

Towards a Just Transition in the Philippine Electricity Sector

Challenges and Opportunities

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List of Abbreviations and Acronyms

ASEAN	Association of Southeast Asian Nations	LCOS	Levelized Cost of Storage
BAU	Business as usual	LED	Light-emitting diode
CCC	Climate Change Commission	LNG	Liquid natural gas
CO₂	Carbon dioxide	MACC	Marginal abatement cost curve
DENR	Department of Environment and Natural Resources	MW	Megawatt
DOE	Department of Energy	MWh	Megawatt-hour
DU	Distribution utility	NCC	National Competitiveness Council
ECC	Environmental Compliance Certificate	NDC	Nationally Determined Contribution
EPIRA	Electric Power Industry Reform Act	NEA	National Electrification Administration
ERC	Energy Regulatory Commission	NGO	Non-governmental organization
FES	Friedrich-Ebert-Stiftung	NM	net (energy) metering
FiT	Feed-in-tariff	NPC	National Power Corporation
GDP	Gross domestic product	NREB	National Renewable Energy Board
GHG	Greenhouse gas	PEMC	Philippine Electricity Market Corporation
GW	Gigawatt	PEP	Philippine Energy Plan
GWh	Gigawatt-hour	PGJA	Philippine Green Jobs Act
HECS	Household Energy Consumption Survey	PPP	Purchasing power parity
kW	Kilowatt	RE	Renewable energy
kWh	Kilowatt-hour	USAID	United States Agency for International Development
kWp	Kilowatt-peak	VRE	Variable renewable energy
LCOE	Levelized Cost of Electricity	WESM	Wholesale electricity spot market

Foreword

Tackling climate change will not be possible without a significant contribution from Asia. According to economic forecasts, Asia's share of global greenhouse gas emissions will grow dramatically in the coming decades due to increasing population rates and relatively robust economic growth. At the same time, millions of people in the region will be affected by climate change. Serious environmental pollution has resulted from the burning of fossil fuels. Health risks due to air pollution already affect millions of Asians.

There is growing interest in renewable energy in many parts of Asia as a result of energy security and environmental concerns and the need to deliver electricity to energy-poor regions. With dropping renewable energy prices, there is growing investment in the sector in Asia. This makes it increasingly possible to talk about the beginning of energy transitions in the region. Greater use of renewable energy may lead to more socially and environmentally just energy structures. We still know little, however, about the actual social and political contributions, costs and implications of renewable energy expansion.

Friedrich-Ebert-Stiftung has examined these questions with a series of country studies in Asia. The studies looked at the political and social factors that drive—but also hamper—socially just energy transitions. The authors of each case study in China, India, Indonesia, Japan, the Philippines, the Republic of Korea, Thailand and Vietnam worked with Miranda Schreurs, Professor of Environmental and Climate

Policy in the Bavarian School of Public Policy, Technical University of Munich, to provide in-depth analysis of the situation in their respective countries. Julia Balanowski, a climate change consultant based in South-East Asia, supported the preparation of each country study and their review.

The studies provide insights into the status of climate and energy policies, their socio-economic implications and the actors involved in developing and implementing those policies. Two of the important questions that motivated this comparative study were whether renewable energy development was contributing to a more socially just energy structure, and which factors foster or impede political acceptance of renewable energy development.

We hope that this study provides a starting point for further analysis to foster a learning process on a transition towards renewable energy in the Philippines, and will provide useful information to policy makers, academics and civil society to work together towards low carbon development in the Philippines and beyond.

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Introduction

The Philippine electricity sector is at a crucial juncture and facing a predicament.

The country's economy continues to grow fast and requires substantial electric power capacity additions. While having one of the lowest per-capita electricity consumption rates in the region, the Philippines' electricity tariffs are among the highest not only in Asia but in the world. To moderate electricity rate increases, the tariff-setting mechanism is based on the least-cost option, i.e. coal at prevailing prices.

Furthermore, the Philippines is considered as one of the most vulnerable countries in the world to the adverse

effects of global warming. Despite its low per-capita greenhouse gas (GHG) emission level, the Philippines has led the push to limit global temperatures to 1.5 degrees Celsius and submitted ambitious Nationally Determined Contributions (NDC), with a conditional greenhouse gas reduction target of 70 per cent below business-as-usual (BAU) levels by 2030.

This paper will attempt to reconcile the need for affordable and reliable power to support the country's development goals, while enabling it to meet its NDC commitment, which can only be achieved by a fundamental transformation of the country's energy sector.

Overview

After decades of near stagnation and reversals, the Philippine economy has exhibited positive economic growth since 1999. According to the World Bank's latest edition of Global Economic Prospects, the Philippines is projected to be the 10th fastest-growing economy in the world in 2017.

The country's continuous growth will entail high demand for energy services, especially electricity. The country's distribution utilities have addressed load growth by prioritizing baseload plants with steady, non-stop output, i.e., coal-, oil- and natural gas-powered plants. Previous administrations decided to shelve the nuclear option, but the current Department of Energy (DOE) under Secretary Alfonso G. Cusi is studying the revival of the mothballed Bataan Nuclear Power Plant. (see Section III).

This increasing dependence on fossil fuels is leading to rising emissions of carbon dioxide (CO₂) and other greenhouse gases (GHG) by the country. At only 0.3 per cent of the world's GHG emissions in 2015¹, the Philippine contribution is low compared to other developing and developed countries. The public has a high awareness of climate change issues, as the Philippines is one of the most vulnerable countries to climate change impacts. In November 2013, the devastating effects on lives and properties of such extreme weather events were most typified by Typhoon Haiyan (locally known as Yolanda). The strongest typhoon on record to make a landfall, Haiyan killed more than 6,300 people in the Philippines alone. Aside from climate change mitigation, decreasing dependence on fossil fuels is necessary to: 1) reduce pollution and its adverse effects on health, society and the environment; 2) moderate and stabilize electricity prices; 3) create more green jobs from cleaner technologies; 4) attract new investments in sunrise industries; and 5) access international climate funds. (see Section IV).

Additional considerations are the steadily declining costs and improving performance of energy efficiency and

renewable energy technologies, micro-grids, and storage systems. These technological trends have made the shift away from fossil fuels to low-carbon renewable energy sources more compelling. Although the DOE under the Duterte administration is taking the direction of a high-carbon path, a low-carbon path is indicated in the country's accession document to the Paris Agreement on NDCs. This difference in approaches between government agencies must be resolved to determine the country's energy transition policies and plans. (see Section V).

The debate on the energy transition is further complicated by specific characteristics of the Philippine electricity situation, such as the country's archipelagic character, very high electricity rates, vulnerability of energy infrastructures to extreme weather events, privatized electricity markets, restricted government subsidies, and increasing demand due to high economic and population growth. The major contending forces affecting the transition are the fossil fuel interests, climate change mitigation and adaptation proponents, and the affected stakeholders. To meet the goals of a stable, affordable and secure power supply, the conflicts between the privatized electricity sector and government regulatory bodies must be resolved. (see Section VI).

Furthermore, the government needs to ensure that the transition to a low-carbon path is socially just. A just transition means universal access, fair distribution of costs and benefits, consumer choice and market competition, equitable treatment of investors regardless of size, and transparent and consistent implementation of policies and regulations. Attaining a socially just transition is politically feasible, provided certain conditions and objectives are met. (see Section VII).

Finally, a set of roadmaps specifying and describing the initiatives required to accelerate the just transition to a low-carbon economy is proposed. (see Section VIII).

The Philippine electricity sector: Growing fossil-dependence

Historical trend (1990-2016)

Historical data from the DOE highlight the growing dependence of the Philippine electricity sector on fossil-based power plants. The following figures clearly show this trend.

The total electricity generation in 1990 was 26,327 gigawatt-hours, of which 14,368 GWh (54.6 per cent, grey) were from fossil-based power plants and 11,959 GWh (45.4 per cent, green) were from renewable sources. By 2016, total generation had reached 90,798 GWh, of which 68,819 GWh (75.8 per cent) were from fossil-based plants and 21,979 GWh (24.2 per cent) were from renewables.

Over the period 1990-2016, fossil-based generation grew by an average of 6.2 per cent per year, while generation from renewables grew by only 2.4 per cent per year.

The next figure shows the growing percentage share of fossil fuels (grey) in the generation mix.

The share of fossil fuels over the 1990-2030 period was lowest (54.6 per cent) in 1990, and highest (75.8 per cent) in 2016.

The power situation as of end-2016

As of the end of 2016, the Philippines had a total installed capacity of 21,423 megawatt, of which 19,097 MW were considered dependable and 14,458 MW available. Of the total installed capacity, 2,691 MW were classified as new; 5,068 MW “committed” (pre-development activities and financial closing completed); and 18,225 MW “indicative” (pre-development phase).

Gross generation for 2016 was 90,798 GWh, of which 75.8 per cent was from fossil-based power plants and 24.2 per cent from renewables. The 75.8 per cent fossil

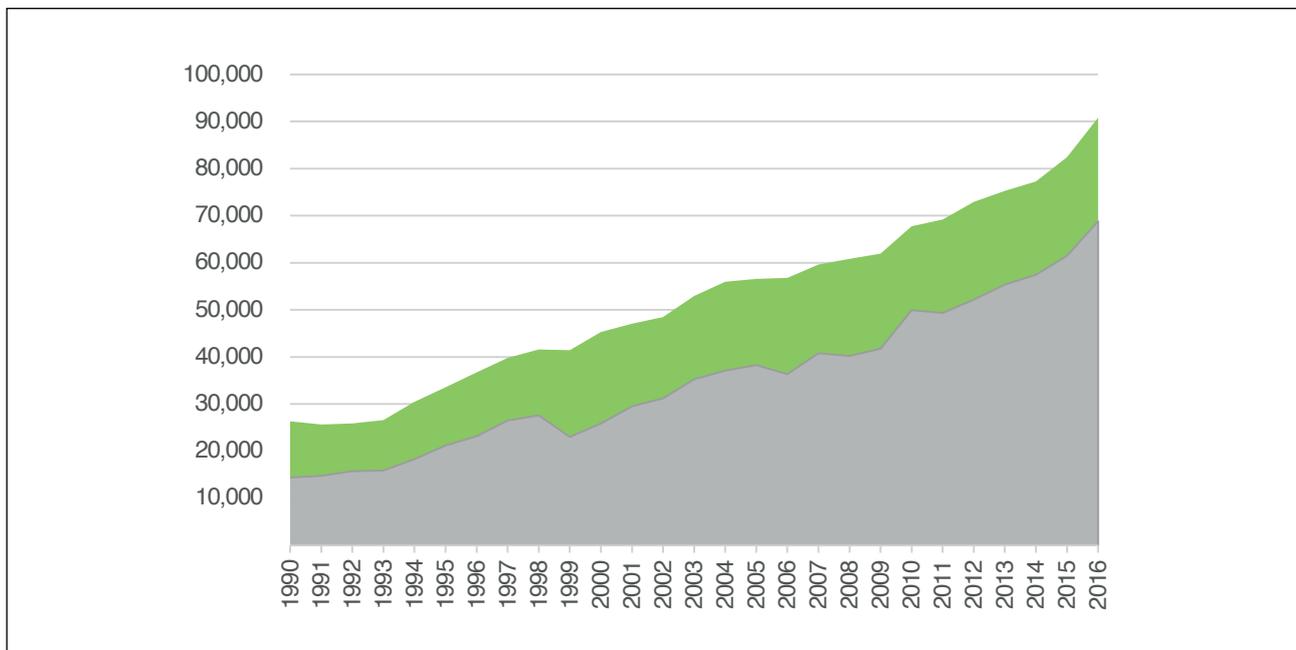


Figure 1. Fossil-fuel and renewable generation in GWh, 1990-2030.

Legend:

Green = Renewable energy (geothermal, hydro, solar, wind and biomass).

Grey = Fossil fuels (coal, oil and natural gas).

Source: Department of Energy. 2015 Power Statistics. 2016.

