FIT for clean energy

Background paper on the Philippine feed-in tariff scheme

On behalf of

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Abbreviations

AA	Administration allowance
BFOE	Barrels in fuel oil equivalent
CAA	Philippine Clean Air Act of 1999
CO_2	Carbon dioxide
CRR	Cost recovery rate
DA	Disbursement allowance
DOE	Department of Energy
DU	Distribution utility
ERC	Energy Regulatory Commission
FD	Feed-in differential
FIT	Feed-in tariff
FIT-All	Feed-in tariff allowance
GDP	Gross domestic product
GHG	Greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
GWh	Gigawatt hour
LWAP	Load weighted average price
MAG	Market Assessment Group
MMAR	Monthly Market Assessment Report
MOT	Merit order table
$MtCO_2e$	Metric ton of carbon dioxide emission
MTOE	Metric ton of oil equivalent
MW	Megawatt hour
NGCP	National Grid Corporation of the Philippines
NREB	National Renewable Energy Board
NREP	National Renewable Energy Program
PEMC	Philippine Electricity Market Corporation
PEP	Philippine Energy Plan
RE	Renewable energy
RES	Retail electricity suppliers
RPS	Renewable Portfolio Standard
TRANSCO	National Transmission Corporation
WCA	Working capital allowance
WESM	Wholesale electricity spot market

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Applied currency conversion rates

- 1 USD = 44 PHP; 1 PHP = 0.02272 USD

These conversion rates are used for USD/PHP and PHP/USD conversions in the text, if necessary.

Executive summary

The Philippines, blessed with many renewable energy sources, finds best preconditions to make the country's power system fit for the future. Increasing fuel prices, high energy import dependence, ever-increasing carbon emissions, and unconsidered external costs of fossil fuels make renewable energies the superior alternative. However, in order to fully exploit the potential of renewable energy, a well-designed support mechanism is inevitable.

The Philippine government is willing to use this window of opportunity and introduced the feed-in tariff (FIT). The costs of the FIT will be passed to all on-grid consumers in the form of a FIT allowance (FIT-All) starting with the February 2015 collection. Even though this now increases the electricity bills of consumers slightly, the long-term benefits of renewable energy will pay this investment off.

In implementing the FIT, the Philippine government took a very important step toward a more reliable and sustainable energy supply while reducing energy dependence. However, many stakeholders are not yet fully aware of the benefits and opportunities of renewable energy development. Furthermore, the FIT system, the collection of the FIT-All, and the disbursement of the FIT revenue is quite complex and difficult to understand.

This paper was developed in order to provide a comprehensive overview of the Philippine FIT scheme and summarize important background information on renewable energy development. Questions that are addressed in the paper include: Why should we support renewables? How does the Philippine FIT system work? Are renewable energies already competitive? How does the introduction of the FIT affect the electricity prices of consumers?

1. Why should we support renewable energy?

There are many reasons for supporting renewable energies. One reason is that electricity generation from renewable energy makes the country less dependent on energy imports. In 2013, indigenous energy sources saved the country's energy imports in the amount of USD 2.7 billion (=25.5 MTOE). 56.75% of the Philippines' energy demand is already covered by indigenous energy sources, yet the energy demand is expected to rise annually by 4%. Renewable energy sources, such as solar and wind, are free of charge and can help to cover the additional demand, keeping the Philippine import dependency on a low level.

Secondly, deploying renewable energies makes the country less vulnerable to volatile prices of fossil fuels. The prices for fossil fuels like natural gas and steam coal are very volatile. This makes it difficult to predict the future costs for electricity generated from fossil fuels. Most renewable energies have no fuel costs, which makes it easier to predict their costs.

A third and also very important reason to support renewable energies is to reduce greenhouse gas (GHG) emissions. Energy still accounts for a large share of the Philippine GHG emissions, with coal as the biggest contributor. The replacement of 1 kWh coal-generated electricity by 1 kWh RE-generated electricity saves around 960 gCO_2/kWh.

RE can reduce energy dependency, vulnerability to volatile prices of fossil fuels, and GHG emissions.

2. How does the Philippine FIT system work?

The FIT is a support mechanism that offers guaranteed payments on a fixed rate per kilowatt-hour for renewable energy. It accounts for the specific cost structure of RE (high installation costs, low operation and maintenance costs) and helps RE developers to overcome current cost disadvantages.

The FIT rates, the price per kWh that is paid to the RE developer, is based on the generation costs for different RE technologies. Thus, the FIT rate for solar-generated electricity is higher than the FIT rate for hydropower. The FIT rates are composed of the cost recovery rate (which equals the market price of electricity) and the FIT differential (the difference between the market price and the FIT rate). The FIT differential is covered by the FIT -All, which will be charged to the on-grid consumers as part of their electricity bill starting with the February 2015 collection.

The more RE electricity is generated, the higher it raises the FIT-All and, thus, the electricity bill. Philippine electricity prices are among the highest in Asia and especially vulnerable to increases. In order to control the amount of installed RE capacity and, with this, also the increase of the FIT-All, the Philippine government introduced installation targets. The installation targets are crucial for RE developers, as FIT eligibility is awarded in accordance with the "first-come, first-served" principle. This regulation is meant to create a race between the RE developers, enforcing fast project completion.

The Philippine FIT system is an efficient and well-designed policy instrument that ensures the exploitation of the benefits of RE.

3. Are renewable energies already cost competitive?

Electricity generated by renewable energies is, under some conditions, already competitive with electricity generated from fossil fuels, yet this depends very much on the context factors. Construction costs account for the largest part of the costs for renewable energies. Due to sinking prices for solar panels and wind turbines, the deployment costs of solar plants are estimated to decline. In contrast, the increasing prices for fossil fuels such as natural gas and steam coal will lead to higher prices for electricity generated from fossil fuels. This will increase the competitiveness of renewable energies and decrease the competitiveness of fossil fuels. In the Philippines, solar plants are already competitive with some fossil fuels, for example, with coal.

However, the competitiveness of renewable energy depends very much also on the capacity factor. Unlike base load technologies that produce a stable amount of electricity, the output of renewable energy plants varies according to the availability of the primary source (e.g. solar irradiation, wind). This indicates that renewable energy plants are more competitive in places with high solar irradiation or strong wind.

Furthermore, fossil fuels generate high external costs, i.e., costs that are not reflected in the electricity price but that society as a whole must bear. External costs mainly refer to environmental damages, climate change impacts, and health impacts. It has often been claimed that if external costs were included in the electricity price, renewable energies would have long been competitive with fossil fuels. Policy instruments such as carbon taxes and emission trading place a price on producers of external costs such as carbon dioxide and internalize at least a part of the external costs of electricity generation.

RE is, under some conditions, already competitive, and due to increasing fuel costs and sinking prices for RE technology, it will become even more competitive.

4. How does the introduction of the FIT affect the electricity prices?

Renewable energy is traded at the wholesale electricity spot market (WESM). As the marginal cost of RE plants is lower than the one of fossil fuels-fired plants, electricity generated from renewable energies will be bought first. This kicks more expensive fossil fuel-fired electricity plants out of the market and decreases the electricity price. A study conducted by the Melbourne Energy Institute found that only 600 MW installed RE capacity already decreases significantly the WESM prices, on average by 0.8 PHP/kWh. As the now approved installation targets equal 1,200 MW, the actual savings might even be higher.

Renewable energies can also reduce electricity prices during peak demand periods. The output profile of solar plants correlates well with the demand profile of the Philippines. Thus, solar power can contribute to slowing down the fast increase of electricity prices during peak demand periods.

The FIT system will decrease long-term WESM prices and short-term peak load prices.

chapter
01

Background

The Philippines is blessed with many renewable energy resources: due to its location being close to the equator, solar irradiation is high throughout the whole year; the windy shores of Northern Luzon and coastlines across the Visayas and Mindanao provide the best conditions for generating wind energy; and the exploitation of geothermal energy already contributes a big share to the national electricity mix. However, fossil fuels still account for the largest share of the Philippines' electricity mix, making the country heavily dependent on energy imports and increasing its CO_2 emissions.

In order to transform the country's power supply toward more sustainability, less carbon intensity, and more indigenous generation, the government introduced the FIT system. The FIT is a policy that offers guaranteed payments on a fixed rate per kilowatt-hour (kWh) for emerging renewable energy (RE) sources to accelerate their deployment. The difference between the FIT rates and the market price of renewable energy is provided by the FIT-All, which is charged to the on-grid electricity consumers. The collection of the FIT-All is due to start in February 2015.

Even though constructing renewable energy plants is still slightly more expensive than fossil fuel plants, the electricity generated from them is already cost competitive during peak price hours. Increasing fuel prices and rising CO_2 emissions make the transformation of the energy system inevitable. Thus, investments in sustainable energy supply will pay off in the future. The time to set the cornerstones for this transformation is now.

The aim of this brochure is, on the one hand, to explain how the FIT works and, on the other hand, to provide a comprehensive summary of the rationale behind supporting renewable energies. The brochure starts with a short overview on the main advantages of renewable energy and outlines the regulative RE framework in the Philippines (Chapter 1). Chapter 2 describes the FIT system and gives a brief outlook on possible effects of the FIT. Renewable energies are often regarded to be not competitive with fossil fuels. Chapter 3 will shed light on this discussion and analyze the different cost structures of fossil fuels and renewable energy. The expected effects of the FIT on the energy prices will be addressed in Chapter 4.

1.1 Why should we support renewable energy?

The use of RE in the Philippines, particularly for power generation, has evolved from merely addressing fuel diversification in the country's power mix to enhancing energy security and achieving sustainable energy development over time.

From an almost total oil dependency to run its power plants in the 1980s, the country has turned into a front-runner in developing renewable energies among the Association of Southeast Asian Nations countries during the 1990s. Due to the deployment of geothermal and hydropower, renewable energy accounted for 32% of the total generating capacity in 2000. Since then, the share of renewable energy stayed more or less the same. In 2013, the total installed capacity was at 17,609 MW, with RE reaching 5,636 MW or accounting for 32.0% of the total capacity and generating a total of 75,265 GWh. Geothermal and hydropower still contribute the major part of the share of renewable energy, and "new renewables" such as solar, wind, and biomass are still at a very early stage of development, covering only 1.0% of the total installed capacity.

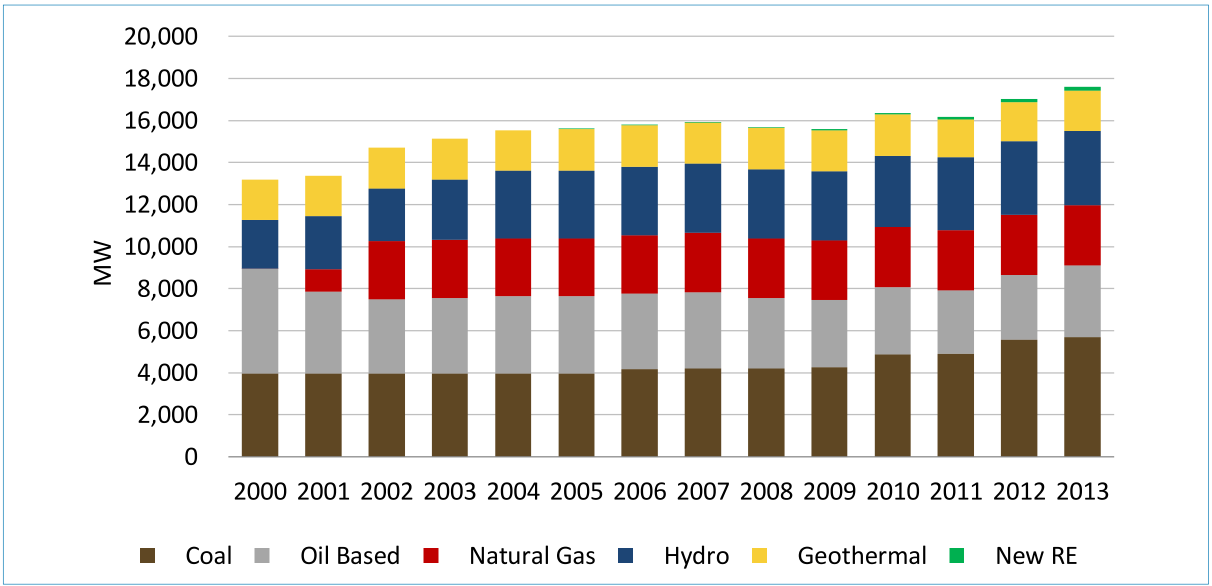

Figure 1. Historical installed generating capacity 2000–2013
Source: DOE (2015a).

RE helps to make the country less dependent on energy imports. In terms of the overall energy mix, the continuous exploration and development of indigenous energy has afforded the country a self-sufficiency level of 56.8% in 2013, with RE contributing a significant part of 40.1%. This has tempered the net share of energy imports to the national balance of payments, with a lower average share of 18.8% in the last 9 years.

Renewable energy already contributes more than 2/3 to the share of indigenous energy, saving the country money from ever-expensing fossil fuel imports. In 2013 alone, from a total energy mix of 45 MTOE and a reported energy independence of 56.8%, the total indigenous energy sources have saved the country a total of 2.7 billion USD from energy importations (at an average price of US$ 107 per barrel of crude oil).

