariffs can be differentiated according to the installed capacity of a given plant. If economics of scale are taken into account, larger power plants usually receive a lower tariff than small-scale power plants, because larger units can produce electricity at lower cost than small-scale plants. By granting higher tariffs for smaller installations, the legislator also increased the chances for small-scale power producers to participate in the power production business. In this case, even smaller-scale projects can reach a certain profitability threshold. Without size-specific tariffs, it is likely that larger-scale producers and investors will profit the most from the national feed-in tariff scheme.

Typically, tariffs are paid for plans within a certain bandwidth of capacity, for instance, different tariffs for plants with an installed capacity ranging from 0-100 kW, 100 kW to 2 MW,2 to 10 MW, and installation larger than an installed capacity of 2 MW. However, this approach involves the risk that the policymaker's choice of size categories influences the choice of power plants in a given territory. If, for instance, the tariff for installations up to 100 kW is significantly higher than in the case of the next-highest plant size category, this might encourage the installation predominantly of such small-scale power plants. In order to avoid these effects on the national market, legislators can also opt for establishing formulas which correlate tariff payment with the exact size of a given plant. This way, the size of the power plants installed in a given country is not influenced by the policymaker as tariff level "jumps" between certain capacity bandwidths are avoided.

Malaysia also makes use of plant-size specific tariff payment. In the case of solar PV, for instance, six different categories have been established in order to take the cost differences into account.

| *Class/category of RE installation* | *FIT rate (in RM per kWh)* |
|---|---|
| Installed capacity up to & incl. 4kW | 1.23 |
| Installed capacity > 4kW, & up to & incl. 24kW | 1.20 |
| Installed capacity > 24kW, & up to & incl. 72kW | 1.18 |
| Installed capacity > 72kW, & up to & incl. 1MW | 1.14 |
| Installed capacity > 1MW, & up to & incl. 10MW | 0.95 |
| Installed capacity > 10MW, & up to & incl. 30MW | 0.85 |

However, in the case of biomass, hydro power and biogas the plant-size categories are more limited. Hydro power, for instance, only has two categories, for all power plant up to 10 MW and above. However, the experience in other countries has shown that even smaller scale hydro power plants might be feasible for Malaysia. Therefore, it might be necessary to implement additional plant size categories for smaller producer (for instance, an additional category for all hydro power producers with an installed capacity of 500 kW including a slightly higher tariff payment). The same is the case for biomass and biogas. The policy maker should observe the development of the national market after the feed-in tariff has been implemented for the first time. If it becomes apparent that only larger scale hydro power projects will be incentives (10 to 30 MW) than this might be an indication for the need of another plant-size category (0-500 kW).

| Hydro | FIT rate (in RM per kWh) |
|---|---|
| Installed capacity up to & incl. 10MW | 0.24 |
| Installed capacity > 10MW, & up to & incl. 30MW | 0.23 |

## E. Long duration of tariff payment

Feed-in tariffs are usually guaranteed for a long period of time.2 This way, the usually high initial investment costs can be recovered over time. Besides, a guaranteed fixed payment over a long period of time significantly increases investment security and therefore facilitates good financing conditions with low interest rates for renewable energy project developers. On average, tariffs are paid for about 20 years because this reflects the general life cycle of many installations for renewable electricity generation. If a legislator opts for a rather short period of guaranteed tariff payment, the tariff level has to be higher in order to assure the amortization of costs. If tariff payment is guaranteed for a longer period, the remuneration level can be decreased. Some feed-in tariff schemes do not set any time limit for tariff payment; that is, tariffs will be paid during the full lifetime of renewable energy power plants. The main reason for opting for a certain limit is to reduce and control of the overall system cost and to provide an incentive to invest in new technologies after tariff payment has ended.

