International Renewable Energy Agency

RENEWABLES
READINESS ASSESSMENT

THE PHILIPPINES

March 2017

IRENA
International Renewable Energy Agency

ISBN 978-92-9260-003-7 (print)
ISBN 978-92-9260-004-4 (PDF)

Citation:
IRENA (2017), *Renewables Readiness Assessment: The Philippines*, International Renewable Energy Agency, Abu Dhabi.

About IRENA

The International Renewable Energy Agency (IRENA) is an intergovernmental organisation that supports countries in their transition to a sustainable energy future, and serves as the principal platform for international cooperation, a centre of excellence, and a repository of policy, technology, resource and financial knowledge on renewable energy. IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy, in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity.

Acknowledgement

The International Renewable Energy Agency (IRENA) and the Department of Energy of the Republic of the Philippines would like to express sincere appreciation for the invaluable contributions of numerous energy experts and stakeholders in the preparation of this joint publication. This report benefited greatly from their review and insightful comments and input. Special thanks to His Excellency Alfonso G. Cusi, the Energy Secretary; Richie Avigale Ramos-Pilares, Assistant Secretary for the Renewable Energy Management Bureau, Gaspar G. Escobar, Jr., Chief, Technical Services and Management Division of Renewable Energy Management Bureau; Pete H. Maniego, Jr., Chairman of the National Renewable Energy Board; Lily L. Gutierrez and Enrique Gallardo, Jr., of the United States Agency for International Development; and Maria Eloida Balamiento, Senior Energy Adviser for EU-SWITCH, Policy Support Component.

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The contribution of Hendrik Meller and Ferdinand Larona of the German International Cooperation Agency (Gesellschaft für Internationale Zusammenarbeit), specifically with respect to mapping out the administrative procedures for on-grid solar PV project development, is also greatly appreciated.

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FOREWORD
from the Secretary of Energy

In recognition of the importance of indigenous energy options to enhance the economic growth and improve livelihoods, the Philippine Department of Energy (PDOE) has been exploring a variety of options to build an energy independent future supplied by sustainable, stable, secure, sufficient, accessible and reasonably-priced energy sources. In pursuit of this ultimate goal, the Philippines has stepped up its efforts in promoting the deployment of indigenous renewables energy over the past few years.

Blessed with abundant renewable energy resources, including geothermal, biomass, solar, wind and hydrological energy sources, the Philippines has already made significant achievements in developing these resources, such as being the second largest geothermal power producer in the world. The use of new renewable energy sources, such as solar and wind energy, has also dramatically increased thanks to the great interest from the private sector and as a result of the favourable policy framework that is in place.

Nevertheless, the rapid scale-up of renewables reached a milestone where a systematic assessment became necessary. In this context, the PDOE through its Renewable Energy Management Bureau (REMB) has closely collaborated with International Renewable Energy Agency (IRENA) to conduct a Renewables Readiness Assessment (RRA). The process aims to identify the gaps that must be filled or narrowed if the national goal of being energy independent is to be achieved. Through the process, constructive engagement from the bilateral and multilateral co-operation agencies, financial institutions and the private sector, was sought. To this end, this study has also defined the priorities that the PDOE would like to continue working in close co-operation with relevant stakeholders. This would provide directional guidance for them to direct their resources towards a common target.

The Philippines has already initiated some of the recommended actions in the RRA report; for example, a mini-grid study for the Philippines with the continued support from IRENA. In line with the recommendations, REMB has been substantially strengthened with additional staff to better serve the renewable energy sector.

Lastly, on behalf of the PDOE, I would like to express our gratitude to IRENA as well as other development partners including Asian Development Bank, Germany's International Cooperation Agency (GIZ), the United States Agency for International Development (USAID) and the European Union (EU) for their invaluable support and technical assistance, and we look forward to a long and fruitful relationship in the future.

Alfonso G. Cusi
Secretary of Energy
The Philippines

FOREWORD
from the IRENA Director-General

Like many countries in South East Asia, the Philippines faces the challenge of a growing population and rising demand for energy to power its economic growth. Yet nearly half of its primary energy supply is imported, making the country vulnerable to rising costs for fuel imports and global oil price volatility. At the same time, the Philippines is frequently exposed to tropical storms and natural disasters that adversely impact its energy infrastructure.

In response to these challenges, the Philippines has resolved to bolster its energy security and pursue low-carbon economic development while taking an active part in global efforts to address climate change. Renewable energy technologies have become increasingly prominent in national planning and policy-making and are gaining importance in the realisation of the country's sustainable development objectives. In 2011, the Philippines set an ambitious renewable energy target of 15.3 gigawatts by 2030. With the entry into force of the Paris Agreement, renewable energy is poised to play an even bigger role in meeting climate objectives and in the decarbonisation of the energy sector.

This Renewables Readiness Assessment (RRA), undertaken in co-operation with the government of the Philippines, examines the energy sector holistically and identifies barriers, as well as key actions to accelerate renewable energy deployment. In this regard, it puts forward options to strengthen the Philippines' renewable energy policy, regulatory and institutional framework. It includes an assessment of the country's grid infrastructure and examines the institutional capacity in the Philippine renewable energy sector, along with the potential for electrification through renewable-based mini- and micro-grid solutions.

Some 30 countries, spanning Africa, the Caribbean, Latin America, the Middle East and the Asia-Pacific region, have undertaken the RRA process since 2011, exchanging knowledge and supporting international co-operation to promote clean, indigenous renewable energy technologies.

IRENA wishes to thank the Renewable Energy Management Bureau at the Department of Energy of the Philippines for providing continuously strong and valuable support. I am encouraged by the active participation and contributions of the international community, including the Asian Development Bank, Germany's International Cooperation Agency (GIZ), the United States Agency for International Development (USAID) and the European Union (EU). A range of stakeholders in the Philippines, meanwhile, provided enthusiastic and serious engagement, without which the process could not have succeeded.

I sincerely hope these RRA findings will strengthen the pursuit of renewable energy solutions. IRENA stands ready to support the Philippines as the country strives for a sustainable energy future.

Adnan Z. Amin
Director-General
International Renewable Energy Agency

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ABBREVIATIONS

AMORE	Alliance for Mindanao Off-grid Rural Electrification
ASEAN	Association of Southeast Asian Nations
CEPALCO	Cagayan Electric Power and Light Company
EPIRA	Electric Power Industry Reform Act
ERC	Energy Regulatory Commission
FiT	Feed-in-Tariff
GDP	gross domestic product
GIZ	German International Cooperation Agency (Deutsche Gesellschaft für Internationale Zusammenarbeit)
GW, GWh	gigawatt, gigawatt-hour
IPP	independent power producer
kW, kWh	kilowatt, kilowatt-hour
m/s	metre per second
Meralco	Manila Electric Company
MW	megawatt
NREB	National Renewable Energy Board
NGCP	National Grid Corporation of the Philippines
NPC-SPUG	National Power Corporation Small Power Utilities Group
NREL	National Renewable Energy Laboratory
NREP	National Renewable Energy Program
PHP	Philippine Peso
PSA	power supply agreement
QTP	qualified third party
RPS	renewable portfolio standard
RRA	Renewables Readiness Assessment
TPES	total primary energy supply
TRANSCO	National Transmission Corporation
UCME	Universal Charge for Missionary Electrification
USAID	United States Agency for International Development
USD	US Dollar

EXECUTIVE SUMMARY

Cabanatuan Solar Power Project
Photo: First Cabanatuan Renewable Ventures, Inc.

The Philippines is a net fossil energy importer and depends heavily on imports of oil for transport, and coal for power generation. On average, nearly half the country's primary energy supply is imported. In addition, due to its geographical location, the country's energy infrastructure is frequently exposed to tropical storms. At the same time, strong power grid interconnections with other countries in the Association of Southeast Asian Nations (ASEAN) as part of the proposed ASEAN Power Grid may not be realised in the near future.

As a result, the country continues to face energy security challenges. Energy independence has become a central aim of policy development to ensure sustainable, reliable, secure, sufficient and accessible energy.

In 2011, the Philippines set an ambitious renewable energy target to raise installed generation capacity by 2030 to almost three times its 2010 level i.e. from 5,438 megawatts (MW) to 15,304 MW. This was established in the National Renewable Energy Program (NREP), which serves as the blueprint for the implementation of the Renewable Energy Act of 2008. This has put the country on a course to meet half its electricity demand with renewables and thus to strengthen energy security. At the same time, this would reduce electricity tariffs in remote areas and islands.

One year after the target was set, Feed-in-Tariffs (FiTs) were issued by the Energy Regulatory Commission (ERC). The Philippines has since then made remarkable achievements in renewable energy deployment. This has taken place not only in the northern region, where the wind resource is great, but also through urban rooftop solar PV. This has been due largely to dramatically declining costs for renewable energy technologies like solar and onshore wind, as well as to attractive FiT schemes.

As a result, the industry has also grown rapidly, fuelled by increasing domestic and overseas investments and thus transforming power markets and business models. ASEAN recently set a regional renewable energy target of 23% by 2025, and this has provided the Philippines with an additional important reason for pursuing cleaner and sustainable alternative energy. Yet emerging concerns need to be resolved in relation to future policy making and institutional evolution in the renewable energy sector. Only then will the country maintain its development momentum and achieve the ultimate policy objective of energy independence by replacing imported fossil fuels with indigenous renewables.

The Renewables Readiness Assessment (RRA) identified and analysed key challenges, recommended action to deal with issues it revealed and offered guidance on fine tuning the Philippine renewable energy policy, regulatory and institutional framework.

Recommended actions

1. **Raise awareness to ensure sustained political commitment**
   In the Philippines, public awareness plays a very important role in influencing the political commitments, decisions and the orientation of public policies. Raising public awareness on the benefits of renewable energy applications is hence essential. The Philippines has the second highest electricity tariff in the region so the economic benefits of adopting renewables have major implications for the general public, especially in the rural areas and islands, where fuel costs are prohibitively high. This is one of the important economic factors explaining regular interruption of the power supply. Renewable energy sources have proved to be the most cost-effective options in these settings, thanks to their near-zero marginal production costs for electricity. Some renewable energy technologies, notably solar PV, have experienced sharp cost reductions. Affordability could thus be significantly improved if capital costs were brought down with the support of the government.

   A range of different stakeholders should initiate a series of public campaigns with the assistance, participation and resources of the development partners. Educational programmes could be set up to provide the public with real examples and can also be used to provide practitioners with hands-on experience.

2. **Assess the country's grid infrastructure**
   A comprehensive grid evaluation with a focus on grid stability is recommended for the islands of Luzon, Visayas and Mindanao. This includes an analysis of the present state of the infrastructure, quality of service and power flow, and stability assessments responding to solar or wind generation inputs at various points and different penetration levels. This would better explain how the connection of variable renewable sources affects the grids to thus minimise potential grid operation problems.

   The results allow the development of proactive energy planning relating to generation, transmission and distribution networks, producing the standards and guidelines for future grid-connected solar PV and wind systems.

   The completion of this recommended study should be followed by a training programme. This would equip the utilities with the knowledge necessary to understand the results and also modify the model when there are changes to the grid.

3. **Examine institutional capacity in the Philippine renewable energy sector**
   A thorough institutional capacity assessment of the Department of Energy Renewable Energy Management Bureau and other relevant agencies is recommended accompanied by an assessment of stakeholders. Its aim should be to analyse their legal mandates and responsibilities for implementing the Renewable Energy Act and the NREP in comparison to their current functions and capacity. It should examine the existing co-ordinating mechanisms of these agencies alongside new and emerging challenges in the Philippine renewable energy development, and the new sets of skills and personnel required to overcome them.

This will draw out and build on the Renewable Energy Management Bureau's current expertise. It will identify the existing skills of current personnel, analysing its wide network to intensify collaborative action, and will explore the efficient use of available resources. The programme will identify the skills and resource deficiencies within the Renewable Energy Management Bureau and key stakeholders in order to address their capacity-building needs. The ultimate goal is to equip the Renewable Energy Management Bureau with the appropriate capacity level while improving the ability of other key stakeholders in the sector to function and perform in a co-ordinated fashion.

As a result of the study, recommendations on improving these capacities will be presented to the Department of Energy and other governmental agencies most relevant to renewable energy sector institutional development in the Philippines. The results can also be presented to development partners to design more effective capacity-building programmes aided by various technical assistance programmes.

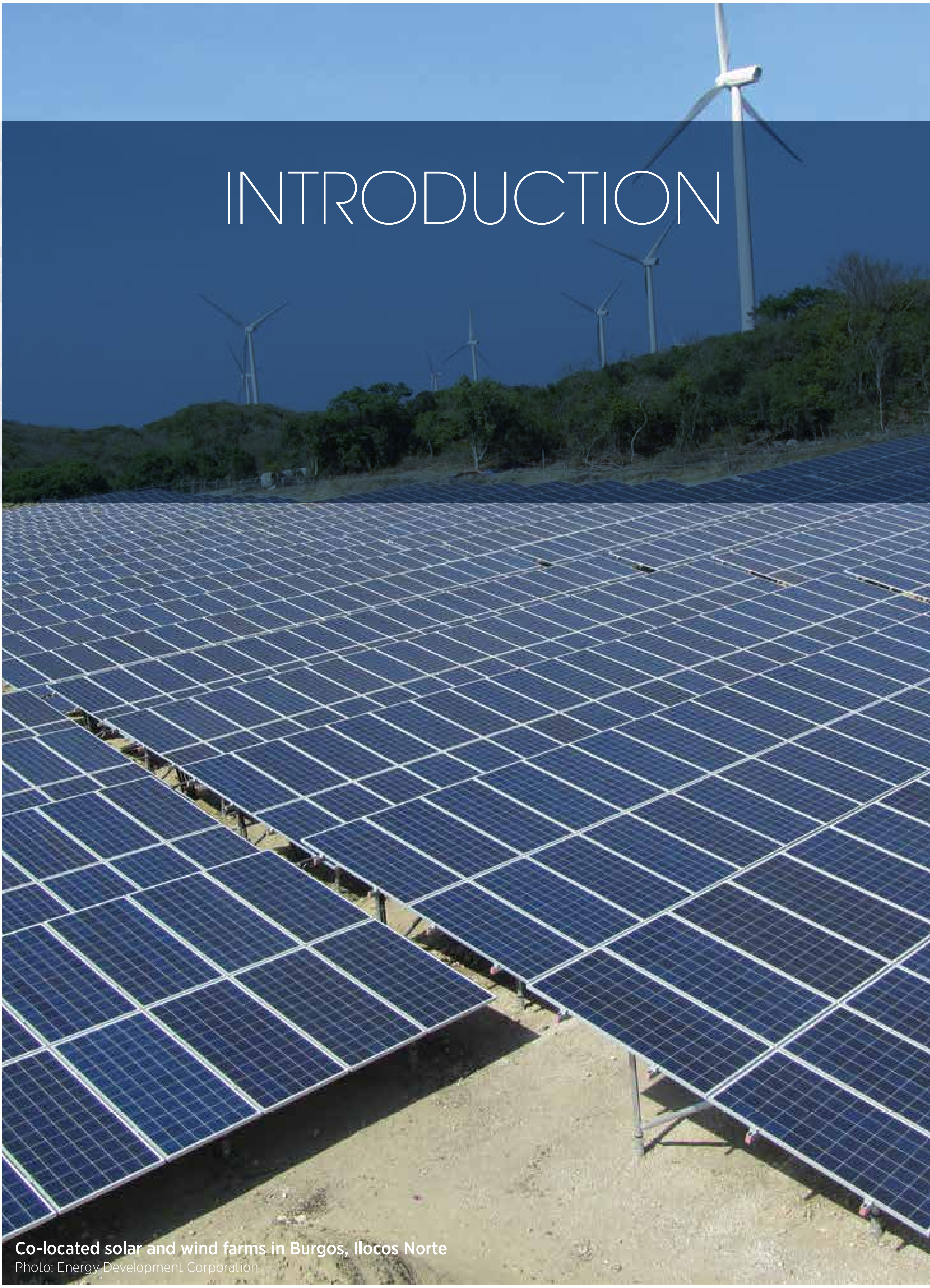
4. **Study potential for renewable electrification through mini- and microgrids**

   The recommended study should cover a range of topics. These include an estimation of physical potential, an assessment of existing policies and regulatory frameworks, technological options/guidelines, business models and long-term social and economic benefits that such systems can generate for society as a whole. It would concentrate on islands and remote regions without electricity where mini-grids powered by renewable energy can be economically viable and also used to promote rural development.

   The recommended study should also consider potential sites for mini-grids and explore renewable energy technology options and available resources that could be tapped for power supply. It should identify barriers and concerns and come up with alternative approaches and recommendations to promoting renewable energy in off-grid areas. In particular, it should examine the franchise areas of electric co-operatives with the highest mini-grid potential. Mini-grids offer numerous advantages, including easier power service restoration after a natural disaster, improved quality of life and income-generating opportunities. These should be studied in relation to rural electrification in the Philippines.

   Finally, the study should produce recommendations to develop the policies and regulatory frameworks necessary to promote investment in mini-grids and facilitate private sector engagement.

INTRODUCTION



Co-located solar and wind farms in Burgos, Ilocos Norte
Photo: Energy Development Corporation

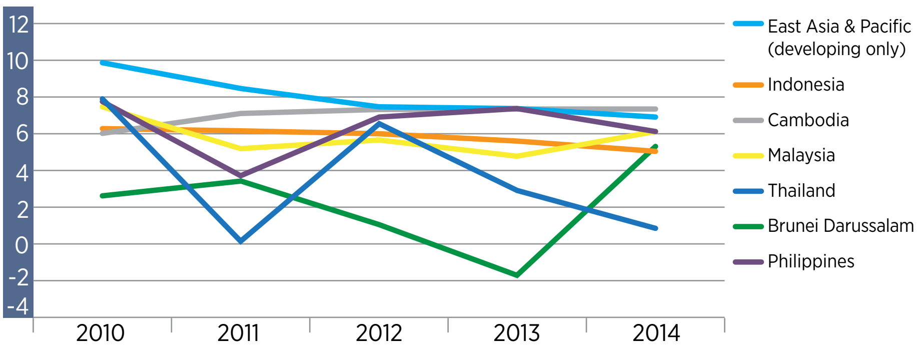
01

1.1 Country background

The Republic of the Philippines ("the Philippines") is a country in Southeast Asia composed of an archipelago of 7,107 islands in three main groups: Luzon, Visayas and Mindanao. The population exceeds 100 million, approximately 55% of which still lives in rural areas. The country is divided into 18 regions and administered under 81 provincial governments (Worldometers, 2015; World Bank, 2014).

