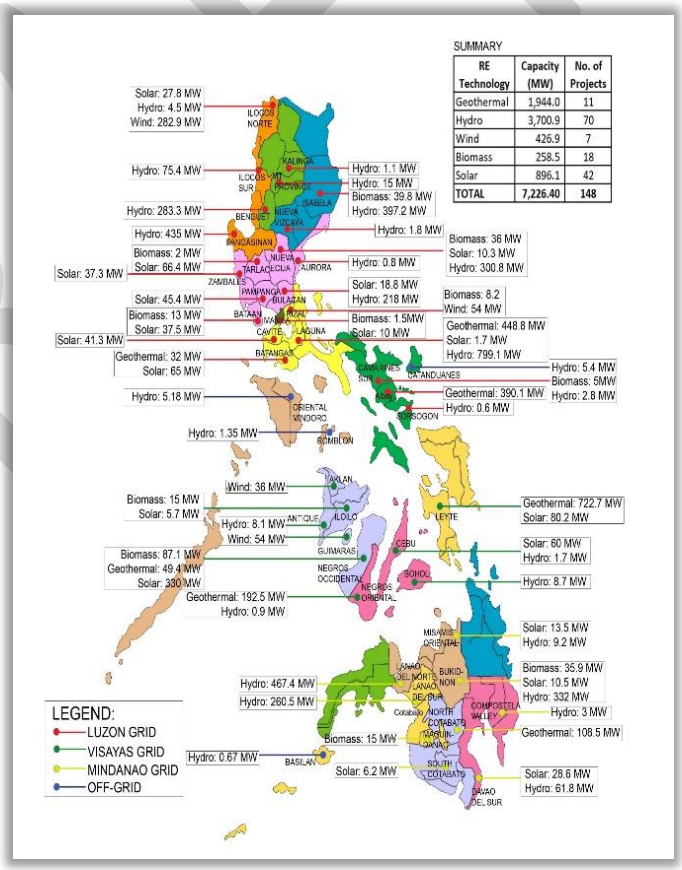
Chapter V.
RENEWABLE ENERGY

The government's regulatory framework on renewable energy (RE) resources provides a sound basis for the impending growth of indigenous clean energy sources in the country. The implementation of the RE law in 2008 establishes a wide range of strategies to further drive developments in the RE industry sector.

Key actions to strengthen policies and program framework remain a priority thrust of government to stimulate RE development and foster innovation on technology advancement. Consistent with this, the DOE formulated and updated the National Renewable Energy Program (NREP) and its implementing roadmap to serve as guideposts for a country-wide approach to achieve the aspirational goal of increasing installed RE capacity to **at least 20,000 MW by 2040**. This goal is expected to sustainably improve the energy supply security, as well as mitigate the effects of climate change and catalyze rural development.

Figure 48. EXISTING RE FACILITIES (2018)



An affirmation of the government's ardent efforts in exhausting the full potential of RE resources are the number of commercially operating RE facilities in the country *(Figure 48)*. As of 2018, 148 RE facilities are currently providing 7,226.4 MW capacities to the country's electricity requirements (both on- and off-grid). This represents 30.3 percent of the country's total generating capacity. Bulk of these capacities were produced from hydro and geothermal resources having aggregate capacities of 3,700.9 MW and 1,944.0 MW, respectively. Variable REs, such as wind and solar have significantly

improved overtime and deployed a combined capacity of 1,323 MW generated from 49 existing facilities.