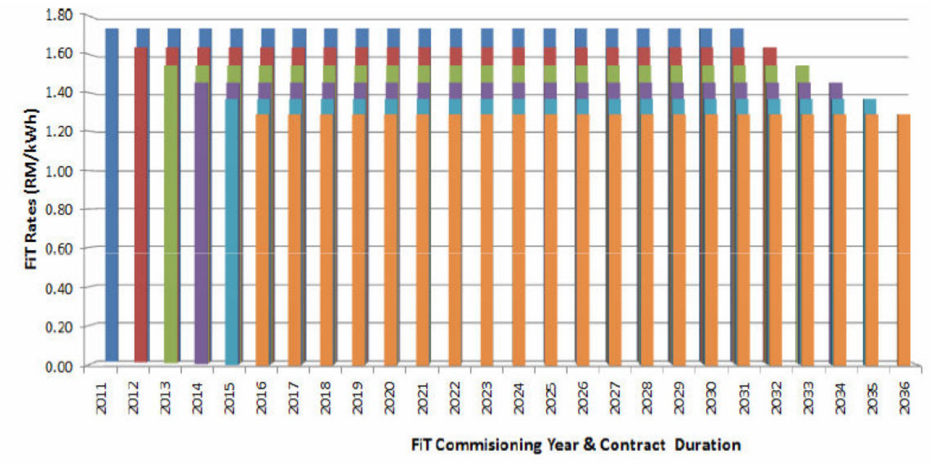
In line with international best practise, feed-in tariffs in Malaysia will be guaranteed over a long period of time. In the case of solar PV, waste and hydro power the tariff payment is granted for a period of 21 years. In the case of biomass and biogas the period is slightly lower, because it is difficult to reach long-term contracts for feedstock provision and therefore cost recovery shall be enabled in a slightly shorter period (the simple payback time is 7 years).

## F. Tariff degression

Tariff degression means that FITs are reduced automatically on an annual basis. This reduction, however, only affects new installation. In other words, once a power plant is installed the tariff payment remains constant over a long period of time despite tariff degression. If the legislator decides to amend the FIT legislation periodically, e.g. every four years, tariff degression allows for automatic reduction of the remuneration rate in the meantime without the negative effects of a lengthy political decision-making process. For instance, in 2009 a solar PV plant in a given country might be grated a

[2] In the EU, tariff payment duration ranges from eight to 30 years (Klein et al. 2008).

tariff of 30 €cent/kWh for the following 20 years. Assuming an annual degression rate of 10 percent, the tariff payment for installations connected in 2010 will only be of 27 €cent/kWh. Therefore, tariff degression also stimulated investors to speed up the planning process: the sooner you get connected to the grid, the higher will be the tariff payment for the power plant. In the figure below it is shown in how far the tariff levels will be decreased in the case of solar PV in Malaysia (the table depicts the highest possible tariff payment, including premium payments for building integration and locally manufactured equipment).




Germany was the first country to implement this design option in order to both anticipate technological learning and provide an incentive for the industry to further improve renewable energy technologies. The cost reduction potential of renewable energy technologies is based on economies of scale and technological innovation. In the last decade, the generation costs for wind and solar power, for instance, dropped by over 50 percent. In line with the remaining learning potential of each technology, a low or a high degression rate is fixed by the legislator. Relatively mature technologies, such as wind energy, have either a very low degression rate or no degression rate. In Malaysia, a similar approach has been followed. In the case of solar PV, the degression rate will be of 8 percent, for hydro power it will be of 0.5 percent and no degression rate will apply to hydro power.

| *Technology* | *annual degression rate* |
|---|---|
| Solar PV | 8.0% |
| Biomass | 0.5 % |
| Biogas | 0.5 % |
| Small hydro | 0 % |

Source: Kettha 2010

# III. Suggestions for future modifications

As shown in the section above, the proposed feed-in tariff already includes most major design features which have been elaborated by researchers based on international best practise. However, after the law will have been implemented, certain design option might need to be changed or added after a certain number of years. However, some of these design options make the feed-in tariff more complex and will therefore also lead to higher transaction costs. Therefore the policy maker has to compare the expected benefits with the additional transaction costs in order to decide whether the implementation of a certain design option really makes sense in the case of Malaysia.