From 2010 to 2014, the Philippine economy grew at an average annual rate of 6.3% (World Bank, 2015) despite the devastation caused by a series of natural disasters throughout 2013, including super typhoon Yolanda (Haiyan).[1] This has made the country among the strongest economies in ASEAN, as illustrated in Figure 1. The 2016 growth rate was estimated by the Asian Development Bank and the World Bank at 6.3% and 6.5% respectively. This would rank the Philippines as the country with the third fastest economic growth after China and Vietnam, according to the Economic Planning Secretary and National Economic and Development Authority.

Figure 1. Annual GDP growth, 2010-2014



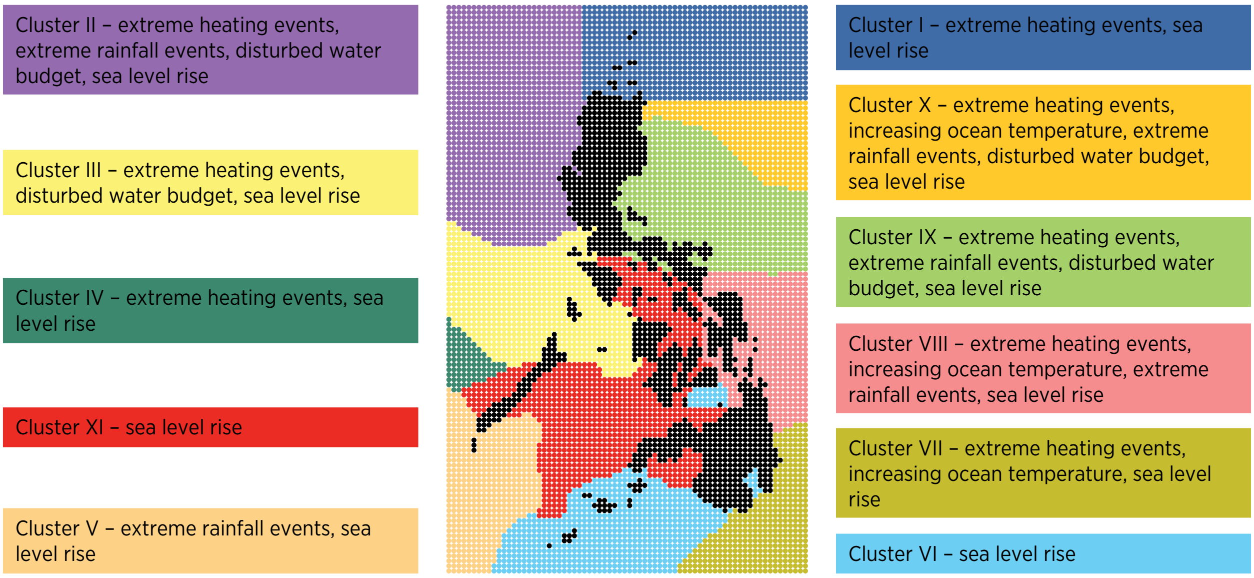
Source: World Bank, 2015

[1] Occuring in November 2013, the typhoon killed more than 6,000 people and left around four million without homes or shelter.

Due largely to its geographical location and densely inhabited coastal regions, the Philippines is highly exposed to severe tropical weather and extremely vulnerable to climate change, as shown in Figure 2. The people affected by these natural disasters often bear significant economic loss and as a result can fall back into poverty. For instance, in several provinces in the Autonomous Region of Muslim Mindanao, poverty incidence exceeds 55%. In the Eastern Visayas, which was struck by typhoon Yolanda, it is 37%. The National Capital Region has the lowest incidence of poverty, which is at 2.6% according to the National Statistical Coordination Board (NSCB, 2015). Among the three, the Autonomous Region of Muslim Mindanao has the highest proportion of areas in the country lacking electricity (apart from areas affected by Yolanda) (National Electrification Administration, 2015).

With 274 disasters over the past two decades, the Philippines has been ranked as the country with the fourth highest number of natural disasters in the world after the United States of America, China and India. During that period, 130 million people in the Philippines were affected by these disasters – the fourth highest number in the world after China, India and Bangladesh (United Nations International Strategy for Disaster Reduction, 2015).

Figure 2. Philippine exposure to climate change



Source: Philippine Department of Environment and Natural Resources, 2013

The Philippines has set an ambitious renewable energy target to raise installed generation capacity by 2030 to almost three times its 2010 level. The ASEAN region recently set a renewable energy target of 23% by 2025, providing the Philippines with an additional important reason to pursue cleaner and sustainable alternative energy. There are a range of social benefits, too. Scaling up renewable energy system deployment will not only improve energy supply security given its indigenous renewable energy resources but also create a variety of job opportunities for local people, for which there is high demand.

In this context, the RRA was conducted at the request of the Philippines and in close collaboration with the country's Renewable Energy Management Bureau. The aim was to assess the country's position on renewable energy development and deployment, and to identify the issues to resolve to unlock the remaining potential renewable energy sources in the Philippines.

1.2 Renewables Readiness Assessment

IRENA developed the RRA as a tool for carrying out a comprehensive evaluation of the conditions for renewable energy deployment in a particular country. The RRA is a country-led and consultative process. It provides a venue for multi-stakeholder dialogue to identify challenges to renewable energy deployment and to come up with solutions to existing barriers. Short- and medium-term recommendations are presented to governments to guide the development of new policies or reform of existing policies to open up a more enabling environment for renewable energy. The RRA also consolidates existing efforts and mobilises available resources for priority action.

IRENA and the Department of Energy worked alongside a local expert to conduct research, set the process in motion and co-ordinate with relevant stakeholders. The first step in the RRA process was to prepare a background paper which presented an overview of the geographical, economic and social environment of the Philippines. It describes the present status of the energy sector, available renewable energy resources, and the energy policies, programmes and strategies adopted thus far to advance renewables use.

To prepare the background paper, a review of recent studies and reports by the country's development partners such as the Asian Development Bank, the United States Agency for International Development (USAID) and the World Bank was carried out to assess what has already been done. These studies identified challenges and deficiencies affecting the renewable energy sector and outlined interventions to resolve concerns relating to renewable energy development and deployment.

The local team interviewed key stakeholders (project developers, financial institutions, government agencies and academia) to validate these issues and to gather first-hand information on what is already happening on the ground.

Four focus groups examined the critical issues raised during the interviews and literature review to identify root causes and conceive possible interventions. In particular, they discussed the following renewable energy sector concerns: (a) lengthy and costly permitting process (b) lack of appropriate (technical) human resources in the sector and (c) ineffective design and lack of implementation of the National Renewable Energy Program (NREP) to accelerate renewable energy deployment.

An issues paper was then prepared to consolidate the outputs of these activities including the salient findings and recommendations of past studies on renewable energy development. It features an issues map that presents in graphic form how challenges interrelate and draws attention to the greatest bottlenecks.

The paper reinforces the findings of past studies and reveals persisting challenges to renewable energy development. It also generates recommendations to resolve them.

In co-ordination with the German International Cooperation Agency (Gesellschaft für Internationale Zusammenarbeit – GIZ), IRENA and the Department of Energy jointly organised and conducted a round table and action planning workshop. This brought together stakeholders from across the whole country to discuss appropriate action to overcome barriers to renewable energy deployment.

Three bottlenecks were prioritised for discussion. They are related to a) institutional capacity development b) proactive power system planning and c) permits. The two-day workshop culminated in a session to prioritise possible interventions and converted them into actions incorporated in the recommendations section of this report. The RRA recommendations will be presented to the National Renewable Energy Board (NREB), a multi-sector body that oversees the direction of the renewable energy sector and guides the development of the National Renewable Energy Program (NREP). The NREP serves an implementation roadmap for the Renewable Energy Act of 2008.[2]

The Philippines RRA assesses the current state of the renewable energy sector and its challenges. It makes recommendations to bridge the implementation gaps in the sector and accelerate the use of the country's abundant renewable energy resources.

[2] It is also known as the Republic Act No. 9513: An Act Promoting the Development, Utilization and Commercialization of Renewable Energy Resources and for Other Purposes. The full text of the act is available at www.doe.gov.ph/laws-and-issuances/republic-act-no-9513.

ENERGY CONTEXT

234 MW TIWI Geothermal Power Plants
Photo: AP Renewables Inc.

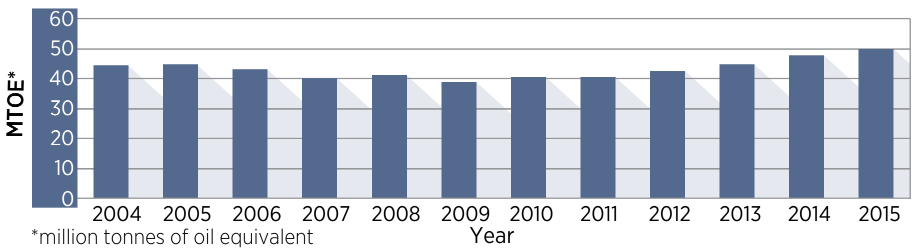
02

As a net fossil energy importer, and a country whose energy infrastructure is inevitably exposed to tropical storms, the Philippines has constantly battled with energy supply security. The threat of power shortages in 2015 was successfully reduced. However, this experience sent a warning signal to decision makers and has provoked public debate on the appropriate type of power grid for the Philippines in future. This is a particular concern because the Philippines may not be able to establish strong interconnections with the ASEAN Power Grid due to its geographical location.[3] Energy independence is therefore the core of energy policy development in the Philippines to ensure sustainable, reliable, secure, sufficient and accessible energy.

2.1 Energy supply and demand

Between 2004 and 2015, global oil prices surged from around 20 US dollars (USD) per barrel in 2004 to peak at USD 147/barrel in 2007. Since 2014, Philippine total primary energy supply (TPES) has returned to its 2005 level following the dip observed in 2007-2009. This is because one-third of national energy demand correlates largely with the changes of oil prices over that period, as shown in Figure 3.

Figure 3. Trends in total primary energy supply, 2004-2015

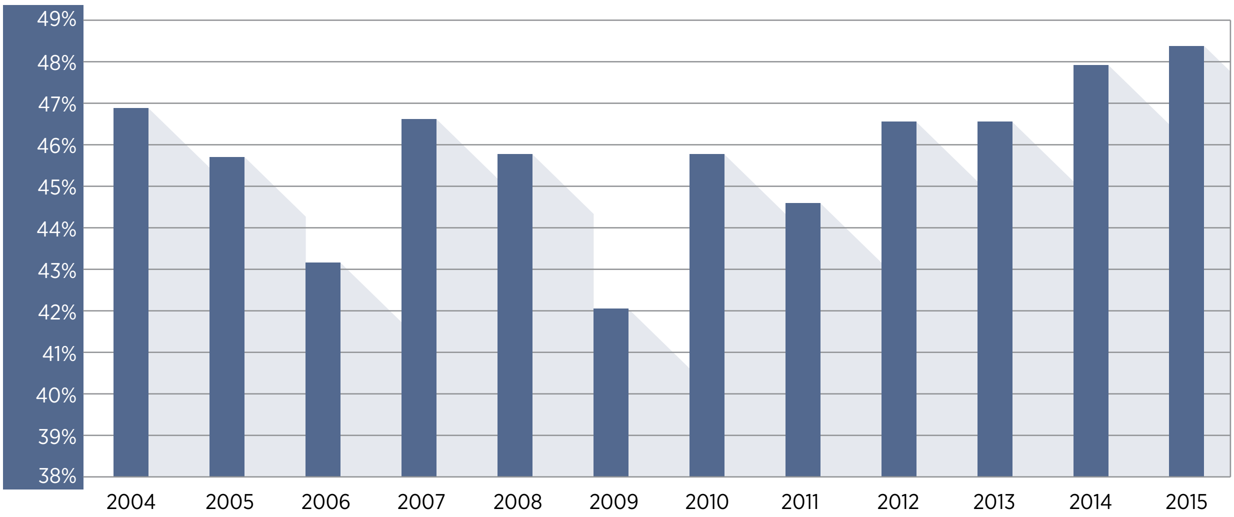


Source: Based on data from the Philippine Department of Energy, 2015

[3] Only one power interconnection project is planned in the Asian Power Grid, namely between the Philippines and Sabah (Malaysia). It has a transmission capacity of 500 MW and is due to be completed in 2022. The country is thus forced to be independent as far as electricity production is concerned.

The Philippines has over that decade been heavily dependent on imported energy – mostly oil and coal for transport and power generation. Over the period, on average nearly half the TPES was imported, as shown in Figure 4. According to the Philippine Department of Energy, the importation of coal reached a record high of 15.2 million tonnes of coal equivalent in 2014 – mostly from Indonesia. Figure 5 indicates that coal accounted for 22% of TPES in 2015. The share of oil in TPES has stagnated at about 30%, and natural gas at 7%-8%. With a significant number of coal power projects in the pipeline, amounting to nearly six gigawatts (GW), the energy dependency ratio measured in million tonnes of oil equivalent could rise even higher. This would therefore have a negative impact on energy and electricity security despite lower energy commodity prices globally.

Figure 4. Energy dependence ratio, 2004-2015

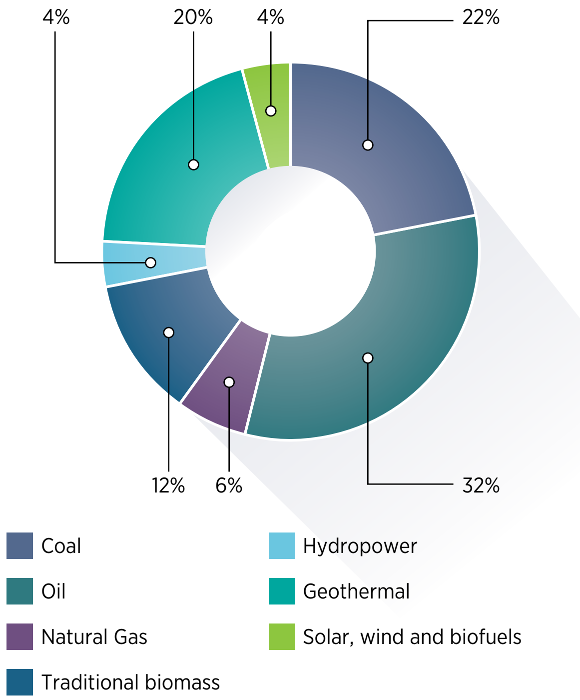


Source: IRENA

Since the Philippines is both in the tropical region and the Pacific "Ring of Fire", biomass and geothermal energy contributed about 12% and 20% respectively to TPES in 2015. The Philippines produces the greatest amount of geothermal electricity in the world while the majority of biomass is consumed in traditional ways. The other renewables represent about 8% of TPES, including hydropower, solar and wind.[4]

Between 2011 and 2015, the residential sector experienced a fairly major increase in share of total final energy consumption, rising from 26% to nearly 31%, as shown in Figure 6. In addition to electricity, fuelwood, charcoal, liquefied petroleum gas and kerosene remain the major sources of household energy in the Philippines.

Figure 5. Total primary energy supply by source, 2015

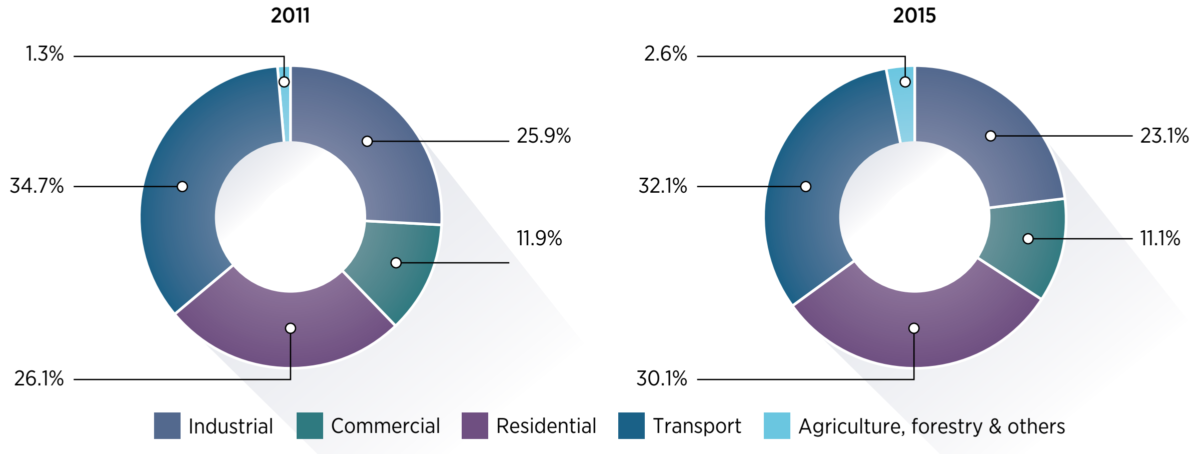


Source: Philippine Department of Energy, 2016

[4] The share of solar PV and wind energy accounts for a tiny proportion of TPES. Nevertheless, with solar and wind technology costs experiencing sharp reductions and significantly improved system performance, renewable energy could provide the Philippines with promising solutions if the enabling environment were further developed.

Figure 6 indicates that industry and transport experienced a fall of around 2% in share of final energy consumption in the period 2011-2015. Over the same timeframe, the commercial sector share barely changed. The final energy consumption share of agriculture, forestry and other sectors doubled but was still insignificant given its very small percentage of the total.

Figure 6. Final energy consumption by sector, 2011 and 2015



Source: Philippine Department of Energy, 2016

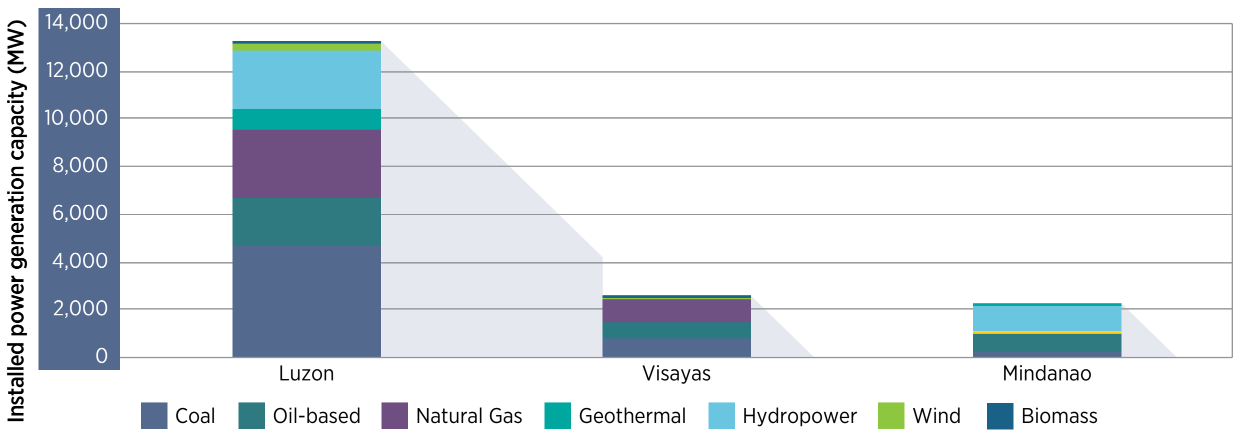
2.2 Electric power system

The Philippines has three main power grid systems as well as off-grid systems serving the three major island groups Luzon, Visayas and Mindanao.