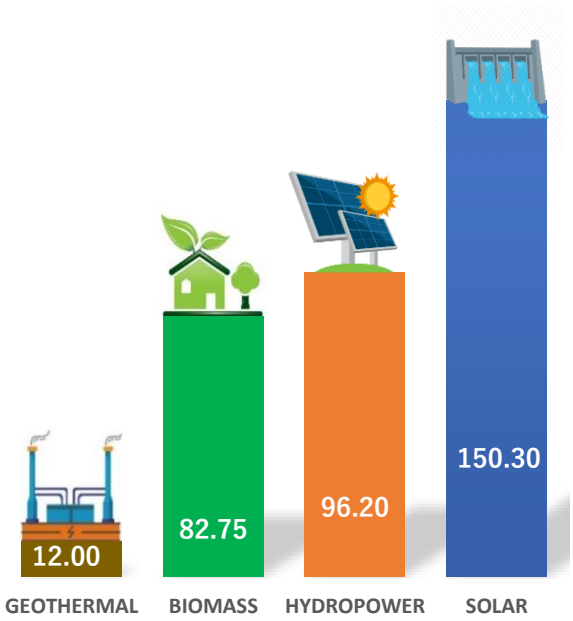
A. ASSESSMENT

Progress has been made on the short-term targets (2017-2018) of the RE roadmap in terms of the number of achievements and completed activities as discussed below.

1. Accelerated RE Position

The Government's forefront policies on RE, coupled with the unwavering effort of the private sector have secured critical investment for the development of renewables. Completion of development contracts have warranted additional capacities of 341.3 MW to the grid *(Figure 49)*. Among the Renewables, solar started providing 150.3 MW capacity, while 96.2 MW is being sourced from hydropower resources. Biomass and geothermal contribute 82.8 MW and 12.0 MW additional capacities, respectively.

Figure 49. NEW RE CAPACITIES, in MW (2017-2018)



To further attract investments and encourage greater deployment of more renewables, the DOE issued and promulgated the following rules and guidelines:

- **Renewable Portfolio Standard (RPS) for On-Grid** *(DC 2017-12-0015)* Areas issued on 22 December 2017. The RPS is a market-based policy mechanism under the RE law that requires load-serving entities to source an agreed portion of their energy supply from eligible RE facilities.

- Rules and Guidelines Governing the **Establishment of the Green Energy Option Program (GEOP)** *(DC 2018-07-0019)* issued on 18 July 2018, which provides end-users the option to choose RE resources as their source of energy.

- Rules and Guidelines Governing the Establishment of **Renewable Portfolio Standards for Off-Grid Areas** (DC 2018-08-0024) issued on 24 August 2018.

- Establishment and Development of **Competitive Renewable Energy Zones (CREZ)** *(DC 2018-09-0027)* issued on 13 September 2018, which covers upgrading and expanding transmission facilities through policy initiatives and activities that shall enable the optimal use of the indigenous RE resources of the country.

- Adopting the Guidelines for the **Operationalization of the Renewable Energy Trust Fund (RETF)** *(DC 2018-10-0018)* issued on 23 October 2018. The RETF shall be used to finance research, development, demonstration, and promotion of the widespread and productive use of RE systems both for power and non-power applications.

- Promulgating the **Omnibus Guidelines governing the awarding and administration of RE** *(DC 2019-10-0013)* contracts and the registration of RE developers issued 01 October 2019. Under said DC, RE projects for own-use and/or RE projects for Non-Commercial Purposes shall not require the issuance of RE Contracts but shall comply with the registration requirements provided under the circular.

- Promulgating the **Renewable Energy Market Rules** *(DC 2019-12-0016)* issued on 04 December 2019.This establishes the market for the trading of RE Certificates (RECs) between and among trading participants.

- Guidelines on the **Duty-Free Importation and monitoring of the utilization of RE machinery** *(DC 2020-02-0005)* issued 13 February 2020, equipment, materials and spare parts and their transfer and other disposition.

- Guidelines governing the **issuance of Operating Permits to RE Suppliers under the GEOP** *(DC 2020-04-0009)* issued on 22 April 2020, which sets rules and procedures in the issuance, administration, and revocation of GEOP Operating permits to RE suppliers.

- The **Green Energy Auction Program** *(DC 2020-07-0017)* issued on 14 July 2020. It sets the framework for which the DOE shall facilitate the procurement of supply from RE projects by the mandated participants under the RPS on-grid rules through a competitive process for compliance with the RPS program and as applicable for their long-term power supply requirements.