## A. Grid interconnection

Clear and transparent grid interconnection rules are key for a fast uptake of the renewable energy market in Malaysia. Although the specific national circumstances have to be taken into account, Malaysia can learn from the experience in other countries. Generally speaker, simplified rules are needed for small scale renewable power producers when it comes to licensing and interconnection requirements. The Malaysian legislator has to keep in mind that with a FIT actors will enter the power generation business that are not used to dealing with complex administrative and technical requirements (such as private person and small and medium sized companies).

Here are some information about technical requirements for renewable electricity producers from other countries around the world:

- Examples EU: In this report you can find summaries of the technical and organisational requirements for small power producers (small PV and CHP) http://www.home-electricity.org/pdf/Interconnection_guide.pdf
- Example Thailand on technical tests that are required
  Technical data that are required from grid connection (up to 10MW):
  http://www.eppo.go.th/power/vspp-eng/Application%20Form%20-VSPP%2010%20MW-eng.pdf
- Example Tanzania
  http://irispublic.worldbank.org/85257559006C22E9/DOC_VIEWER?ReadForm&I4_KEY=B6A8F473D71B5FFD85256B8700039FB4D3A52C390D54DBC6852570D1007C9403&I4_DOCID=141C5C21234C2B0F852576E4005EDFDA&
- Example from Peru (unofficial English translation):
  http://irispublic.worldbank.org/85257559006C22E9/DOC_VIEWER?ReadForm&I4_KEY=B6A8F473D71B5FFD85256B8700039FB4D3A52C390D54DBC6852570D1007C9403&I4_DOCID=19C67D22D2B8019A852576E40065D838&

- Here you can find a sample of technical information that independent renewable power producers have to provide (test record, see page 26).

http://irispublic.worldbank.org/85257559006C22E9/DOC_VIEWER?ReadForm&I4_KEY=B6A8F473D71B5FFD85256B8700039FB4D3A52C390D54DBC6852570D1007C9403&I4_DOCID=ED1552AD3A34A2C7852576E4005E8CD2&

- Establish more simple connection standards for very small renewable energy producers (for instance up to 100kW)
- http://www.ewura.go.tz/pdf/SPPT/PROPOSED%20GUIDELINES/PROCESS%20GUIDELINES/Small%20Power%20Project%20Development%20Guidelies.pdf
- http://www.ewura.go.tz/pdf/SPPT/PROPOSED%20GUIDELINES/TECHNICAL%20GUIDELINES/Guidelines%20for%20Grid%20Interconnection%20-%20Part%20A.pdf
- http://www.ewura.go.tz/pdf/SPPT/PROPOSED%20GUIDELINES/TECHNICAL%20GUIDELINES/Guidelines%20for%20Grid%20Interconnection%20-%20Part%20B.pdf
- http://www.ewura.go.tz/pdf/SPPT/PROPOSED%20GUIDELINES/TECHNICAL%20GUIDELINES/Guidelines%20for%20Grid%20Interconnection%20-%20Part%20C.pdf

## B. Time-differentiated tariff payment

Several countries around the world have tried to align the production of electricity from renewable energy sources with general electricity demand patterns by offering timely differentiated tariff payments. The policymaker can decide to pay a higher tariff in times of high demand (peak) and lower tariffs in time of low demand (off-peak). This way, producers will have an incentive to align their production to general consumption patterns. This type of design is applied in countries like Slovenia, Hungary and France. In France, for instance, hydro power producers can opt into different groups of timely-differentiated tariff payment, as shown by the table below. In the case of the "five-component tariff", for instance, the tariff level per kilowatt hour can be as low as 4.25 €cent/kWh in off-peak periods during the summer. However, the tariff payment can go up to 17.72 €cent/kWh during peak demand periods in winter.