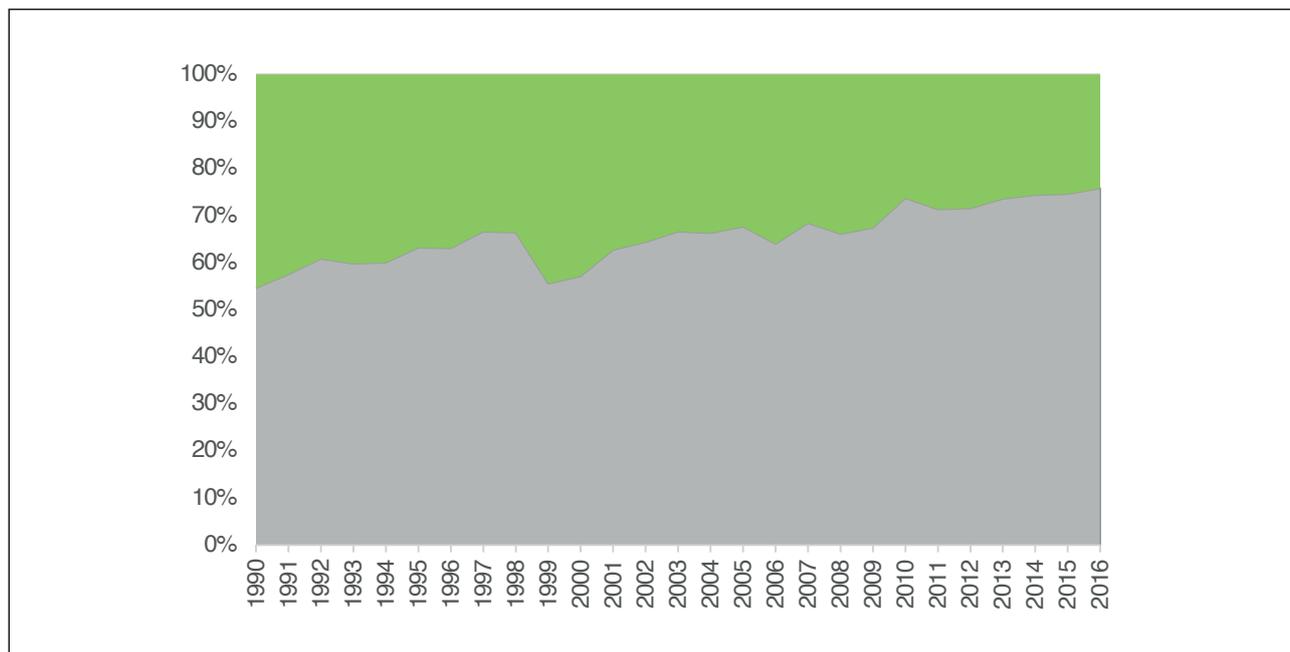


Figure 2. Generation mix in per cent, 1990-2016.
Source: Department of Energy. 2016 Power Statistics. 2017.

share is split among coal (47.7 per cent), oil-based (6.2 per cent), and natural gas (21.9 per cent). The 24.2 per cent renewable energy (RE) share is divided among geothermal (12.2 per cent), hydro (8.9 per cent), solar (1.2 per cent), wind (1.1 per cent), and biomass (0.8 per cent).

In terms of installed capacity (MW), the 2016 mix was 67.5 per cent fossil and 32.5 per cent RE. The RE share in the generation (GWh) mix is lower at 24.2 per cent, because of the lower capacity factors of RE power plants compared to fossil-based power plants.

Annex 2 provides an overview of the electricity market in 2016.

The transmission and distribution system

The on-grid power transmission system is managed by the National Grid Corporation of the Philippines. Distribution is handled by 23 privately owned utilities, 100 electric cooperatives and two utilities owned by local government units. Peak demand reached 13.3 GW in 2016, as shown in Annex 3.

Resources for electricity generation

The Philippines is poor in fossil fuel resources, and imports most of its oil and coal requirements. The DOE reported that the Philippines consumed 22 million metric tonnes of coal in 2015, with the power sector accounting for almost 80 per cent. Seventy per cent of coal imports of the country come from Indonesia. According to data from the Bureau of Customs, total coal importation reached 21 million tonnes in 2016, an increase of 47.8 per cent over 2015².

RE share in the generation mix (in GWh) reached a high of 45.5 per cent in 1990. However, the influx of high-capacity coal and natural gas power plants had steadily reduced the RE share to 24.2 per cent by 2016³.

The RE share is declining despite the high potential of RE resources in the country. These huge resources can be tapped to meet the country's energy sufficiency and security goals. Based on a study conducted by the United States Agency for International Development (USAID) in cooperation with the DOE, the country's RE potential can be quantified as follows: biomass – 4.4 GW; geothermal – 1.2 GW; solar insolation (all

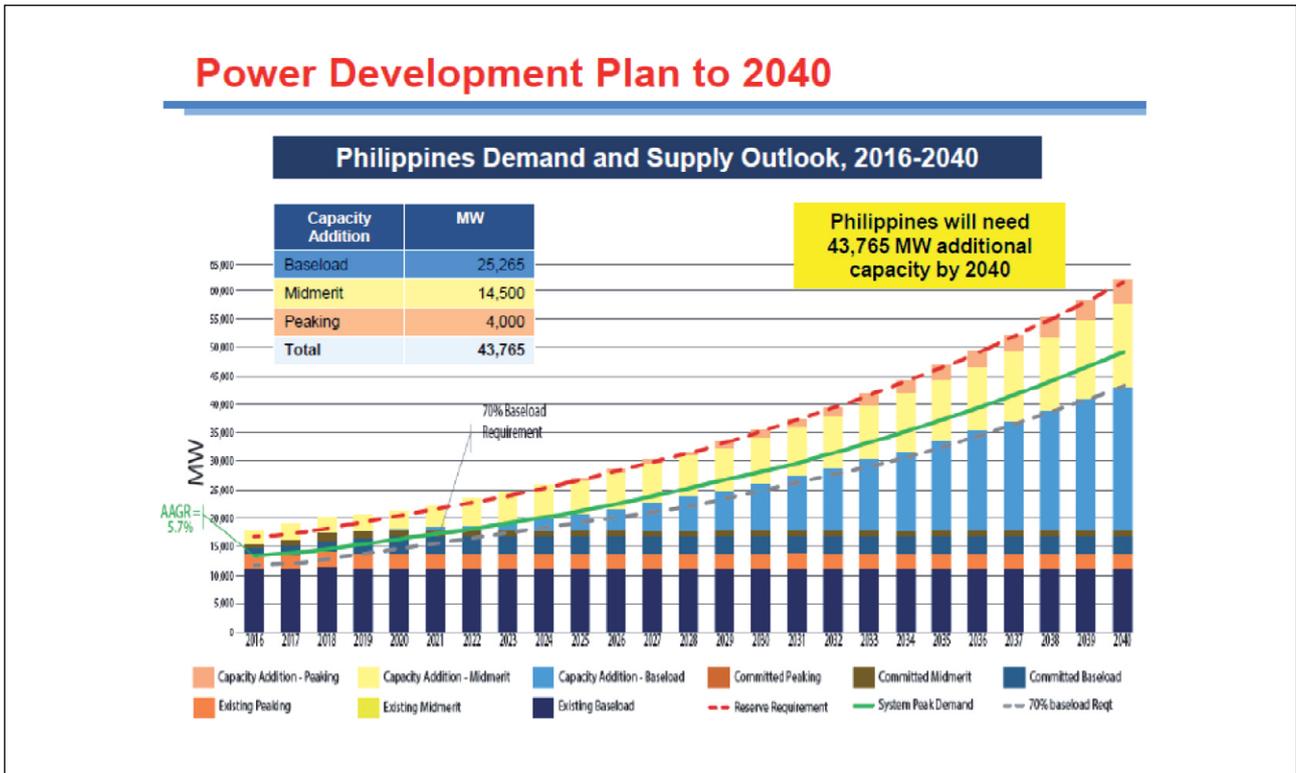


Figure 3. Philippine Power Development Plan, 2016-2040.
 Source: Department of Energy, Power Development Plan 2040, 2017.

forms of solar energy) - 5 kWh/m²/day; hydro – 10.5 GW; ocean – 170 GW; and wind (2001 study) – 76.6 GW. The Philippines could source its entire electric power requirement solely from these indigenous RE resources.

The demand and supply scenario of the Department of Energy, 2016-2040

The following figure shows the DOE’s demand and supply projections for the period 2016-2040.

The scenario maintains a 25 per cent reserve requirement and 70 per cent baseload supply throughout the 24-year period. As the most common baseload power plants are fossil-fuelled, this scenario is bound to maintain the country’s heavy dependence on imported fossil fuels and keep the country on the high-carbon BAU path. The DOE plan is based on a peak demand of 13,272 MW in 2016, growing at an average annual growth rate (AAGR) of 5.7 per cent and reaching around 29,000 MW by 2030 and 50,000 MW by 2040.

The projected installed capacity mix (in MW) by 2040 is 65 per cent fossil fuels and 35 per cent RE, which means only a slight change from the 2016 capacity mix of 67.5 per cent fossil, 32.5 per cent RE. The RE share in the generation mix will be lower, because RE sources generate less GWh for the same MW capacity.

The fossil-fuel reduction scenario of the Climate Change Commission, 2000-2030

Another official scenario is proposed by the national Climate Change Commission (CCC), in line with the country’s international commitment under the Paris agreement. The low-carbon scenario would require a substantial reduction in fossil fuel use.

These two contending government scenarios will be explored further in subsequent sections.

The imperatives for the Philippines to shift to a low-carbon path

Severe impacts of climate change on the Philippines

The Philippines has been identified as one of the most vulnerable countries to climate change. From 1996 to 2015, the Philippines ranked fifth among the 10 countries most affected by extreme weather events linked to global warming.

The high level of GHG emissions contributing to global warming is a major factor in the ever-increasing frequency and strength of extreme weather events. Although the per-capita CO₂ emissions of the Philippines in 2014 of 1.0 metric tonne represents only one fifth of the world average of 5.0 tonnes, the Philippines is always on top of the list of countries with the highest number of strong typhoons. The table below shows that annual losses amounted to more than US\$2.5 billion in purchasing-power parity (PPP) from 1996 to 2015 and a death toll of 1.0 per 100,000 inhabitants.⁴

A study⁵ by a group of Stanford scholars summarizes the economic impacts from all climate-induced events for the country. Findings include a certainty (100-per cent likelihood) that the Philippine gross domestic product

(GDP) will be reduced by 20 per cent due to disasters caused by extreme weather events, and a 99 per cent likelihood that this reduction will reach more than 50 per cent by 2080.

Policies and laws governing climate change mitigation and adaptation

Recognizing the dangerous consequences of climate change to the world and the vulnerability of the Philippines to its ill effects, the Climate Change Act was enacted in 2009. The Act mandates the State to cooperate with the global community in the resolution of climate change issues, including disaster risk reduction. The Climate Change Commission (CCC) with the president as chairman, was created under the Act to coordinate, monitor and evaluate the programs and action plans of the government relating to climate change. Certain powers, especially regarding adaptation, are devolved to local government units. Climate committees are also active in both houses of Congress. The CCC represents the country at all conferences and events on climate change.

Table 1. Long Term Climate Risk Index (CRI): the 10 countries most affected from 1996 to 2015 (annual averages)

CRI 1996-2015 (1995-2014)	Country	CRI core	Death toll	Deaths per 100,000 inhabitants	Total losses in million US\$ PPP	Losses per unit GDP in %	Number of events (total 1996-2015)
1 (1)	Honduras	11.33	301.90	4.36	568.04	2.100	61
2 (2)	Myanmar	14.17	7,145.85	14.71	1,300.74	0.737	41
3 (3)	Haiti	18.17	253.25	2.71	221.92	1.486	63
4 (4)	Nicaragua	19.17	162.90	2.94	234.792	1.197	44
5 (4)	Philippines	21.33	861.55	1.00	2,761.53	0.628	283
6 (6)	Bangladesh	25.00	679.05	0.48	2,283.38	0.732	185
7 (8)	Pakistan	30.50	504.75	0.32	3,823.17	0.647	133
8 (7)	Vietnam	31.33	339.75	0.41	2,119.37	0.621	206
9 (10)	Guatemala	33.83	97.25	0.75	401.54	0.467	75
10 (9)	Thailand	34.83	140.00	0.22	7, 574.62	1.004	136

Source: Kreft, Sonke, David Eckstein and Inga Melchior. Global Climate Risk Index 2017. Bonn: Germanwatch eV, 2016.