Total installed generating capacity has reached 17,943 MW,[5] out of which only 15,933 MW is dependable[6] capacity that can be made available to generate electricity whenever needed. This accounts for nearly 90% of the total. Dependable grid-connected capacity is currently 12,970 MW.[7] Of this, Luzon accounts for 9,706 MW, Visayas accounts for 1,801 MW and Mindanao accounts for 1,463 MW to meet peak demand of 8,617 MW, 1,612 MW and 1,428 MW respectively. This suggests that reserve capacity ranges from 2% in Mindanao to 11% in Luzon, which is fairly modest.

Generation capacity based on fossil fuel accounts for 72% of the total, and geothermal and hydropower account for most of the remainder, as illustrated in Figure 7. This shows the insignificance of variable renewable energy sources such as wind and solar power in the power system at the moment.

Figure 7. Installed electricity generating capacity in the Philippines



Source: Philippine Department of Energy, 2015[8]

5 By the end of 2014.
6 They can be put into operation when needed.
7 As of 9 March 2016, according to www.ngcp.ph/power_situation.asp.
8 www.doe.gov.ph/power-and-electrification/philippine-power-sector-situationer.

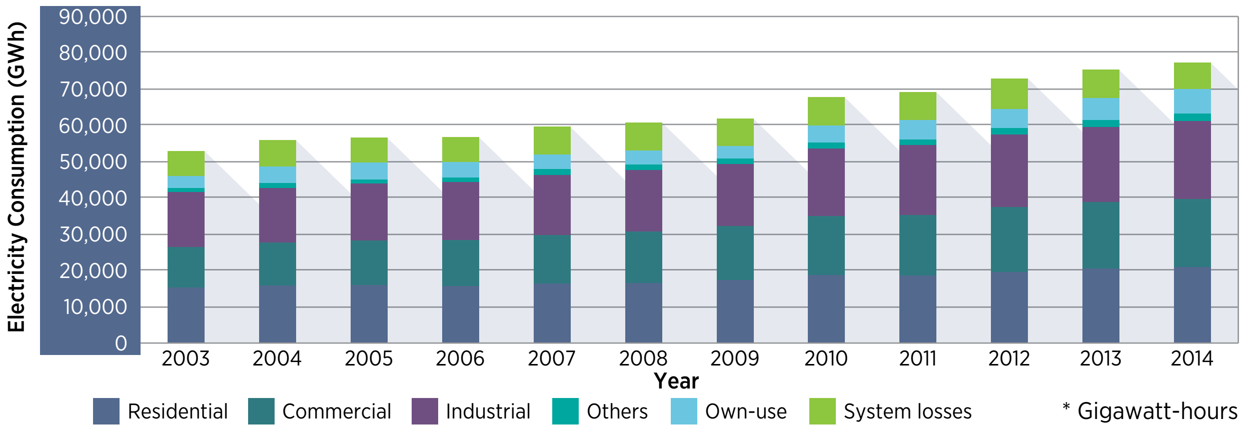
At present, the Luzon and Visayas grids are interconnected, and there is a plan to interconnect the Mindanao grid with the Visayas grid by 2018. Half the generating capacity in the Mindanao grid is from hydropower. However, for an isolated grid, the security of power supply can be a concern; it is more vulnerable to disruption due to seasonal variations in the hydrological resource and the physical power infrastructure. This is especially the case when a large portion of the generator fleet is utility-scale centralised power, and reserve capacity is very low. The bombing incidents of late 2015 put 16 transmission line towers out of service and caused significant stress to power supply in Mindanao.

All three power grids are owned by the Government of the Philippines through the National Transmission Corporation, known as TRANSCO. They are operated and managed[9] by the National Grid Corporation of the Philippines (NGCP) while generation assets[10] are being privatised in accordance with the Electric Power Industry Reform Act of 2001 (EPIRA).[11] The three grids cover the service areas of 15 out of a total of 18 regions, leaving the rest served by electric co-operatives[12] and private utilities on a franchise area coverage basis.

Unlike TPES, electricity consumption had seen the steady growth charted in Figure 8. This indicates that electricity is an essential product for the Filipinos, especially during the summer when the weather is hot and humid. During that season, the use of air conditioning units and other cooling devices is necessary for residential and commercial sectors in particular. Reliability and adequacy of power supply capacity were put to serious test in 2015 as a result of a hot summer combined with low precipitation caused by the powerful El Niño effect. Power shortages loomed, and panic broke out across the country. The potential crisis was avoided mainly owing to the Department of Energy's Interruptible Load Program, which delivered effective demand-side management. This has encouraged businesses with a load exceeding or equal to 1 MW to participate in the Interruptible Load Program by running their own generator sets (gen-sets) instead of drawing power from the grid. Distribution utilities have requested participating customers to switch from the grid to their own generation systems when there is a power supply deficit. In return, they will be compensated by the distribution utility for their actual fuel costs plus a certain margin to be agreed by the customer and distribution utility. The grid peak load was therefore significantly reduced (ERC, 2014).

9 This lasts 25 years under the Franchise Law enshrined in RA 9511 and can then be renewed for another 25 years. www.ngcp.ph/corporate.asp.
10 Except for rural electrification through National Power Corporation Small Power Utilities Group (NPC-SPUG).
11 It is also known as the Republic Act No. 9136: An Act Ordaining Reforms in the Electric Power Industry, Amending for the Purpose of Certain Laws and for Other Purposes. The full text of this Act is available at: www.neda.gov.ph/wp-content/uploads/2013/12/R.A.-9136.pdf.
12 Electric co-operatives are non-profit, member-owned entities that operate a distribution system to provide retail electricity services within an exclusive franchise area. The National Electrification Administration supports electric co-operatives by providing loans and capacity-building, for example. It regulates their key activities such as election of officers.
13 www.transco.ph/downloads.

Figure 8. Electricity consumption by sector in the Philippines



Source: Philippine Department of Energy, 2015[13]

Demand for electricity will continue to rise along with the continued GDP growth.[14] However, an Economist Intelligence Unit analysis has shown that the Philippine electricity consumption growth rate (5.7%) will in any case outstrip the growth rate of energy generation (5.3%) in 2015-2020.[15]

Hence the question is not whether additional electricity generating capacities in all three grids are needed but what power generation portfolio the country should develop from a long-term perspective, taking energy security into consideration.

2.3 Rural electrification

The Philippine rural electrification programme started in the early 1960s, when the Philippine government declared its commitment to universal electrification. It established the Electrification Administration, which quickly began financing over 200 small-scale generation-distribution systems. In 1972, 36 rural electric co-operatives were launched and started operating with the financial support of USAID and the Philippine government while more formed on their own. The rural electric co-operative model has to a large extent been considered a good practice. However, some of the newly formed electric co-operatives failed to follow strict cost-recovery criteria. They thus suffered significant financial deficits mostly due to the high cost of power purchase from main grid, which in turn limits low-income consumer access to electricity.

Since 2001, as part of the power sector reform engaged under the EPIRA, the government has mandated the National Electrification Administration and the National Power Corporation Small Power Utilities Group (NPC-SPUG) to lead rural electrification activities to achieve the 90% electrification goal. Of these two, the National Electrification Administration carries out the Barangay Line Enhancement Program and Sitio Electrification Program, both of which extend distribution lines to unelectrified barangays, sitios[16] and households. The National Electrification Administration implements these programmes through the electric co-operatives by providing them with the funds to extend their distribution networks.

NPC-SPUG provides power and/or distribution services to small, isolated and island grids. It provides power to 78 small islands and eight isolated grid areas nationwide by operating 92 land-based diesel power plants, 11 power barges, 17 mini-grids, 154 microgrids, a hybrid grid-connected wind plant and a mini-hydropower plant.

In most off-grid areas, especially isolated islands, electricity is generated by diesel gen-sets, resulting in high electricity costs. The average energy price set by the Manila Electric Company (Meralco) retail tariffs was 8.82 Philippines Pesos (PHP) in 2013,[17] and the NPC-SPUG notified rate for its operations in Mindoro area was PHP 6.19 per kilowatt-hour (kWh) as of October 2015. This was higher than the highest main grid rate i.e. for Luzon at PHP 5.71/kWh. It was more than double the rate applied to grid-connected consumers in Mindanao i.e. PHP 2.95/kWh. The biggest component of this tariff is the generation component (65% of the overall retail tariff) (NPC-SPUG, 2015; Somani *et al.*, 2013). To sustain operations in off-grid areas, revenue is collected under the EPIRA from sales in the missionary areas[18] and from the Universal Charge for Missionary Electrification fund (UCME – a common tariff charged to all electricity end-users). It is used to cover the cost difference that the Power Sector Assets and Liabilities Management Corporation (often known as PSALM) would not able to recoup from end-users.

In past years, governmental programmes have taken place to achieve its target to reach 90% household electrification by 2017.

[14] The International Monetary Fund has estimated an average 4.6% GDP growth rate for the Philippines in 2011-2035. Sources: International Monetary Fund (2013); Organisation for Economic Co-operation and Development (2013).
[15] http://country.eiu.com/ArticleIndustry.aspx?articleid=1173164301&Country=Philippines&topic=Industry&subtopic=Energy#.
[16] A barangay is the smallest government unit in the Philippines, composed of a group of households. A sitio is a smaller cluster of households within a barangay.
[17] USD 1 = PHP 43.135 (June 2013).
[18] As explained in Box 1.

The Renewable Energy Management Bureau in 2008 initiated a complementary programme entitled the Household (Sitio) Electrification Program. This supplies household lighting to off-grid areas using mature renewable energy technologies such as PV solar home systems, PV streetlights and micro-hydropower. The Household (Sitio) Electrification Program is a continuation of the Department of Energy's Barangay Electrification Program, which started in 1998 and played a role in completing barangay electrification by 2010. The Household (Sitio) Electrification Program aims to contribute to the national government's goal to attain 90% household electrification level by 2017.

Generally, solar PV systems are the most common renewable energy technology for household lighting purposes. However, micro-hydropower systems are a better strategy when hydropower resource is available within a reasonable distance of clustered household beneficiaries.

Between its inception and June 2016, the Household (Sitio) Electrification Program was able to complete the energisation of 33,304 households. It installed 1,610 communal PV lighting systems (solar home systems and streetlights) in various off-grid areas nationwide with an aggregate capacity of 930 kW. The overall electrification rate is now at around 87.5% while only 73%[19] of rural households have access to electricity (World Bank, 2015). A table of rural electrification programmes is presented in Annex 1.

The Missionary Electrification Development Plan, explained in Box 1, is one such government initiative supported by development partners – the World Bank and the United Nations Development Programme. The World Bank also supported the implementation of the Rural Power Project with USD 40 million funding to the Development Bank of the Philippines under the Global Environment Facility. The Rural Power Project aimed to reduce poverty and improve the quality of life of 10,000 rural households in the hard-to-reach, isolated and poorest areas of the country, particularly Mindanao. The Global Environment Facility's financial support takes the form of a long-term partial credit guarantee with seed money for relatively low-risk, financially viable investments to improve the efficiency of selected electric co-operatives. This loan guarantee fund also shares the risks faced by primary lenders such as microfinance institutions (Rural Power Project, 2014). When it closed in 2012, the Rural Power Project had achieved some of its development objectives to electrify rural households with solar home systems via a public-private partnership with the Department of Energy. The Development of Bank of the Philippines managed the microfinance credit.

The approach taken for its Sustainable Solar Market Packages is known to be the successful feature of the Rural Power Project. It made barangay clusters commercially viable despite the usual requirement for large-scale solar business operations to overcome transaction costs (Rural Power Project, 2014). Over 21,000 rural solar home systems have been connected, exceeding the target 20,000 (World Bank, 2012). Most Rural Power Project strategies are stand-alone solar systems but in the next phase they may include small wind home systems and pico-hydropower (Rural Power Project, 2014).

In addition, many rural electrification initiatives have taken place with the support of the Department of Energy and development partners, and active engagement at the regional levels. The Alliance for Mindanao Off-grid Rural Electrification (AMORE) programme was co-ordinated from 2002 to 2009 for three purposes: lighting up households, energy access for education in school and safe water supply for income generation.

By September 2009, the end of the programme's phase II, AMORE had provided electricity to 44,000 pupils in over 200 rural schools and more than 13,000 households in over 400 remote rural villages (barangays) in 12 provinces in Muslim Mindanao. It used stand-alone solar and micro-hydropower systems and was supported by the Department of Energy, USAID, NGOs and Winrock International, a US-based foundation. AMORE improved the living standards of rural households dependent on fishing and farming by providing safe water using solar battery chargers and solar-powered drinking water systems.

While most rural electrification programmes work on a subsidised grant basis, the AMORE programme developed rural electrification using a resident autonomy commercial approach. This encouraged rural households not only to be energy and service providers but also financing institutions. Community members were organised into Barangay Renewable Energy and Community Development Associations. These were trained to operate and maintain the renewable energy systems and raise their own funds. One of the successful features of the AMORE rural programme is a building operations and maintenance fund mechanism in each community for the efficient ongoing collection of community funds to cover expenses (AMORE 2014).

These rural electrification programmes were instigated by the public sector. However, the private sector can also participate in rural electrification through two schemes: (1) the New Power Producers scheme and (2) the Qualified Third Party (QTP) Programme. The New Power Producers scheme involves the full or partial takeover of an NPC-SPUG area. The QTP scheme on the other hand allows the delivery of electricity services to "unviable"[20] areas that the electric co-operative has waived from its franchise coverage. The New Power Producer scheme covers all the NPC-SPUG areas in which power supply is predominantly fuelled by diesel. A New Power Producer for a particular NPC-SPUG area is chosen through a competitive selection process and is entitled to receive subsidies from the UCME. The scheme permits the assets of NPC-SPUG to be used or new power plants and distribution network to be constructed.

Through a public notice in 2005, the Department of Energy designated 428 barangays as remote and unviable areas open for QTP participation. These areas are exempt from the electric co-operative/distribution utility franchise coverage and are thus made available to QTPs. However, only three accredited QTPs exist to date: PowerSource Philippines, DMCI Power Corporation and Sabang Renewable Energy Corporation. The PowerSource Philippines is the first ever QTP in the country and provides power to barangay Rio Tuba, Bataraza and Palawan. DMCI Power, on the other hand, provides generation and distribution services to Semirara Island in Antique (GIZ, 2013). Sabang Renewable Energy Corporation is the third QTP which was awarded the service contract in September 2015 and is operating in Sabang, Puerto Princesa.

Unlike the New Power Producer scheme for NPC-SPUG areas, QTPs do not go through a competitive selection process although they are entitled to the UCME. Instead, QTPs are subject to the Department of Energy accreditation process. After this, they file for approval of the retail rate and final authorisation from the ERC. There are still numerous unviable areas eligible for the QTP scheme. At the moment, no takers are to be found for these remaining areas, largely due to the regulatory challenge at the national level. They will thus in the meantime be included in the government's electrification programmes.

[19] Equivalent to around 2.4 million households (National Electrification Administration, 2015).
[20] Unviable areas are generally remote, isolated locations in which the electric co-operative could not provide electricity services.

NorthWind Power Development Corporation's 33 MW Bangui Wind Power Project in Bangui, Ilocos Norte
Photo: Shutterstock

Box 1:

Missionary Electrification Development Plan

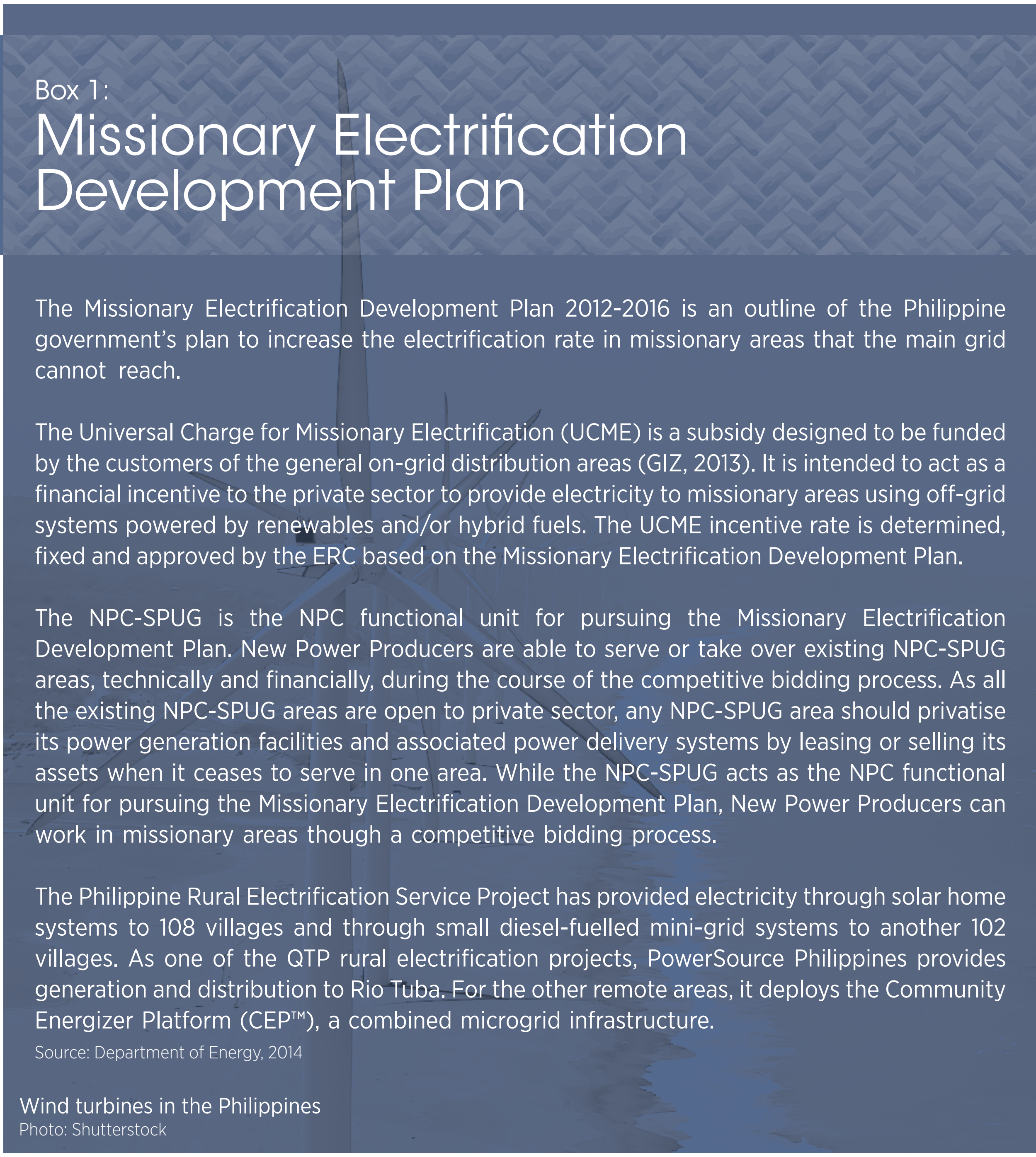
The Missionary Electrification Development Plan 2012-2016 is an outline of the Philippine government's plan to increase the electrification rate in missionary areas that the main grid cannot reach.