| | | |
|---|---|---:|
| Single-component tariff | No differentiation | 6.07 €cent/kWh |
| Two-component tariff | Summer | 8.38 €cent/kWh |
| | Winter | 4.43 €cent/kWh |
| Four-component tariff | Winter, normal demand | 10.19 €cent/kWh |
| | Winter, off-peak demand | 5.95 €cent/kWh |
| | Summer, normal demand | 4.55 €cent/kWh |
| | Summer, off-peak demand | 4.25 €cent/kWh |
| Five-component tariff | Winter, peak demand | 17.72 €cent/kWh |
| | Winter, normal demand | 8.92 €cent/kWh |

| | | |
|---|---|---|
| | Winter, off-peak demand | 5.95 €cent/kWh |
| | Summer, normal demand | 4.55 €cent/kWh |
| | Summer, off-peak demand | 4.25 €cent/kWh |

This type of tariff differentiation is usually only implemented for power generation technologies where the power producer can influence the timing of power output. In other words, this type of tariff payment usually not applies for solar PV and wind energy. Malaysia might consider this design option once a significant share of the total electricity demand will be covered by renewable energy sources (for instance, 15 percent). In the case of the limited biomass resources, for instance, it might be beneficial shift power generation activities to peak demand periods. However, the legislator has to make sure that the profit margin will still be sufficient in order to amortize all costs in a given number of years.

## C. Consider other sources of income for the feed-in tariff fund

Currently, the Malaysian legislator is planning to finance the deployment of renewable energy sources via a one percent increase of the retail electricity price. The revenues from this one percent price increase will go into a fund which will be established to finance the tariff payment for renewable electricity producers under the national feed-in tariff. In order to increase the share of renewable electricity in the future, the government would have to consider further increasing the electricity price (for instance, a two to five percent electricity price increase). However, as in all countries around the world, electricity price increases are a politically very sensitive issue. Even though they are necessary in Malaysia – to fade out subsidies and encourage energy efficiency measures – the policy maker might be reluctant to further increase the electricity price for final consumers in order to finance an increasing share of share of renewable energy sources. Therefore, other sources of financing the feed-in tariff fund might have to be considered.

It would also be possible to generate incomes for the FIT fund via a small tax on electricity produced from conventional power generation. In fact, the current power generation costs of natural gas and coal in Malaysia do not reflect the real costs for the society, since the negative external costs (e.g. CO2 emission) are not being internalised. The negative external costs can be internalised via an electricity tax. At the same time, the money from taxing conventionally produced electricity can be dedicated to the support of the cleaner renewable energy sources.

Another option would be to take a certain share of the revenues made from exporting fossil fuels for the support of nationally available renewable energy sources. Malaysia is making large revenues from exporting natural gas and oil to other countries. If only a small fraction of the incomes generated from exporting fossil fuels would be used for feeding the FIT fund, Malaysia could significantly increase its targets for renewable energy deployment. At the same time, Malaysia would use less of the precious fossil fuels for generating electricity in the country and have more resources available for exporting fossil fuels.

### D. Extend the plant-size cap for certain renewable energy technologies

Some feed-in tariff legislations include capacity limits for the power plants that are eligible for tariff payment. By limiting the size of power plants eligible for tariff payment the legislator is generally trying to reduce the overall costs. At the same time, the plant size is often capped in countries were the total installed capacity is also capped. This way, legislators try to assure that a large number of power producers can actually profit from the support scheme – instead of assigning the total capacity to just a few power producers. In Kenya, for instance, the feed-in tariff payment is guaranteed for the first 150 MW of wind energy and the total size of wind power plant cannot exceed 50 MW. However, size restrictions are also based on the (historically outdated) idea that renewable energy plants are by definition small scale (and cannot replace large-scale conventional power plants).