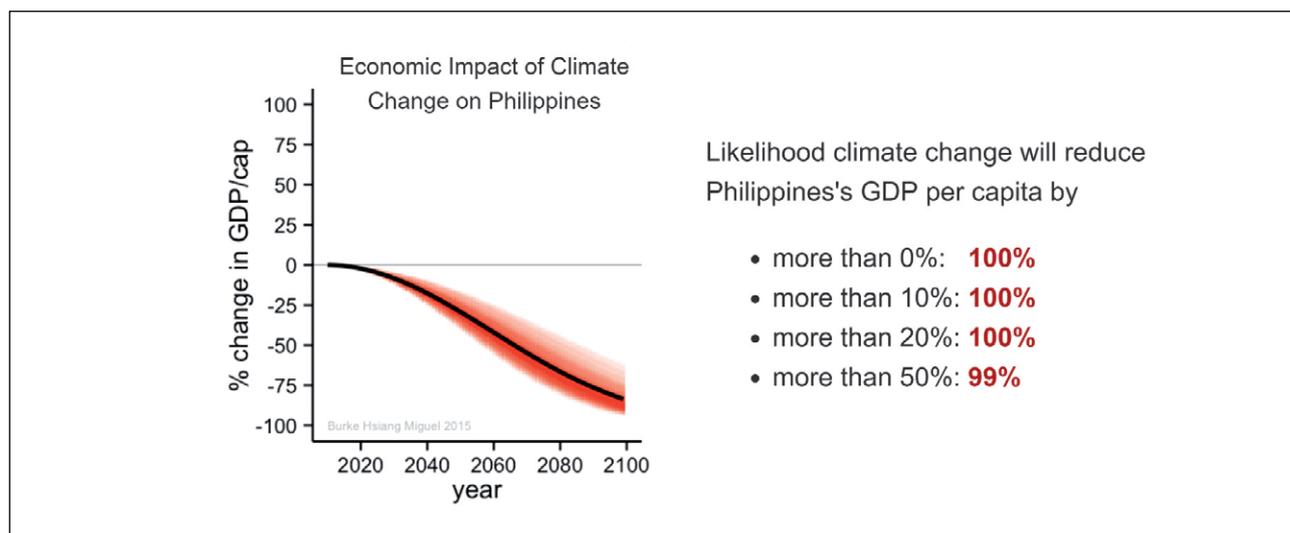


Figure 4: Economic impact of climate change in the Philippines.

Source: Burke, Marshall, Solomon Hsiang and Edward Miguel. "Global Non-linear Effect of Temperature on Economic Production." *Nature* 527 (2015): 235–239.

While environmental protection, climate change mitigation and adaptation are enshrined in the Philippine constitution and laws, the bureaucracy tends to enforce laws selectively. Some laws are strictly implemented while others are ignored, depending on the priorities of the administration in power. Major provisions in environmental laws like the Clean Air Act and energy laws like the Electric Power Industry Reform Act (EPIRA) and RE Act have not yet been implemented. As to the NDC commitment, DOE Secretary Cusi has declared that he will not support any measure tending to increase electricity prices or impede industrialization and economic growth. Although the laws are clear, the divergence in views among government officials is hindering the formulation of a path to a clean energy transition.

The Philippine nationally determined contribution

The executive branch has endorsed the Paris Agreement and the Philippine Senate has approved the resolution ratifying the agreement. On March 1, 2017, President Rodrigo Duterte signed the instrument of accession.

Under the NDC submitted to the United Nations, the Philippines pledges to reduce its GHG emissions by 70 per cent against BAU by 2030, subject to availability of

funds under the Agreement.⁶ However, this condition failed to consider measures that reduce emissions while requiring only minimal incremental costs, and which usually result in savings.

Compelling reasons for the transition to clean energy

Health impacts

A 2015 Harvard study⁷ was commissioned by Greenpeace to estimate the mortality impacts of particulate emissions from 17 existing coal plants in the Philippines. The table below contains estimates of premature deaths for adults and for children from various health outcomes. The study first estimated annual emissions in local air sheds (a specified air quality monitoring area), then used air dispersion modelling to estimate population exposure to ambient air concentrations. The mortality impacts, i.e. premature deaths resulting from the air pollutants of existing and new coal plants are shown in Table 2.

Electricity price

High cost of electricity. Philippine media and businesses regularly complain that the country suffers

Table 2. Mortality impacts of particulate emissions from coal plants		
Health impact	Current impacts	Projected impact
PM_{2.5} Exposure among adults		
Stroke	200	380
Ischemic Heart Disease	420	1050
Lung cancer	40	100
Other cardiovascular diseases	80	200
Respiratory diseases	110	180
PM_{2.5} Exposure among children		
Lower respiratory infections	20	30
Ozone Exposure among Adults		
Respiratory diseases	90	450
TOTAL	Central: 960	Central: 2410
	Low: 540	Low: 1270
	High: 1420	High: 3600

Source: Greenpeace. Coal: A Public Health Crisis, Diseases and Deaths attributed to coal use in the Philippines. 2016.

from one of the highest electricity rates in Asia as well as the world. In a survey conducted by International Energy Consultants in 2016, the Philippine power rates are the third highest in Asia, fourth highest in the Asia-Pacific Region, and 16th highest in the world. However, the study noted that electricity rates in the Philippines are relatively more competitive when the subsidies granted by other countries like Indonesia, Korea, Malaysia, Taiwan, Thailand and Vietnam are considered. It is estimated that subsidies in these countries amounted to more than US\$ 50 billion in 2015 alone.⁸

Renewables have reduced the electricity rates. The electricity supply from new solar and wind power plants into the grid had benefited the consumers by reducing spot market rates due to the merit order effect.

The merit order is a ranking of power plant units based on prices bid at each interval (e.g. an hour) in the spot market. In a competitive setting, these bids are based on variable or marginal costs. Because renewables have almost zero variable costs, these lower the price at which the market clears, or when supply equals demand at each interval.

The study conducted by the Philippine Electricity Market Corporation (PEMC) for the period November 2014 to October 2015 showed that supply from new RE plants reduced WESM prices by 8.29 billion Philippine pesos (Php), resulting in net savings to consumers of Php 4.04 billion after deducting the total feed-in-tariff (FiT) payments of Php 4.26 billion.⁹ With the additional 192 MW of wind power in 2015 and 700 MW of solar in 2015, the net savings are expected to be higher.

Solar power prices have reached grid parity. Solar power prices for rooftop passed retail price parity in the Philippines in 2013 and those for utility systems reached grid parity in 2017. The costs of solar projects in the Philippines dropped by 80 per cent between 2011 and 2016, while costs of wind projects dropped by around 50 per cent. With solar power attaining retail price parity in 2013, net metering has been a viable option for residences and small business establishments for several years. Offers from solar developers to distribution utilities in 2017 under the competitive selection process range from Php 3.50 to 5.29 per kWh (\$0.07-\$0.11). At less than Php 4.00 per kWh (\$0.08) fixed over the long term, solar developers are claiming that solar is already cheaper than coal.

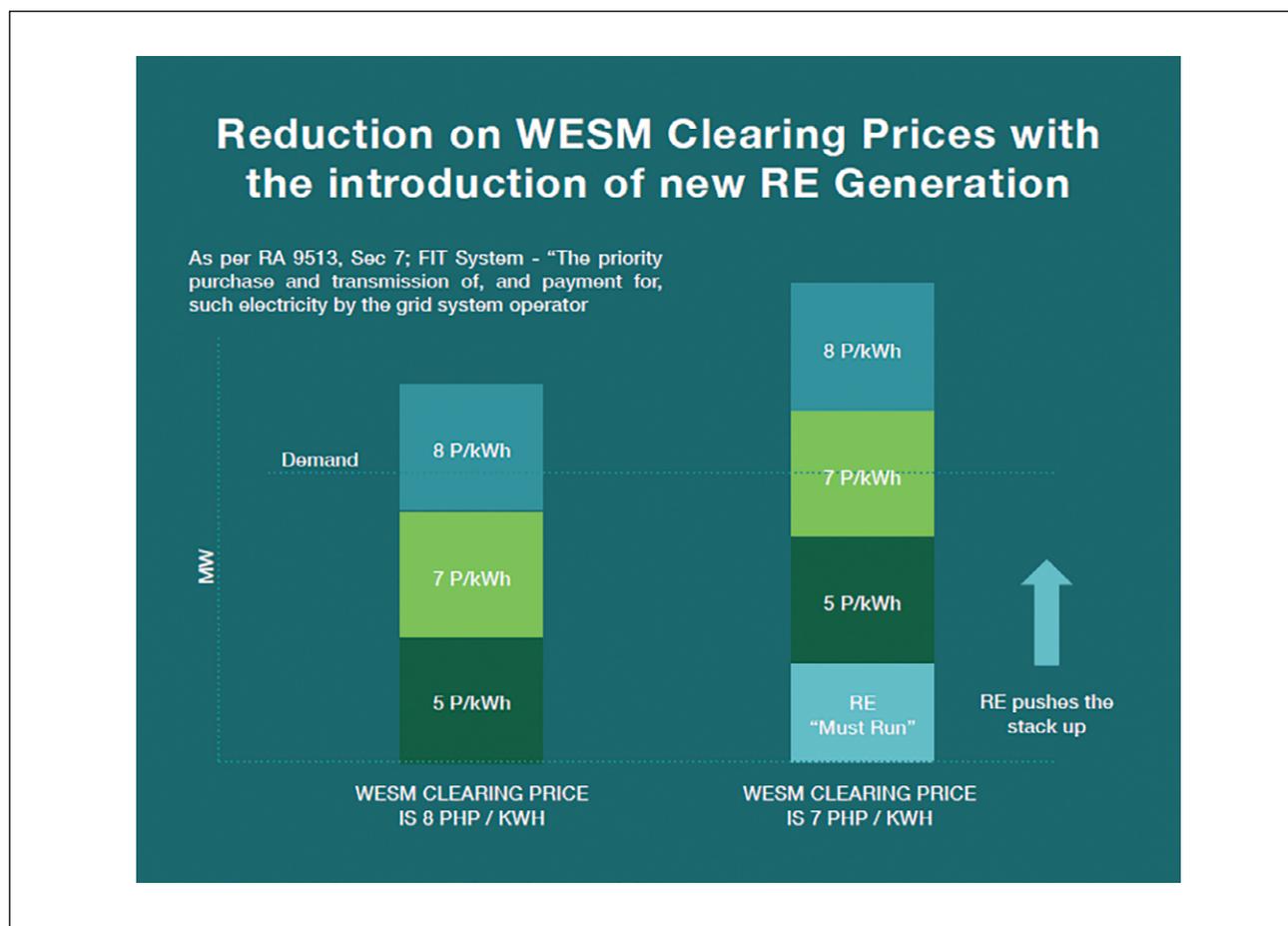


Figure 5. Reduction on Wholesale Electricity Spot Market (WESM) Clearing Prices with the Introduction of new RE Generation. Renewable Energy Board, WESM Price Impacts from New RE- Philippines, January 2012.

Renewables create more jobs compared to fossil fuels

Republic Act No. 10771 or the Philippine Green Jobs Act (PGJA) of 2016 was enacted by the Philippine legislature on April 29, 2016, and took effect on May 18, 2016. The PGJA policies aim to generate, sustain and incentivize “green jobs” to develop an environmentally friendly economy. Under the PGJA, “green jobs” are defined as any form of employment in any economic sector that contribute to the quality of the environment. These green jobs are required to be “decent,” in that they are productive, respect worker rights, deliver fair income, provide workplace security, provide social protection for families, and promote social dialogue. The impact of the legislation has not been substantial, as the implementing rules and enforcement mechanisms are still being established.

Solar may be curtailing jobs in fossil fuel related industries, but is creating more jobs, especially for women. The International Renewable Energy Agency (IRENA) reported that the RE sector employs more women than the oil, gas, and coal branches together. The percentage of women among workers in the solar sector is rising —from 19 per cent in 2013 to 24 per cent in 2015 of the estimated 209,000 solar jobs in the United States. Worldwide, employment in green energy grew 5 per cent over the course of 2015, to 8.1 million jobs, while the slump in oil prices that began in the fall of 2015 and extended to 2016 eliminated an estimated 350,000 oil jobs across the planet.¹⁰

In the Philippines, industry sources claim that more than 100,000 people were employed during the construction of 840 MW utility solar plants from 2013 to 2016 alone. This number does not include jobs from small rooftop

installations. Assuming a ratio of 100 jobs per MW, the almost 2,000 MW RE power projects installed in the past several years have generated around 200,000 jobs.

Public Concerns on Global Warming

Media coverage. The Paris Agreement and the delayed ratification by the Philippines were given major coverage in a broad variety of national media. The majority of media does not generally advocate positions, but covers climate science, impacts, and space for advocates, including those conforming to the administration's views. However, the link between global warming and extreme weather events, as well as the urgency to implement low-carbon initiatives, must be given more prominence in media.

Public awareness. A nationwide survey¹¹ commissioned by the World Bank in early 2013 had some interesting results. Sixty-six per cent said they were aware of the adverse effects of climate change prior to the survey; 80 per cent considered the country's contribution to the problem as either medium or high, compared with other countries; 12 per cent reported they were extensively aware of climate change impacts, and 35 per cent said they were partially but sufficiently aware; 11 per cent reported they had severe personal experience of the impacts, 43 per cent moderate, and 31 per cent, little personal experience of climate change impacts. The respondents were not asked, however, how they became aware of the problem other than from personal experience. Another survey conducted in 2017 revealed that the public is willing to pay more for clean energy, particularly solar power.¹²

The feasibility of the transition to a low-carbon, renewables-based electricity sector

Solar, Wind and Battery Storage: Declining Prices

A strong factor favouring the move from heavy dependence on fossil fuels is the steadily declining prices of solar and wind power generation, and of battery storage. In 2017, solar and wind have become competitive against coal-based generation worldwide. Based solely on commercial reasons, the lower costs per kW and the stable rates per kWh over the long term can justify the shift to RE sources.