The Universal Charge for Missionary Electrification (UCME) is a subsidy designed to be funded by the customers of the general on-grid distribution areas (GIZ, 2013). It is intended to act as a financial incentive to the private sector to provide electricity to missionary areas using off-grid systems powered by renewables and/or hybrid fuels. The UCME incentive rate is determined, fixed and approved by the ERC based on the Missionary Electrification Development Plan.

The NPC-SPUG is the NPC functional unit for pursuing the Missionary Electrification Development Plan. New Power Producers are able to serve or take over existing NPC-SPUG areas, technically and financially, during the course of the competitive bidding process. As all the existing NPC-SPUG areas are open to private sector, any NPC-SPUG area should privatise its power generation facilities and associated power delivery systems by leasing or selling its assets when it ceases to serve in one area. While the NPC-SPUG acts as the NPC functional unit for pursuing the Missionary Electrification Development Plan, New Power Producers can work in missionary areas though a competitive bidding process.

The Philippine Rural Electrification Service Project has provided electricity through solar home systems to 108 villages and through small diesel-fuelled mini-grid systems to another 102 villages. As one of the QTP rural electrification projects, PowerSource Philippines provides generation and distribution to Rio Tuba. For the other remote areas, it deploys the Community Energizer Platform (CEP™), a combined microgrid infrastructure.

Source: Department of Energy, 2014



Wind turbines in the Philippines
Photo: Shutterstock

2.4 Legal and regulatory frameworks

The legal and regulatory framework for the energy sector was set up in 1936 through the Public Service Act (Commonwealth Act No. 146), which established the Public Service Commission with the mandate to issue the certificates authorising the operation of public services. This was followed by a number of key decrees and acts outlined below.

- Presidential Decree No. 910 signed on 22 March 1972 to create the Energy Development Board, composed of the heads of the key government ministries such as the Ministry of Finance, Ministry of Economic Planning, as well as the head of the Philippine National Oil Company and the Chairman of the Energy Development Board. The board has an overarching role to co-ordinate the formulation and implementation of energy policies, regulations and programmes, among other functions.

- The Department of Energy Act (Republic Act No. 7638)[21] approved by the President on 9 December 1992. This act creates the Department of Energy of the Philippines and sets forth its powers and functions, and composition. The Department of Energy is made up of four bureaus and one administrative support service unit. It acts under the leadership of the Secretary, three Undersecretaries and three Assistant Secretaries. It performs a wide range of duties from energy policy formulation to facilitating the engagement of private enterprises in variety of energy projects.

- The Electric Power Industry Reform Act (EPIRA; Republic Act No. 9136)[22] approved by the President on 8 June 2001. Its main aim is to improve the reliability of power supply and reduce tariffs. This is achieved by opening up the power market to competition by restructuring the power industry from a vertical to horizontal model and privatising the NPC.

- The Renewable Energy Act (Republic Act No. 9513)[23] approved by the President on 16 December 2008. This act aims to accelerate the exploration, development and utilisation of all forms of renewable energy resources including hybridisation with other energy sources. It provided for the creation of the NREB. Among other functions, this was mandated to set the sector Renewable Portfolio Standard (RPS) on a per grid basis and minimum renewable power generation capacities in off-grid areas.

The EPIRA and the Renewable Energy Act have provided the most important framework to achieve energy security and clean energy generation in the country.

Electric Power Industry Reform Act (EPIRA)

The EPIRA provided a structure for reforming the electric power industry to allow more private sector participation and attain power security. The EPIRA's primary objectives are to ensure and accelerate total electrification; to ensure the quality, reliability, security and affordability of the supply of electric power; to ensure transparent and reasonable prices in a regime of free and fair competition; and to encourage private sector capital and participation into the sector. To achieve this, the EPIRA restructures the power industry by unbundling it into four sectors: (1) generation (2) transmission (3) distribution and (4) supply. Before the EPIRA, the government operated the electricity sector as a vertically integrated industry. This led to the reorganisation of certain government agencies and the creation of new entities: the Wholesale Electricity Spot Market, the Power Sector Assets and Liabilities and Management Corporation, and TRANSCO. The functions of these entities will be described in the next section.

The EPIRA emphasises the importance of private sector support and renewable energy deployment to provide electricity to remote areas. The Rules and Regulations to Implement Republic Act No. 9136[24] lay down the requirements described below.

- Section 6 (Provision of Service in Unviable Areas) in Rule 7 on Distribution Section provides that, in remote and unviable areas where the distribution utility is unable to serve for any reason as authorised by the ERC in accordance with the Act, the areas shall be opened to other qualified third parties that may provide the service pursuant to Rule 14 on Provision of Electricity by Qualified Third Parties (QTP).

- Section 3 (Obligations of SPUG) in Rule 13 on Missionary Electrification prescribes that, whenever feasible, SPUG shall utilise Renewable Energy Resources.

Private sector participation is possible under two general schemes, the QTP for the unviable areas and the New Power Producer for SPUG generation.

[21] Republic Act No. 7638: An Act Creating the Department of Energy Rationalizing the Organization and Functions of Government Agencies
[22] Related to Energy and for Other Purposes. The full text of this act is available at www.doe.gov.ph/republic-act-no-7638-0. Republic Act No. 9136: An Act Ordaining Reforms in the Electric Power Industry, Amending for the Purpose of Certain Laws and for Other Purposes. The full text of this act is available at www.neda.gov.ph/wp-content/uploads/2013/12/R.A.-9136.pdf.
[22] Republic Act No. 9513: An Act Promoting the Development, Utilization and Commercialization of Renewable Energy Resources and for Other Purposes. The full text of this act is available at www.doe.gov.ph/laws-and-issuances/republic-act-no-9513.
[24] The full text of these Rules and Regulations is available at www.doe.gov.ph/sites/default/files/pdf/downloads/final_irr_dtd_02.27.02.pdf.

Renewable Energy Act

The Philippines Renewable Energy Act was considered the first in Southeast Asia to act as comprehensive legislation on renewable energy. The primary goal of the act is to achieve energy self-reliance through the accelerated exploration and development of renewable energy resources. To attain this objective, the Renewable Energy Act offers various fiscal and non-fiscal incentives to private sector investors, renewable energy equipment manufacturers and suppliers, and renewable energy project developers.

The non-fiscal incentives in the Renewable Energy Act include the RPS and FiT. The RPS mandates a minimum percentage of renewable energy generation for on-grid systems while the FiT guarantees a fixed price for at least 12 years for systems within the RPS. However, the RPS has not yet been set and is still under public consultation and design.

To make use of the incentives, project developers must first secure a renewable energy service contract from the Department of Energy Renewable Energy Management Bureau. In addition, renewable energy equipment manufacturers, fabricators and suppliers must be accredited to avail of the incentives.

The NREB was created through this act. It is composed of representatives from various government agencies and from relevant stakeholders. It is supported by a technical secretariat from the Department of Energy Renewable Energy Management Bureau sourced from the Technical Services Management Division. More details can be found in Annex 2.

2.5 Key institutions of the energy sector

Under the two above-mentioned acts, the role of the Department of Energy was expanded, and several key institutions were established. These now play important roles in governing the energy sector in the Philippines.

Philippine Department of Energy

This key department of the government was created in 1992 pursuant to RA No. 7638, also known as Department of Energy Act of 1992. It is responsible for preparing, integrating, co-ordinating, supervising and controlling all plans, programmes, projects and activities of the Government of the Philippines relative to energy exploration, development, utilisation, distribution and conservation (Department of Energy, n.d.).[25]

To this end, the Philippine Department of Energy takes a long-term and sustainable perspective when it designs energy policies and regulations. This is to ensure the provision of reliable, accessible and sufficient energy sources in a sustainable and secure fashion to all. To deal with the excess dependence on energy, the Department of Energy has over the past decade stepped up its efforts to strengthen the security of energy supply by harnessing more indigenous energy resources coupled with measures to improve energy efficiency and conservation.

As it evolves, the Department of Energy has assumed additional responsibilities and functions including that mandated by the EPIRA and Renewable Energy Act of 2008.

Renewable Energy Management Bureau

The Renewable Energy Management Bureau is an integral part of the Department of Energy with the mandate to formulate and implement policies, plans and programmes related to the accelerated development, transformation, utilisation and commercialisation of renewable energy resources including emerging energy technologies. It has five divisions: biomass; hydropower and ocean energy; geothermal; solar and wind power. In addition, a special division provides technical services to the NREB.

As a result of the recent rapid deployment of renewable energy projects in the Philippines, particularly in response to FiTs issued in 2012, the human resources capacity at the Renewable Energy Management Bureau was overstretched. In 2015, the Philippine Department of Energy management decided to reinforce the Renewable Energy Management Bureau staffing in recognition of this emerging challenge.

[25] www.doe.gov.ph/about-doe/who-we-are/history.

Energy Regulatory Commission. The EPIRA converted the Energy Regulatory Board into the ERC, strengthening its role over the industry. It is the only regulatory body created by the EPIRA that exerts control over the four components of the industry, i.e. generation, transmission, distribution and supply. The ERC role is to promote competition, encourage market development, ensure customer choice and penalise abuse of market power in the restructured electricity industry.

National Transmission Corporation. TRANSCO is the system operator of the nationwide electrical transmission and sub-transmission system. It assumes the authority and responsibility of the NPC for the planning, construction and centralised operation and maintenance of its high voltage transmission facilities, including grid interconnections.

Wholesale Electricity Spot Market. The role of this market is to provide the mechanism for identifying and setting the price of actual variations from the quantities transacted under contracts between sellers and purchasers of electricity. It was envisioned to create a more competitive electricity market and offer a reasonable and more affordable rate to end-users. The Philippine Electricity Market Corporation was incorporated on the initiative of the Department of Energy as the governance arm of the Wholesale Electricity Spot Market.

Power Sector Assets and Liabilities Management Corporation. Often known as PSALM, this corporation is owned and controlled by the government. It takes ownership of NPC generation assets, liabilities, independent power producer (IPP) contracts, real estate and other disposable assets. The principal purpose of the Power Sector Assets and Liabilities Management Corporation is to manage the orderly privatisation of NPC assets and IPP contracts in order to liquidate all NPC financial obligations in an optimal manner. The sale of NPC assets increases private sector participation in the industry.

National Renewable Energy Board. This was created pursuant to the Renewable Energy Act and is composed of representatives of various government agencies and from relevant stakeholders. The NREB is supported by a Renewable Energy Management Bureau technical secretariat, specifically from the Technical Services Management Division. The tasks of the NREB are described below.

- To evaluate and recommend to the Department of Energy the mandated RPS and minimum renewable energy generation capacities in off-grid areas as it deems appropriate.
- To recommend specific action to facilitate the implementation of the NREP.
- To monitor and review the implementation of the NREP, including compliance with the RPS and minimum renewable energy generation capacities in off-grid areas.
- To oversee and monitor the utilisation of the Renewable Energy Trust Fund. This fund's implementing guidelines have not yet been finalised.
- To cause or initiate the establishment of a one-stop facilitation scheme to accelerate implementation of renewable energy projects.

The 20 MW Maibarara Geothermal Power Plant
Photo: Maibarara Geothermal Inc.

RENEWABLE ENERGY DEVELOPMENT IN THE PHILIPPINES

NorthWind Power Development Corporation's 33-MW Bangui Wind Power Project in Bangui, Ilcos Norte
Photo: Shutterstock

03

The Philippines has been increasing its efforts to develop renewable energy since passing the Renewable Energy Act. In 2011, the NREP was launched and has set a roadmap for the Philippines towards a reliable, affordable and resilient energy future powered by independent indigenous renewable energy sources. The NREP target to triple installed generation capacity by 2030 has put the country on a course to meet half its electricity demand with renewables and thus to strengthen energy security while reducing electricity tariffs in remote areas and islands.

Since the FiTs were put in place in 2012, and also thanks to the sharp decline in costs of technologies like solar and onshore wind, the Philippines has made remarkable achievements in renewable energy deployment. These have taken place not only in the northern region, which has a strong wind resource, but also in cities through the use of rooftop solar PVs. As a result, the industry has also grown rapidly, fuelled by growing domestic and overseas investments, thus transforming the power markets and business models.

Nevertheless, emerging challenges need to be overcome through future policy making and institutional evolution in the renewable energy sector if the country is to maintain its development momentum. This will be discussed in the next chapter.

3.1 Renewable energy resource potential and development

The country's location offers great potential for geothermal, hydropower and ocean energy, and fairly good resources of solar and wind energy.

Geothermal energy

After the 1970s global oil crisis, the country established the Philippine National Oil Company-Energy Development Corporation in 1976 to explore alternative forms of energy. It focused on geothermal energy at the early stage in view of its geological advantage given its position on the Pacific "Ring of Fire". The first geothermal power plant was built in 1977 on the island of Leyte.

Over two waves of rapid development from 1976 to 2001,[26] total installed geothermal electricity generation capacity in the Philippines ramped up to about 1,900 MW. At that time, this represented about 22% of the national power generation capacity mix, and 23% of the world's total geothermal electricity generation capacity. In terms of net capacity addition, growth slowed down after this period given decommissioned capacities such as the 110 MW facility in Tiwi. From 2010 to 2015, the country experienced a net decrease of 34 MW, contributing to the loss of 2% in total electricity generated from geothermal energy (Bertani, 2015).

In 2015, with the total installed geothermal electricity generation capacity reaching about 1,900 MW, the Philippines is second largest in the world after the US, according to the International Geothermal Association. It generates not only 14% of total national electricity output but also a significant amount of budgetary saving from avoided fuel imports.

The Philippine Department of Energy estimates significant remaining potential – as much as 2,600 MW. Bertani (2015) has forecast that by 2020 geothermal power will increase in the Philippines by more than 600 MW. In the most recent Philippine Energy Plan (2012-2030), the Department of Energy identified 26 sites to increase existing installed capacity by 62% throughout the 18-year planning period, as shown in Table 1. The total estimated potential capacity of these sites will reach 1,165 MW. The majority of the listed areas have either been awarded or have submitted an application for a Renewable Energy Service Contract (Bertani, 2015).

The 20 MW Maibarara geothermal power plant was the most recent award. It started up on a commercial basis in February 2014. The plant is linked by a transmission line to the Luzon grid five kilometres (km) in length. This goes through Meralco's distribution system. More are in the pipeline. For instance, the Philippine Department of Energy approved the Declaration of Commerciality of the 31 MW Bacman geothermal project, which is an expansion project within the Bacman geothermal production field with total project cost amounting to approximately USD 129 billion. The plant was expected to come online by the first quarter of 2019.

[26] First wave (1976-1984): 330 MW MakBan, 330 MW Tiwi, 112.5 MW Tangonan I and 112.5MW Palinpinon I. Second wave (1990-2001): 95.73 MW Makban, 610.18 MW Unified Leyte, 151.5 MW Bacman, 108.48 MW Mindanao, and 80 MW Palinpinon II.

Kite surfing in the Philippines with wind turbines in the background
Photo: Shutterstock

Table 1. Geothermal projects identified in the Philippine Energy Plan (2012-2030)

Region	Site	Location	Generation capacity (MW)
Cordillera Administrative Region	Kalinga	Kalinga	120
	Daklan	Benguet	60
	Buguis-Tinoc	Ifugao	60
	Acupan-Itogon	Benguet	20
	Mainit-Sadanga	Mt. Province	80
II	Cagua-Baua	Cagayan	45
III	Natib	Bataan	40
IV-A	Mabini	Batangas	20
	San Juan	Batangas	20
IV-B	Montelago	Oriental Mindoro	40
V	Del Gallego (Mt. Labo)	Camarines Sur	65
	Camarines Sur Geothermal Project	Camarines Sur	70
	Southern Bicol	Sorsogon	40
VI	Mandalagan	Negros Occidental	20
VII	Lagunao	Negros Oriental	60
VIII	Biliran	Biliran	50
	Bato-Lunas	Leyte	65
IX	Lakewood	Zamboanga del Sur	40
X	Ampiro	Misamis Occidental	30
	Balingasag	Misamis Oriental	20
	Sapad-Salvador	Lanao del Norte	30
XI	Amacan	Compostela Valley	40
	Mt. Zion	North Cotabato	20
	Mt. Matutum	General Santos	20
	Mt. Parker	South Cotabato	60
XIII	Mainit	Surigao del Norte	30
TOTAL			**1,165**

Source: Philippine Energy Plan (2012-2030)

Hydropower

The country is rich in hydropower resources. The first mini-hydropower plant, which had an electricity generation capacity of 560 kW, was installed as early as 1913 in Camp John Hay, Northern Luzon. The private sector continued to make use of water resources for power generation until the creation of the NPC in 1936. The NPC was given the exclusive rights to develop all streams, lakes and rivers for power generation.

However, the National Electrification Administration received a mandate in 1979 to develop the country's small-scale hydropower potential. Similarly, the private sector was also encouraged to develop power projects under a Build-Operate-Transfer scheme introduced in 1987. In addition, the Mini-Hydroelectric Power Incentives Act of 1991 (Republic Act No. 7156)[27] aims to grant mini-hydroelectric power developers the necessary incentives and privileges to provide an environment conducive to the maximum development of the Philippine hydroelectric power resources. Prior to the Renewable Energy Act of 2008, hydroelectric power capacity amounting to 3,291 MW had been installed. This had risen to 3,543 MW by 2014.

The assessment has identified untapped hydropower resource amounting to 13,097 MW. Of this, 11,223 MW is suitable for large hydropower in the 18 potential sites identified across the country, accounting for nearly 86% of the total potential. The rest consists of mini- and micro-hydropower schemes in 888 locations significantly more spread out than the large hydropower sites.[28]

Solar energy

Updated resource potential data produced by the Philippine Department of Energy with the US National Renewable Energy Laboratory (NREL) show that the Philippine average solar energy resource is fairly good. This is based on the NREL's previous assessment conducted in 2000 while applying a new methodology, calibrating the Climatological Solar Radiation Model results with ground measurement validation. NREL assessed the annual average solar resource at 5.1 kWh per metre squared (m^2) per day. The highest solar irradiance occurs in April at 6.1 kWh/m^2 per day throughout the country and is at its most intense in the northwestern part of Luzon (Region I) (NREL, 2015). As illustrated in Figure 9, the solar resource data with 3 km resolution presented in IRENA's Global Atlas also show similar results. It also shows that the solar resources in the southern areas are also fairly good.