The Feed-in-Tariff (FiT) scheme for biomass and run-of-river hydro which expired in 2017 was extended for two (2) years (2018-2019) or until fully subscribed. This is for the purpose of completing the installation target of the remaining unsubscribed **29.4 MW for biomass** and **105.4 MW for run-of-river hydro (as of 31 March 2020).** Private entities have ample time to invest in the energy sector and deploy additional power supply utilizing renewables. In 2019, the DOE issued Certificates of Endorsement to ERC for FIT Eligibility to four (4) hydropower projects with a total capacity of 32.18 ME and seven (7) biomass projects with a total capacity of 70.35 MW.

Through the conduct of detailed technology and resource assessment, the DOE was able to identify frontier areas for RE development. In 2018, two (2) areas in Quezon Province and five (5) areas in Nueva Viscaya were assessed for hydropower development. Whereas, some of the areas that proved to be fitting candidates for detailed wind resource assessment are the two (2) potential areas in Barangay Caragsacan, Dingalan, Aurora and Barangay Sinisian East, Lemery, Batangas. Continuous data collection to validate the initial collected wind data using Sonic Detection and Ranging (SODAR) equipment will be undertaken in the following areas:

1. Brgy. Poblacion, Pantabangan, Nueva Ecija;
2. Brgy. Malasin, San Jose City, Nueva Ecija;
3. Brgy. Malacapas, Dasol, Pangasinan;
4. Brgy. Ibis, Bagac, Bataan; and,
5. Brgy. Puro, Magsingal, Ilocos Sur.

2. *Conducive Business Environment*

In line with government's initiative on the *Ease of Doing Business Act*[59] *(RA 11032)*, the DOE further improved transparency and shorten the processing time for the issuance of RE service contracts and permits. This helps unleash the full potential of private sector investments for renewable energy.

[59] President Rodrigo R. Duterte signed Republic Act (RA) 11032 or the "*Ease of Doing Business Act*" on 28 May 2018.

Setting the progressive pace for RE developers, the DOE revised the existing guidelines and procedures governing the awarding and administration of Renewable Energy Service/Operating Contracts, and providing for the Registration Process of Renewable Energy Developers. From 45 working days, the processing period has been reduced to not more than 25 working days.

This was supported with the issuance of the **DC 2019-10-0013** on 1 October 2019 promulgating the Omnibus Guidelines governing the awarding and administration of RE contracts and the registration of RE developers. Under said DC, RE projects for own-use and/or RE projects for Non-Commercial Purposes shall not require the issuance of RE Contracts but shall comply with the registration requirements provided under the circular.

Recognizing that expeditious realization of energy projects aids economic progress, the President issued **Executive Order No. 30 (EC 30)** on 28 June 2017 creating the Energy Investment Coordinating Council (EICC) chaired by the DOE. The EICC is tasked to simplify approval process, harmonize all relevant rules and regulations of all government agencies involved in issuing permits and regulatory approvals. The declaration of energy projects as "*Energy Projects of National Significance (EPNS),*" provides rights and privileges to project proponents in securing the necessary permits and clearances for their projects.

EXECUTIVE ORDER NO. 30

Creating the Energy Investment Coordinating Council (EICC) in order to Streamline the Regulatory Procedures Affecting Energy Projects

EPNS are major projects for power generation, transmission and/or ancillary services including those required to maintain grid stability and security, identified and endorsed by the DOE that are in consonance with the policy thrusts and specific goals of the Philippine Energy Plan (PEP). Since the issuance of the Implementing Rules and Regulations (IRR) through DC 2018-04-0013 on 25 April 2018, the EICC has received various applications from energy stakeholders requesting that their respective projects be identified and endorsed by the DOE as EPNS. As of July 2019, 13 RE projects were endorsed and issued with EPNS certificate as indicated in *Table 26.*

Complementing to EO 30 is the enactment of the **Republic Act (RA) 11234** or the ***"EVOSS Act"*** which was signed in March 2019. The law aims to streamline the permitting process of power generation, transmission, and distribution projects by creating and establishing an online platform that will remove duplications and redundancies in the documentary requirements. Prospective developers, including RESC holders can apply, monitor, and receive all needed permits and applications, submit all documentary requirements, and even pay for charges and fees through this platform.