The extent of the 2016 plunge in price is impressive, as the following table shows (Table 3).

Although different framework conditions in regions worldwide need to be kept in mind and cannot be compared like for like, there may be a decreasing trend of the levelized cost of electricity (LCOE) globally.

A subsequent announcement from Elon Musk of SpaceX, Tesla Motors and SolarCity claimed that his new solar product—a solar roofing material—will be cheaper than conventional ceramic roofing tiles, making electricity from the rooftop a free bonus.¹³

In November 2016, the US National Renewable Energy Laboratory detailed the continually improving efficiencies

in the solar research and development pipeline. Commercial solar panels have reached efficiencies in the 16-20 per cent range. Those in the research pipeline have reached as high as 46 per cent, an assurance that the price declines will continue into the foreseeable future.¹⁴

In the Philippines, an FES-sponsored industry round table in August 2017 determined that current solar prices stood at around \$1,200/kW-peak, and solar LCOE at around \$0.10/kWh. These are roughly 10 per cent lower than the previous year, and more or less consistent with the global trend of solar prices over several decades.

The cost of wind power and lithium batteries have also been coming down. In the US, the decrease in wind LCOE is equivalent to 14 per cent per year, or around 1.2 per cent per month. Wind LCOE went down to US\$32/MWh in 2015 (3.20 US cents/kWh), less than the solar low of 4.80 US cents/kWh in February 2016.¹⁵

In the Philippines, the FiT for wind was reduced from \$0.17/kWh to \$0.15/kWh, which means a 12 per cent decrease over two years.

Lithium battery prices are also declining significantly. Tesla, for instance, introduced its Powerwall 2 to the Australian market in late October 2016. The battery storage system sold for about the same price but with

Table 3. Winning bids in solar auctions conducted in 2016

Location	Bidders	Size (MW)	Levelized cost of electricity (LCOE) (US\$/kWh)	Month (2016)
Peru	Enersur	185	4.80	February
Palo Alto, US	Hecate Energy	26	3.68	February
Mexico	Enel Green Power	1,700	3.55	March
Dubai	ALJ+FRV+Masdar	200	2.99	May
Chile	Solarpack	120	2.91	August
Abu Dhabi	Marubeni+JinkoSolar	350	2.42	September

Source: Saurabh, CleanTechies, Sep. 20, 2016, <http://cleantechies.com/2016/09/20/jinkosolar-marubeni-score-lowest-ever-solar-pv-at-us%C2%A2-42kwh-in-abu-dhabi/> with additional data compiled by authors from various industry reports, 2016 and 2017.

twice the capacity as Powerwall 1, a price drop of 50 per cent in one year, or 5.6 per cent per month. Analysis reached the astounding conclusion that a solar PV + Powerwall 2 combination produces electricity comparable to the grid price in Australia.¹⁶

The cited FES study found that while lead-acid prices have not moved, adding \$0.30/kWh to \$0.60/kWh to the cost of electricity, lithium battery leveled costs have dropped significantly to around \$0.20/kWh, making a solar/lithium battery combination already competitive in off-grid applications. If the price drops continue at this rate, the solar/lithium combination can compete with Philippine retail electricity prices within a few years and with average generation costs soon after. These long-term price declines are seldom seen in the non-renewable world, where the prices are frequently characterized by volatility in the short term and steady rise over the long term.

Most price discussions apply to utility-scale renewable facilities, whose outputs need to be distributed through transmission and distribution lines, adding to the retail price of electricity. Despite the oil price decreases and the corresponding drops in the retail price of electricity in 2015, rooftop solar remained cheaper.¹⁷ This makes the arguments for solar rooftops the most compelling of all, especially from the consumer perspective.

Renewable Resources for the Transition

Long-term potential of RE resources

The long-term RE potential is the capacity that can be extracted if all RE resources available in the country were utilized to the fullest. It reflects the total capacity available as far as the current state of knowledge can determine. Estimates of the Philippines' long-term RE potential have been compiled in a book by one of the authors of this report,¹⁸ and can be summarized as follows:

Solar: 0.15 kilowatts-peak/square meter, or 6.67 sqm/kWp pf electricity, at around 4.5 peak-hours/day (the 5 kWh/sqm/day cited earlier referred to solar energy and did not yet consider the low conversion efficiencies of current commercial solar panels). For large-scale projects, the land required is roughly 1 hectare

(10,000 sqm) per MW-peak, or 1,000 hectares per Gigawatt-peak. The Philippines has a total land area of 30 million hectares. The overall solar electricity potential depends on how much land area a territory is willing to allot for solar power generation. If rooftops are used, then land-use conflicts are mitigated, although solar power will still need to compete (or share space) with other uses like roof gardens and roof decks. In energy rather than capacity terms, Verzola calculates that 0.1 per cent or 30,000 hectares of the country's total land area could have produced enough kWh from solar panels to make Philippines 100 per cent renewable in 2015.¹⁹

Wind: A 2014 study by Jacobson indicates that 25 per cent of the whole country has average wind speeds greater than 6.0 m/sec at 80 metres above ground level, and 30 per cent of the country at 100 metres.²⁰ The estimated potential wind capacity for the whole country is 173,650 MW. This is 10 times the total DOE target capacity additions of 17,388 MW by 2030.

Hydro: Large hydro, 10,500 MW; mini-/micro-hydro, 1,874 MW; 8.9% of the generation mix in 2016.

Geothermal: 1,200 MW; 12.2% of the generation mix in 2016.

Large hydro and geothermal projects are considered as mature technologies in the RE Act, and thus were not granted FIT incentives. Since most of the resources are in protected and/or ancestral domains, securing permits usually take several years. These technologies are also not competitive against fossil-fuel, solar, and wind power plants at current prices.

These two RE sources should be given higher priority in power development. They could play an even more important role in the future, since their output can be ramp up or down under operator control. As flexible plants, they can complement variable renewables like solar and wind. In turn, the latter's decreasing costs can offset the increasing cost trends of the former.

From the above data, we can conclude that the country has enough resources to achieve the transition. However, it must adopt and implement the proper policies to attract sufficient investments in RE.

Short-term potential of RE awarded and pending projects by DOE

The short-term RE potential is the total capacity from all RE service contracts awarded by the DOE which are completed, under construction, or on pre-development stage, plus projects still awaiting approval. As of 30 June 2017 there were 831 awarded projects with capacity of 21,938 MW and 341 pending projects with capacity of 4,697 MW.²¹ Combining both gives 26,635 MW, which exceeds the government's total target capacity additions by 2030 of 17,388 MW.

Laws in support of the energy transition

The shift from fossil fuels to renewables is supported by many Philippine laws.

The most important of these laws are: The Philippine Constitution, and the Electric Power Industry Reform Act of 2001, which give priority to the utilization of natural and indigenous sources of energy; the Renewable Energy Act of 2008 (RA 9513) which provides incentives to RE development in the country; the Biofuels Act of 2006 (RA 9367) which sets specific targets for biofuels adoption; the Clean Air Act of 1999 which regulates GHG emissions; the Solid Waste Management Act of 2000, which mandates ecological waste management; the commitments under the Paris Agreement; various RE-related DOE circulars; court decisions on environmental protection; and resolutions and rules of the Energy Regulatory Commission (ERC). The ERC approves all proposed power plant costs and contract prices.

The 2008 RE Act defines renewable resources in Section 4(uu) as follows: "Renewable Energy Resources (RE Resources) refers to energy resources that do not have an upper limit on the total quantity to be used. Such resources are renewable on a regular basis, and whose renewal rate is relatively rapid to consider availability over an indefinite period."

The government's choice of the word "resource" is significant. It follows the Regalian doctrine of absolute ownership of all natural resources within its territory. All developers of solar, wind, hydro, geothermal or ocean/

tide power plants are required to enter into a "service contract" with the government.

The Philippine Constitution includes a provision that recognizes the "prior rights" of indigenous peoples to their land and resources under the "ancestral domain" doctrine. This conflict between the Regalian doctrine, "ancestral domain", and private land ownership is the root of many resource conflicts in the countryside.

By acceding to the Paris Agreement, the government has made its commitments including the NDC part of the law of the land.

The dominant government energy policies, however, are contained in the DOE's most recent Philippine Energy Plan (PEP), which sets the general direction for energy investments in the country. The Aquino administration launched the PEP 2012-2030. The Duterte administration's PEP 2016-2040 was released in August 2017.

Two contending government approaches to the energy transition

Two contending approaches to the transition exist within the government.

The high-carbon approach, represented by the DOE and expressed in its 2016-2040 scenario, is to continue the country's reliance on fossil fuels for electricity, delaying the shift to renewables and keeping the country on the BAU path.

The low-carbon approach, represented by the Climate Change Commission (CCC) and expressed in the country's international commitment to reduce its carbon emissions by 70 per cent versus BAU by 2030, commits the country to pursue a low-carbon path as soon as possible. The programmes of the Energy Utilization Management Bureau of the DOE, and the National Renewable Energy Board (NREB), a government body that advises the DOE, ERC and other government agencies involved in RE development are broadly consistent with this approach.

Since the privatization of the electricity sector has weakened the government's capacity to set the actual

electricity mix, these two approaches must contend with the investment priorities of the private sector. The wide disparity between these two approaches must be bridged to enable the low-carbon transition.

a) The DOE's high-carbon approach

The DOE's high-carbon approach involves raising the country's total supply capacity from 19,097 MW in 2016 to around 36,000 MW by 2030 and 63,000 MW by 2040-- an average annual growth rate of 5.1 per cent/year. These projections are based on a reserve requirement of 25 per cent over peak demand. The DOE is allotting 70 per cent of the total supply to baseload power plants, mainly from coal plants.

The DOE approach will attain carbon emission reductions of around 32 per cent of the 2030 BAU scenario, far short of the country's 70 per cent reduction commitment.

This scenario means a total generation of two million GWh over the 14-year period 2016-2030. Based on the current average price of around Php 8 (\$0.16)/kWh, this represents an electricity expenditure of some \$326 billion over 14 years. The expenditure will be divided as follows: \$240 billion to the fossil industry and the remaining \$86 billion to the renewables industry.

The DOE scenario tends to overestimate the country's baseload requirements on several counts:

- It is based on the high end of GDP growth estimates of the country's economic planners. The medium and low estimates are not considered.
- The DOE raised the reserve requirement and requires backup of more than 15 of the largest generating units on the grid, instead of the two largest as previously required.
- The DOE applies the 70 per cent-baseload rule on the total supply (peak demand plus reserves), instead of the peak demand only. Coal and nuclear plants are not suited for reserve role because they are not flexible, i.e., they cannot be turned on or off quickly.
- The DOE maintains its 70 per cent-baseload rule throughout the 2016-2040 planning period, and does not consider the continually declining prices of solar, wind and battery prices.
- The DOE added to "installed" and "dependable", a new supply category - "available", which is even

lower. If this lower base is used instead of the installed or dependable base, more baseload plants will appear to be needed.

DOE defines the supply categories as follows:

Installed Capacity: maximum amount of electricity that the power plant can produce as indicated in the nameplate.

Dependable Capacity: load carrying ability of an electric power plant or a generating unit, i.e. capacity that can be relied upon (monthly or annually).

Available Capacity: current available capacity of an electric power plant, i.e. ability of a power plant or a generating unit to produce electricity in a certain time-period (hourly or daily).

The baseload debate is important in the Philippine context. A high baseload requirement expands the roles of coal and possibly nuclear power plants, while restricting the space for variable renewables like solar and wind.

With zero fuel costs, variable renewables have practically no marginal or variable costs. Thus, their outputs are dispatched ahead of fossil-fired plants. Since solar and wind have priority dispatch, the overall role of non-flexible power plants will decrease over the long term. One of the authors estimated that once solar supply exceeds 25 per cent of the system peak demand, the share of baseload plants in the mix will start to shrink. At 50 per cent solar share, only 43 per cent of the mix can be baseload; at 70 per cent solar, only 23 per cent can be baseload; and at 90 per cent solar, baseload will have a minimal (3 per cent) role.

In the era of cheap renewables and distributed generation, flexible plants whose output can be ramped up or down quickly will play a larger role in the power mix.

In contrast, the following baseload technologies tend to be highly controversial:

Coal power plants. Even before greenhouse gas emissions became an issue, coal plants were already

controversial for their harmful health, environmental and social impacts throughout the coal life cycle. Coal plants also use a lot of precious water. In addition, coal plants do not guarantee their costs per kWh, but pass on any fuel price and foreign exchange volatility risks to consumers due to the automatic fuel cost “pass-through” provisions in coal power supply agreements.