However, due to the fast-growing economy, the energy demand is expected to further rise. The Department of Energy (DOE) estimates that the power generation will increase by 4.1% annually (DOE 2012). Solar, wind, and biomass can help to cover the additional energy demand and avoid an increase of energy imports.

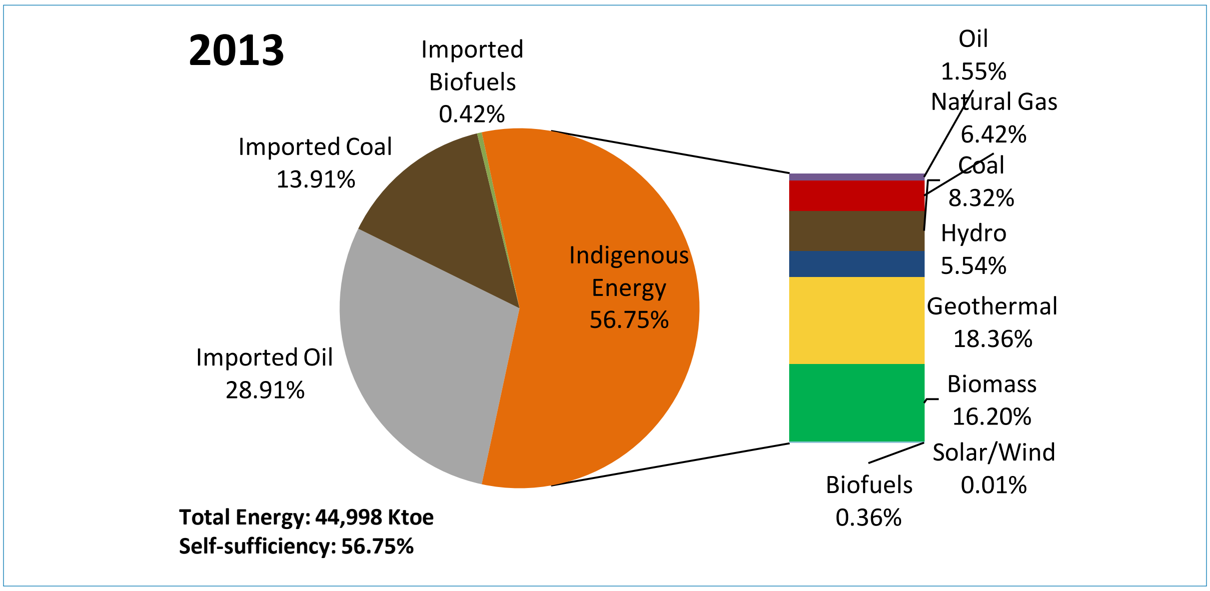

Figure 2: Imported and indigenous energy
Source: DOE (2015a).

Meanwhile, based on the DOE Energy Policy and Planning Bureau, total GHG emissions coming from fossil fuels reached 80.9 metric ton of carbon dioxide equivalent ($MtCO_2e$) in 2013 or a 6.7% increase from the emission level of the previous year. The indigenous RE resources could play an important role in realizing the provision of electricity to more remote sitios and help address the expected average increase in demand for energy at 4.79% per year (DOE 2012). Thus, a window for high CO_2 avoidance potential to support sustainable energy development is achievable. The use of RE is a key measure for a climate-friendly energy supply in the Philippines. The Philippines is one of the countries most affected by the adverse impacts of climate change (German Watch 2015). Climate change affects economic growth, food security, public health, and safety of human lives.

Given the dynamics of energy demand under the Philippine Energy Plan (PEP) business-as-usual planning scenario, total GHG emission from fossil fuels (oil, coal, and natural gas) is foreseen to increase at an average level of 4.8% per year throughout the planning period, from a level of 79.5 $MtCO_2$ in 2014 to 168.2 $MtCO_2$ in 2030. Coal remains a major contributor to GHG emission, accounting for an annual average increase of 6.8%, whereas those from oil-based fuels and natural gas will account for annual increases of 1.7% and 4.9%, respectively.

Table 1. Projected greenhouse gas (GHG) emission in million tons of carbon dioxide ($MtCO_2e$)

Actual outlook	Energy source ($MTCO_2e$)			Total ($MTCO_2e$)
	Oil	Coal	Natural gas	
2014	35.26	36.69	7.57	79.52
2015	35.33	39.39	7.84	82.56
2016	35.39	43.23	8.51	87.13
2017	36.25	46.83	9.5	92.58
2018	37.4	50.7	9.74	97.84
2019	38.61	53.61	10.26	102.48
2020	38.33	57.6	10.36	106.29
2021	39.35	62.16	10.5	112.01
2022	40.38	66.83	10.68	117.89
2023	41.49	69.66	11.42	122.57
2024	42.54	74.75	11.74	129.03
2025	41.34	79.43	12.39	133.16
2026	42.27	85.23	12.71	140.21
2027	43.22	88.7	14.06	145.98
2028	44.12	94.18	14.83	153.13
2029	45.09	99.9	15.56	160.55
2030	45.93	105.88	16.39	168.2
Total	**682.3**	**1154.77**	**194.06**	**2,031.13**
Average annual growth rates				
2014–2030	1.70%	6.80%	4.90%	4.80%

Source: DOE (2012).

1.2 National Renewable Energy Program (NREP) targets

The government launched the National Renewable Energy Program (NREP) to steer the country in achieving the goals of higher utilization of RE. The NREP sets targets for each RE and looks at tripling the total RE capacity until 2030 to reach 15,304 MW by the end of the time frame. Each sub-sectoral program follows a road map, which serves as a guide for the achievement of the market penetration targets of a particular RE resource in the energy industry. It indicates the milestones over the 20-year planning period, which will depend on the implementation of other support activities. Table 2 shows the potential power capacities coming from RE.

Table 2. NREP target RE capacity addition

Sector	Installed Capacity (MW) as of 2010	Target Capacity Addition by				Total Capaity Addition (MW) 2011-2030	Total Installed Capacity by 2030
		2015	2020	2025	2030		
Geothermal	1,966.0	220.0	1,100.0	95.0	80.0	1,495.0	3,461.0
Hydro	3,400.0	341.3	3,161.0	1,891.8	0.0	5,394.1	8,724.1
Biomass	39.0	276.7	0.0	0.0	0.0	276.7	315.7
Wind	33.0	1,048.0	855.0	442.0	0.0	2,345.0	2,378.0
Solar	1.0	269.0	5.0	5.0	5.0	284.0	285.0
Ocean	0.0	0.0	35.5	35.0	0.0	70.5	70.5
TOTAL	5,438.0	2,155.0	5,156.5	2,468.8	85.0	9,865.3	15,304.3

Source: DOE (2011, p. 23).

1.3 Legal mandate of the FIT in the Philippines

Republic Act (RA) No. 9513 or the Renewable Energy Act of 2008 was enacted to accelerate the exploration and development of the country's RE resources and promote its efficient and cost-effective commercial application by providing fiscal and non-fiscal incentives to private sector investors and equipment manufacturers/suppliers. The FIT system is considered to be the most important non-fiscal incentive to trigger investments into RE capacity development. The FIT is a policy that offers guaranteed payments on a fixed rate per kilowatt-hour (kWh) for emerging RE sources, excluding any generation for own use. Besides the FIT, Renewable Energy Portfolio Standards (RPS), net-metering, and green energy options are other non-fiscal incentive schemes under the RE Act of 2008. The following provides an overview of important cornerstones in the development of the Philippine FIT scheme and summarizes the corresponding regulations.

1.3.1 FIT rates and degression rate

The FIT rates are guaranteed fixed prices for RE applicable for 20 years (see Table 3). They were determined by the Energy Regulatory Commission (ERC) based on the proposal submitted by the National Renewable Energy Board (NREB). They help overcome the cost disadvantages of renewable energy sources at the installation and early operation stage. ERC Resolution No. 10, Series of 2012, approved the following FIT rates for all RE technologies entitled to the FITs (except ocean energy) and the corresponding degression rates (ERC 2012).

Table 3. ERC-approved FIT and degression rates

RE resource	FIT rates (PHP/kWh)	Degression rate
Hydropower (run-of-river)	5.9	0.5% after year 2 from effectivity of FIT
Biomass	6.63	0.5% after year 2 from effectivity of FIT
Wind	8.53	0.5% after year 2 from effectivity of FIT
Solar	9.68	6% after year 1 from effectivity of FIT

Source: ERC (2012).

The difference between the market price of renewable energy and the FIT rate is provided by the FIT-All, which is charged to the on-grid electricity consumers. With the start of the billing of the FIT-All in January 2015, a major step to set the FIT scheme operational has been done.

In order to encourage developers to invest at the initial stage and hasten deployment of RE power capacities while ensuring that windfall revenues for developers are avoided and no unreasonable costs are passed on to the consumers, the FIT shall be subject to degression rates (see Table 3). This also means that any cost reductions in the RE technologies are immediately passed on to the consumers in terms of a lower FIT-All. The FIT Rules were initially fixed for a period of 20 years to ensure that the ensuing cost to electricity end users is spread out over a longer period.

Furthermore, within the FIT rules, defined in ERC Resolution 16 (ERC 2010), the ERC also determines the priority connection to the grid for electricity generated from RE, its priority purchase, transmission, and payment by grid system operators.

1.3.2 FIT Allowance

ERC Resolution 16, Series of 2010, states that on-grid electricity consumers shall share in the cost of the FIT through a uniform charge, known as the FIT-All (ERC 2010). The FIT-All is a uniform charge similar to the universal charge for missionary electrification that is to be imposed on all on-grid electricity consumers who are supplied with electricity through the distribution or transmission network. The FIT-All is collected in a fund – administered by the National Transmission Corporation of the Philippines (TRANSCO) – and then disbursed to the eligible RE developers. Under Section 2.5 of the FIT Rules, the ERC is mandated to establish and set the FIT-All on an annual basis upon petition of TRANSCO, who shall take into account the following parameters: (a) forecasted annual required revenue of eligible RE plants; (b) previous year's over or under recoveries; (c) TRANSCO's administration cost; (d) forecasted annual electricity sale; and (e) such other relevant factors to ensure that no stakeholder is allocated with additional risks in the implementation of the FITs (for detailed discussion of the FIT-All, see Chapter 2). Details on the collection of the FIT-All and the disbursement of the FIT-All fund are determined in ERC Resolution 24, Series of 2013 (ERC 2013).

1.3.3 Provisional FIT-All rate

The TRANSCO, as fund administrator of the FIT-All, filed an application for provisional authority under ERC Case No. 2014-109 RC for the approval of the FIT-All for calendar years 2014 (covering August to December) and 2015 based on the ERC's guidelines. In its decision on October 7, 2014, the ERC provisionally approved the FIT-All of PHP 0.0406/kWh, effective in the January 2015 billing of all on-grid electricity consumers (ERC 2014). Given this decision, the distribution utilities (DUs), the retail electricity suppliers (RES), and the National Grid Corporation of the Philippines (NGCP) are directed to adopt the necessary modifications in their respective billing and collection systems, to effect the implementation of the said FIT-All as a separate line item in their bills to end users, consistent with the prescribed date, and remit the same in accordance with the FIT-All guidelines.

1.3.4 Framework for implementation of must and priority dispatch

Section 20 of the RE Act allows qualified and registered RE-generating units with variable RE resources to be considered as "must dispatch" based on available energy and shall enjoy the benefit of priority dispatch. Thus, this amends provisions in the WESM rules. The DOE issued on April 8, 2015 Department Circular No. DC2015-03-0001: Promulgating the Framework for the Implementation of Must Dispatch and Priority Dispatch of Renewable Energy Resources in the Wholesale Electricity Spot Market. The "must dispatch" is facilitated in the WESM, wherein qualified and registered variable RE-based plants, whether or not under the FIT system, such as wind, solar, run-of-river hydro, or ocean energy, are given preference in the dispatch schedule whenever generation is available (DOE 2015b).

The provision of "must dispatch" by variable RE-based plants is based on the difficulty to precisely predict the availability of RE resource, thereby making the energy generated variable. "Priority dispatch" refers to giving preference to biomass plants under the FIT system in the dispatch schedule pursuant to Section 7 of the RE Act.

chapter
02

How does the FIT system work?

As already outlined above, the FIT is the main mechanism to promote the deployment of RE in the Philippines. Electricity generated from RE sources is still, at times, more expensive than electricity from conventional sources. In order to fasten the use of renewable energy, RE producers get a fixed rate per kWh (see Table 3), based on the cost of generation for the respective RE technology. The difference between the market price for electricity and the cost of generation of RE has to be paid by the consumers. In the Philippines, this difference is covered by the FIT-All that is charged to every on-grid electricity consumer.

2.1 FIT rate, cost recovery rate, and FIT differential

The Philippines adopted a technology-specific FIT system, and the FIT rates are based on the particular generation costs of different RE technologies. For example, the FIT rate for solar is higher than the one for hydropower; this secures a cost-effective deployment of both technologies. The FIT rate consists of two components: the (forecasted) cost recovery rate (CRR), which equals the market price for electricity, and the FIT differential (FD) (see Figures 3 and 4).