The data show the resource distributed fairly evenly across the country, varying by 10%-20% in any given month. This qualifies both northern and southern parts of the country for solar power generation. However, when factoring in seasonal variation between the wet months of May to October and dry months of November to May, solar irradiance changes substantially by 30%-50% due to cloud coverage.

[27] Republic Act No. 7156: An Act Granting Incentives to Mini-Hydroelectric Power Developers and for Other Purposes.
[28] Contributed by Andresito F. Ulgado, Hydropower Division Chief of the Department of Energy – Renewable Energy Management Bureau.

Figure 9. Solar energy resource in the Philippines

VAISALA Global solar dataset 3km with units in W/m^2/day

- 77.9574 W / m^2
- 124.892 W / m^2
- 145.328 W / m^2
- 160.063 W / m^2
- 172.654 W / m^2
- 184.423 W / m^2
- 206.783 W / m^2
- 236.519 W / m^2
- 283.954 W / m^2
- 365.164 W / m^2

Global Atlas for Renewable Energy (IRENA); map data: 3TIER 2015; base map: Google 2016

Beyond the country's physical assets, rising electricity demand and job creation potential are additional incentives for solar. This is particularly true for remote areas, rural electrification and efforts to reduce dependency on imported fuels.

The first on-grid solar farm in the country is the Cagayan Electric Power and Light Company's (CEPALCO) PV power plant in Cagayan de Oro in Northern Mindanao (Region X), which has a capacity of one megawatt-peak. CEPALCO is a private investor-owned utility serving Cagayan de Oro city and three nearby municipalities in Misamis Oriental. The 1 MW embedded generation solar PV plant operates in conjunction with CEPALCO's 7 MW run-of-river small hydropower plant. Electricity produced is fed to CEPALCO's distribution network (Global Environment Facility, 2005). During its first year of operation, the actual generated power reached 1.5 GWh, which is 19% higher than the projected 1.2 GWh (Abaya, 2005).

Notwithstanding this early installation, the real evolution of the solar PV market began with the implementation of a long overdue FiT for solar PV projects granted by the ERC in 2012.[29] The USD 0.24/kWh FiT attracted considerable attention from investors and the development community. Its first round ended with a combined generation capacity of 108 MW across six projects. These were fully financed by equity capital due to the unique policy design. They were the first to come online and first to get served by FiTs.

The San Carlos Solar Energy (SaCaSol) project is the second stand-alone and first eligible solar farm in the Philippines to supply power to the Visayas grid. It was developed in two phases: Phase 1 with 13 MW and Phase 2 with 9 MW and has a total gross capacity of 22 MW. It was inaugurated and commissioned in May 2014.

Given the dramatic fall in costs, solar PV has been increasingly economically attractive to end-users, particularly industrial and commercial companies. Several commercial and industrial establishments have installed solar rooftop systems to reduce their electricity consumption from the distribution utilities. A notable example is the Central Mall Biñan 700 kW solar rooftop in the province of Laguna. The installation provides 30% of the shopping mall's electricity requirements, giving a monthly saving of more than PHP 100,000 (USD 2,000) in power costs (Philippine Star, 2014). Solar Philippines, the company that designed and installed the Central Mall's solar rooftop system, also developed a similar system for SM North EDSA Mall under the FiT schemeand will be constructing a solar rooftop for at least two more malls. There are over 500 major shopping malls across the country appropriate for similar systems.

Smaller capacity rooftop installations can benefit from the net-metering scheme enabled by the Renewable Energy Act. In 2013, the ERC Resolution No. 9, Series of 2013 (Resolution Adopting the Rules Enabling the Net-Metering Program) presented the rules for enacting the net-metering programme for renewable energy technologies. Under this scheme, consumers who generate their own electricity may sell their excess supply to their distribution utility. The net-metering is limited to 100 kW capacities from solar, wind, or biomass systems installed within the consumer's premises (ERC, 2013). A net-metering agreement is entered into by the consumer and its electricity distribution utility. Currently, Meralco, Visayan Electric Company (known as VECO) and Davao Light are the private distribution utilities with systems and procedures in place to operate a "two-way" grid with its consumers subscribed under the net-metering programme. The Department of Energy and GIZ have prepared a net-metering guidebook that outlines the steps required to enter the programme.

The cap set originally at 50 MW was quickly met, and the industry filed a request to scale up. On 27 March 2015, the ERC responded positively with the approval for the proposed ceiling expansion to 500 MW with the timeframe extended to 15 March 2016. At the same time, the FiT was reduced to USD 0.18/kwh.

By April 2016, the total installed solar power generation capacity had reached nearly 800 MW – 95% of which was installed in Luzon and Visayas. The government is considering a switch to auction schemes aimed at reducing the overall costs of solar PV installations in the country, especially in

[29] Under Resolution No. 10, Series of 2012: Resolution Approving the Feed-in Tariff (FiT) Rates. The full text of the Resolution is available at: http://lia.erc.gov.ph/documents/862.

view of the significantly oversubscribed service contracts from the Department of Energy. By the end of March 2016, these had amounted to nearly 4 GW, consisting of 147 service contracts – including 4.3 MW off-grid.

Wind energy

Meteorological data from both PAG-ASA, the NREL's computerised geographic information system (GIS) and IRENA's Global Atlas for Renewable Energy depicted in Figure 10 show fairly good wind energy potential for the Philippines. The greatest wind resources are in northern and central areas such as Batanes and Babuyan and the northern and central Luzon areas.

As shown in Table 2 below, 11,055 km^2 of windy territory has been identified as a "good-to-excellent" wind resource. The wind speeds in these sites are 6.4-10.1 metres per second (m/s) and wind power density values are 300-1,250 watts/m^2 (W/m^2) (40 m hub height). This makes them theoretically suitable for grid-connected electricity generation. Using conservative assumptions of about 7 MW/km^2, these areas could support more than 76,000 MW of potential installed capacity, providing more than 195 billion kWh per year.

Table 2. Wind energy resource potential in the Philippines[30]

Wind resource utility-scale	Wind power W/m^2	Wind speed m/s	Total area km^2	Total capacity installed MW	Total power GWh/year
Good	300-400	6.4-7.0	5,541	38,400	85,400
Excellent	400-500	7.0-8.0	2,841	19,700	52,200
Excellent	500-700	8.0-8.8	2,258	15,600	47,900
Excellent	700-1,250	8.8-10.1	415	2,900	9,700
TOTAL			**11,055**	**76,600**	**196,200**

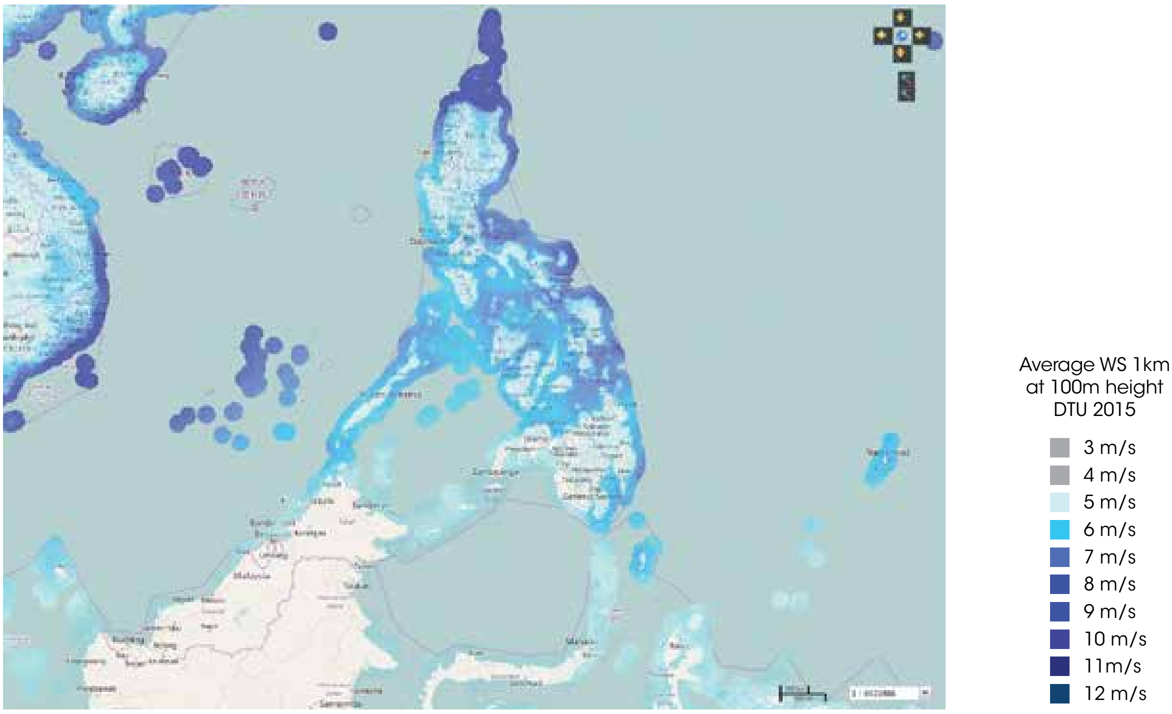
Source: NREL, 2014

Under USAID's Capacity for Low Emission Development Strategies, NREL updated the previous wind resource estimates in 2014 after modernising its approaches. The output is a geospatial wind toolkit that provides wind resource data at specific sites across the country. This assessment expands the datasets from 40 m (2001 NREL wind atlas) to 50 m, 80 m, 100 m, 140 m and 200 m. The geospatial toolkit visually explores data and combines renewable energy information with other base and infrastructure data. The toolkit includes data layers on transmission lines, infrastructure (airports, wind manufacturing facilities, existing wind farms etc.) land ownership (restricted areas, indigenous people, lands among others), topography etc. The updated atlas provides valuable preliminary information that will allow investors and project developers to identify economically viable wind sites. Another output is the wind prospector. This web-based application can be downloaded to obtain detailed wind and meteorological data. The wind geospatial toolkit and prospector may be accessed on the NREL's website. The resource assessment will continue in order to further populate the data and to estimate the potential power generation from wind resources across the country.[31]

30 The results were computerised by the NREL resource data assessment methodology based on GIS data. It used the following assumptions: turbine size 500 kW; hub height 40 m; rotor diameter 38 m; turbine spacing 10 D by 5 D; capacity/km^2 6.9 MW.

31 Raw data are available at www.nrel.gov/international/ra_philippines.html. Analysis of raw wind measurement data is yet to be concluded to determine the potential capacities from wind energy resources across the country.

Figure 10. Wind energy resource in the Philippines



Global Atlas for Renewable Energy (IRENA); map data: 3TIER 2015; base map: Google 2016

Some of the latest developments in Ilocos Norte include the EDC Burgos Wind Power Corporation 150 MW wind farm in Burgos, the 18.9 MW NorthWind Power Development Corporation's Phase 2 in Bangui and the North Luzon Renewable Energy Corporation 81 MW wind farm in Pagudpud. Full integration of the total capacities generated by these wind farms has already been achieved following the completed upgrade of transmission network capacity. They had initially stalled due to its technical limitations, as it could only export a maximum power of 110 MW to the rest of the Luzon grid. So far, total installed wind farms capacity is 393.9 MW.

Biomass and biofuels

The Philippines produces a large amount of agricultural residues annually from farm land amounting to 14 million hectares, accounting for nearly half its total area. Rice husk and straw make up the lion's share of the residue, while the rest includes coconut shell and sugarcane bagasse, for instance. Forest residue, municipal solid wastes and animal manure from the husbandry industry are also part of the biomass feedstock.

An investigation on resource potential conducted by USAID's Climate Change and Clean Energy (CEnergy) project in 2013 predicted 4,450MW[32] net available capacity for power generation from different types of biomass feedstock[33] across the country (De Guzman, 2014). The indicative megawatts were calculated at a 70% capacity, reflecting biomass resources that can be reasonably collected and used for power generation.

The biomass resources considered in the assessment varied per main island group, i.e Luzon, Visayas and Mindanao, as shown in Table 3. In Luzon, the biomass commodities quantified were rice residues, corn residues, coconut husks, coconut shell, coconut coir and coconut fronds, pig and poultry manure, and solid waste. Luzon leads on biomass resources with 2,094 MW due to its abundant coconut (husk, shell and frond) resources followed by rice and livestock manure. Isabela province alone (the second largest in the Philippines) has the potential to generate about 800 MW electricity mainly from the by-products of its massive corn production. Known as the "sugar bowl of the Philippines", Visayas' resource base comprises sugarcane residues, rice residues, corn residues, coconut, poultry and hog animal wastes. The major sugar mills in the region own and operate their own power-generating boilers.

[32] The results of the study are still preliminary and under evaluation by the Department of Energy.
[33] Biomass used for other competing purposes such as cooking and drying was deducted to work out the available quantity for power generation.

In Mindanao, the biomass resources quantified include rice residues, corn residues, sugarcane residues, coconut residues, plantation crops (cassava residues, banana wastes, pineapple wastes, rubber wastes, empty palm fruit) and emerging energy crops (sweet sorghum, bamboo, napier grass). Bukidnon has been identified as offering the most abundant residual rice straw, cornstalk and bagasse that may be utilised for power production. Coconut has the potential to be the major power generator, particularly in the province of Davao del Sur, which has 200 MW equivalent (MWe), and Davao City (130 MWe), offering a combined potential 330 MWe. Corn presents a significant source of power too, especially in Bukidnon, which has a 90 MWe potential. In addition, Bukidnon produces large amounts of sugarcane residues, offering a potential 43 MWe. Several energy crop plantations exist in Mindanao, including at least 440 hectares of Napier grass, 200 hectares of bamboo and sweet sorghum. Almost all plantations are owned and cultivated by biomass power companies. Some state universities, as well as the Department of Agriculture, grow sweet sorghum for energy crop research.

Table 3. Potential electricity generation capacity from biomass-based fuel

Major island group	Potential biomass power generation (MW)
Luzon	2,094
Visayas	1,513
Mindanao	843
TOTAL	**4,450**

Source: De Guzman, 2014

However, the biomass energy resources thus far used for non-power applications are mainly required for household cooking, contributing to about 12% of national TPES (based on 2013 data) as shown in Figure 5. Installed biomass-based power generation capacity amounted to 119 MW producing 152 GWh of power in 2013. This represented around 60% of the potential generation capacity estimated from available biomass resources (International Energy Agency, 2015).

The Biofuels Act of 2006 (Republic Act No. 9367),[34] which entered into force in 2007, provides the legal mandate for blending bio-liquid fuels, i.e. bioethanol and biodiesel, into liquid transport fuels. Blending requirements have increased progressively to current levels of 10% for bioethanol and 2% for biodiesel, up from an initial 5% and 1% respectively. This reflects the enlargement of production and feedstock capacity. Meanwhile, the promotion of biofuel use in the transport sector has driven growth in the domestic sugar industry and cultivation of coconut and other oil-rich plants.

Notwithstanding a range of incentive schemes, including a value added tax exemption and financing through public institutions, the prices of domestically produced biofuels have increased. This is especially true for biodiesel, discouraging the adoption of a 5% blending requirement. The government may review its biofuel programmes in the light of experience to date.

The largest biomass power plant is the 21 MW First Farmers Holding Corporation's cogeneration plant, which primarily uses bagasse from its sugar milling operation as feedstock. Electricity produced is utilised by the sugar mill and refinery while surplus electricity is sold to the Wholesale Electricity Spot Market. Rice husks, the by-product of the rice milling process, are used by several rice mills to fire rice grain dryers and other crops such as corn, coffee, legumes and cassava (Ragudo, 2011).

Similarly, commercial livestock farms generate significant amount of animal wastes. Biogas recovery to fuel gas engines for power generation is a clean and cost-effective strategy for managing wastes. The power they generate may be used in farm operations for lighting or cooling livestock housing, generating power cost savings. Cavite Pig City is a large hog farm with a population of 100,000 heads, which invested in a 1.1 MW biogas facility to manage its animal wastes. This generates power used in the farm (Box 2).

[34] Republic Act No. 9367: An Act to Direct the Use of Biofuels, Establishing for this Purpose the Biofuel Program, Appropriating Funds Therefor, and for Other Purposes.

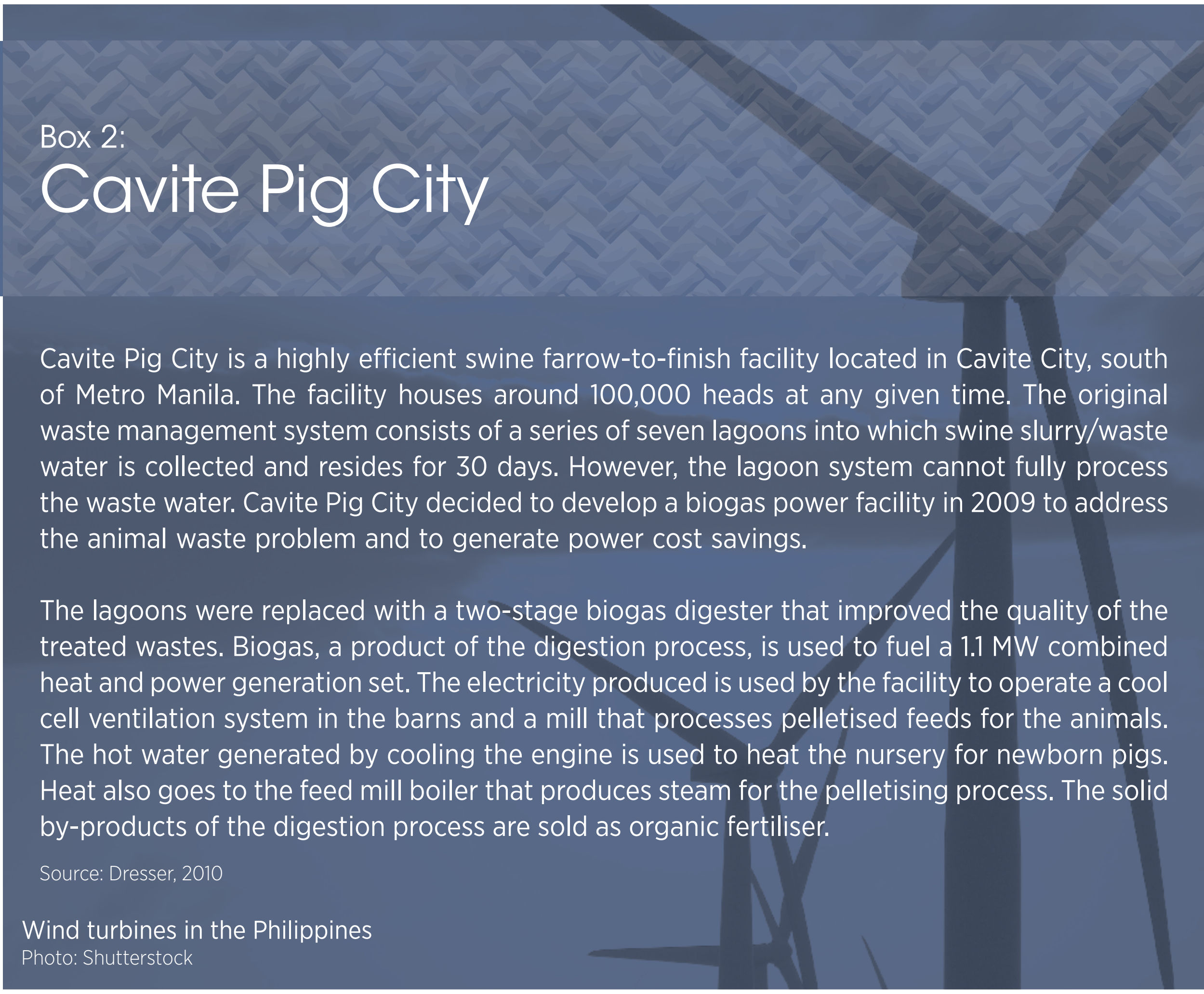
Box 2:

Cavite Pig City

Cavite Pig City is a highly efficient swine farrow-to-finish facility located in Cavite City, south of Metro Manila. The facility houses around 100,000 heads at any given time. The original waste management system consists of a series of seven lagoons into which swine slurry/waste water is collected and resides for 30 days. However, the lagoon system cannot fully process the waste water. Cavite Pig City decided to develop a biogas power facility in 2009 to address the animal waste problem and to generate power cost savings.