Nuclear. Nuclear projects are even more controversial, in part because of widely publicized nuclear disasters—from Three-Mile Island, to Chernobyl, to Fukushima—in countries with far more advanced technological and safety infrastructures than the Philippines. The DOE is considering reviving the Bataan Nuclear Power Plant. This was completed in early 1980s, but never went into commercial operation. The massive corruption linked to the project and the Chernobyl disaster led the Cory Aquino government (1986-1992) to mothball the plant instead.

b) The CCC’s low-carbon approach

In the NDC, it is not detailed how the country’s 70-per cent carbon reduction commitment is supposed to be attained.

One of the authors has worked out detailed calculations, starting with the BAU scenario, the government’s energy efficiency programme, and the list of RE projects awarded and pending with the DOE. Verzola has determined that the 70 per cent commitment is in fact “doable”.²²

A BAU scenario based on 2000 data (45,290 GWh of total generation, 25,865 GWh or 57.1 per cent of which was fossil-based, 6.5 per cent average annual growth

rate), meant 171,081 GWh of projected fossil-based BAU generation by 2030. Since 70 per cent reduction means 30 per cent retention, the 70 per cent commitment set a retention ceiling of 51,324 GWh of fossil-based generation by 2030, which was the country’s level in 2012. It is 25 per cent lower than the 2016 fossil-based generation level of 68,819 GWh.

The DOE is working with the EU through the SWITCH-Asia programme to craft an energy efficiency programme for the country, while the NREB is working with industry to update the National Renewable Energy Program (NREP) of the DOE. The updated NREP aims to restore the RE share in the generation mix (*in terms of MWh rather than MW*) to 35 per cent by 2030 and to 50 per cent by 2040.

Imputing the potential energy efficiency savings as well as the RE projects the DOE had already approved, and those still pending as of December 2016, it is possible to meet the DOE 2030 targets under the CCC approach.

With the CCC’s low-carbon approach, \$144 billion (instead of \$240 billion) of the country’s 14-year electricity expenditures will go to the fossil industry while \$182 billion (instead of only \$86 billion) will go to the renewables industry. In effect, the fossil and renewable proponents are contesting a \$96-billion pot over the next 14 years. The crux of the debate between the DOE’s high-carbon approach or the CCC’s low-carbon approach is where the \$96 billion will go—to the fossil-fuel industry or to the renewables industry. The renewables industry potentially includes the millions of households that can generate their own electricity by putting solar panels on their rooftops.

Driving forces influencing the energy transition

There are several driving forces that affect the energy transition to a low-carbon economy. These include: the declining prices of solar and wind power generation and of battery storage; a rapidly growing population; consistent economic growth; low per-capita consumption of electricity due to its high cost; the archipelagic character of the country's geography; privatized electricity generation and distribution; the proposed constitutional shift in the form of government from centralized to federal; and competing interests among energy stakeholders.

To provide further insights into these factors, a political, economic, social and technological (PEST) analysis was included in Annex 1.

Cost deflation in solar and wind power, and in battery storage

The key factor driving the transition is the changing economics especially of new energy technologies. Most likely, the cost deflation of renewables, especially solar and wind as well as lithium-based storage batteries will continue. Coupled with the continuing price decline of liquid natural gas (LNG) that now threatens the primacy of coal for baseload use, this creates a window of opportunity for industry disruption. This development is technically fortuitous, because LNG-fuelled combined-cycle gas turbines can serve as a transition technology, enabling the grid to absorb more RE and become more flexible, while waiting for battery storage to become competitive.

Rapidly growing population

The Philippines had a population of 101 million according to the 2015 national census. Even at the lower annual growth rate of 1.72 per cent recorded in 2010-2015 versus 1.90 per cent in the 2000-2010 period, the population is expected to exceed 142 million by 2045. This factor alone will be a strong driver for growth in the electricity sector, as more and more people require more power.

Consistent economic growth

The Philippine GDP grew by an annual average of 6.3 per cent during the Aquino administration (2010-2016). The Duterte administration (2016-2022) is projecting growth rates in the range of 6 per cent-8 per cent/year. Economic growth and the growth in electricity services are mutually supportive. Economic growth creates demand for more electricity, while higher electricity use propels more economic growth.

Electricity has already become the most common source of energy for Philippine households, according to the 2011 Household Energy Consumption Survey (HECS). About 87 per cent of the country's 21 million households used electricity from March to August 2011. The other sources included fuel wood, charcoal, liquid petroleum gas and kerosene, with at least one-third of the total households using one or more of these types of fuel in 2011.²³

In 2011, electricity was the most common source of power. Electricity was used for lighting by 74 per cent of households, while kerosene was used by 30 per cent of households.²⁴

Higher household incomes lead to higher electricity consumption for two reasons: (1) the households can afford to buy more electrical appliances (refrigerator, electric stove, rice cooker, water heater, washing machine, etc.) to substitute for non-electrical ones, and (2) they can afford to pay for more kilowatt-hours per appliance. The expected growth in the electric vehicle market will be another huge driver of demand for electricity.

Low per-capita consumption of electricity due to its high cost

Despite the growth drivers above, 13 million Filipinos have no access to electricity. At 706 kWh per year, the Philippines has one of the lowest per-capita electric power consumption in the Association of Southeast Asian Nations (ASEAN). Its per-capita consumption is

only 15 per cent of that of Malaysia, 28 per cent of that of Thailand, and 49 per cent of that of Viet Nam.²⁶

Some 2.4 million households (around 12 million Filipinos) have no access to electricity. The Mindanao regions suffer from the lowest household electrification rates: the Autonomous Region of Muslim Mindanao (39 per cent), Central Mindanao (68 per cent), Southern Mindanao (72 per cent), and Western Mindanao (73 per cent).²⁷

One reason for this low access is that the Philippines suffers from very high electricity rates compared to other ASEAN countries. The residential rate in Metro Manila as of June 2017, for instance, was around \$0.16/kWh. Industrial/commercial rates were slightly lower, while rates outside Metro Manila and its adjacent provinces tended to be somewhat higher.

The archipelagic character of the country's geography

The Philippines comprises more than 7,500 islands, second only to Indonesia.

Providing electricity to so many islands creates unique challenges, which can be turned into opportunities. The country consists of two national grids, the Luzon-Visayas grid, and the Mindanao grid. Smaller islands have their own mini- or micro-grids. The dispersed nature of the rural population leaves many—around 13 million people—without electricity at all.

The Philippines lies in the typhoon belt. More than a dozen typhoons hit the country each year—not to mention earthquakes, volcanic eruptions, tsunamis and other natural disasters. These pose a constant threat to the country's energy infrastructure, creating challenges relating to the maintenance and resilience of power plants, transmission and distribution. The country's archipelagic nature and its proclivity to natural disasters are strong arguments in favour of distributed generation, micro-grids and even stand-alone capability, over centralized generation and transmission.

As analogy, distributed computing had replaced centralised computing in the information and communications industries. Mainframe computers have

generally been supplanted by stand-alone computers (desktops, laptops, smart phones) linked through networks and the internet. In the case of electric power, the increasing number of electricity prosumers are threatening the long-term viability of distribution utilities in Europe and several states in the USA.

Electricity generation and distribution are privatized, unlike most countries in the asean region

The Philippines occupies a unique electric power environment among ASEAN countries. Although electricity tariff is regulated, it is not subsidized. EPIRA mandates that power generation should be entirely under private entities. Even power generation in missionary or remote areas are required eventually to be taken over by private companies.

Any discussion of the electricity mix and market must begin with the evolution of the power sector structure before and after the 2001 EPIRA. The make-up of the mix is a legacy of the era before restructuring, when generation capacity additions, along with transmission additions, were centrally planned under the National Power Corporation (NPC). EPIRA broke up the generation monopoly, and privatized electric power generation. The transmission system remains regulated, but is operated by a private company under a long-term concession agreement. EPIRA also created a WESM under the PEMC.

Prior to restructuring, the NPC conducted long-term generation capacity expansion planning, which was published as the Philippine Development Power Plan and updated annually. This was a real plan, because the NPC had control of investment from its own income and national government cash infusions. While it practised least-cost expansion planning, factors other than cost were also considered, namely energy independence and environmental concerns. At the time, therefore, the government could plan a capacity and generation mix.

With a private sector-led, decentralized, market-oriented power system, the country's capacity and generation mix results from the procurement decisions of the distribution utilities in addressing current and future loads. These

decisions are based on private financial costs and profit targets. The energy plans continually updated by the DOE are more like declarations of intention or scenarios. However, since major energy projects still need approval by various government agencies, levers for encouraging some projects and discouraging others exist, and which can set the direction of power development.

Despite the policies and mechanisms in EPIRA, the power generation sector remains an oligopoly, controlled by fewer than 10 firms. These large firms favour and continue to build large coal plants because of the zero-fuel risk resulting from the automatic pass-through cost provision. A foreseeable danger is the stranded costs resulting from excess baseload supply and higher power costs, once fossil prices rise to higher levels and/or RE prices reach fuel parity.

The proposed constitutional shift in the form of government from a centralized to a federal system

The Philippine governmental system contains features of a Western-oriented democracy, including participatory decision-making. However, the political system is described as dysfunctional and remains dominated by traditional political families. In contrast to Western democracies, the major political parties are not organized on ideological or programmatic grounds. Thus, quantifying the constituency and support for the transition to renewables through electoral results would be difficult.

The Duterte administration (2016-2022) has expressed its determination to amend the Philippine Constitution and change the country's form of government to a federal system by decentralizing government powers to the 16 regions of the country. Under the federal system, the implementation of key policies and programmes, including the low carbon transition, will be devolved to the regional level, introducing another complicating factor.

Constitutional change will lead to major and permanent changes in the administration of the branches of government. Different regions may adopt different

energy transition approaches, dictated not only by the different energy resources locally available to them, but also by local politics. Moreover, predicting what other constitutional changes aside from a federal system may be adopted by the constitutional commission will be difficult. There are clear signals that the constitutional commission may consist of presidential appointees, as both the executive and legislative branches keep harping on the high expense of a national election.

The strengths of contending stakeholders

An important factor in the transition is the relative strengths of contending stakeholders. Ultimately, the interests with the stronger economic and political clout tend to get their way. The power sector remains dominated by oligarchs (a term used by President Duterte), who invest where the biggest profits can be made. Thus, coal plants with their huge capacities and high guaranteed returns due to zero fuel risks are greatly favoured.

All the major power conglomerates except the Lopez-controlled Energy Development Corporation are invested in coal. Former Secretary of Natural Resources and Environment Regina Lopez belongs to the Lopez family. A Duterte appointee, she waged a popular campaign against destructive mining. But her appointment was rejected by the powerful Commission on Appointments of the Philippine Congress, where mining interests are heavily represented.

The costs of solar and wind power as well as storage technologies continue to decline, while the cost of fossil remains volatile. With their window of opportunity rapidly closing, coal interests have intensified their efforts to slow down the adoption of RE. The DOE, with its emphasis on lowest-cost electricity to drive industrialization, is influencing the construction of large baseload plants. But only if externality costs, life-cycle costs, as well as fuel and foreign exchange volatility risks are not factored in can coal generation be considered as the cheapest and least problematic baseload technology.

The distribution utilities, in fulfilling the mandate to provide least-cost power to ratepayers, are wary of rapid

absorption of renewables because of misperceptions on cost and reliability.

The chambers of commerce, business organizations, and some economics research institutes consistently favour coal because of what they claim to be its reliability and low cost. Interestingly, the Makati Business Club, one of the most prominent industry organizations, lobbied for the ratification of the Paris Agreement. The National Competitiveness Council (NCC), a public-private sector organization, is working with international and domestic consultants to identify supply options which could provide affordable and reliable power supply to the country over the long term.

Strong and consistent advocates for the energy transition can be found among non-governmental organizations (NGOs), particularly those involved in climate change and critical environmental issues. A few are focused on the issue of the energy transition, especially as it relates to climate change. They engage with advocates in Congress

and intervene in the proceedings of regulatory bodies such as the ERC and the Department of Environment and Natural Resources. Some NGOs focused on sustainable development pursue their own community-based RE development projects in non-electrified areas. While the outcomes in terms of affecting the national energy mix are not significant enough to appear in national statistics, these projects raise awareness on RE way outside the borders of these communities. As is true with most developing-country NGOs, Philippine NGOs are highly dependent on international organizations, especially those that are promoting a low-carbon transition. This fact is often used by their adversaries to discredit them.

Because of the characteristics of the Philippine political system, a few visionaries in Congress are deeply engaged in the transition. These legislators need to be recognized and encouraged for their efforts, and the NGOs must work within the formal political sphere to make the transition a real political issue.

The transition to low-carbon electricity should be a socially just transition

The transition to a low-carbon electricity sector will enjoy broad social support if it is implemented in a just manner. By a “just” transition, we are referring to the following desirable features:

Universal access

No citizen should be excluded from access to electricity due to either lack of service or poverty. This is an expression of society’s commitment to social justice. It recognizes that access to electricity has become an essential factor in full participation in the cultural, social, economic and political life of the nation. This justifies such government policies as the “lifeline charge” and “missionary access”.