The Malaysian feed-in tariff will guarantee tariff payment for renewable energy power plants up to 30 MW. For all technologies which are currently eligible under the feed-in tariff (small hydro, biomass, biogas, waste and solar PV) this limitation is usually not limiting the overall growth. However, as soon as other technologies will become eligible for tariff payment, the legislator might have to consider extending this capacity limit. Especially in the case of wind energy and geothermal, power plants have sometimes proven to be larger than 30 MW. The experience in France shows that the deployment of renewable energy potential can be hindered by implementing capacity limits for the maximum plant size of renewable energy power plants eligible under the feed-in tariff. The early feed-in tariff legislation in France included a maximum plant size of 12 MW. However, this hindered the development of wind energy in this country. The sector only started to grow after this capacity limit was removed in 2005.

# IV. Potential future research opportunities

The analysis of the Malaysian feed-in tariff and the conversation with a large number of stakeholders in the Malaysian energy sector has encouraged the author of this report to point at potential future research opportunities. Based on the experience in other countries that already operated with a feed-in tariff for a number of years, policy maker and the responsible ministry should incentivize research in the following areas.

## A. Market analysis and tariff calculation

Renewable energy markets are developing rapidly. Therefore, it is very important for all policy makers around the world to acquire up-to-date information about the international market development, including the cost of different renewable power sources (cost of different equipment components), the newly installed capacity around the world, etc. This sort of analysis is especially important for rapidly developing power generation sources such as solar PV. Tariff levels have to be re-assessed frequently in order to take potential cost reductions into account and avoid windfall profits.

In order to keep track of the technology development, policy makers around the world also analyse tariff payment guaranteed in other (neighbouring) countries with similar resource potential. Feed-in tariffs have only been implemented recently in most Asian countries. Therefore, it would be interesting to compare feed-in tariff design in a number of Asian countries, for instance, Malaysia, Thailand, China and Taiwan.

In additional, it is also important to keep track of the future market development in Malaysia. The legislator or independent research institutes should, for instance, analyse the locations of solar PV systems in Malaysia. If after a certain a number of years it turns out that all solar PV plants will be installed in just of region of the country (with high solar radiation levels), it might be necessary to implement location specific tariffs in the mid-term in order to incentivize a more evenly distributed use of solar PV systems throughout the country.

Information about Thailand:

The feed-in tariff that was implemented in Thailand (VSPP program, up to 10 MW) has proven to be very successful in triggering newly installed renewable energy capacity. As of March 2010, 792 MW new renewable energy capacity have been connected to the grid. Moreover, PPAs have been signed for **additional** 3974 MW. In order to avoid speculation in the renewable electricity sector in Thailand, power producers have to pay a bond of 200 baht/kW. Besides, PPAs expire if the project is not built within the scheduled Commercial Operation Date.

The information about the Thailand market development can be downloaded at:

http://www.eppo.go.th/power/data/

## B. Grid impact and grid extension

The existing Malaysian electricity grid was developed in order to accommodate electricity from large-scale, conventional power plants. Now, the Malaysian legislator is planning to increase the share of grid-connected renewable energy sources. The experience from other countries shows that once the decision has been made to increase the share of renewables it is also necessary to initiate the transformation of the national electricity grid. In order to accommodate hundreds or thousands of small-scale, independent power producers the electricity grid usually needs to be extended, although grid losses can usually be reduced, since renewable energy power plants are generally closer the location of the load.

Several countries in the world, for instance Germany, have commissioned studies from independent research institutes in order to analyse the impact of renewable energy sources on the national electricity grid. In other countries, the grid operator or utility is obliged to do those studies. If Malaysia is planning to increase the share of renewable electricity to 5.5 percent in 2015 and 9 percent in 2020 it needs to be analysed whether grid extension or grid reinforcement will be necessary to achieve this targets. Grid extension usually takes a long time and therefore it is important to anticipate the future demand for grid capacity in order to expand the share of renewable energy sources rapidly. Besides these national grid studies, it might also be interesting for Malaysia to analyse the impact in certain regions in more detail.