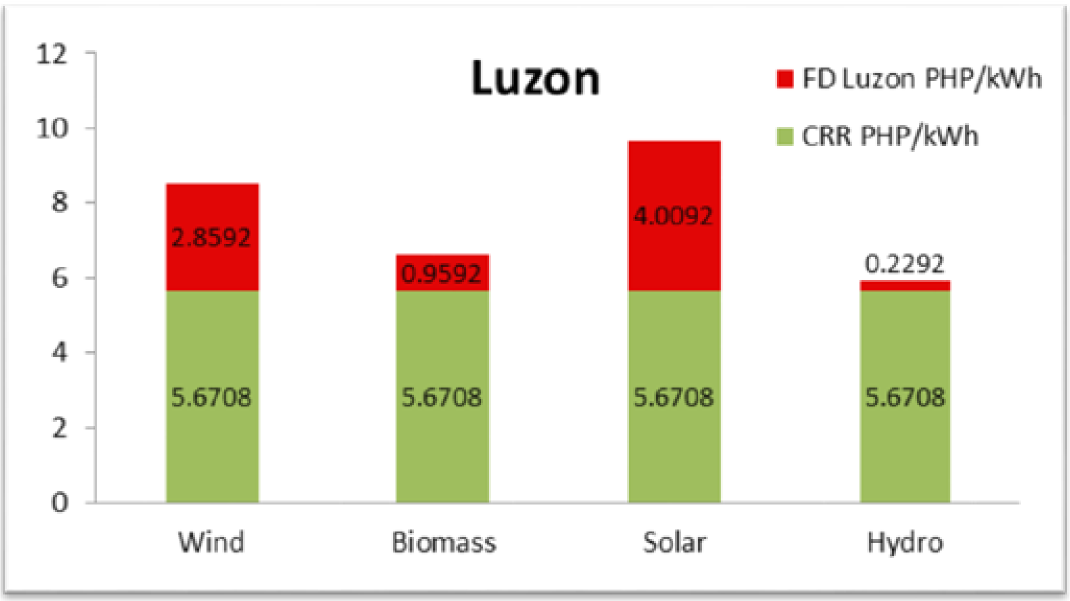

Figure 3. FIT differential and cost recovery rate for the Luzon grid
Source: ERC (2014).

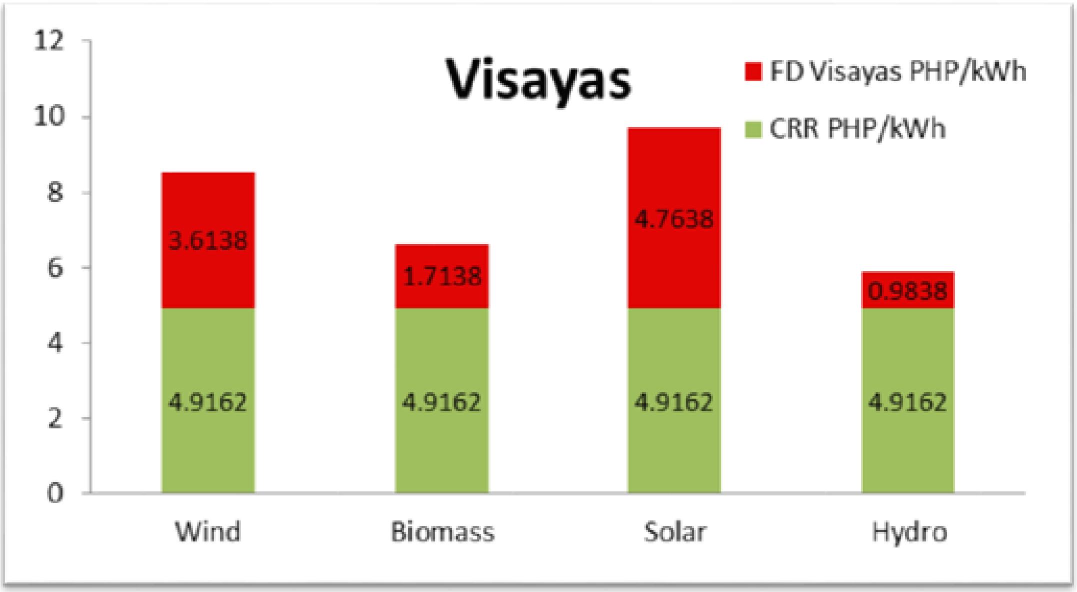

Figure 4. FIT differential and cost recovery rate for the Visayas grid
Source: ERC (2014).

The modus of determining and collecting the cost recovery rate depends on whether the RE plant is run in an area where the WESM is operational (Luzon and Visayas) or not (Mindanao). Figure 5 presents the process of FD and CRR collection, and the disbursement of the FIT revenues for a RE plant operating in a WESM area.

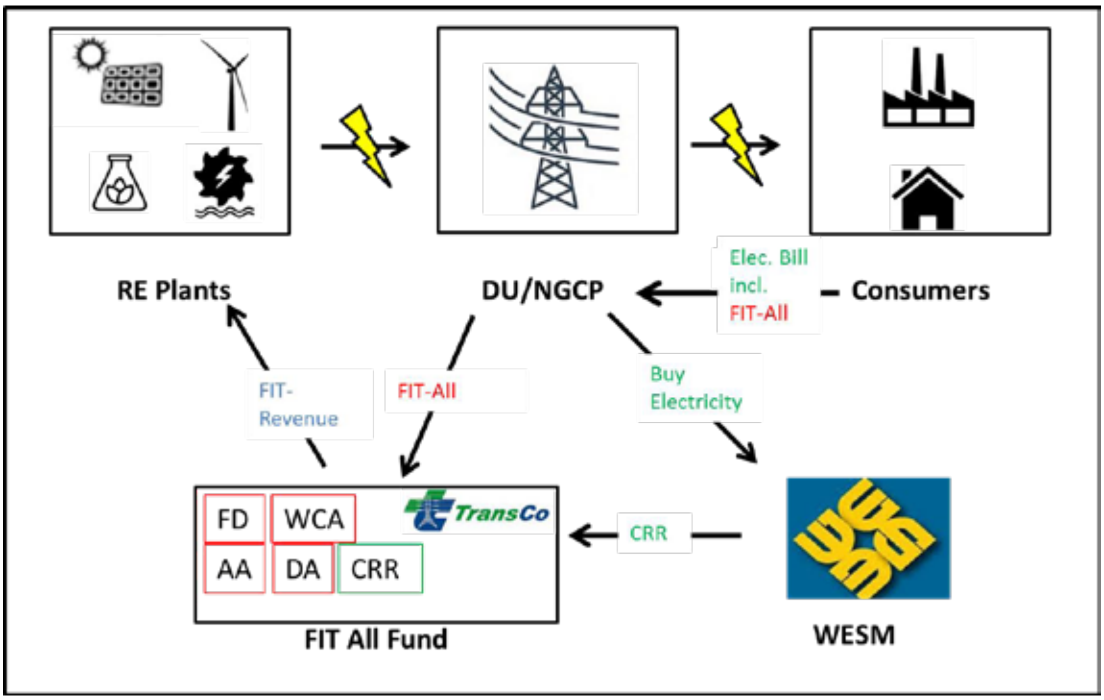

Figure 5. Scheme FIT-All and FIT revenue

2.2 Cost recovery rate and trading RE at the WESM

Eligible RE plants operating in a WESM area have to participate at the WESM. Trading energy at the WESM is regulated by the merit order table (see Figure 6 and, for a more detailed discussion, Chapter 4). The merit order table ranks available sources of energy in ascending order according to their short-run marginal costs of production. Sources of energy with the lowest marginal costs will be the first ones to be bought. As RE sources (apart from biomass) have no fuel costs, their operational costs are very low and power utilities will buy (and have to buy) them first. However, as the market clearing price is set by the most expensive plant at the market, the price that power utilities pay to WESM for electricity produced from renewables varies.

As part of the FIT procedure, Philippine Electricity Market Corporation (PEMC) remits the WESM proceeds from eligible RE plants to the FIT-All Fund, administered by TRANSCO (see Figure 5). The WESM proceeds equal the (actual) cost recovery rate (CRR) for renewable energy.

However, for the disbursement of the FIT revenue, the CRR for the following year has to be estimated in advance. Therefore, the Energy Regulatory Commission decided that the forecast CRR equals "[…] the average monthly system Ex-Ante Load Weighted Average Price (LWAP) of the WESM for the Luzon and Visayas grids for the thirty-six months immediately preceding the filing of the application for the setting of the FIT-All" (ERC 2013). Based on LWAP data from January 2011 to May 2014, PEMC set the forecast CRR for the Luzon grid at 5.6708 PHP and for the Visayas grid at 4.9162 PHP (ERC 2014; see Figures 3 and 4).

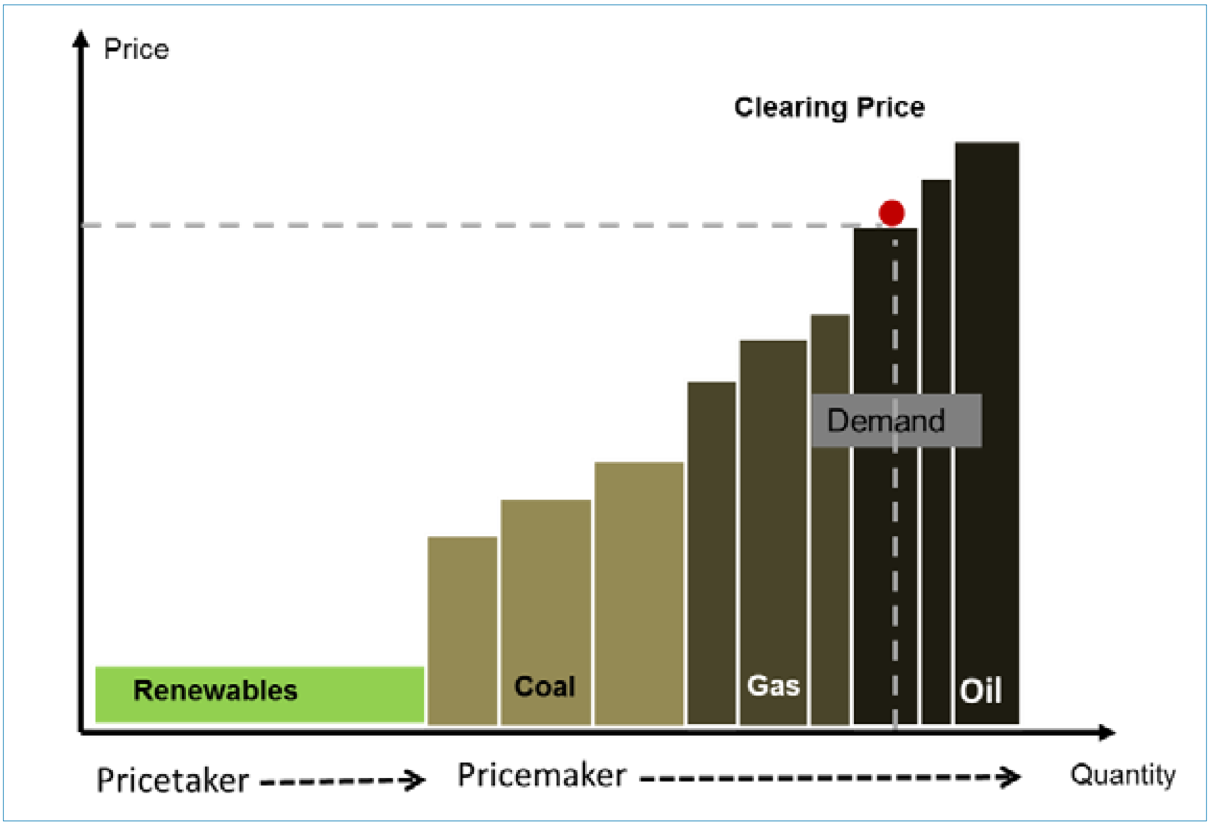

Figure 6. Merit order table
Note: Illustration modified from GIZ (2013, p. 9).

For an eligible RE plant operating in an area where the WESM is not operational, the CRR is to be paid by the host DU. In this case, the CRR is the product of the actual RE generation and the weighted average of the generation charge of the host DU for the respective billing period. The host DU collects the CRR as a part of the electricity bill from their consumers and forwards it to the FIT-All Fund for proper disbursement to the eligible RE plants.

2.3 FIT differential

The second component of the FIT rates is the FIT differential (FD). The FD is the difference of the forecast CRR (the forecasted market price of electricity generated by RE) and the FIT rates. Due to the differences between the forecast CRR in the Luzon and the Visayas grid (see Figures 3 and 4), the FD for RE technologies varies according to the site of the RE plant (Visayas or Luzon grid). The FD is provisioned by the FIT-All. The FIT-All is paid by every consumer as a uniform charge and collected as part of the electricity bill by the DUs and – in the case of direct-connected consumers – by NGCP. The DUs and NGCP then forward the FIT-All to the FIT-All fund (see Figure 5).

Actually, the FD is only one part (though the main part) of the FIT-All. The FIT-All also comprises a working capital allowance (WCA) that serves as a buffer to address any default or delay in the collection and remittance of the FIT-All and the actual cost recovery rate, an administration allowance (AA) and a disbursement allowance (DA) taking account of the administration and disbursement costs for the FIT-All Fund administrator. For the year 2014–2015, the AA and DA are proposed to be set at zero, and the WCA is 0.2 centavos/kWh (ERC 2014).

The FIT-All is calculated for a given year using the following formula:

$$FIT - All = \frac{FD + WCA + AA + DA}{FNS}$$

The FD is the total FIT differential required for a given year, and forecasted national sales (FNS) refers to an estimated total kWh of electricity billed to consumers who are supplied with electricity in all on-grid areas for a given year.