In the 2011 HECS undertaken by the Philippine Statistical Authority for the DOE, 13 per cent of households in remote areas get their electricity from neighbours who own generators that power an informal micro-grid. Field research undertaken by one of the authors of the current report (Logarta) revealed that the power entrepreneurs charge fixed fees per appliance per month.

EPIRA not only privatized the electric power industry, but went as far as excluding the government and NPC from power generation. The NPC today is responsible only for the so-called “missionary” areas, where the private sector chooses not to enter because they deem the areas to be unprofitable. These are usually small islands or remote areas.

The government keeps statistics on the numbers of barangays (villages centres), *sitios* (house clusters away from village centres) and households that remain unelectrified. In his presentation in the power and electricity conference held in July 2017, Administrator Edgardo Masongsong of the National Electrification Administration (NEA) reported that 100 per cent of *barangays* and 69 per cent of *sitios* have been electrified.

Philippine utilities extend what is called a “lifeline” subsidy or special rate (down to zero) to households

that consume less than a threshold monthly kWh consumption. The coverage is set by the distribution utility (DU), and ranges from 10 kWh (free) to 100 kWh (discounted). The subsidies are paid for by non-lifeline ratepayers.

A just transition should leave no Filipino behind.

Full-cost/benefit accounting and fair distribution of costs and benefits

Costs should be borne (i.e., internalized) by the entities that incur them, and not passed on (i.e., externalized) to other sectors, who may be unable to resist these imposed costs due to lack of information, poverty, or helplessness. Benefits, in turn, should accrue to those who spent the time, effort and money to bring about those benefits. This aspect includes such well-established principles as the “polluter pays”, “fair return on investment”, and “common but differentiated responsibilities”. In the international arena, the biggest responsibility for carbon reduction should lie on those countries who are emitting the most carbon per capita, with historical emissions data taken into account.

Consumer choice and market competition

A fair operation of the energy markets requires that consumers be free to choose from among various energy sources, products and services, and that market competition be enhanced by a level playing field among an increasing number of market participants. Provisions in Philippine energy laws already provide mechanisms for these to happen. Under the competitive selection process, distribution utilities must source their supply requirements through a transparent bidding process instead of negotiating contracts directly with specific sources, which are often a subsidiary, parent or related company. The retail competition and open access mechanisms mandate big industrial or commercial users

and electricity supplier to deal directly without passing through the franchised utilities. Through the green energy option, consumers can require their distribution utilities to provide them with electricity from grid-connected RE suppliers specified by the consumer.

Fair treatment of investors

Investors are entitled to a fair return on their investment, subject to the risks posed by the usual vagaries of the market. They should be governed by a consistent set of rules that are not changed arbitrarily. Payments guaranteed by the State should be made promptly. Small investors should not be discriminated against, especially since the increasing availability and affordability of small-scale renewables are enabling distributed and self-generation down to the household level.

Government oversight and no regulatory capture

Markets always need to be monitored by government agencies due to the tendency by bigger players to exercise market power unfairly against smaller players as well as consumers. The biggest players can become so powerful economically and politically that they can capture and control government regulatory bodies and exercise monopolistic behaviour with relative impunity. This is an ever-present danger in the Philippine energy sector, with its long history of monopolies.

Political feasibility of a just transition

Despite being identified as one of the countries most at risk from climate change,²⁸ the debate on whether the Philippines should set high national targets for carbon reduction is far from settled. There are a range of views, even within the government, about the need for a low-carbon energy transition and whether it is going to be affordable.

One extreme is represented by President Duterte, who believes that global warming is the fault of the big carbon-emitting territories like the US, EU, and China,

and that these countries should therefore take the lead in carbon reduction. He further asserts that the Philippines must accelerate the development of affordable power sources to hasten its industrialization programmes. President Duterte has gone on record questioning high carbon reduction targets for the Philippines. The attitude that the country is a victim and not a cause of global warming, is widely shared among the national agencies and the private sector. Rationalizing that the country only accounts for 0.3 per cent of global emissions²⁹, the Duterte administration gives higher priority to industrialization programmes over emission reduction initiatives.

The other extreme is represented by the Climate Change Commission (CCC) under the Aquino administration. The CCC advocates taking the lead in carbon reduction, arguing that the high moral ground would better qualify the country to international funds for climate change mitigation. For this reason, the CCC took the helm of the Climate Vulnerable Forum, and submitted a GHG emission reduction target that ranks in the top five of the NDC submissions. Since President Duterte eventually approved the country's NDC, which then led to the accession to the Paris Agreement, this position now seems to have gained the President's support.

As an indication of the government's policy ambiguity, the Department of Environment and Natural Resources (DENR) under Secretary Lopez started reviewing the Environmental Compliance Certificates (ECCs) issued to coal-fired power plants in early 2017. ECCs are conditional approvals that allow projects to proceed if the ECC conditions are subsequently met. The DOE, however, responded by getting energy projects declared as "projects of national significance" in July 2017, allowing some agencies to be bypassed. It asked the DENR for a much more streamlined Environmental Impact Assessment process for such projects. Secretary Lopez eventually lost her job in June 2017, when the legislature-controlled Commission on Appointments refused to confirm her appointment. Although the rejection was a major win by coal and mining advocates, President Duterte strongly criticized mining interests as "oligarchs" in his July 2017 State of the Nation address and referred to climate change as a major national concern.

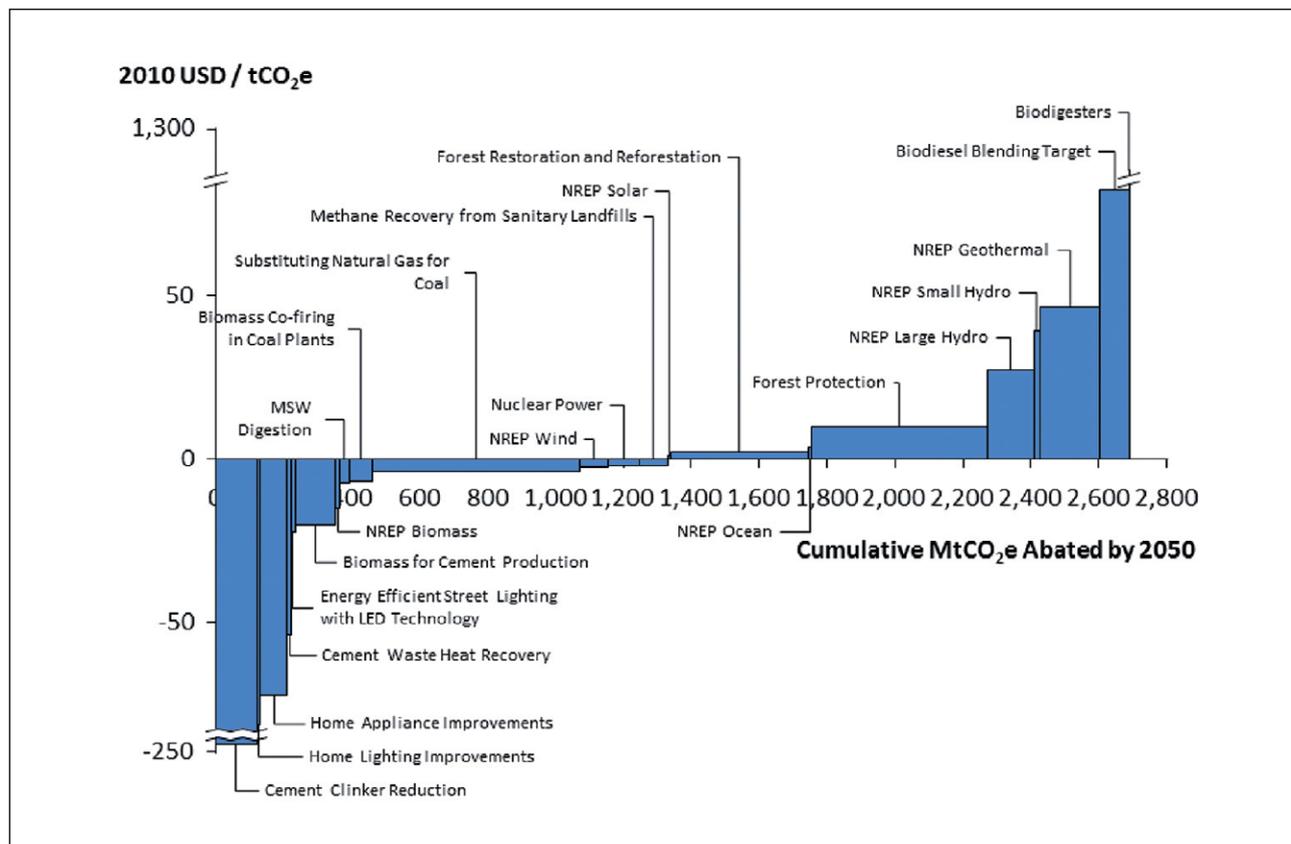


Figure 6: Marginal abatement cost curve for the Philippine Energy Sector.

Source: B-LEADERS for the Climate Change Commission, Marginal Abatement Cost Curve for the Philippine Energy Sector, (2015).

Under the previous Aquino administration (2010-2016), the DOE had echoed the CCC rhetoric but only paid lip service to reducing GHG emissions. In practice, Aquino’s DOE approved a construction binge of coal power plants (nearly 40 by the end of his term). Meralco, the largest utility in the country, has pending long-term power purchase applications for more than 4 GW of coal power. This orientation has been formalized under DOE Secretary Cusi’s official assertion that the country needs baseload plants for 70 per cent of its electricity mix. Solar and wind are not considered as baseload, while hydro is baseload only during the rainy season.

These conflicting government approaches are a political reality. The economic feasibility of the energy transition to a low-carbon economy is usually determined through a marginal abatement cost curve (MACC), which lists the various carbon-reduction measures that can be taken, their potential for carbon reduction, and their cost per unit of CO₂ avoided. Below is the MACC generated

by a study undertaken for the CCC on energy-related emissions. The measures from the left that fall under the X-axis entail no incremental economic costs while those above it do. The data used is what was available from the DOE, as there was no access to the technical models and the underlying databases. Care must also be taken in interpretation, because the discount rate used in the study was 5 per cent. Measures that provide a net benefit using a commercial rate can be deemed to be financially rewarding for private agents.

The question of affordability is also a question of how electricity prices can be reduced. The major components of electricity costs can be seen from a sample electric bill in the Metro Manila area below (Table 4).

The five biggest components of the cost of electricity are generation (45.8 per cent), distribution (26.3 per cent), government taxes (9.4 per cent), transmission (8.6 per cent), and universal charges (4.1 per cent). These are the

**Table 4. Breakdown of electricity charges
(211 kWh, June 2017)**

Bill subgroup	Php	
Generation	831.02	45.76%
Transmission	156.58	8.62%
System Loss	57.18	3.15%
Distribution	478.43	26.34%
Subsidies	9.05	0.50%
Government taxes	170.89	9.41%
Universal charges	74.36	4.09%
FiT-Allowance (Renewable)	38.61	2.13%
Other charges	0.00	0.00%
TOTAL	1,816.12	100.00%

Source: June 2017 electric bill of one of the authors.

areas where efforts to bring down the cost of electricity can be most effective.

As solar and wind get a bigger share of the generation mix, their declining costs are bound to pull the price of electricity down, too. Such a downward pull has already been documented in the previously cited study by the PEMC on the impact of RE FiTs on electricity spot market prices.

Roadmap to a socially just energy transition

To enable the energy transition, the Philippines should set clear policies to immediately shift to distributed from centralized generation. Primary considerations favouring distributed generation are the archipelagic nature of the Philippines and the high incidence of extreme weather events and natural disasters per year. Bringing supply closer to demand with shorter transmission and distribution lines, and utilizing smart grid and storage technologies would lead to a more robust electric grid. Given the advantages of micro-renewables and taking social justice into consideration, the government should give the highest priority towards enabling small players such as individual households, business enterprises and small communities to set up their own small-scale renewable facilities. As prosumers, they can become part of the logistics chain not just as buyers, but also as producers of electricity.

Besides the need to reduce GHG emissions, the country must avoid the burden of stranded costs resulting from baseload overcapacities of coal plants. The costs of renewables are steadily declining, while fossil fuel prices will always be volatile. More RE sources at fixed tariff would redound to stable electricity rates over the long term. By reducing its dependence on imported fossil fuels, the transition to renewables would make the country energy self-reliant and economically independent.

Based on the above considerations, the CCC initiated a national policy review and framework development on energy through a whole-of-nation approach. The review involved all concerned national government agencies, multilateral agencies, civil society and stakeholders. In line with the Paris Agreement, the review prescribed a low-carbon development pathway to address goals in climate change adaptation and mitigation and disaster risk reduction, without sacrificing sustainable development. One of the authors of this report (Maniego) was involved in the review from its inception and continues to advise CCC on energy policies.