For an example of these grid studies, see Germany (http://www.wind-watch.org/documents/wp-content/uploads/dena-integratingwind2020.pdf), South Africa (http://www.gtz.de/en/themen/umwelt-infrastruktur/energie/13742.htm) and Ireland (http://www.dcenr.gov.ie/Energy/North-South+Co-operation+in+the+Energy+Sector/All+Island+Electricity+Grid+Study.htm).

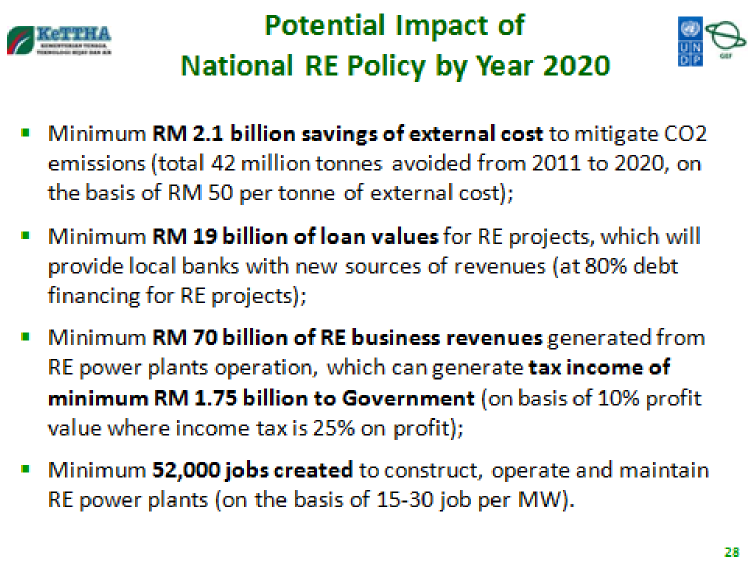
## C. Cost benefit analysis for renewable energy support

In many countries, the legislator is frequently assessing and amending the national feed-in tariff mechanism since renewable energy technologies are developing rapidly. In most countries, the periodic review of feed-in tariffs takes place every three or four years. When the feed-in tariff is implemented for the very first time it is usually recommended to already do the first assessment after one or two years in order to correct some “design errors”, if necessary.

Evaluating and periodically reporting on the state and progress of FIT programs is crucial for long-term success. Reporting and evaluation is usually the task of the responsible ministry. They will ensure that the law is functioning well, and if necessary, how it could be improved or amended. In some countries, progress reports provide the scientific grounds for periodic amendments of FIT schemes. These assessment report usually include an analysis of growth rates and average production costs of the eligible technologies and an evaluation of the progress towards the achievement of targets.

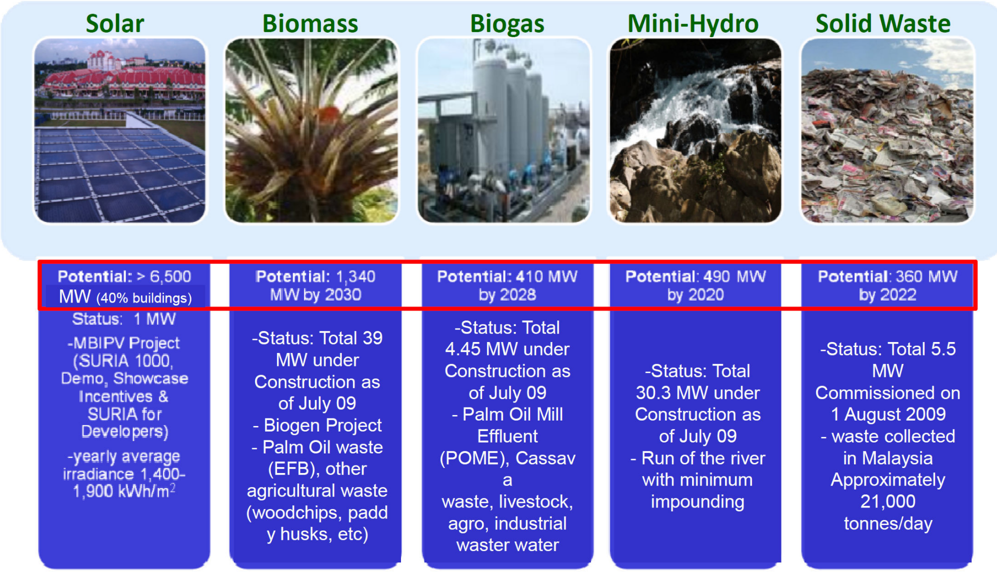
When analysing the support for renewable energy sources people tend to focus on the additional costs for the final consumer. Therefore, it should be in the interest of all legislators to assess the economic, social and environmental benefits of renewable energy support. These studies are usually done by independent, national research institutes. For instance, it would be interesting to evaluate the newly established jobs in the renewable energy sector, to assess the additional income that can be made by selling oil and gas on the international market (instead of using it for electricity generation in Malaysia), and others.