According to the formula, the FIT-All for 2014–2015 is set at 4.057centavos/kWh, effective with the January 2015 billing (ERC 2014). The FIT-All increases – to put it simply – when the share of RE to the national electricity mix rises. In more detail: the FIT-All rises when the total FD required for a given year increases proportionally faster than the forecasted national electricity sales (FNS). However, the FIT-All is, in general, very low in the Philippines: 4.057 centavos/kWh, equalling less than 1% of the average electricity rate (7.89 PHP/kWh as of March 2014; DOE 2014b, p. 8). For an average Philippine household with 200 kWh monthly consumption, the FIT-All is only 8.114 PHP per month. Even a doubling of the FIT-All would only have a marginal influence on the electricity bill.

2.4 Installation targets

Philippine electricity rates are among the highest in Asia and therefore especially vulnerable to increases. Experiences from abroad, especially from Germany and Spain, showed that the expansion of renewable energy can happen faster than expected. As outlined above, an increase in the share of renewable energy rises the FIT-All. In order to control the amount of installed RE capacity, and thus also the increase of the FIT-All, the DOE introduced installation targets (see Table 4). Yet, the installation targets – especially the ones for solar and wind – are already oversubscribed and subject to revision. The DOE already certified the increase of the installation target for solar power to 500 MW; the installation target for wind power is still under review.

Table 4. Installation targets and proposed additional capacity

	Installation target (MW)	Approved and proposed additional capacity (MW)
Biomass	250	
Hydro	250	
Solar	50	450 (approved)
Wind	200	200 (proposed)
Total	**750**	**450**

Source: ERC (2012).

The installation targets are crucial for RE developers, as FIT eligibility is awarded in accordance with the "first-come, first-served" principle. This regulation is meant to create a race between the RE developers, enforcing a fast project completion. However, as the certificate of FIT eligibility is issued at a relatively late status of project development (about 80% of project completion), the RE developers have to start the project development without knowing whether they will be eligible for FIT revenue. This regulation causes certain investment insecurities that only big, financially strong companies can overcome.

Table 5. RE projects in the pipeline as of November 2013

	Projects in the pipeline	
	Awarded projects (DOE) Potential capacity (MW)	Pending approval (MW)
Biomass	336.95	99.00
Hydro	6,304.81	1021.25
Solar	1,216.45	198.80
Wind	1,397.50	0.00
Geothermal	750.00	60.00
Ocean	25.00	6.00
Total	**10,030.71**	**1,385.05**

Source: DOE (2014b).

A glance at the RE projects in the pipeline shows that RE developers are very interested in doing business in the Philippines, and installation will most probably not end with the capacity under the installation targets. As of November 2014, the DOE signed service contracts with RE developers totaling 10.03 GW of RE-based capacity. Further applications from RE developers with a combined capacity of 1.38 GW are still waiting for approval. However, these projects are at very different stages of development, and realization of all projects is not guaranteed.

chapter 03

Competitiveness of RE

Are renewables already competitive with fossil fuels? The costs of generating electricity from renewable energy sources worldwide are constantly declining due to dropping prices for renewable energy technology and more efficient technical innovations, whereas electricity from fossil fuels, especially coal, is becoming more expensive as a result of increasing prices for fossil fuels. Nevertheless, a general answer to the question above cannot be provided. Evaluating competitiveness of RE depends a lot on how the "cost" of power generation is defined and measured.

The following provides a cost comparison of renewable energy and fossil fuels on a global level: The Philippine market for renewable energy (especially for wind and solar) is still in an early stage of development. So far, there are only a few projects suitable for comparison, and prices for equipment and construction are due to few experiences still changing fast. Therefore, a detailed cost comparison for the Philippine market is not yet reasonable. However, a short overview on some key statistics of the Philippine market is given in Chapter 3.3.

3.1 LCOE and cost components

Assessing the levelized costs of energy (LCOE) is a widely used method in taking account of these different cost structures in order to compare the competitiveness of different energy technologies. LCOE "[…] represents the per-kilowatt-hour cost […] of building and operating a generating plant over an assumed financial life and duty cycle. Key inputs to calculating LCOE include capital costs, fuel costs, fixed and variable operations and maintenance (O&M) costs, financing costs, and an assumed utilization rate for each plant type" (EIA 2014). The impact of each factor varies according to the energy technology. Although renewable energies are usually capital cost-intensive, conventional energies have, due to their dependence on fossil fuels, higher operating costs.

Figure 7 shows that (at least within the OECD countries) some RE technologies are already competitive with fossil fuels. The average lifetime costs of onshore wind, hydropower, geothermal, and biomass power are less than or equal to nuclear, coal, and most natural gas power plants, and are significantly cheaper than diesel power plants, yet the variance of LCOE of renewables is relatively large, ranging from 0.1 to 0.4 USD/kWh. This indicates that LCOE not only depends on the cost for the technology but also on a range of other context factors (IEA 2010, p. 112). These context factors determine whether RE plants can already compete with coal- and gas-fired plants.

The context factors influencing the LCOE of renewables and fossil fuels are either time- or space-variant. The time variance is especially crucial for renewable energies and gas-fired plants and, to a lesser extent, also for coal-fired plants. The time variance for RE LCOE is mainly caused by declining prices for equipment, whereas the LCOE for gas and coal plants is particularly sensitive to increasing fuel prices. The LCOE of renewable energy is determined by the capital cost (see Figure 8), which is again mainly dependent on the cost of equipment. As can be seen in Figure 8, capital cost contributes to nearly 80% of the LCOE of wind power and to more than 90% of solar power. Therefore, dropping prices for wind turbines and solar modules have a crucial effect on deployment costs for wind and solar plants.

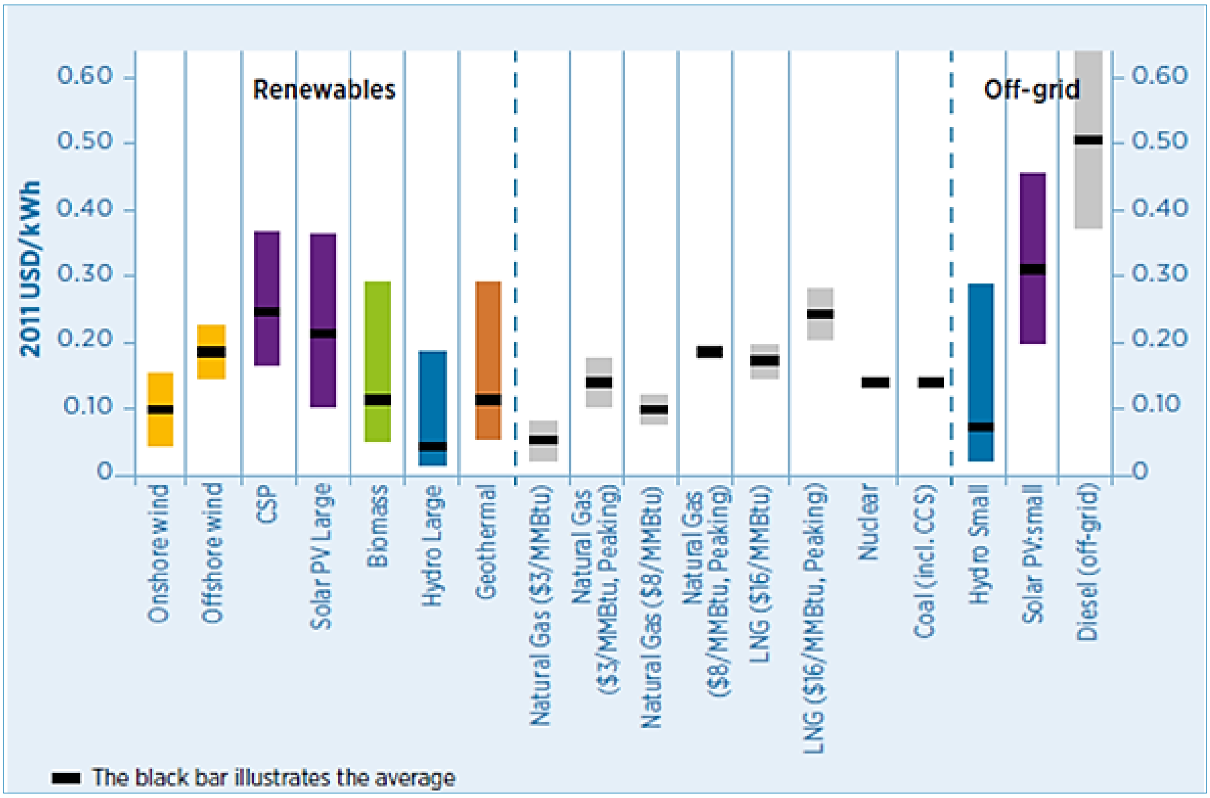

Figure 7. LCOE for utility and off-grid power – OECD countries (ranges and average)
Source: IRENA 2014c (cited in IRENA 2014a, p. 27).

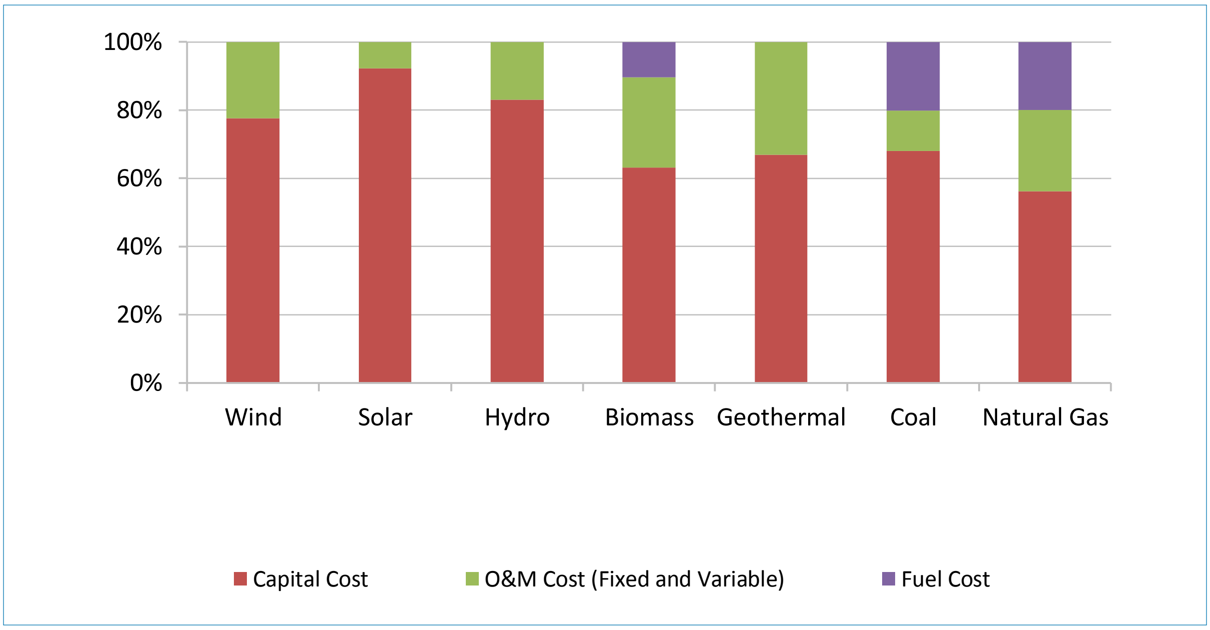

Figure 8. Components of levelized cost of energy (US conditions)
Source: OpenEI (2014).

Figures 9 and 10 illustrate this for solar plants. The deployment costs of solar plants are estimated to decline by 50% between 2010 and 2020. The main part of this cost reduction can be attributed to the sinking prices for solar modules. Prices for solar modules and other renewable energy technologies are dropping due to learning effects and maturity of the technologies. While in 2010 the cost for solar modules contributed to more than 50% of the overall deployment costs, the International Renewable Energy Agency (IRENA) estimates that their share will decline to around 30% in 2020, causing an incremental decrease of costs for solar power.