The CCC conducted a public consultation on the draft of the policy review in November 2016. The following roadmap was presented and well received. The proposed roadmap was adopted in this paper. The final CCC

national energy policy review report will be released by the end of 2017.

Roadmap A: integrated energy system planning

National energy vision and fuel mix scenarios

Under the Philippine Energy Reform Agenda of the DOE, the country's energy vision is supported by the three pillars of energy security, optimal pricing and sustainability of the whole system. To attain energy security, the country must shift away from its dependence on imported fuel; to achieve optimal pricing, the long-term cost trends of both thermal and renewable technologies must be taken into account; and to build a long-term sustainable system, the archipelagic character of the country and its exposure to natural disasters must be considered. A transparent long-term planning model that considers energy security, job and wealth creation, environmental impacts and health should be developed and implemented. The NCC with one of the authors (Maniego) as Co-Champion for the Power and Energy Working Group is conducting a study on the optimum power mix. The National Engineering Center is developing the model for determining the best energy mix for the country, and plans to complete it in three years.

Grid expansion planning

The country's transmission grid is not fully interconnected, since Mindanao is not yet connected to the Luzon-Visayas grid. Interconnecting the entire country will be prohibitive, due to high number of islands and remote areas. There is a need to fast track the Transmission Development Plan to cope with the high economic demand. Policies and programmes for the integration of RE sources into the grid must be set. With the declining costs of solar, wind and storage technologies, bringing supply close to demand should be the norm. The eventual shift to distributed generation plus the goal of a more resilient grid would require a shift to smart and micro-grids.

Energy access in rural areas

Thirteen million Filipinos have no access to electricity. Moreover, most off-grid and missionary areas do not enjoy uninterrupted power supply 24x7. Because of the high cost of transporting diesel, the costs per kWh in the so-called missionary areas range from Php 15 to 100 per kWh. With solar power cost trending below Php 4 per kWh, the conversion of diesel generators to hybrid systems would lead to a more reliable supply as well as huge savings. The Universal Charge for Missionary Electrification collected from all consumers would be immediately reduced and could be phased out over the long term. Access to electricity would boost the quality of life in rural areas by spurring livelihood and improving education.

Roadmap B: renewable energy development

Renewable energy permitting process

Although the incentives and mechanisms under the RE Act are clearly specified, the process needs to be streamlined and shortened. Approval permits for RE projects can take months to years, depending on the technology. The Virtual One-Stop Shop bill in the legislature and the executive order classifying certain energy projects as of national significance should facilitate faster approval of RE projects rather than coal plants.

Renewable energy support schemes

All RE support schemes in the RE Act must be implemented. The FiT for solar and wind could be reduced sooner for the next batch of FiT participants, if their project costs decline faster than expected, and eventually phased out as they become competitive with coal. However, other technologies like biomass, waste-to-energy, run-of-river hydro and ocean still need FiT support. Even large hydro and geothermal are clamouring for FiT and other incentives, as they cannot compete with coal at prevailing fuel prices. The FiT system must be fine-tuned to correct its weaknesses, such as the race to finish and the absence of competitive bidding. To accelerate net

metering in houses and small buildings, the application process must be rationalised and the fees charged by the DUs and ECs reduced or eliminated. Financing schemes under energy conservation or house improvement loans will encourage net-metering installations. The RE Act provisions on Renewable Portfolio Standard (RPS) and Green Energy Options (GEO) should be implemented within 2018. RPS will ensure that DUs and ECs will secure a minimum percentage of their requirements from RE. With GEO, retail customers can tell their DU which generation company the former want to buy their electricity from.

Including fuel cost and forex risk in "least-cost" calculations

As implemented by ERC, "least cost" does not include fuel cost and foreign exchange risks. The cost of fuel and forex fluctuations are automatically passed on to the end users. Coal developers are not concerned about these risks as they are shouldered by the consumers. To level the playing field between fossil-fuel and RE plants, there must be a cap on the fuel cost and forex risk that can be passed on by power producers. Such a control mechanism is already being implemented in countries like India.

Integrating fluctuating wind and solar power

Although solar and wind are variable, EU countries have shown that the penetration limits of these technologies could reach high levels with proper forecasting and system control. The grid system must be able to integrate increasingly higher supply from variable RE (VRE) sources. The DOE should ensure that the VREs will be distributed and not concentrated in a limited number of areas.

Prioritizing rooftop solar

Because rooftop solar is not saddled with transmission and distribution costs, system losses, government taxes, and miscellaneous utility charges, it has become the cheapest, cleanest, and greenest supply-side source of electricity in the Philippines. By reducing demand for grid-sourced electricity, rooftop solar

is also a demand-side measure and brings in all the benefits of demand-side management. The short installation times, low incremental investment costs, continually declining prices, and zero fuel costs should make it a top priority for support by the government. Urgent measures include: banning unidirectional electric metres which scam grid-tied rooftop owners by recording the export of solar surplus as consumption; implementing true net energy metering instead of net billing; and removing barriers to entry such as additional impositions of unnecessary bureaucratic requirements and exorbitant connection and recurring fees by the utilities.

Roadmap C: energy efficiency and conservation

Mainstreaming energy efficiency and conservation

The Philippines is one of the few countries in ASEAN without an energy efficiency or conservation law. Described by the International Energy Agency as the “first fuel”, energy saving is a low-hanging fruit that provides the cheapest cost of electricity. The legislature must pass an energy conservation law immediately. Informational campaigns should be pursued on how to conserve energy by replacing incandescent bulbs with light-emitting diodes (LEDs), setting air-conditioner thermostat defaults to 25 degrees Celsius rather than 18 degrees, buying energy-efficient appliances, and providing incentives to industries and businesses for energy savings projects.

A public campaign every summer on energy conservation

First raised by one of the authors of the present document in the summer of 2016, this media campaign hinges on the real-time display of the grid’s instantaneous demand and supply curves, which can be easily provided by the grid operator. Best undertaken in summer when high peak demands often cause power outages, the real-time display in social and traditional media of the demand curve approaching the supply curve will make it much easier to convince consumers to immediately switch off

non-essential loads. The collective impact of this simple act can then be immediately seen on the real-time display as a slowing down in the rise of the demand curve. The goal is to keep it below the supply curve. This approach will cost much less than the government alternative of subsidizing the fuel cost of in-house diesel generators deployed by big industrial and commercial firms during the peak summer months.

Enhancing solar generation and LED lighting complementation

Embedded (i.e., behind the meter) solar power reduces daytime demand, while LED lighting reduces night-time demand. These two technologies are therefore perfect complements. Both are highly cost-effective demand-side measures that deserve priority government support. By combining the two, the need for more expensive supply-side flexible plants is reduced.

Roadmap D: conventional electricity generation technologies

Establishing and implementing regulations to decrease environmental pollution from conventional power plants

Based on existing and committed projects in the pipeline, the Philippines will be locked in to coal plants for the next three decades. The Clean Air Act was approved in 1999, and the emission levels prescribed in the law must be updated to meet international standards. Even the relatively low standards in the law are not strictly implemented, and penalties on offending plants are minimal. To cover externalities such as health and environmental costs, penalties based on the “polluter pays” principle must be enforced. With these schemes, investors will be pushed towards cleaner technologies. Coal plants that fail to meet international standards must not be allowed to operate. Existing plants that have already exceeded their planned lifespan must either be shut down or renovated to meet GHG emission goals and pollution standards.

Re-engineering conventional generation technologies for flexible operation

Strict requirements for flexible generation must be imposed on conventional power plant generation, i.e. minimum stable load, ramp rate, and start-up/shut-down times. With these parameters, conventional power plants will adhere to economic dispatch schedule. These requirements must be imposed prior to construction, since any changes after completion of the plant will be very costly. Flexible generation will facilitate integration of VRE resources, and avoid the negative pricing experienced by other countries where the outputs of baseload plants are difficult to curtail. There should be sufficient remuneration on plants that are needed to provide system stability.

Minimizing the risks of stranded costs and assets

Conventional tariffs are computed using high minimum capacity loads, which if not utilized will lead to stranded

costs. These costs may eventually be passed on to the consumers. Like the cap on fuel costs, there must be a similar cap on stranded costs that could be passed on by power producers to consumers or the government.

Using tax policy to influence capacity and generation mix

Tax policy can be honed to play a part in the determination of the capacity and generation mix. As the levelized costs of RE technologies continue to decline and achieve parity with conventional thermal generation, carbon taxation and pricing will force thermal plants to internalize more costs, pre-empting the continued operation of plants whose capital costs have been recovered and that may run as highly polluting merchant plants. The asymmetry today between taxes on coal and oil products should be corrected, moving specific oil taxes to a more general carbon tax. This is also consistent with global trends in carbon taxation.

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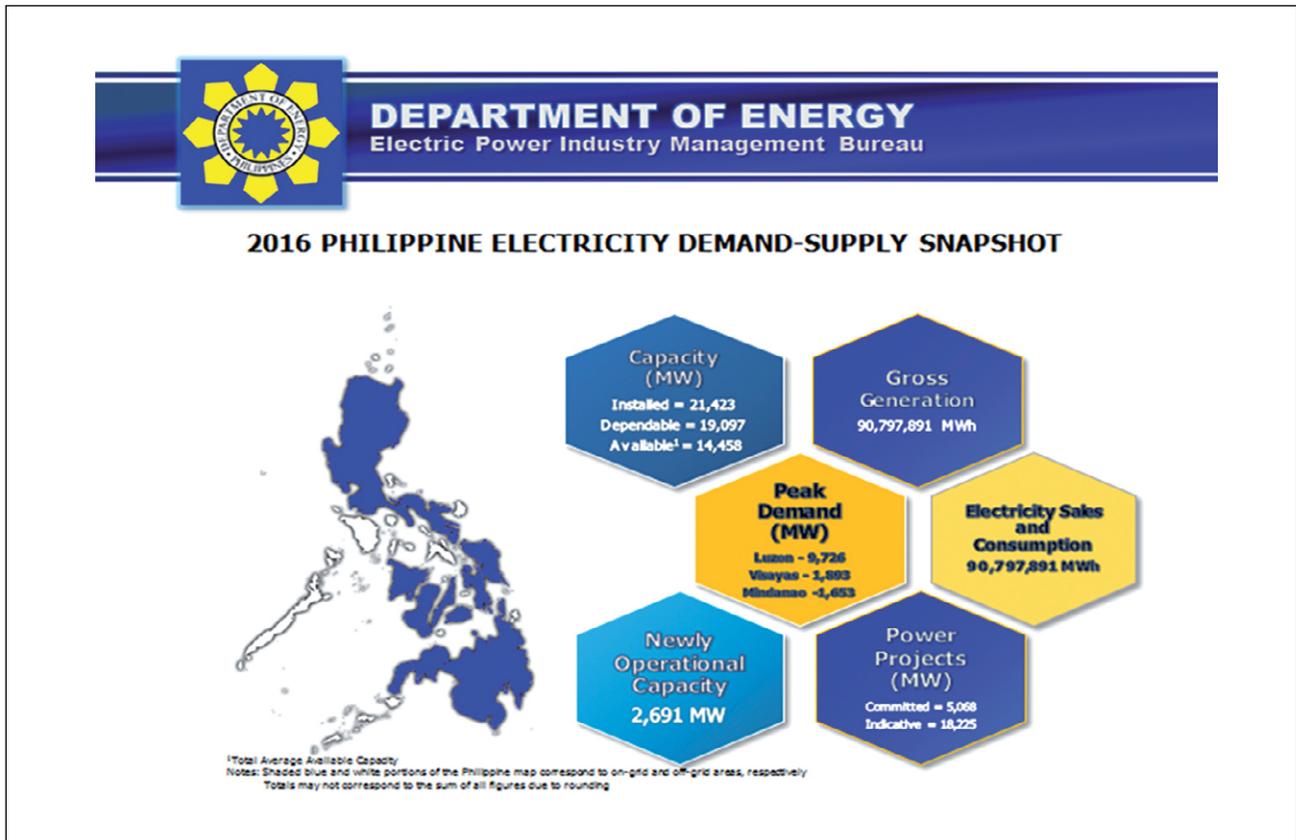
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Annexes