The lagoons were replaced with a two-stage biogas digester that improved the quality of the treated wastes. Biogas, a product of the digestion process, is used to fuel a 1.1 MW combined heat and power generation set. The electricity produced is used by the facility to operate a cool cell ventilation system in the barns and a mill that processes pelletised feeds for the animals. The hot water generated by cooling the engine is used to heat the nursery for newborn pigs. Heat also goes to the feed mill boiler that produces steam for the pelletising process. The solid by-products of the digestion process are sold as organic fertiliser.

Source: Dresser, 2010



Wind turbines in the Philippines
Photo: Shutterstock

Ocean energy

The exploration of ocean energy potential in the Philippines began with a study of the ocean resource assessment conducted by Mindanao State University in the 1980s. The result indicated the theoretical potential could be as much as 170 GW of electricity generation capacity thanks largely to the Philippines' geographical location. Several private and public institutions conducted further studies in the 1990s and 2000s on ocean energy potential, including wave energy and ocean thermal energy conversion.

On the basis of the prevous relevant studies, estimated ocean energy generation capacity of 70.5 MW was proposed for development in 2013-2030 in the Philippines Energy Plan 2012-2030 (Department of Energy, 2012). However, the sites identified in the plan require more detailed exploration studies to ensure technical and economic viability. The first of the potential sites is the 10 MW Cabangan ocean thermal project in Zambales Province in Luzon. This is being developed by Bell Pirie Power Corporation with a service contract to explore, develop, build and operate a power plant in 1,300 hectares of sea. This was awarded by the Philippine Department of Energy.

The offshore power facility will be housed on a ship-based platform. It is expected to start commercial operation in 2018 and evacuate the electricity to the mainland via a undersea power cable. H&WB Asia Pacific Corporation (Pte Ltd) is another example of a private investor developing ocean energy in the Philippines. It was awarded service contracts to develop four separate sites with a total capacity of 20 MW.

The government hopes the facilities will help stimulate investor interest in exploring and developing the untapped potential of the country's ocean resource.

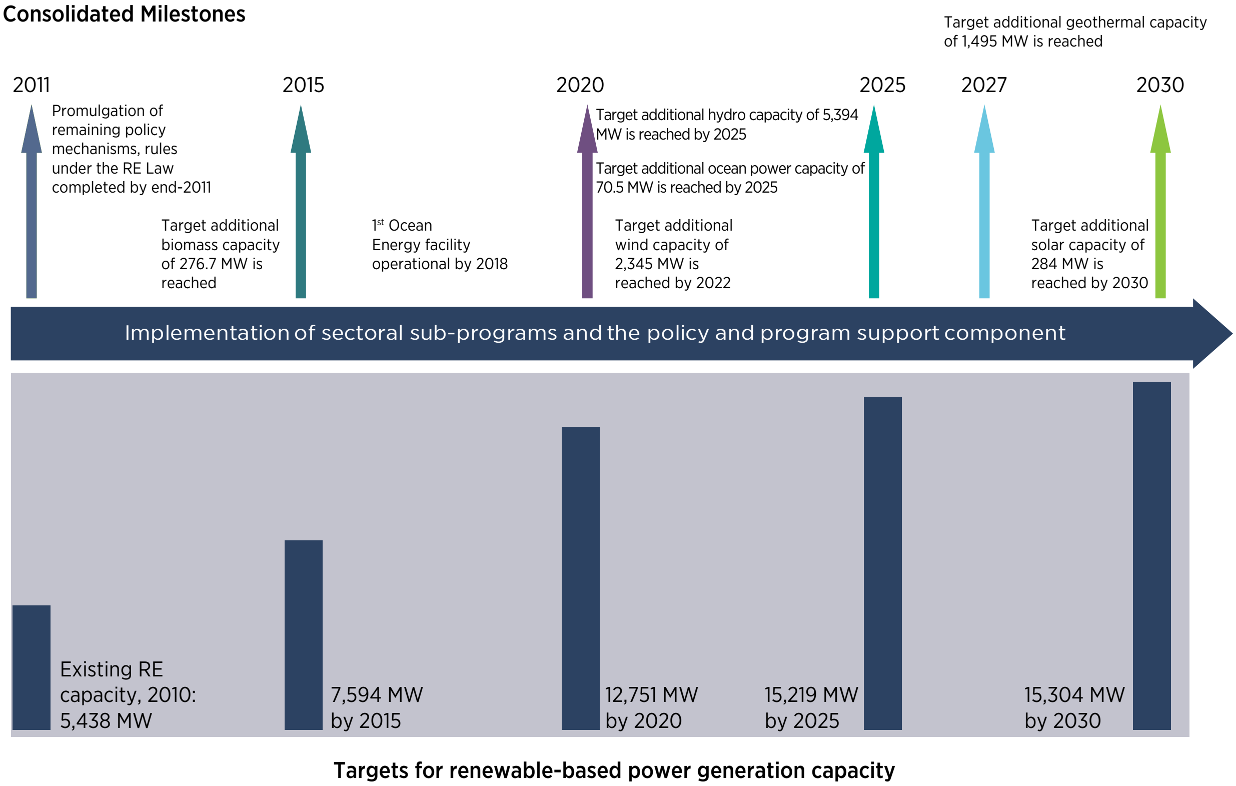
3.2 Key supportive initiatives for renewable energy deployment

A number of important initiatives have been taken to scale up renewable energy systems deployment in the Philippines. The NREP has drawn up a long-term roadmap with a target set on the basis of a bottom-up approach. International development partners have also been increasing their efforts to support the country with technical assistance on various aspects. All these have made significant contributions to the development of renewable energy sources in the Philippines.

National Renewable Energy Program 2011-2030

The NREP was launched in 2011, three years after the enactment of the Renewable Energy Act. It serves as the blueprint for implementing the Renewable Energy Act. It set an aggressive target to triple the 2010 renewable energy capacity level (5,438 MW) to 15,304 MW by 2030, as illustrated in Figure 11. This is 61% of projected power demand by 2030.

Figure 11. Timeline for NREP implementation



Source: NREP 2011-2030

The policy mechanisms and instruments set forth in the Renewable Energy Act ought to create an enabling environment to attract investors into the renewable energy sector. They are in some senses the key determining factors for renewable energy investments and serve as basis for financial projections. However, there have been delays in developing and implementing the renewable energy policy mechanisms. The Renewable Energy Act was passed in 2008, mandating the FiT scheme as policy instrument. Yet the scheme did not take effect until 2012, while net-metering was introduced in 2013. The delayed implementation of policy instruments contributed to the time lag in renewable energy project development.

As a result, the fulfilment of the renewable energy target set in the NREP has also been delayed significantly. However, the Department of Energy is optimistic that although it has taken a long time to add to installed capacity, more renewable energy power plants will be constructed in the next few years. This is evidenced by the large number of projects awarded service contracts. By January

2015, the Department of Energy had awarded 622 renewable energy service contracts, which had an aggregated total capacity of almost 10,000 MW.

The NREP is designed to undergo a biennial review that it initiates itself and can be revised as necessary. It was first reviewed in 2013 but was not updated. The primary recommendation of that review was to fast-track the enforcement of the FiT and RPS (Department of Energy, 2013). The NREP is once again under evaluation, and the launch of an improved NREP is expected thereafter. This revised design and active NREP implementation would be expected to accelerate and advance renewable energy development.

Mapping out administrative procedures for on-grid solar PV project development[35]

With the proper policies in place, private sector interest in renewable energy has been high. Yet the permitting procedures, administrative applications and regulations on grid interconnection designed by relevant government agencies are complex. The complexity makes the project development process tedious, and this has become a barrier to renewable energy project development in the Philippines.

In addition, there is a lack of harmonisation and standardisation of administrative processes at the regional and local level. This is complicating compliance with the requirements and creating additional delays and cost to the project developer.

What is more, administrative barriers make a financial impact on the overall costs of renewable energy projects. Administrative costs indirectly affect soft cost components such as capital costs and profit. High administrative costs indicate risks, which reduce the predictability and cost security of the renewable energy project. Financing institutions thus usually demand a risk premium, which will raise capital costs.

To provide a clear overview of the administrative and regulatory requirements for on-grid solar PV project development in the Philippines, the Department of Energy and GIZ have developed the Solar Photovoltaic (SPV) Guidebook. This has subsequently been split into two electronic guidebooks (e-guidebooks) under the ASEAN RE Guidelines Initiative: (i) Large Solar PV Project Development in the Philippines and (ii) Small Solar PV Project Development in the Philippines. This maps out the administrative procedures for on-grid solar PV project development. It was created under the "Support of the Climate Change Commission" project funded by the International Climate Initiative of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit).

The SPV Guidebook analysed the legal and administrative milestones and the procedures necessary for granting incentives and other privileges specified in Chapter VII of the Renewable Energy Act of 2008 and in Section 18 of the Rules and Regulations Implementing RA No. 9513. The assessment process has verified the outcome of the guidelines and measured the efficiency of compliance. This will further unblock a possible impasse during the process and will provide the avenue for necessary improvement.

Ideally, investment policies and administrative guidelines should be predictable and easy to comply with if they are to generate interest from the private sector. The guidelines should ensure clear business direction and niche market opportunities including the assurance of long-term company existence. Strong business policy and legal support will build investor confidence.

Since the regulation in the Philippines is mostly the same for other renewable energy technologies, the SPV Guidebook can be used as a reference tool for project development for the other renewable energy resources. More information is available on the ASEAN RE Guidelines web platform at www.re-guidelines.info (Renewable Energy Support Programme for ASEAN, 2014).

A project developer can pursue four major types of business models for on-grid solar PV projects, namely FiTs, a Power Supply Agreement (PSA) with distribution utilities, commercial contracting and net-metering. Table 4 below gives a comparative overview of project development for the four business models and their milestones. In general, the table also holds true for other renewable energy projects, such as wind, hydropower or biomass.

[35] GIZ contributed this section (Hendrik Meller and Ferdinand Larona); see www.giz.de/fachexpertise/downloads/giz2013-en-administrative-procedures-philippines-on-grid.pdf.

Table 4. Comparative overview of project development for on-grid solar PV

Milestones	Business models			
Project development phases Milestone documents/certificates/contracts/agreements	FiT Direct negotiation	PSA Competitive selection	B2B Commercial contracting	Net-metering application
1 Project preparation				
1.1 Renewable energy application	X	X	X	
1.2 Net-metering application to the distribution utility				X
1.3 Renewable energy service contract	X	X	X	
2 Pre-development preparation				
2.1 BOI Project Registration	X	X	X	
2.2 NCIP Certificate	X	X	X	
2.3 DENR Environmental Compliance Certificate	X	X	X	
2.4 DENR Permit to Operate	X	X	X	
2.5 DAR Order of Conversion	X	X	X	
2.6 LGU Resolution of Support from host barangays	X	X	X	
2.7 LGU Resolution of Support from host municipality and provincial government	X	X	X	
2.8 LGU Building Permit (submit to distribution utility)	X	X	X	X
2.9 LGU Electrical Permit (submit to distribution utility)	X	X	X	X
2.10 Distribution impact study (performed by distribution utility)				X
2.11 LGU Certificate of Final Inspection (submit to distribution utility)				X
2.12 Department of Energy Certificate of Confirmation of Commerciality	X	X	X	
3 Development				
3.1 Department of Energy Confirmation of Electromechanical Completion	X	X	X	
3.2 Department of Energy Certificate of Endorsement for FiT Eligibility	X			
3.3 ERC Certificate of Compliance	X	X	X	X
4 Registration and connection				
4.1 NGCP/distribution utility Connection Agreement	X	X	X	
4.2 NGCP Transmission Service Agreement	X	X	X	
4.3 NGCP/distribution utility Metering Service Agreement	X	X	X	
4.4 TRANSCO Renewable Energy Payment Agreement	X			
4.5 Registration on the Wholesale Electricity Spot Market	X	X	X	
4.6 Registration on the Interim Mindanao Electricity Market (in Mindanao alone, which has no wholesale electricity spot market)	X			
4.7 Distribution utility PSA	X	X		
4.8 ERC PSA approval		X		
4.9 Distribution utility Connection Agreement	X			X

Source: GIZ, 2013

FiT: Feed-in-Tariffs PSA: Power Supply Agreement B2B: Business to Business

The involvement of various government agencies in the permitting process, such as the ERC, Department of Energy and the Department of Environment and Natural Resources, ensures a comprehensive regulatory process. However, it makes it tedious as investors/developers are obliged to follow all the procedures including the timelines and milestones of the agencies concerned. People usually express doubts about the process when authorities do not react promptly, a public authority uses its discretion improperly, or simply as a result of the high number of public authorities involved. In one public forum, a solar developer revealed that no less than 160 signatures were needed for its project before it was able to start construction. It revealed that the permitting process took almost three years while actual construction (over 20 MW of solar PV) took less than a year.

The milestones for each phase of the project cycle (especially for solar projects) are presented below.

Project preparation

The renewable energy developer has to prepare and submit its response to the legal, technical and financial requirements to the Department of Energy to show its serious intention to develop the project. During this stage, the renewable energy developer assesses a suitable location for solar project development. Necessary data/information have to be collected, and desk studies and site surveys carried out.

A so-called "blocking system", which allocates specified areas for development, determines whether permission is given to develop a renewable energy project in the Philippines. In practice, the developer must apply to the Department of Energy with a request for a Renewable Energy Service Contract. This entitles the developer to fiscal and non-fiscal incentives under the Renewable Energy Act, provided all other requirements are met.

Pre-development

This phase is crucial, especially under the milestone approach through which the Renewable Energy Service Contract is terminated if the developer does not satisfy all the requirements within 12 months. Numerous permits or licences must be obtained from various government agencies *e.g.* the Department of Environment and Natural Resources, Department of Agrarian Reform, National Commission on Indigenous People and local government units. Financial support must be secured and mobilised from financial institutions or investors. A financial closure must be reached in order to commence physical construction and equipment procurement and go on to the next phase (development stage).

Development

After securing the Department of Energy Certificate of Conversion from pre-development to development, the renewable energy developer proceeds with the construction of the plant. In the development stage the developer will work on the financial closure, equipment procurement and physical construction of the solar PV power plant. When the power plant construction reaches electromechanical completion (about 80% of the way through the project) the Department of Energy conducts final inspection. Several permits/certifications must be obtained especially before the solar PV plant can begin its commercial operation. Where solar PV projects use FiTs, the Certificate of FiT Eligibility must be issued by Department of Energy and endorsed to the ERC. Where solar PV projects use a PSA between the distribution utility and the developer, ERC approval is required for the PSA. In both cases the solar PV project developer must obtain a Certificate of Compliance from the ERC which allows the power plant to go into commercial operation.

Registration and connection

The solar PV project developer must obtain an approval, allowing the power plant to be connected to the grid through a connection agreement. The agreement will allow the developer to connect the power plant to the power grid. Where the power plant is to be connected to the distribution network, the renewable energy developer must seek approval from the relevant distribution utility owning the franchise in the area. Where the power plant is to be directly connected to the national transmission grid, the solar PV project developer secures a connection agreement with the national grid company, NGCP. After a connection permit is secured, a service agreement must be applied for. Two agreements constitute the service agreement: a transmission service agreement and a metering service agreement. NGCP is mandated to provide revenue meters to all renewable energy installations, except for embedded systems, where this is carried out by the distribution utility owning the distribution system. This means a metering agreement must be signed between the renewable energy developer and either NGCP or the distribution utility.

Financing initiatives supporting renewable energy developers

Although there has been strong growth in renewable energy project applications and installations, the majority of private renewable energy projects is funded by corporate balance sheets rather than project finance. Local commercial banks are recognising the business potential of renewable energy and are becoming more open to lending to renewable energy projects. Nevertheless, the high risk perception associated with renewables means lending terms for renewable energy projects are still conservative, especially for new renewable energy players still establishing their financial track record (Milo, 2013).

While the bulk of the total project cost is allotted to the actual construction of the renewable energy power facility, significant expenses are also incurred during the pre-development or preparatory phase of the project cycle. Pre-development activities include conducting feasibility studies, detailed engineering design, permitting, public consultations and other preparatory activities.

At this early stage of project development, there are very few sources of local financing. Larger companies can finance their own pre-development activities but this is challenging for newer and smaller companies. In this context, governmental financial institutions, particularly the Land Bank of the Philippines and the Development Bank of the Philippines, offer special loan packages or strategies. These help developers fund the renewable energy preparatory phase as described below.

1. **Development Bank of the Philippines.** This provides loans for preparatory activities and can provide 0% finance for feasibility studies for renewable energy projects. These type of loans are usually bundled or tied in with the main project loan (Cruz, 2014).
2. **Land Bank of the Philippines.** This is the Programme and Fund Manager for the Project Preparation Fund created by the United Nations Development Programme's project, entitled Capacity Building to Remove Barriers to Renewable Energy Development (CREDP). The Project Preparation Fund is a partial loan fund that provides 0% loan interest for up to 50% of the project preparatory costs (Center for Environment Studies and Management, 2011) (Calado and Ramos, 2014).

The Development Bank of the Philippines and the Land Bank of the Philippines have provided sizeable loans for renewable energy and other environmental projects over the years. They are the largest providers of local debt financing for renewable energy projects (Milo Sjardin, 2013). Both governmental financial institutions are recipients of most Official Development Assistance (ODA) funds intended to provide financial support to developmental projects, including clean energy projects. The evaluation process and lending terms are generally the same if the governmental financial institutions are using their internal funds (Cruz, 2014) (Calado and Ramos, 2014). The Development Bank of the Philippines and the Land Bank of the Philippines are able to offer loans with long tenor but the interest rates are usually level with commercial rates.