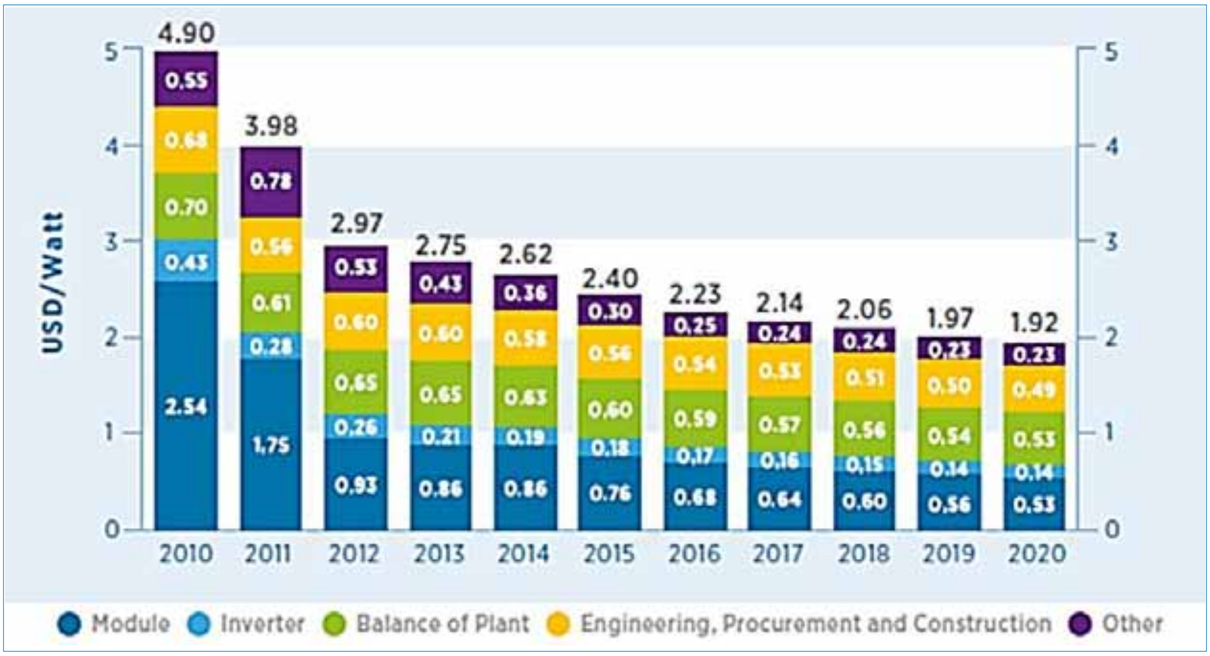

Figure 9. Projected solar PV system deployment cost (2010–2020)
Source: IRENA 2014b (cited in IRENA 2014a, p. 35).

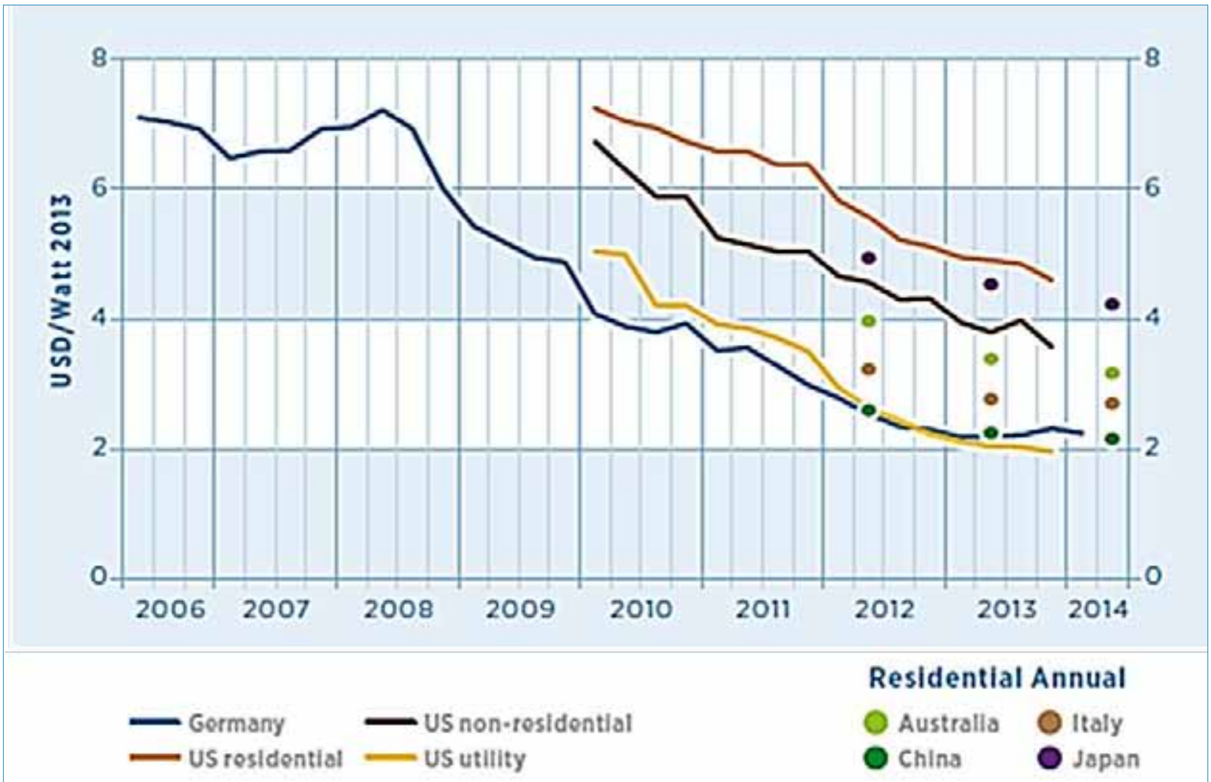

Figure 10. Solar PV system costs by country (2006–2014)
Source: IRENA Cost Alliance (cited in IRENA 2014c, p. 35).

The same holds true for wind power. Wind turbines contribute to the capital costs of wind power by around 60% of the LCOE. After a short incline during the late 2000s, the price for wind turbines is again dropping. As capital costs account for 80% of the LCOE of wind power, the overall costs for wind power are also expected to decline, increasing the competitiveness of wind power.

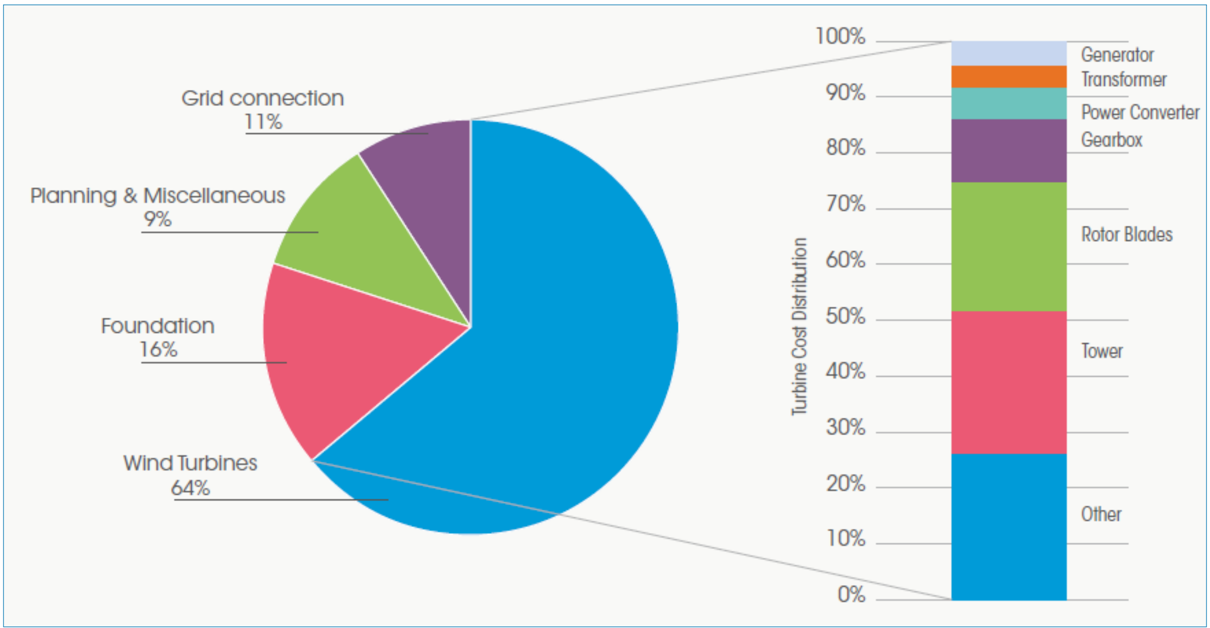

Figure 11. Capital cost breakdown for a typical onshore wind power system and turbine
Source: Blanco 2009 (cited in IRENA 2012, p. 18).

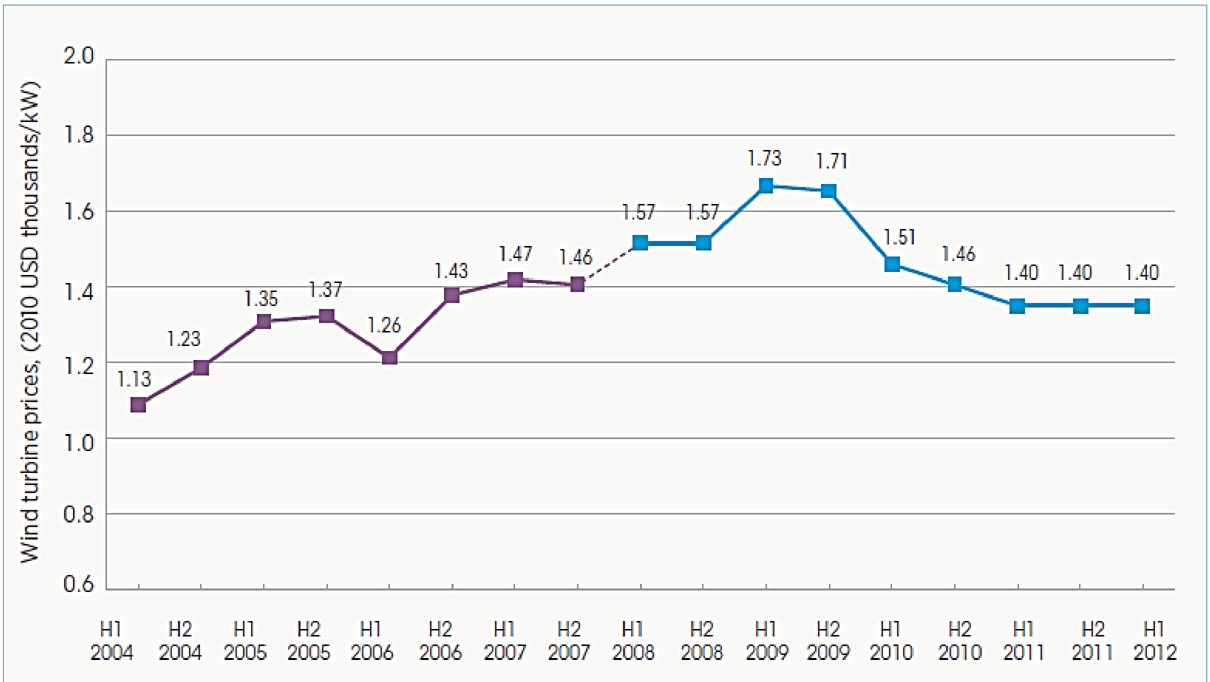

Figure 12. Wind turbine price index by delivery date, 2004–2012
Source: BNEF 2011 (cited in IRENA 2012, p. 20).

In contrast, energy generated from fossil fuels will most probably become more expensive. Fuel costs account for more than 20% of the LCOE of coal and gas. Even though the prices for coal and gas differ from region to region, and even from country to country, the general global trend is upward. Everything else staying equal, this means that the share of fuel costs to LCOE of coal and gas will further increase.

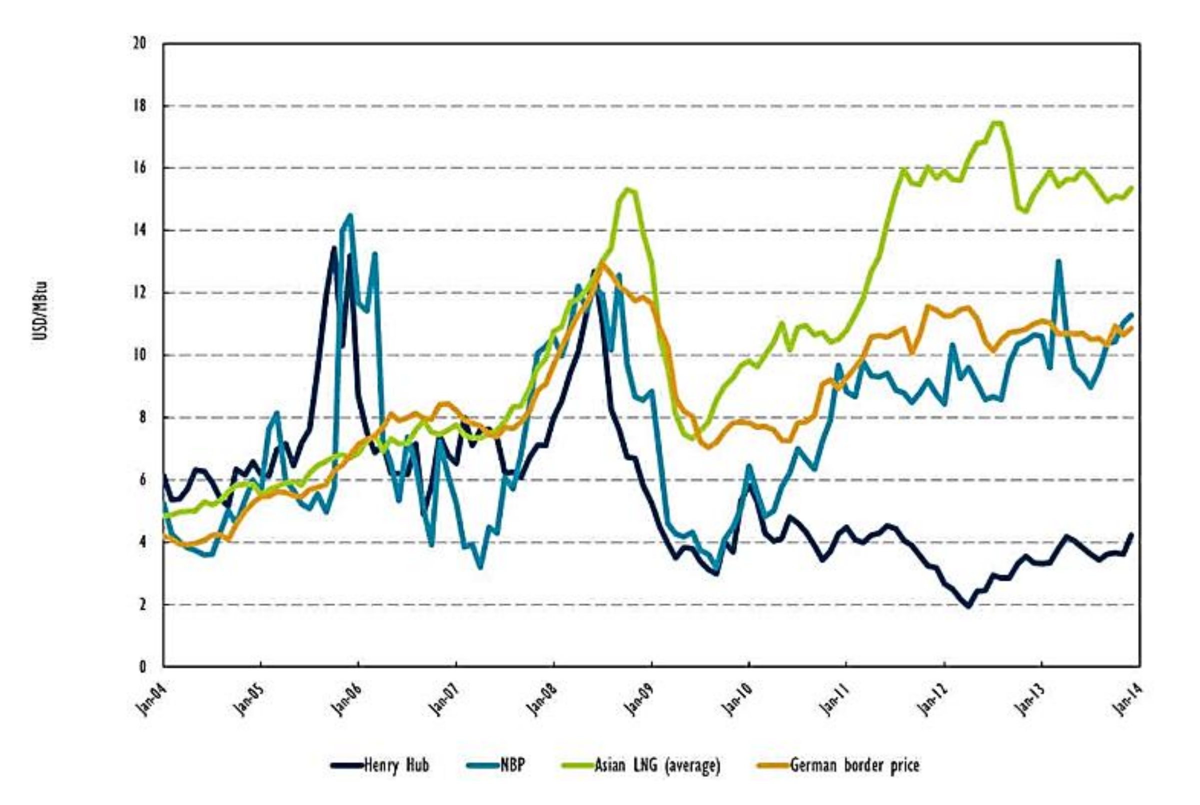

Figure 13. Natural gas prices in Asia, United States, and Germany
Source: IEA (2014).