Annex 1: Political, Economic, Social and Technological Analysis

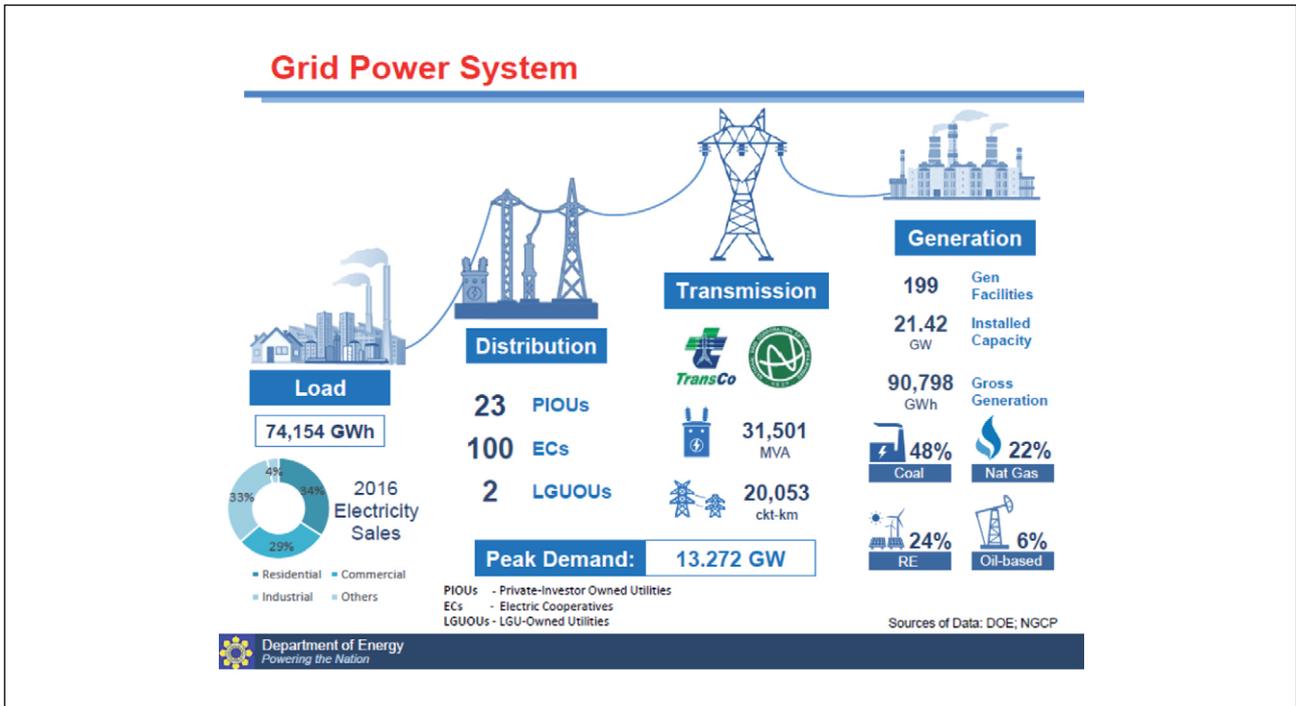
Political	Economic
<p>Ecological & Environmental Legislation</p> <ul style="list-style-type: none"> – Clean Air Act, Ecological Solid Waste Management Act, Climate Change Act, Toxic Substances, Hazardous & Nuclear Waste Act, Environmental Awareness & Education Act, Fisheries Code, Indigenous Peoples Rights Act, Water Crisis Act, National Integrated Protected Areas System Act, National Water & Pollution Control Act, plus many Presidential Decrees and Codes still in force <p>Energy & Electric Power Legislation</p> <ul style="list-style-type: none"> – Build, Operate and Transfer Law, Electric Power Crisis Act, EPIRA, Renewable Energy Act, Biofuels Act, National Electrification Act <p>Regulatory Agencies</p> <ul style="list-style-type: none"> – DOE, DENR, ERC, NEA, PEMC, National Water Resources Board, National Commission on Indigenous People, NREB, Biofuels Board <p>Government Policies</p> <ul style="list-style-type: none"> – Ensure sustainable, stable, secure, sufficient, accessible & affordable electricity and energy <ul style="list-style-type: none"> • Accelerate the exploration and development of indigenous and RE sources • Reduce the dependence on fossil fuels to minimize the country's exposure to international market price fluctuations – Mitigate climate change & preserve the environment • Reduce harmful emissions & thereby balance the goals of economic growth with the protection of health and the environment. – Transparent and reasonable prices of electricity in a regime of free and fair competition <ul style="list-style-type: none"> • Deregulation of the generation sector <ul style="list-style-type: none"> - Privatization of generation and transmission - Unbundling of supply activities • Elimination of cross subsidies • Free market policy <ul style="list-style-type: none"> - Retail competition - Open access - Wholesale electricity spot market 	<p>Economy</p> <ul style="list-style-type: none"> – One of the best performing economies in Asia and in the world, registering annual average GDP growth of over 6 % p.a. since 2010 – Investment grade raised by major investment rating firms from BBB- to BBB/A-2 <ul style="list-style-type: none"> • Lower foreign & domestic interest rates • Easier access to both foreign & domestic funds – Fiscal and non-fiscal incentives are granted to power generation projects – But renewable and clean energy incentives are delayed, suspended, or terminated <p>Industry</p> <ul style="list-style-type: none"> – Power shortages being experienced in the main grids and off-grid areas <ul style="list-style-type: none"> • Daily brown-outs in Mindanao due to poor infrastructure • Very thin reserves in Luzon & Visayas • Push to build more coal-fired plants, with more than 45 in the pipeline – Mindanao is not yet connected to the Luzon and Visayas grid – Transmission and distribution lines are not able to withstand strong typhoons and require long time to restore <p>Seasonality Issues</p> <ul style="list-style-type: none"> • Higher electricity demand combined with lower supply during the summer season from hydro-power sources lead to shortages • Brown-outs and black-outs during the typhoon season, because of damaged transmission & distribution lines • Planned maintenance and breakdowns of power plants depletes the thin power reserves <p>Power Rates</p> <ul style="list-style-type: none"> – Electricity rates are among the highest in the world <ul style="list-style-type: none"> • Rates for a typical residential household in April 2017 in Meralco franchise area was US\$ 0.20 per kWh • Parity with retail electricity rates for solar has already been reached since 2015 <p>International Issues</p> <ul style="list-style-type: none"> – Highly dependent on imported fuel and subject to fluctuations in international prices – Sixty per cent share of the capital of RE plants must be owned by Filipinos
<p>Social</p> <p>Demographics</p> <ul style="list-style-type: none"> – Population reached 104 million in July 2017, ranking the Philippines 13th in the world – Young population with 34.6% in the 0-14 age bracket, and only 4.3% in the over-65 age range – There are more than 2.3 million Filipinos working in foreign countries <p>Literacy</p> <ul style="list-style-type: none"> – 97.5% can read and write – More than 65% of the population can speak and understand English <p>Consumer Attitude</p> <ul style="list-style-type: none"> – Among the world's most optimistic, with consistent high confidence levels about the future – Increased consumer spending for travel and leisure – More health conscious – Willing to pay higher rates for clean energy 	<p>Technological</p> <p>Competing Technologies</p> <ul style="list-style-type: none"> – Coal, natural gas, oil, nuclear, solar, hydro, wind, waste-to-energy, biomass, ocean, fuel-cell and geothermal – Costs of solar panel dropped by about 80% from 2009 to 2014, while costs of wind power systems are stable with increased efficiencies – Storage costs remain high, but projected to decline at an increasing rate <p>Manufacturing and Construction</p> <ul style="list-style-type: none"> – Limited manufacturing capability for power equipment, components and systems – Lack of the experienced technical personnel and equipment who are needed in the construction and installation of solar, wind and other emerging RE technologies <p>Research and Development Capability</p> <ul style="list-style-type: none"> – Limited to none

Annex 2. 2016 Philippine electricity demand and supply



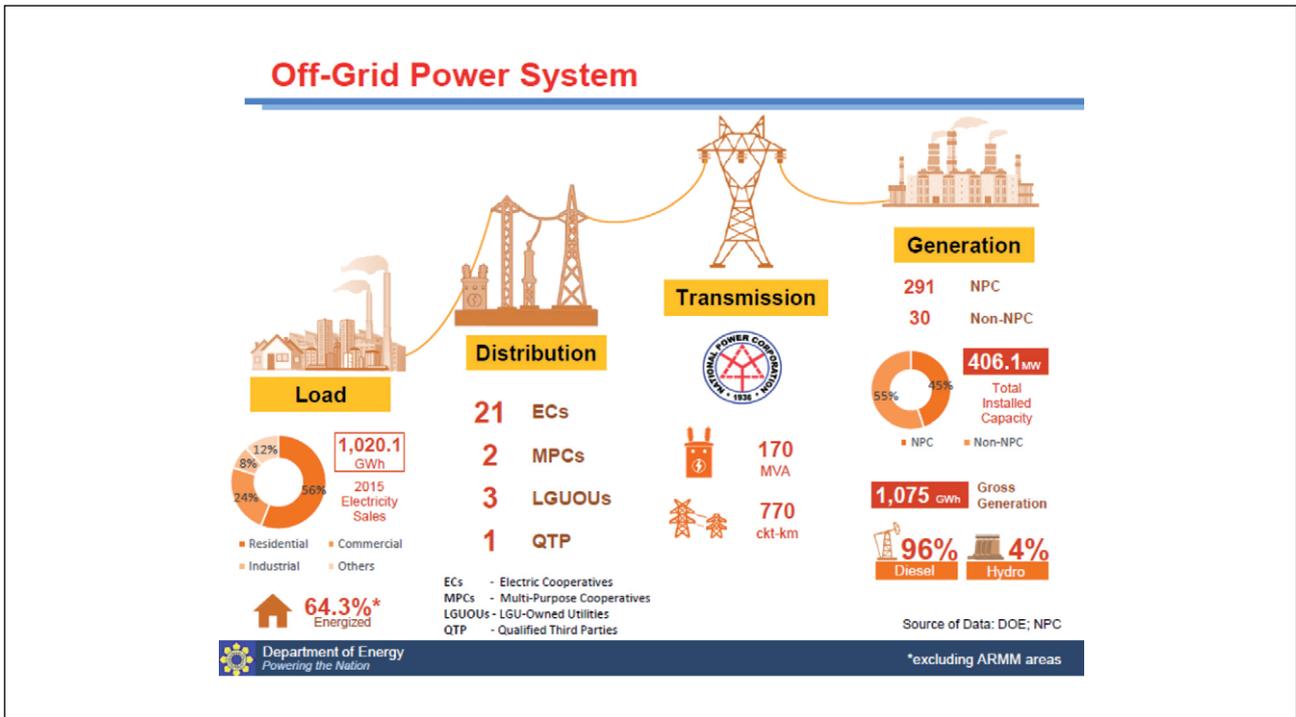
Source: DOE Undersecretary Felix William Fuentebella, "Power Development Plan 2040" presented at the 5th Philippine Power and Electricity Week on July 19, 2017.

Annex 3: On-grid power system



Source: DOE Undersecretary Felix William Fuentebella, "Power Development Plan 2040" presented at the 5th Philippine Power and Electricity Week on July 19, 2017.

Annex 4: Off-grid power system



Source: DOE Undersecretary Felix William Fuentebella, "Power Development Plan 2040" presented at the 5th Philippine Power and Electricity Week on July 19, 2017.

About the authors

Roberto S. Verzola is an electrical engineer with a background in economics. He has also spent several decades working with non-profits and campaign groups, from his college days as a student activist, including time as a political prisoner in the early 1970s, and serving non-profits and campaign groups as a technical resource person since the 1980s. Today, he is president of the non-profit Center for Renewable Energy and Sustainable Technology (CREST).

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Pedro H. Maniego, Jr. is a professional industrial engineer, lawyer, and economist with around 50 years of experience as a top executive in major Philippine and multinational corporations. He is the Chairman of the University of the Philippines (UP) Engineering Research and Development Foundation, Co-Champion of the Power and Energy Working Group of the National Competitiveness Council, Senior Advisor to the Institute for Climate and Sustainable Cities, Adviser to the Climate Change Commission, and Trustee of the Institute of Corporate Directors. He was Chairman of the National Renewable Energy Board from 2010 to 2016, professor in the UP College of Engineering from 1970 to 1979, and lecturer in the UP Law Center. A firm advocate of sustainable development and corporate governance, he regularly serves as speaker, resource person or consultant on these matters to private companies, government agencies, corporations, and civil society groups.

Philippines study copy-edits

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Founded in 1925, FES is named after Friedrich Ebert, the first democratically elected president of Germany. With an international network of more than 100 offices worldwide, it contributes to fostering the core values of social democracy - freedom, solidarity and social justice. Promoting sustainable development models for many decades, FES established a new global working line focusing on climate justice and social-ecological-transformation in 2010.

Since 2015, FES Vietnam has served as a regional hub in the field of climate change, energy, and the environment for the work of Friedrich-Ebert-Stiftung in Asia.

The Manila office of Friedrich-Ebert-Stiftung (FES) started to focus its climate program on energy and the transition to renewable sources in 2010. Since then, FES Manila has been working with local partners to provide platforms for coming up with all-inclusive strategies to implement more viable and sustainable energy source alternatives.