The Ministry KeTTHA has already done some initial estimates of the positive macro-economic effects of the feed-in tariff (see below). However, these figures need to be backed up by more elaborated research based on real figures.




## D. (Re-)assessment of the national renewable energy potential

The responsible Ministry KeTTHA has already assessed the resource availability for some of the renewable energy technologies that will be eligible for tariff payment in the first years (small hydro power, biomass, biogas, solar PV and waste – see below). The availability of resources for other technologies, for instance wind power and geothermal power, still needs to be assessed.



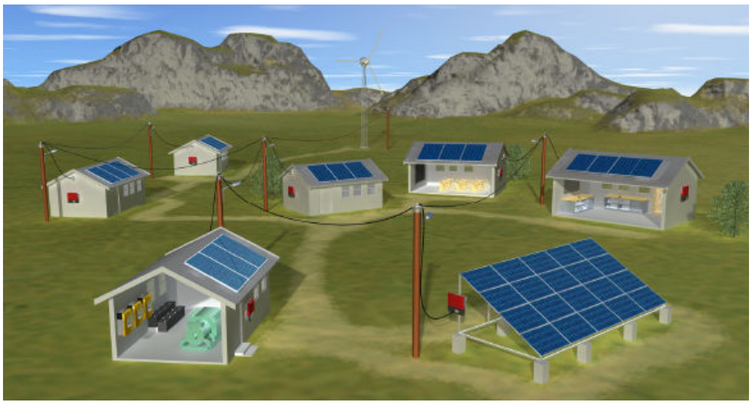

However, also the resource availability of the already eligible technologies has to be re-assessed from time to time. Renewable energy technologies are improving and therefore the potential for power generation from these sources also increases. Early assessments of the renewable energy resources in Germany in the 1990s have indicated that the country can not produce more than three percent of its electricity from renewable energy sources. Today, Germany is already producing more than 18 percent from its total electricity demand via renewable energy sources.

## E. Analysis of extending the national FIT to off-grid systems

Malaysia could consider extending the feed-in tariff for also promoting the use or renewable energy sources in off-grid areas or mini-grids (Sarawak and Sabah). Several researchers have written studies and book about possible ways to do this (for instance, JRC 2008, Mendonca et al. 2009).

Mini-grids refer to interconnected, small-scale, modular electricity networks that rely on a small, local, and often isolated distribution system. Typically, a small village or a group of houses is interconnected by such a mini-grid. Local mini-grids can later be extended by linking several village mini-grids in a given area. Electricity can be provided by a large variety of technologies. In most cases, wind turbines and solar panels are backed up by small diesel generators or batteries. Ideally, biomass and small hydro can provide this backup power as well.

*Mini-grid powered with renewable energy sources*



Source: ARE and SMA 2009

Per definition, costs that occur in an isolated mini-grid cannot be shared amongst all electricity consumers in the country. Therefore, the financing mechanism of a FIT scheme has to be adjusted to meet the needs of the actors that participate in such a system. Further research needs to be done of how to adjust the payment flows to the energy market structure in Sabah and Sarawak.