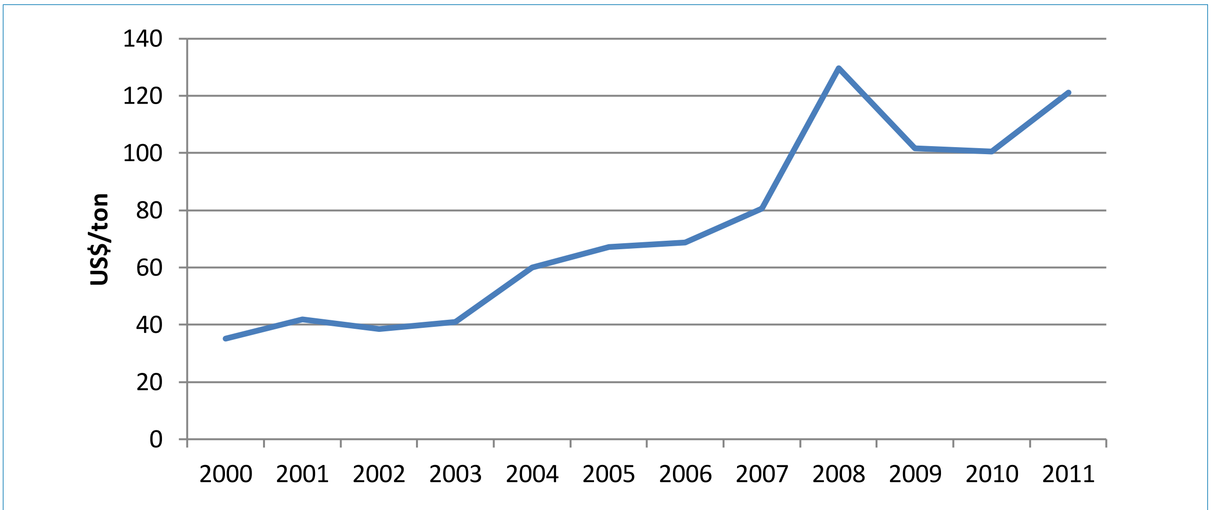

Figure 14. Average import price steam coal (OECD)
Source: OECD (2013).

Furthermore, the LCOE of a given energy technology might also vary across and within countries. A decisive factor for the competitiveness of renewable energy is the load or capacity factor (IEA 2010, p. 110). Unlike base load technologies, which run at a fixed load factor, the load factor of renewable energy plants varies according to the availability of the primary source. According to an analysis of the International Energy Agency, the LCOE of wind and solar is particularly sensitive to decreasing load factors. A 50% decrease of a solar plant's load factor leads to a 90% increase of its LCOE. The strong influence of the load factor also explains the vast variance of LCOE of wind and especially of solar power (see Figure 7).

Policy frameworks also have a strong influence on the LCOE of fossil fuels. Special regulations and laws can determine the competitiveness of a particular energy technology. For instance, the competitiveness of coal-fired plants depends a lot on the costs of CO_2 emissions. In countries where a carbon emission trading system is in place, the operating cost for coal plants rises, making them less competitive (IEA 2010, p. 108).

This global perspective on costs of renewables and fossil fuels showed, on the one hand, that some renewables such as onshore wind, large solar plants, geothermal, biomass, and large hydropower are, in some parts of the world, already competitive or are expected to become competitive soon. However, LCOE values do not represent a uniform global cost of power but can vary according to context factors such as the price of equipment, fuels and carbon emissions, as well as the load factor. Dropping prices for solar modules and wind turbines makes electricity production from renewable energy cheaper, whereas increasing fuel prices for coal and natural gas decrease their competitiveness. In order to assess the true costs of a particular energy technology, one has to also consider specific characteristics such as the load factor for renewable energy plants or the regulatory framework, which can impose additional costs on particular energy technologies.

3.2 External costs of energy generation

Usually, levelized cost calculations do not consider external costs of electricity generation. Yet, a holistic and balanced assessment of power costs should also account for the environmental and social impacts of electricity generation. Costs that are not reflected in the electricity price but society as a whole must bear are called external costs for electricity (EEA 2008). The term mainly refers to environmental damages, climate change impacts, and health impacts. For example, a private owner of a coal plant pays for the construction of the plant, the used resources, and the salary of the workers but not for the damages to health and environment caused by the emissions of the power plant. "In a perfect market, which maximises social welfare, private costs would be equal to societal costs, with no externalities to the price mechanism and all the costs and benefits to society of economic activity reflected in the price" (Ecofys 2014, p. 12). However, without regulatory interventions, this is not very likely to happen.

By order of the European Commission, the European consultancy Ecofys conducted a comprehensive study examining the external costs of various energy technologies (Ecofys 2014). The calculations were made for EU conditions. Even though the value of the externalities might differ outside of the EU, the study provides a good overview on the relation of the costs.

Considered impact categories are:

- Climate change: The valuation of climate change is based on estimates of the damages done in the future by emissions now. It is worth noting that the original costs for climate change impacts are even higher than displayed in Figure 15. Within the European Union, a carbon trade system is installed, placing a price on carbon emissions. To account for this internalization, the value for 1 ton of CO_2 (6.67 EUR) has been subtracted from the external costs of climate change (Ecofys 2014, p. 15).

- Particulate matter formation: Air pollution that damages human health. Important precursors for particulate matter formation are NOx, SO_2, and NH_3, which are highly relevant emissions from the energy sector (Ecofys 2014, p. 37).

- Human toxicity impacts: For example, coal-based technologies' emissions to air and waste, and spoil from mining, which causes pollution (Ecofys 2014, p. 37).

- Agricultural land occupation: Represents the value of the loss of biodiversity on lands used for agricultural production (e.g. production of biomass) rather than left in its natural state (Ecofys 2014, p. 37).

- Depletion of energy resources: Value represents the increased marginal cost to society of the consumption of finite (fossil and nuclear) fuel resources now, rather than in the future. Due to current extraction, future marginal costs of extraction are likely to increase if a finite resource becomes scarcer (Ecofys 2014, p. 15).

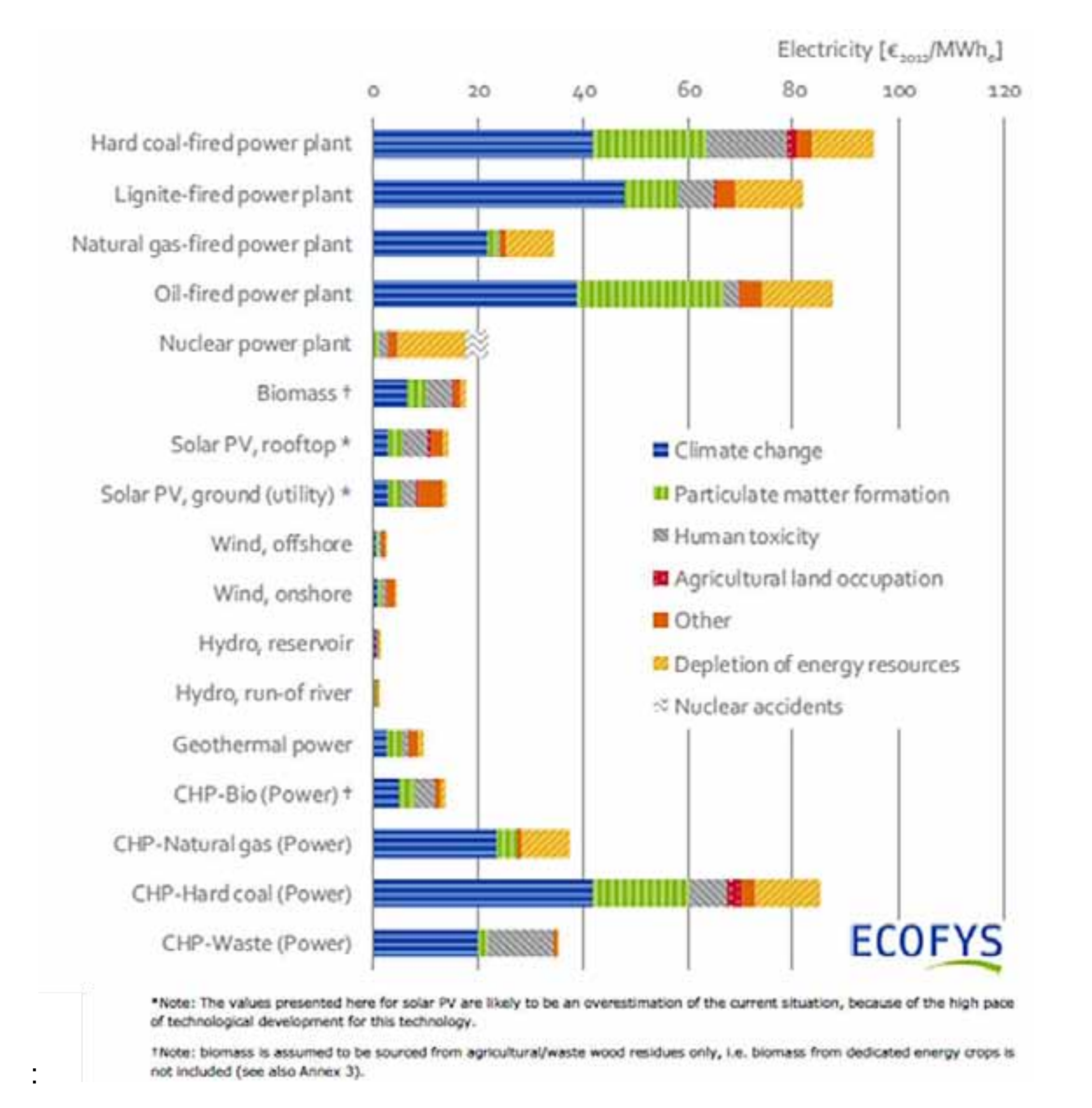

Figure 15. External cost per technology for electricity technologies, EU28 weighted average (in €/MWh)
Source: Ecofys (2014, p. 36).

Coal- and oil-fired plants place by far the highest marginal costs to society: between 70 and 80 USD per MWh (1 EUR = 0.846 USD). The major part of these costs can be attributed to climate change and, to a lesser extent, to health impacts. Most external costs for renewables result from their upstream energy use, such as fuel for transportation or electricity in production (Ecofys 2014, p. 36).

It has often been claimed that if externalities were included in the electricity price, renewable energies would have long been competitive with fossil fuels. However, it is impossible to examine the "real value" of external costs as any calculation grounds only on assumptions, estimations, and approximations. However, there are policy instruments placing a price on producers of external costs such as carbon dioxide. Carbon taxes and emission trading systems are the most widely known of these policy instruments aiming at internalizing at least a part of the external costs of electricity generation.

3.3 Situation in the Philippines

As already argued above, the Philippine market for RE technology is still developing, and there are too few projects for a comprehensive cost and price comparison. So far, solar, wind, and biomass account for only less than 1% in the Philippine energy mix. Therefore, Figure 16 provides a snapshot of current capital costs of new power projects in the Philippines. The costs displayed here are not representative. Especially for geothermal, the costs seem to be too low.

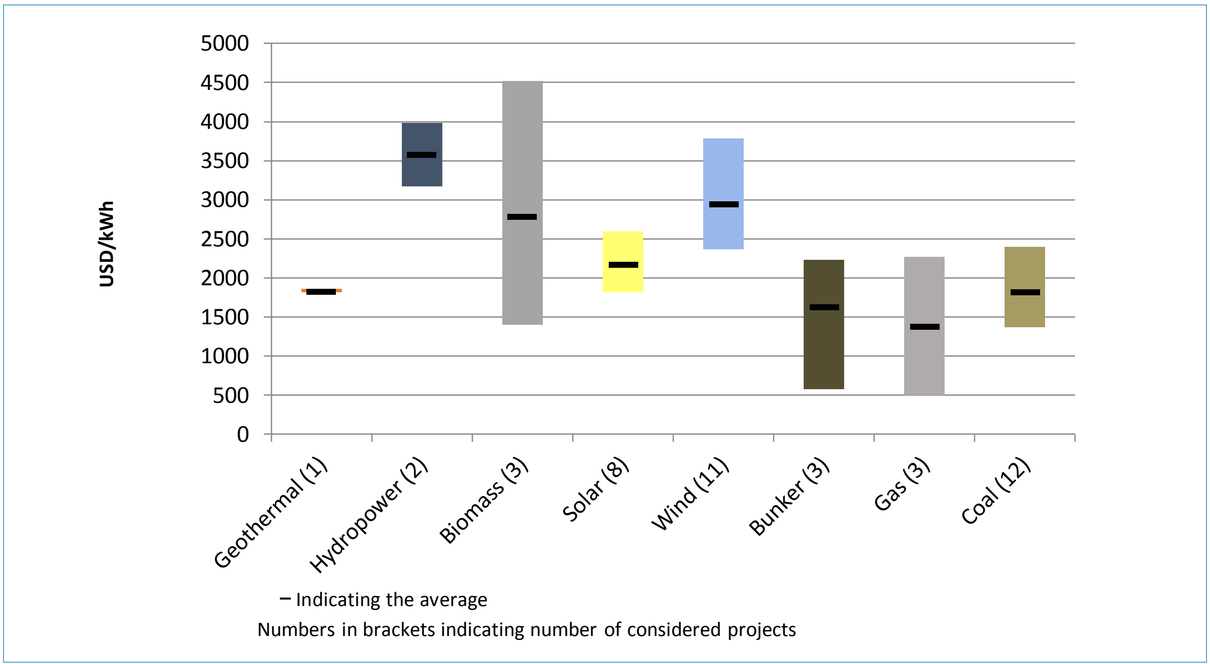

Figure 16. Capital costs of new power projects in the Philippines
Source: DOE (2014c).