The Environmental Development Project is the Development Bank of the Philippines' primary lending facility for green investments. In addition to renewable energy, it supports investments in industrial pollution prevention and control, solid and hazardous waste management, and water supply and sanitation. It is funded by a JPY 24.8 billion (USD 210 million) loan from the Japan International Cooperation Agency. In 2014, the Environmental Development Project approved 17 renewable energy loan applications amounting to PHP 5.8 billion (USD 129 million) (Development Bank of the Philippines, 2015).

The challenge for project developers is to access funds from local banks. Financial institutions require proponents to put up 25%-30% of the total project cost as equity share. Some companies are unable to raise domestic equity, while foreign ownership is constitutionally limited to 40%.

Local commercial banks, including Bank of the Philippine Islands, Banco de Oro and Rizal Commercial Banking Corporation, have funded renewable energy projects mostly through corporate debt financing. Project finance is not yet widely adopted for renewable energy. New and smaller industry players thus do not find it easy to secure debt for project development.

The Bank of the Philippine Islands is one of the more aggressive commercial banks funding clean energy projects. It works with the International Finance Corporation's Sustainable Energy Finance Program to provide financing for energy efficiency and renewable energy projects. In 2013, the Bank of the Philippine Islands and the Sustainable Energy Finance Program reported total outstanding loans of PHP 9.77 billion (USD 232 million) to clean energy projects. The credit risk instruments provided by the Sustainable Energy Finance Program are an effective risk mitigation mechanism that allows the Bank of the Philippine Islands to finance clean energy projects (Gatdula, 2014).

The United Nations project entitled Capacity Building to Remove Barriers to Renewable Energy Development project, known as CBRED, initiated a Loan Guarantee Fund to spread the risk among the guarantor, lender and borrower-proponent of renewable energy projects. The Local Government Unit Guarantee Corporation (LGU Guarantee) is the fund manager for the Loan Guarantee Fund. This guarantee fund was designed especially for renewable energy projects as a financial instrument mitigating risk to encourage more banks to lend to renewable energy. However, Loan Guarantee Fund coverage is limited to PHP 20 million (USD 0.47 million), which is appropriate for smaller renewable energy projects (Center for Environment Studies and Management, 2011).

Since its inception in 2008, the fund has guaranteed one mini-hydropower project in Mindanao, which is now operating. LGU Guarantee Corporation is also the Guarantee Program Manager of the World Bank's Electric Cooperative Partial Credit Guarantee Program. This is intended to provide partial credit guarantee to electric co-operatives for power distribution system upgrades, including the purchase of sub-transmission assets and emergency capital expenditure. Also eligible are renewable energy projects implemented by or in joint partnership with electric co-operatives or renewable energy projects whose power off-taker is an electric co-operative. An additional USD 40 million from the World Bank's Philippine Renewable Energy Development Project expands the Electric Cooperative Partial Credit Guarantee Program (LGU Guarantee Corporation, 2013).

Renewable Portfolio Standard

The RPS is a policy instrument obliging the power suppliers to produce or acquire a certain percentage of electricity from renewable energy sources. It was required as one of the policy mechanisms mandated by the Renewable Energy Act of 2008 (RA No. 9513). Its purpose is to contribute to the growth of renewable energy by diversifying energy supply and to help reduce greenhouse gas emissions.

However, it is not fully operating despite public consultations and technical working group meetings across the country in 2011-2013. The delay was due in part to the thrust created by the FiT implementation in 2012. Over recent years, like other countries experiencing the mounting pressure of FiTs on the governmental budget, the Philippines has been seeking an alternative policy tool that can be sustained over the long term.

The Philippine Department of Energy thus revived the RPS and issued draft RPS rules in the form of a draft government circular in June 2016. Proposals called for at least a 30% share of renewables in the country's installed total power generation capacity, with the continued support of other policy instruments such as FiTs. The NREB and Department of Energy are working closely together and engaging with other stakeholders to advance the development of RPS and the implementation rules.

About half the rural population and a fifth of households without electricity are found in remote or isolated areas

3.3 Renewable-powered mini/ microgrids

It has been widely recognised that meeting demand for electricity in rural/remote areas by extending the main grid would be increasingly difficult and uneconomic, if not completely impossible. This is due to increasing connection costs per consumer, low-level economic activities and associated high costs encountered when managing rural systems. This is largely the case with the electrification of rural and isolated areas in the Philippines, usually islands.

About half the rural population lives in these types of remote/isolated areas, including about 20% of the households without electricity access. Many areas connected to the mini- or microgrids powered mostly by diesel have electricity only four to seven hours per day due to operational and economic constraints. Owing to these remote or isolated locations, the diesel is usually very expensive, creating high electricity prices for end-users. To achieve the 90% household electrification rate – the target set by the government – many regions would have to make greater efforts to provide electricity. This would at least meet basic needs through stand-alone power generation facilities such as solar home systems.

In most cases, stand-alone power generation systems are unable to deliver the reliable high/near-grid quality electricity essential to supporting productive use, creating new businesses and generating revenues/incomes. There has been a sharp decline in renewable energy system costs, and interest is growing from private sector, known as the QTP in the Philippines. This sector wishes to provide electricity services to the rural and isolated areas, particularly the remote and unviable villages. Hybrid micro/mini-grid systems[36] with diesel and renewable energy sources are able to meet the technical requirements for industrial and commercial applications and thus generate the sustained demand for energy supply.

However, only three private companies i.e. Power Source Philippines, DMCI Power and Sabang Renewable Energy Corporation have thus far taken action and operate as an "alternative electricity provider".[37] They serve Rio Tuba, Palawan and Malapascua Island in Daanbantayan, Cebu, Semirara Island in Antique and Sabang, and Puerto Princesa City.

Clearly, there is a gap between policy design and reality. The reasons behind the lack of private sector engagement merit further investigation. A study of this kind will help identify incentives and policy measures that need to be put in place, and the needs for further improvements in the legal and regulatory frameworks. This will allow and encourage the private sector, or "alternative electricity provider", to participate in and scale up the business of providing electricity services to remote and unviable areas in the Philippines.

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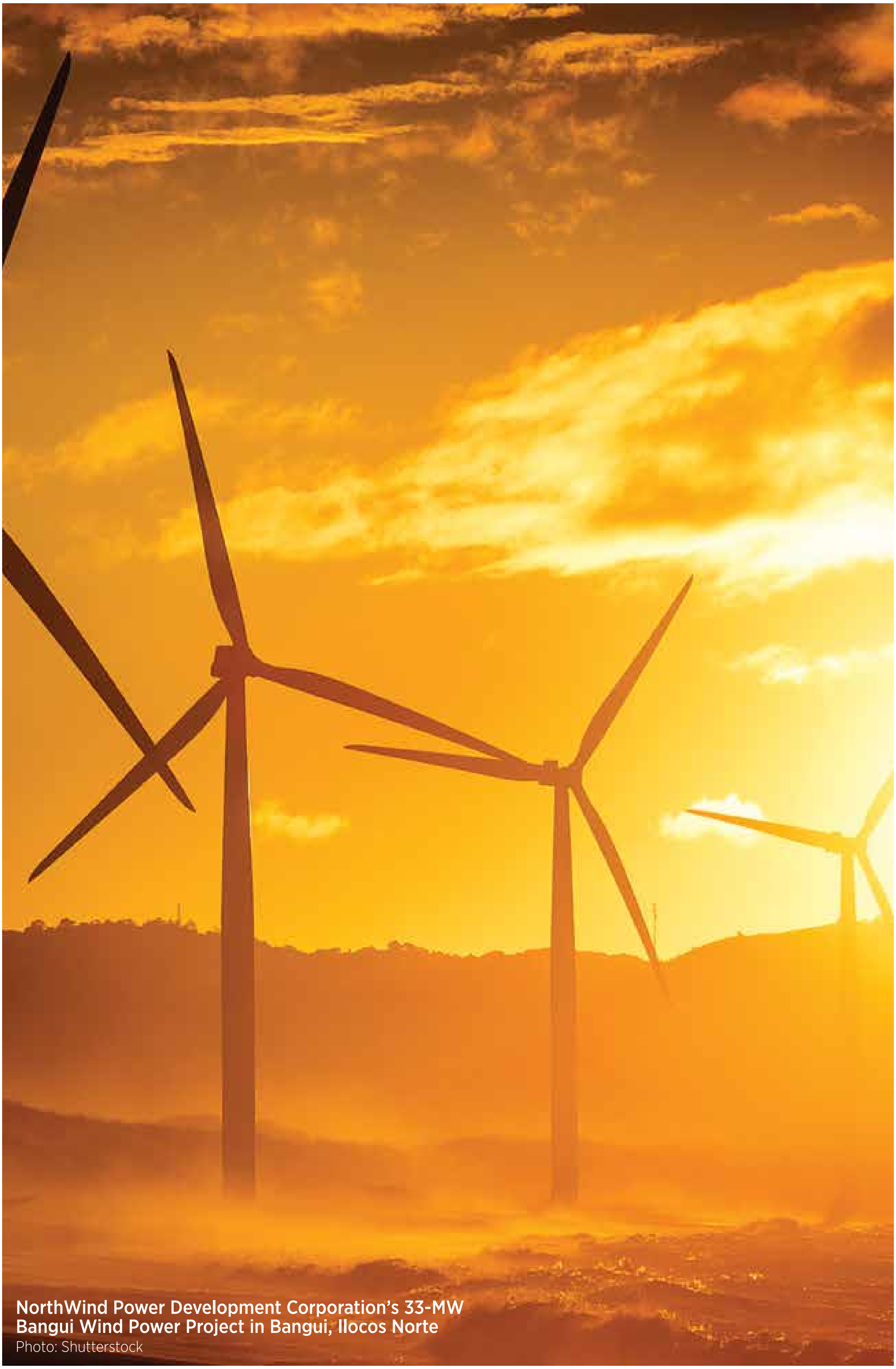
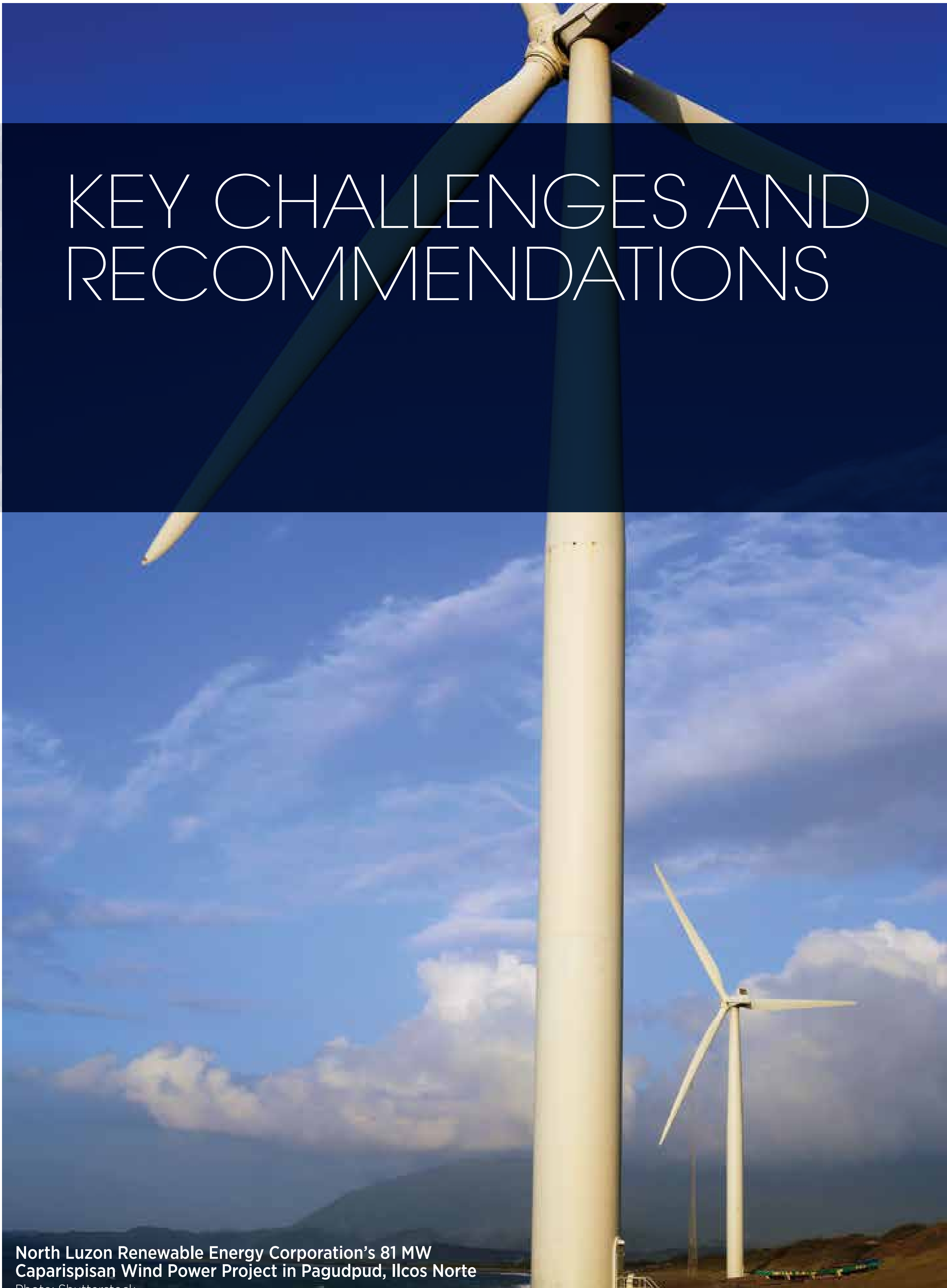
[36] Mini/microgrid is a modern concept for a small-scale decentralised generation system with the capacity to integrate different energy sources and energy storage technologies on a modular basis. It can operate off the main grid or be integrated into a grid-connected model. In rural settings, it typically operates in off-grid mode.

[37] Reference to the term used by SolarPower Europe.



NorthWind Power Development Corporation's 33-MW Bangui Wind Power Project in Bangui, Ilocos Norte
Photo: Shutterstock

KEY CHALLENGES AND RECOMMENDATIONS



North Luzon Renewable Energy Corporation's 81 MW Caparispisan Wind Power Project in Pagudpud, Ilcos Norte
Photo: Shutterstock

04

The Philippines has rapidly ramped up its renewable energy deployment in recent years, particularly since the FiTs have been introduced, attracting a great deal of attention from the private sector. However, this has brought about a variety of challenges that could obstruct the further development of renewable energy resources in the country.

This chapter discusses some of the priority concerns identified from literature reviews and the insights gained from respondent interviews, focus groups and multi-stakeholder round table discussions. We present general recommendations as well as specific recommended action to deal with them.

The RRA process co-ordinates development partners, financial institutions and the private sector in contributing to the formulation and implementation of an articulated list of activities and initiatives identified by the stakeholders and experts in the RRA.

4.1 Political commitment

Challenges

Since the Renewable Energy Act was signed in 2008, the Philippines has made remarkable progress in renewable energy development. However, the government has given many private sector stakeholders mixed signals. On the one hand it called for an increase to investment in renewable energy, especially from the private sector. On the other it expressed concern about the high capital costs of renewable energy and variability of its supply. The government has reiterated that its energy sector objective has always been reliable power that is “preferably clean” and “reasonably priced”. This has caused some confusion in the renewable energy industry. Private sector stakeholders are trying to make sense of how far the government has really committed itself to stimulating renewables deployment.

General recommendation

Strong political commitment is an extremely important factor for nurturing a healthy and sustained market for renewable energy development. This commitment should not only be clear and strong but also consistent and able to withstand changes of administration. This would guarantee investor and developer confidence in the Philippine government as a reliable partner in the investment or development of renewable energy projects.

Recommended action: Raise awareness to ensure sustained political commitment

In the Philippines, public awareness plays a very important role in influencing the political commitments, decisions and orientation of public policies. For a country with the second highest electricity tariffs in the region, the economic benefits of adopting renewables are of great interest to the public. This is especially the case in rural areas and islands, where fuel costs are prohibitively high, and is one of the important economic factors explaining electricity service provision disruption. The renewable energy sources have proved the most cost-effective options in these settings thanks to the near-zero marginal production costs of electricity. Costs of certain renewable energy technologies, especially solar PV, have fallen dramatically. If capital costs could be bought down with support from the government, affordability could be significantly improved.

Different stakeholders should launch a series of public campaigns with the assistance and participation of the development partners allocating resources to the endeavour. Educational programmes could be set up to provide real examples to the public and can also be used to provide practitioners with hands-on experience.

4.2 Grid infrastructure study

Challenges

The Philippines has taken the lead in the region and introduced a comprehensive set of policy tools and a regulatory framework propelling the scale-up of renewable energy deployment. Sustained positive interest from investors and developers means there is a surplus in applications for renewable energy projects, especially for solar PV.

This poses a growing challenge for the grid operators. It is particularly tough in areas where the grid is relatively weak or demand is low while variable renewable energy resources are geographically distributed across a small area. One example is Northern Luzon, which offers 337 MW of installed generation capacity from wind resource, most of which is on its northern coastline. According to the national grid corporation NGCP, frequency limit violations increased by more than one-third in 2015 compared to the previous year and were caused partly by the rapid increase in variable renewables in the main grids. This indicates mounting stress on the Philippines power system. In some areas, solar and wind power have to be curtailed to ensure reliable grid operation. Although the share of variable renewables in the main power grids is comparatively low, evidence of grid instability is emerging and has to be addressed.

General recommendation

Variability is the primary technical challenge experienced by variable renewable energy sources. A low share does not cause much concern for the grid operator. However, when there is an expansion in renewable energy generating capacity in the grid, its operators have to deal with variability on both the demand and supply side, particularly in the case of utility-scale solar PV and wind parks. This requires new capabilities and methods to control and regulate the power system to ensure reliable power supply.

To accomplish this goal, further intelligence on the power system condition is needed through a grid infrastructure assessment examining grid stability at a time when variable renewable energy penetration is high.

Recommended action: Assess the country's grid infrastructure

A comprehensive grid evaluation is recommended concentrating on grid stability in Luzon, Visayas and Mindanao. This should include the present state of the infrastructure and quality of service, as well as power flow and stability analysis in response to solar or wind generation inputs at various points and different penetration levels. This will provide a better understanding of the impact of variable renewable resource connection on the grids and thus minimise potential grid operation problems. Load profiles and future electricity demand should also be part of the study. The existing and pipelined utility-scale and small-scale variable renewable energy generation projects, primarily solar PV, also need to be investigated. This should be aligned with research into the need to improve the transmission and distribution grids, enabling the networks to be more flexible and resilient and to respond quickly to variations and abnormal situations. An islanded model of mini/microgrids in the bulk power system could be one option for designing and configuring the future grid.