The author of this report was informed that in the past TNB was responsible for (partially) financing and operating renewable energy power plants in off-grid areas. Under the “monopolist approach”, so called Rural Energy Service Company (RESCO, in the case of Malaysia TNB) has a partial monopoly, i.e. they have the exclusive right for energy services and other public services in a given area.

The Rural Energy Service Company (RESCO) normally sells electricity to the final consumer below generation costs. This would also be the case if a RESCO incorporates renewable energy plants into its portfolio. In order to guarantee profitability in power generation, the RESCO receives additional money from the Malaysian feed-in tariff fund. In combination, the FIT payment from the national level and the regulated tariff from the final consumer shall offer a sufficient profitability margin for TNB. As mentioned before, further research is needed of how to organised the revenue streams from the feed-in tariff fund to the operators of off-grid renewable energy power producers.

The international experience on off-grid feed-in tariffs is so far very limited. Only Tanzania and Peru implemented similar legislations in 2009 and 2010. In Peru, the national legislature implemented a FIT for off-grid renewable energy systems in August 2010. With a national electrification rate of 80%, but only a 28% electrification rate in rural areas at the end of 2008, the Peru has set an ambitious rural electrification plan to bring electricity to un-served areas up to 84% by 2018. Rural electrification tariff rates of \$0.09 – \$0.33/kWh (S/.0.25 – 92/kWh) were set in August 2010 for PV systems and were differentiated by region, PV system size, and ownership (i.e., public or private investment. The specific program regulations are still be drafted.

## F. Analysis of tax benefits for rural communities (social acceptance)

Renewable energy power plants are generally located in rural areas, especially in the case of small hydro, biomass, biogas and wind energy. In order to increase the social acceptance of renewable energy technologies, it is important to assure some financial benefits for the local population that is "confronted" with the renewable energy power plants.

In Germany, for instance, the local community profits from wind power development in their region or municipality because 70 percent of the business tax revenues will be directed to the local community or municipality. Only 30 percent of the business tax revenues will flow to the city or region where the company of the power plant operator has its main seat. This way, the German legislator made sure that the local community is general in favour of accommodating renewable energy power plants in their area. In order to achieve similar support from the local administration in Malaysia it is necessary to analyse the Malaysian tax regime in more detail in order to see where potential modification would be possible.

# V. References and further reading

## FEED-IN TARIFFS

A 2008 pamphlet from the World Future Council ("Feed-in tariffs – Boosting energy for our future"), explaining the basic concept of FITs. Good for an introduction.
http://www.worldfuturecouncil.org/fileadmin/user_upload/Maja/Feed-in_Tariffs_WFC.pdf

A 2008 report from the International Feed-in Cooperation ("Evaluating feed-in tariff design options"), analysing all European countries with feed-in tariffs and their specific policy design.
http://www.feed-in-cooperation.org/wDefault_7/content/research/research.php

A 2010 report from the National Renewable Energy Laboratory (NREL) in the US ("A Policy maker's guide to feed-in tariffs"), analysing FIT design options.
http://www.energy.eu/publications/A_Policymakers_Guide_to_Feed-in_Tariffs_NREL.pdf

## COMPARISON OF SUPPORT MECHANISMS

A summary of a 2008 report from the International Energy Agengy IEA ("Deploying renewables") on the effectiveness and efficiency of renewable energy support policies.
http://www.iea.org/Textbase/npsum/DeployRenew2008SUM.pdf

A 2008 report from the European Commission ("The support of electricity from renewable energy sources"), analysing different support instruments in the EU and arguing that FITs have been most successful.
http://ec.europa.eu/energy/climate_actions/doc/2008_res_working_document_en.pdf

A 2007 report from a large research consortium ("Assessment and Optimisation of renewable support schemes in the European electricity market"), analysing European support instruments and showing how to improve them.
http://ec.europa.eu/energy/renewables/studies/doc/renewables/2007_02_optres.pdf

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