The capital costs of renewable energies in the Philippines are still more expensive than fossil fuels. However, the cost difference is smaller than one might expect. Setting up a solar plant costs only 20% more than a coal-fired plant. Assuming that the relation between capital, O&M, and fuel costs in the Philippines is comparable to the ones in the United States (see Figure 8), solar plants are already competitive with coal-fired plants. In the US market, capital costs of coal plants represent only 2/3 of the total LCOE, whereas capital costs of solar contribute by more than 90% to its total LCOE. Transferring this to the Philippine setting, the LCOE of coal would be as, or even more, expensive than solar. Considering external costs would further increase the competitiveness of renewable energy in the Philippines.

However, as already argued, this is only a very selective snapshot of the Philippine market. Dropping prices for RE technology due to learning curve effects and increasing prices for fossil fuels can change this picture tremendously. It is suggested to conduct a more detailed cost analysis of the Philippine energy market once the market for renewable energy is more mature.

chapter
04

Expected effect of the FIT on the overall electricity price

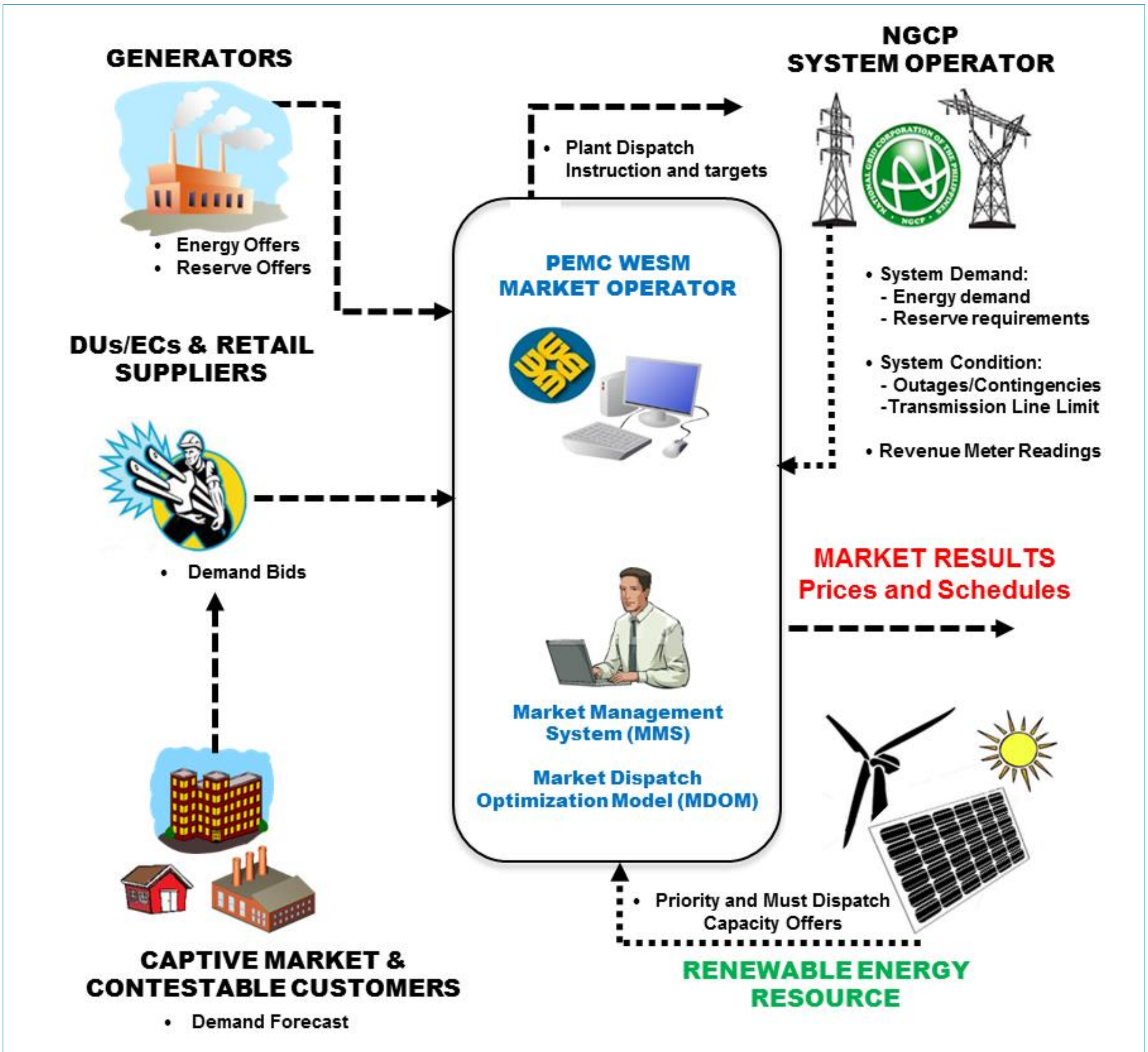

Figure 17. WESM trading mechanism

4.1 Basic principles and operation of the WESM

The Philippine WESM serves as a market clearing house that reflects the market-based value of electricity. Trading electricity at the WESM is done hourly, 24/7. Each generator has to submit energy offers that reflect price and quantity inclusive of their bilateral contracts for central scheduling and dispatch to the PEMC market operator. The market operator determines the hourly dispatch schedule, which satisfies market requirements given the physical system constraints.

The actual central dispatching of plants is – in accordance with the dispatch schedule submitted by the MO – done by the NGCP system operator. Through their bid offers, power plants are ranked and dispatched starting from the lowest bidder until enough power plants are dispatched to meet expected demand. The bid of the last plant dispatched is called the "market clearing price" and will be the same price that will be received by all other dispatched power plants.

4.1.1 How RE plants are dispatched under the WESM – merit order effect

As already described in Chapter 2, trading electricity at the spot market is regulated by the merit order table, which ranks sources of energy in ascending order according to their short-run marginal costs of production. There exist two different kinds of trading blocks at the WESM: "pricetakers" and "pricemakers." Pricemakers are generation entities such as coal-fired, natural gas, geothermal, hydro, and oil-based plants that are required to play an active role in the spot market by submitting generation offers. Renewable energy plants are pricetakers. They are considered as either "must dispatch" or "priority dispatch." By definition, must dispatch are registered variable RE-based plants, whether or not under the FIT system, such as wind, solar, run-of-river hydro, or ocean energy, according to the preference in the dispatch schedule whenever generation is available. Priority dispatch means giving preference to biomass plants under the FIT system in the dispatch schedule.

As renewables have no fuel costs, their marginal costs are lower than the one of electricity from fossil fuels. Furthermore, due to the priority purchase, transmission companies are obliged to buy electricity from RE first, and thus, expensive plants running on fossil fuels are kicked out of the market. Accordingly, the clearing price declines (see Figure 18). Therefore, a higher amount of renewable energy decreases the price per unit of electricity that has to be paid at the WESM. This also lowers the consumer electricity rates.

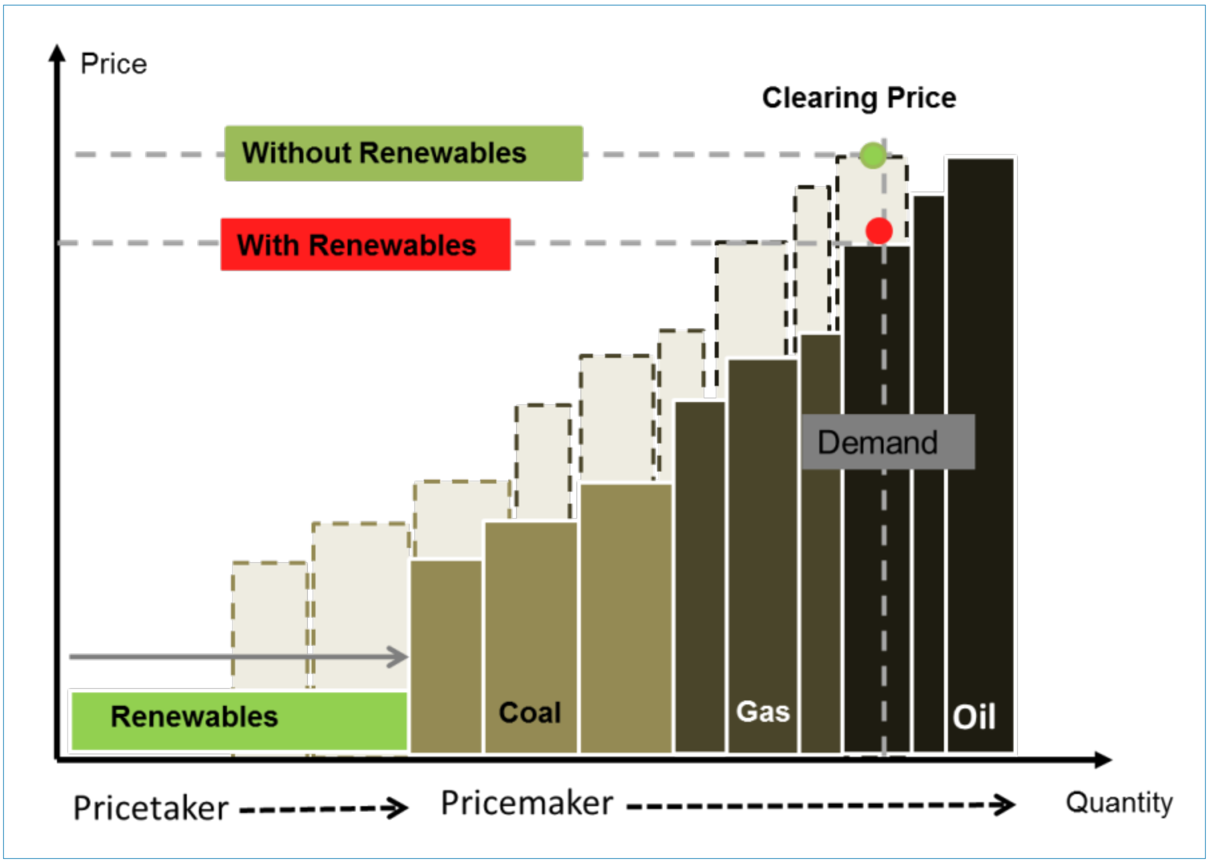

Figure 18. Merit order effect

Note: Illustration modified from GIZ (2013, p. 9).

4.2 Impact of RE generation on the WESM

As described above, due to the merit order effect, renewable energy plants push expensive power plants running on fossil fuels out of the market. Thus, dispatching capacity from renewable energies decreases the load weighted average price at the WESM. Even though the installation targets set a limit to the maximum RE capacity that can be dispatched under the WESM, the effect of RE on the WESM should not be underestimated. A study that has been conducted in 2012 by the Melbourne Energy Institute by order of the NREB showed that even an installed capacity of 600 MW would significantly decrease the LWAP (Melbourne Energy Institute 2012).

4.2.1 Estimating the average merit order effect

The researchers from the Melbourne Energy Institute developed an economic dispatch engine with two regional markets for Luzon and Visayas, simulating the dispatching mechanism at the WESM. The study uses real WESM bid and price demand data from 2011 and simulates two scenarios: 1) scenario without RE injection; and 2) scenario with 600 MW installed RE capacity (170 MW base load capacity). In order to predict the impact of RE generation on the WESM as realistically as possible, the study uses different capacity factors for different RE technologies (see Table 6).

Table 6. Capacity and demand contribution factors used in the Melbourne Energy Institute Study

			Base load modeled (MW)	
	Installed capacity (MW)	Est. demand contribution factor	Luzon	Visayas
Wind	200	25%	50	0
Solar	50	20%	5	0
Hydro	200	40%	20	10
Biomass	150	70%	60	25
Total	600		135	35

Source: Melbourne Energy Institute (2012, p. 13).

According to the simulation, an installed RE capacity of only 600 MW would already decrease the monthly average LWAP by up to 1.34 PHP. The simulation predicts an average decline in the monthly LWAP of 0.80 (Luzon grid) and 0.86 PHP/kWh (Visayas grid) (see Figures 19 and 20). In total, the simulated merit order effect for 2011 was worth approximately 3.7 billion PHP.

The Melbourne Energy Institute study used 2011 data. Even though this study gives a good estimation on possible LWAP reduction due to the merit order effect, the actual savings in 2015 and 2016 might be even higher. The now-approved installation targets (including the installation target extension for solar) equal 1,200 MW and are either already oversubscribed or will soon be oversubscribed. This means that the actual installed capacity will soon outreach 600 MW (the RE capacity used in the said study). In January 2015, the DOE endorsed 14 RE projects with a combined capacity of 300 MW, and as indicated in Table 5, many other projects are already in the pipeline.