The results should produce proactive energy planning including the generation, transmission and distribution network. This provides the standards and guidelines for future solar PV grid-connected systems.

The completion of this recommended study should be followed by a training programme. This would equip the utilities with the knowledge necessary to understand the results and also modify the model when there are changes to the grid.

4.3 Institutional capacity analysis

Challenges

The Renewable Energy Act provides a legislative framework for renewable energy development in the Philippines including the institutional set-up. The Renewable Energy Management Bureau and NREB are the primary architects of the country's renewable energy sector. However, a number of key stakeholders are playing an important part in the development of the renewable energy sector in the Philippines, particularly in engaging renewable energy developers. They include, for instance, the ERC, TRANSCO, the National Electrification Administration, NPC and its branch focusing on off-grid electrification (SPUG), as well as local government units.

During the course of the RRA, stakeholders identified the lack of capability and resources of existing institutions against a backdrop of rapid renewables deployment in the Philippines. This is due largely to the mismatch between physical project applications or installations and institutional capacity-building. Nonetheless, this matter has been recognised and to an extent dealt with. For instance, the Renewable Energy Management Bureau had scaled staff down to about 80 in 2008-2014 but this increased by 50% in 2014-2016, providing it with sufficient staff to perform its duties. This is an indicator of the renewable energy boom in the Philippines.

Yet the rapid growth of renewables requires capacity improvement in all the relevant institutions, not just the Renewable Energy Management Bureau. New and emerging issues are also likely to further require the bureau's attention and capacity, though not quite yet.

To some extent, this has contributed to the further increase in renewable energy projects that have received service contracts. Without a clear institutional framework guiding and explaining the role of each player, the implementation of the NREP has not been easy.

General recommendations

A well designed and functional institutional framework helps sustain renewable energy programmes including NREP, mainstream the administrative procedure and identify the areas across the renewable energy sector in which an effective capacity-building programme may be needed.

A thorough assessment and analysis is thus recommended on renewable energy institutional structure, including mandates, the capacity of each agency or stakeholder, and the interaction/co-ordination between them.

Recommended action: Examine institutional capacity in the Philippine renewable energy sector

A thorough institutional capacity assessment of the Department of Energy Renewable Energy Management Bureau and other key relevant agencies and stakeholders is recommended. This analyses the legal mandates and responsibilities for implementing the Renewable Energy Act and the

NREP. It compares this to the current functions and capacity of the concerned agencies, co-ordinating mechanisms in place, and new and emerging challenges in Philippine renewable energy development that would require new sets of skills and staff to address.

More specifically, it evaluates the Renewable Energy Management Bureau current capability and established expertise against the mandates, and builds on them. It identifies the existing skills of current personnel, analysing its wide network to intensify collaborative action, and exploring the efficient use of available resources. This recommended action will also consider the need and possibility for creating a third-party entity supporting the Renewable Energy Management Bureau on service contract review of application submitted by developers for the request of authorisations of permits. This will be based on the preliminary results of the institutional capacity and the future needs assessment. This will help improve the ability of the other key stakeholders in the sector to function and perform in a co-ordinated fashion.

The study results will yield recommendations to enhance capacities, which will be presented to the Department of Energy and other governmental agencies most relevant to institutional development affecting renewable energy in the Philippines. The results can be also presented to development partners for the purpose of designing more effective capacity-building programmes aided by various technical assistance programmes.

4.4 National mini/microgrid study

Challenges

About 6.1 million households have no electricity in the Philippines, most of whom are farmers and fishermen who live in remote, unviable areas and islands. Unviable areas have been defined as a geographical area within the franchise zone of a distribution utility where immediate distribution line extension is not feasible. Because of the country's geography, achieving 90% household electrification by 2017 is not easy, especially if it involves connecting all households to main power grids.

Mini-grids can be a viable and cost-effective solution to electrification where the distance from the main grid is too great and the population density too low to justify a grid connection on economic grounds. Mini-grids provide an improved service compared to household systems. Depending on local resources and technologies employed, they can be as good as a well functioning grid. From a long-term and development perspective, it thus makes sense to deploy mini-grid installations in areas with no electricity. Renewable energy systems, and especially both solar PV for power generation and run-of-river small hydropower, have become highly cost-effective compared to mini-grids powered by diesel gen-sets. This is due to falling technology costs.

For areas with mini-grids already installed, high and volatile fuel costs make it more difficult to produce continuous electricity. For instance, diesel in some islands can exceed USD 1.3 per litre, nearly 60% more expensive than the Philippines average due to the high transportation cost. High expenditure on diesel fuels for rural electrification resulted in a shortfall of USD 70 million in operational costs in 2011, according to the Philippines NPC. This has also contributed to very limited service in most of the islands, lasting between four and 12 hours.

These diesel-fuelled power facilities can be retrofitted or hybridised with renewable energy technologies if substantial energy resources are available. The Philippine long-term energy scenario states that it will remain substantially dependent on imported oil for the next two decades. Renewable-powered or hybrid mini-grids will thus improve national energy security.

In this context, a number of studies related to mini-grids have been conducted with support from different development partners. However, those studies either examined mini-grid potential at the project, community or island level, or a particular policy or scheme relevant to mini-grids or off-grid electrification. At the national level, there is little understanding of why mini-grids powered by renewables are strategically important to energy security nor what the current regime requires to mainstream such mini-grids in future. Nevertheless, the whole spectrum of issues related to mini-grids needs to be investigated. This includes physical potential, the policy and regulatory framework, technological options, business models, and social and economic benefits.

General recommendation

Establishing an enabling environment for mini-grids based on renewable energy is recommended; it would shift the model for universal energy access and increase energy security. To achieve this objective, a comprehensive national study on mini-grids powered by renewable energy is recommended.

Recommended action: Study potential for renewable electrification through mini- and microgrids

The recommended study should estimate physical potential and cover the policy and regulatory framework, technological options/guidelines and business models. This will yield an understanding of the long-term social and economic benefits that such systems can generate for the whole of society. Its geographical focus is on islands and remote regions with no electricity, where mini-grids powered by renewables can be economically viable and also encourage rural development.

The recommended study will also research potential sites for mini-grids and explore renewable energy technology options and available resources for power supply. It will identify problems and barriers, and come up with alternative approaches and recommendations to promoting renewable energy in off-grid areas, especially in the electric co-operative franchise areas. This is where the sites with high mini-grid potential are to be found. Mini-grids offer abundant benefits, including the ability to restore power more easily after a disaster, improved quality of life and new opportunities for income generation when providing power to rural areas. All these impacts should be studied.

The study will generate recommendations for developing the policy and regulatory frameworks necessary to promote mini-grid investments and to facilitate private sector engagement.

Annex 1. Summary of rural electrification projects in the Philippines

No.	Project name	Partners	Brief description
1	USAID AMORE project	USAID, barangay renewable energy community development associations	This project provided renewable energy systems to remote off-grid communities in Mindanao affected by conflict and with no electricity. It consulted with the relevant communities throughout project implementation, and organised and trained the barangay renewable energy community development associations. They were shown how to operate and maintain renewable energy systems, sell solar systems and manage the community's operation and maintenance funds, which it had raised itself. The profit earned from selling systems is reinvested in new systems.
2.	Philippine Rural Electrification Service Project	NPC-SPUG	This project successfully provided electricity to 5,129 households in 108 barangays using PV systems, and 12,183 households in 102 barangays using a diesel-fired mini-grid system. It was intended to be passed on to a QTP upon completion in 2009. However, there was no interest in carrying the responsibility further. NPC-SPUG currently acts as an interim QTP for the Philippine Rural Electrification Service Project areas (Department of Energy, 2012).
3.	Solar Power Technology Support Project	Department of Agrarian Reform, Government of Spain	This project is an integrated social fund and agricultural support project. It used PV energy systems as enabling technology for agricultural and rural enterprise development in agrarian reform communities.
4.	Philippine National Oil Company Solar Home Distribution Project	Philippine National Oil Company	This project aimed to distribute 15,000 solar home systems. It bears 60% of the total cost of the system while the remaining 40% is paid by the end-users. The Philippine National Oil Company partnered with local microfinance institutions to help the beneficiaries pay for their solar home systems in instalments with minimal interest. Using this approach, the maintenance and upkeep of the solar systems was sustained.

Annex 2. Overview of the Renewable Energy Act of 2008

The Renewable Energy Act 2008 (Republic Act No. 9513) is the first comprehensive renewable energy legislation enacted in Southeast Asia. The Act co-ordinates with and provides support to other Philippine government policies. The objective is to ensure the provision of reliable indigenous renewable energy sources to replace imported fossil fuels. Its approach is to create an enabling environment to make renewables financially attractive to investors by providing fiscal incentives and implementing non-fiscal economic instruments.

To achieve the desired target, the Renewable Energy Act created two important institutions tasked with policy planning and implementation. The Department of Energy Renewable Energy Management Division was transformed into the Renewable Energy Management Bureau. This is the policy development, planning and implementation arm supporting the growth of the renewable energy industry as mandated by Section 32 of the Renewable Energy Act. It also has the task of supervising and monitoring the activities of other governmental agencies related to renewables, as well as monitoring private entities to ensure they comply with existing rules.

The second arm is known as the National Renewable Energy Board (NREB). It was created pursuant to Section 27 of the Renewable Energy Act. The NREB is a multi-stakeholder body composed of one representative each from various government agencies, renewable energy project developers, distribution utilities, electric co-operatives and governmental financial institutions, NGOs and others. Its activities are supported by a technical secretariat at the Department of Energy Renewable Energy Management Bureau. Its role is advisory in nature, gathering inputs from its members, recommending specific action for implementing policies and programmes, and overseeing the use of the Renewable Energy Trust Fund.[38]

The Renewable Energy Trust Fund was also established under the Renewable Energy Act with the aim of financing the activities that accelerate the exploration and commercialisation of the country's renewable energy resources in line with Section 28 of the Renewable Energy Act. Eligible activities under the Renewable Energy Trust Fund are renewable energy resource assessment, capacity-building and technical research on emerging renewable energy technologies such as ocean energy. The Rules and Regulations Implementing RA No. 9513[39] identify the monetary sources of the Renewable Energy Trust Fund. They include:

- proceeds from emission fees collected from all generating facilities (RA No. 8749 Philippine Clean Air Act)
- 1.5% of the net annual income of the Philippine Charity Sweepstake Office
- 1.5% of the net annual income of the Philippine Amusement and Gaming Corporation
- 1.5% of the net annual dividends remitted to the National Treasury by the Philippine National Oil Company and its subsidiaries
- 1.5% of the proceeds of the government share collected from the development and use of indigenous non-renewable energy resources
- contributions, grants and donations made to the Renewable Energy Trust Fund
- any revenue generated from the utilisation of the Renewable Energy Trust Fund
- proceeds from fines and penalties imposed under the Renewable Energy Act.

[38] The Renewable Energy Trust Fund has yet to be established and will be described below.
[39] The text of these implementing Rules and Regulations is available at www.doe.gov.ph/sites/default/files/pdf/issuances/dc2009-05-0008.pdf.

In addition to the institutional frameworks it created, the Renewable Energy Act introduced a number of fiscal and economic incentives in Chapter VII. To make use of the fiscal privileges and incentives, renewable energy project developers, manufacturers, fabricators and suppliers of locally produced renewable energy equipment must register with the Department of Energy Renewable Energy Management Bureau and Board of Investments. They must also secure Certificates of Endorsements from the Renewable Energy Management Bureau for each transaction. The fiscal incentives and privileges of renewable energy development are listed below.

- Income tax holiday valid for the first seven years of commercial operations.
- Duty-free imports of renewable energy machinery. This incentive is valid for ten years after a certification of entitlement to incentives is issued.
- Special realty tax rates on equipment and machinery. These taxes on civil works, equipment, machinery and other improvements exclusively used for renewable energy facilities cannot exceed 1.5% of their original costs.
- Net operating loss carry-over. The operating loss by the renewable energy developer in the first three years after the start of commercial operation is carried over as a deduction from gross income for the next seven consecutive taxable years.
- Corporate income tax rate of 10% on net taxable income. This is valid after the income tax holiday.
- Accelerated depreciation of plant, machinery and equipment used for the exploration, development and utilisation of renewable energy resources. These can be depreciated using a rate not more than twice the rate which would have been used otherwise.
- Zero percent (0%) Value Added Tax on sales of fuel or power generated from renewable sources.
- Tax exemption on all proceeds from the sale of carbon emission credits.
- Tax credit on domestic capital equipment and services. This tax credit is equivalent to 100% of of the combined Value Added Tax and customs duties on renewable energy machinery and equipment had these items been imported. This is given to a renewable energy project developer that purchases them from a domestic manufacturer or supplier.
- Cash incentive for missionary electrification. Developers of renewable energy projects for missionary electrification are entitled to a cash incentive per kilowatt-hour rate generated.

In addition to fiscal incentives, the Renewable Energy Act has also provided for economic or non-fiscal stimuli to create a friendlier market for systems based on renewable energy. The renewable energy policy mechanisms to be implemented are explained below.

- **Renewable Portfolio Standards.** This policy requires electricity generators, distribution utilities or suppliers to source or produce a specified portion of their electricity supply from eligible renewable energy sources. This will be imposed on all electric power industry participants serving on grid areas, on a per grid basis upon determination by the NREB (Section 4 of the Rules and Regulations Implementing Republic Act No. 9513). The NREB sets the required minimum percentage that must generated from renewable energy resources.
    - The RPS rules have been drafted by the Department of Energy and will be finalised when the minimum percentage of required renewable energy generation has been set by the NREB. The NREB's guiding target in setting the RPS is to bring the share of renewable energy to the power generation mix to at least 35% by 2030 (NREB 48th Minutes of Meeting, 2014).
- **Renewable energy market (REM).** Under the Renewable Energy Act (Section 4), "Renewable Energy Market" (REM) refers to the market where the trading of renewable energy certificates equivalent to an amount of power generated from renewable energy resources is made. The Rules and Regulations Implementing Republic

Act No. 9513 (Section 10) further specifies: "the REM shall be a sub-market of the WESM [Wholesale Electricity Spot Market] where the trading of Renewable Energy Certificates may be made." The renewable energy market will facilitate the compliance of electric power participants to the RPS. A renewable energy registrar will be established and operated by the Philippines Electricity Market Corporation (PEMC). It will issue, keep and verify renewable energy certificates corresponding to energy generated from eligible renewable energy facilities. Electricity generators, distribution utilities or suppliers not be able to meet the required minimum generation of renewable energy can purchase renewable energy certificates to make up for the gap and comply with the RPS (Section 8, Renewable Energy Act).

- o The renewable energy market is still being set up. Its implementing rules are still being finalised. The Department of Energy and PEMC formed a joint steering committee to formulate its framework and rules and to set it up as a sub-market of the Wholesale Electricity Spot Market (Department Order DO 2010-06-0012).

- **Feed-in Tariff.** Applicable only to solar, wind, biomass and run-of river hydropower, the FiT guarantees fixed tariffs for not less than 12 years for these resources (Section 7, Renewable Energy Act). The FiT rates proposed by the NREB for the capacity allocations were approved by the ERC in 2012 (ERC Resolution No. 10, Series of 2012). The rate for wind projects was cut in October 2015 to PHP 7.40/kWh for the additional installation target of 200 MW.

- Renewable energy power plants are deemed eligible for FiTs once a Certificate of Compliance has been issued by the ERC. Own-use generating plants, and renewable energy plants operating commercially before the establishment of the FiT, were not eligible under this scheme. Inclusion was made on a first-come first-serve basis until the capacity allocations had been filled. Payments are charged to all electricity end-users as a uniform fee entitled a FiT-Allowance (FiT-All). This covers the FiT payments to renewable energy power generators. As the designated fund administrator for FiT-All, TRANSCO disburses the appropriate FiT payments to the corresponding renewable energy generator (ERC Resolution series No 16, 2010).

- o Solar and wind power associations requested an increase in their cap allocations even before the FiT system was introduced. In 2015, a large volume of solar energy projects in progress coincided with a looming power supply crisis caused by the El Niño effect, which can reduce hydropower generation. The Department of Energy thus increased the FiT installation targets for solar from 50 MW to 500 MW (Department of Energy Certification, April 2014). Increasing the solar capacity allocation is expected to encourage more solar power plant development, helping alleviate power supply deficiency. The ERC approved the solar FiT rate of PHP 8.69/kWh (ERC Resolution series No. 06, 2015) for the additional solar installation target.

- o The Department of Energy increased the capacity allocations for wind power plants to 400 MW (Department of Energy Certification, April 2015) since the wind FiT had already been oversubscribed. The ERC accordingly approved a FiT rate of PHP 7.40/kWh (ERC Resolution series No. 14, 2015) for the additional increase. The table below shows the number of eligible FiT projects and their total installed capacities under the FiT scheme.

Table 5. Eligible FiT projects, January 2015

	Capacity allocation/ installation target (MW)	Number of eligible projects	Total approved FiT capacities	Subscribed allocation (%)
Biomass	250	5	21.651	6%
Hydropower	250	3	12.60	5%
Solar	500	1	22	4%
Wind	200	3	249.9	124%

Source: Philippine Department of Energy, January 2015

- **Green Energy Option.** The Green Energy Option scheme provides the end-users with the option to choose renewable energy resources as their sources of energy. Once the Department of Energy has ascertained its technical viability, end-users may directly contract from renewable energy facilities their energy requirements distributed through their respective distribution utilities (Section 9, Rules and Regulations Implementing Republic Act No. 9513).
  - The rules and mechanics of the Green Energy Option are being finalised by the Department of Energy with inputs from the NREB and must be approved by the ERC before it can be implemented.
- **Net-metering.** "Net-metering is a consumer-based renewable energy incentive scheme wherein electric power generated by an end-user from an eligible on-site Renewable Energy generating facility and delivered to the local distribution grid may be used to offset electric energy provided by the DU [distribution utility] to the end-user during the applicable period" (Section 7, Rules and Regulations Implementing Republic Act No. 9513). This is limited to small capacity generation not greater than 100 kW. The distribution utility is entitled to any renewable energy certificate resulting from net-metering agreements with its customers that it may use to comply with the RPS requirements.
  - The ERC adopted the rules enabling the net-metering programme for renewable energy on 27 May 2013 (Resolution No. 9, Series of 2013) and implemented them by July 2013. Thus, net-metering is the first policy mechanism to be implemented under the Renewable Energy Act.
  - The private distribution utilities Meralco, VECO and Davao Light have already accepted and entered net-metering agreements with some of their power generation consumers.
  - A net-metering guidebook was developed by GIZ to assist interested electricity end-users to enter into net-metering agreements with their distribution utilities (www.doe.gov.ph/netmeteringguide/).

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