The higher the installed RE capacity, the higher the merit order effect is and the lower the LWAP at the WESM. These price reductions will then be passed on to the consumers, leading to lower electricity bills. Thus, depending on the dispatched capacity, a net saving for consumers might be possible. However, reliable estimations on possible impacts of renewable energy on consumer prices are still lacking.

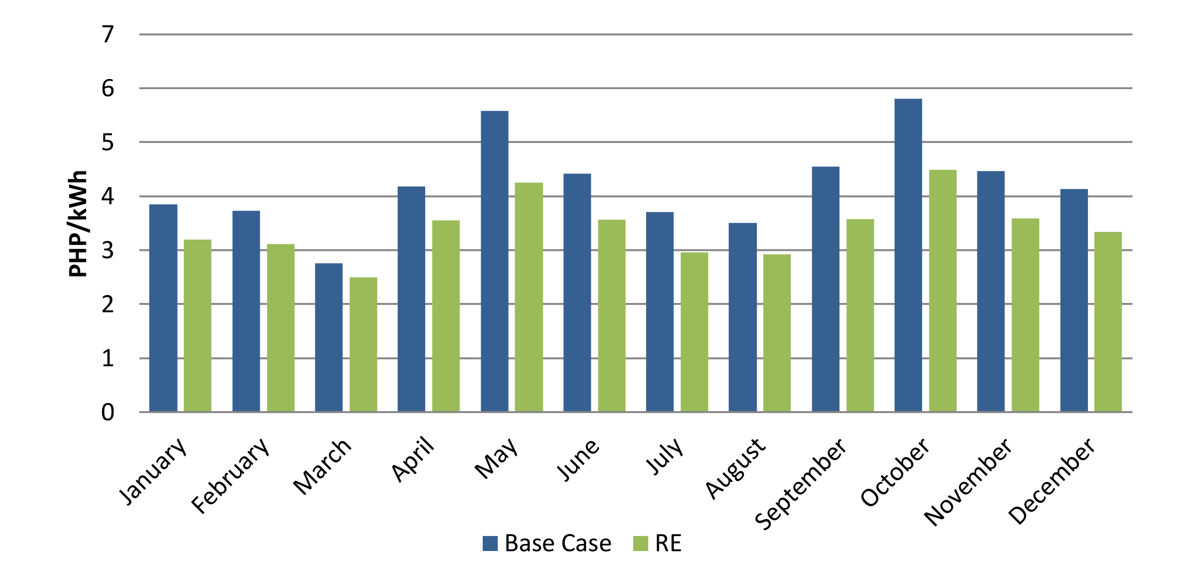

Figure 19. Simulation LWAP Luzon grid

Note: Illustration modified from Melbourne Energy Institute (2012, p. 18).

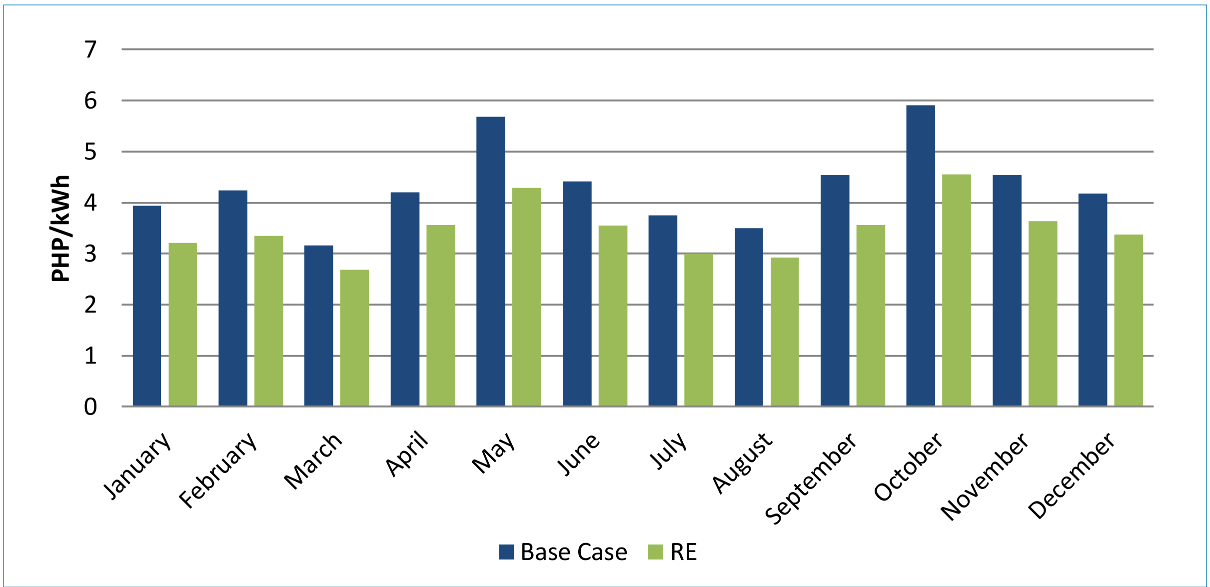

Figure 20. Simulation LWAP Visayas grid

Note: Illustration modified from Melbourne Energy Institute (2012, p. 18).

4.2.2 Ability of RE to reduce peak load prices

Prices at the WESM increase particularly fast during peak demand periods. During these periods, small changes in demand can significantly increase the clearing price (for a better understanding, see Figure 18). A comparison of the average daily demand curve and the average daily LWAP curve illustrates this (Figures 22 and 23). Although the increases of the demand are comparatively "flat," the corresponding increases in the LWAP are much "steeper." For example, the average demand rises between 7 and 11 am by 34%. At the same time, the LWAP rises by 280%, reaching daily peak prices from more than 8 PHP/kWh – more than the FIT rates for hydropower and biomass, and around the same as the FIT rate for wind power.

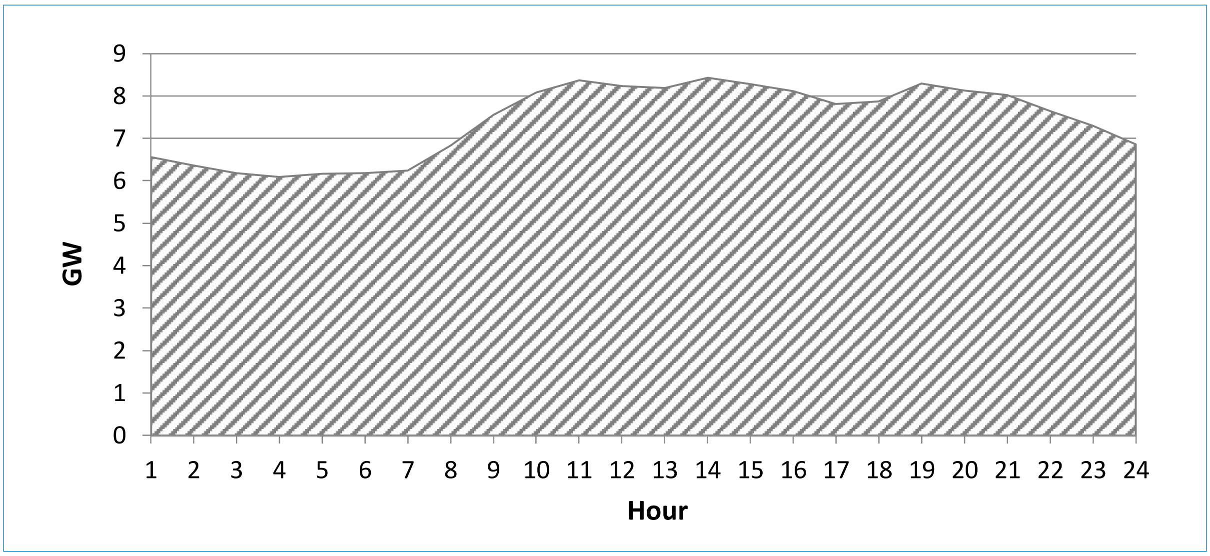

Figure 21. Hourly average demand (May 2013–October 2014)
Source: WESM (2014).

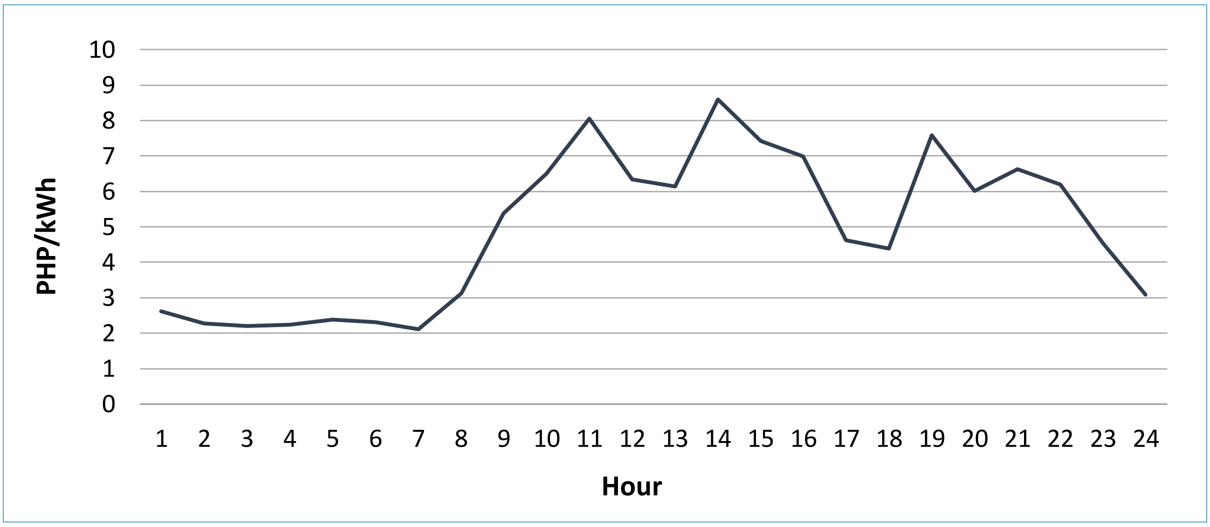

Figure 22. Average hourly LWAP (May 2013–October 2014)
Source: WESM (2014).

Here, the advantage of renewable energies becomes most evident. The output profile of some renewable energy technologies, such as solar power, correlates quite well with the high demand periods, helping to stabilize LWAP. Likewise, the renewable energy technologies also add capacity to the market and thus contribute to flatten the merit curve during peak demand periods.

In reality, even higher extreme peak prices were registered on several market trading activities that greatly exceeded beyond the regulated FIT rates. Extreme high demand during March and April, forced outages of major natural gas and coal-fired plants, or a shutdown of the Leyte–Luzon high-voltage direct current link interconnection that connects the Luzon grid with the Visayas grid push the WESM prices. For instance, during the Malampaya shutdown, coupled with the outages of several plants, the average WESM price ballooned to 33.22 PHP/kWh in November and 36.08 PHP/kWh in December 2013. Likewise, maintenance shutdown of the Leyte–Luzon high-voltage direct current link interconnection resulted to a sudden decrease in the supply margin coming from the geothermal plants in Leyte, pushing the market clearing price up to 28.88 PHP/kWh. Also for 2015, especially during March and April, energy shortages are expected, leading again to looming WESM prices.

The combined effect of tight supply conditions caused by planned and unplanned outages of the Malampaya natural gas facility and coal-fired plants, and seasonal increases in demand will always continue to haunt the power sector year after year. It is time to look deeper and consider RE electricity generation as the source to alleviate what is crippling the country's power industry.

chapter 05

Conclusions

The Philippines, blessed with manifold renewable energy sources, finds the best preconditions to make the country's power system fit for the future. Increasing fuel prices, high energy import dependence, ever-increasing carbon emissions, and unconsidered external costs of fossil fuels make renewable energies the superior alternative. However, in order to fully exploit the potential of renewable energy, a well-designed support mechanism is inevitable.

The Philippine government is willing to use this window of opportunity and introduced the FIT. The FIT is a support mechanism that offers guaranteed payments on a fixed rate per kilowatt-hour for renewable energy. It accounts for the specific cost structure of RE (high installation costs, low operation and maintenance costs) and helps RE developers to overcome current cost disadvantages. The costs of the FIT will be passed to all on-grid consumers in the form of a FIT-All starting with the February 2015 collection. Even though this now increases the electricity bills of consumers slightly, the long-term benefits of renewable energy will pay this investment off.

As shown in Chapter 3, renewable energies are under certain conditions already competitive with fossil fuels. Due to declining costs for equipment, the LCOE of geothermal, large hydro, solar plants in areas with high solar irradiation, or wind plants in areas with constantly blowing wind are already competitive with coal and gas plants. Rising fuel prices will further strengthen this development. However, the remaining cost advantage of fossil fuels almost disappears when accounting for the external costs of fossil fuels.

Furthermore, due to the merit order effect, renewable energies will significantly lower the prices at the WESM and, thus, also have a lowering effect on consumer prices. This becomes especially evident for peak load prices, where renewable energy can "flatten" the otherwise rapid increase of WESM prices.

In implementing the FIT, the Philippine government did a very important step toward a more reliable and sustainable energy supply while reducing energy dependence. There is still a huge RE potential untouched in the Philippines. It is now time to release this potential!

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