EVOSS Portal (www.evoss.ph)

Moreover, 275 Certificate of Endorsements (COE) for duty-free importation were also issued to RE developers to further lower the investment cost. As part of the DOE's promotional strategy and incentivize local technology producers, the DOE endorsed seven (7) RE accredited manufacturers, fabricators, supplier of locally-produced RE equipment and component in 2017 and 2018.

Table 26. LIST OF RE PROJECTS WITH ISSUED CEPNS[60]

	Resources	Name of Project	Company	Type of CEPNS	Date Issued
1	Geothermal	Kalinga Geothermal Project	Aragon Power and Energy Corporation	Pre-Development	14 August 2018
2	Wind	151.2 MW Talim Wind Power Project	Island Wind Energy Corporation	Pre-Development	30 August 2018
3	Hydro	500 MW Kibungan Badeo Pumped Storage Project	COHECO Badeo Corporation	Pre-Development	26 October 2018
4	Biomass	1.2 MW Biogas Power Plant Project	First Quezon Biogas Corporation	Commerciality	26 November 2018
5	Biomass	6 MW Pangasinan Green Atom Waste to Energy Project	Green Atom Renewable Energy Corporation	Pre-Development	27 November 2018
6	Solar	100 MW TPI Sarangani Solar Power Project	Total Power Inc. Sarangani	Pre-Development	20 December 2018
7	Hydro	Olilicon Hydropower Project	SN Aboitiz Power Group	Commerciality	10 April 2019
8	Hydro	Alimit Pumped Storage	SN Aboitiz Power Group	Pre-Development	10 April 2019
9	Hydro	19.7 MW Ilaguen 3A Hydropower Project	Rio Norte Hydro Corporation	Pre-Development	10 April 2019
10	Wind	600 MW Rizal Wind Power Project	Rizal Wind Energy Corporation	Pre-Development	10 April 2019
11	Hydro	Alimit Hydroelectric Power Plant	SN Aboitiz Power Group	Commerciality	27 May 2019
12	Hydro	20-MW Sablan 1 Hydroelectric Power Plant	Hedcor, Inc.	Pre-Development	6 June 2019
13	Hydro	15.7 MW Maladugao River (Lower Cascade) Hydroelectric Power Project	Bukidnon Maladugao Hydro Power Corporation	Commerciality	18 July 2019

3. Reliable and Efficient Infrastructure

Since the country is vulnerable to natural calamities, energy facilities and infrastructures should be made stronger to withstand the adverse effects in the energy system. In view of this, the DOE issued ***DC 2018-01-0001*** **adopting energy resiliency in the planning and programming of the energy sector** to mitigate potential impacts of disasters. The policy aims to: (1) strengthen existing infrastructure facilities; (2) implement the "*build back better*" principle in terms of reconstruction and rehabilitation; (3) improve existing operational, maintenance and practices to ensure continuous operations and energy supply; and, (4) develop resiliency standards as bases for future construction of energy facilities.

In compliance to the DC, all energy industry participants need to submit their respective Resiliency Compliance Plans (RCPs) to the DOE containing adaptation measures, which include both structural and non-structural measures options. This is to gauge infrastructure and human resource preparedness during and in the aftermath of disruptive events. In 2018, a total of 94 RE industry participants submitted their RCPs coming from 12 geothermal projects, 60 hydropower projects, 13 wind projects, and nine (9) solar projects.

To further strengthen resiliency of RE systems, several projects have been proposed, among which are:

- Adoption of Solar-Powered Emergency Shelter Solution (SPESS) as an Energy Resilience Tool for Natural Disaster Relief in the Philippines Project; and,
- Adoption of Resilient Solar Energy Solution for Calamity Susceptible Areas Project (RESCUE).

[60] Certificate of Energy Projects of National Significance (CEPNS)

4. *Promote and Enhance Research, Design and Development (RD&D) Agenda*

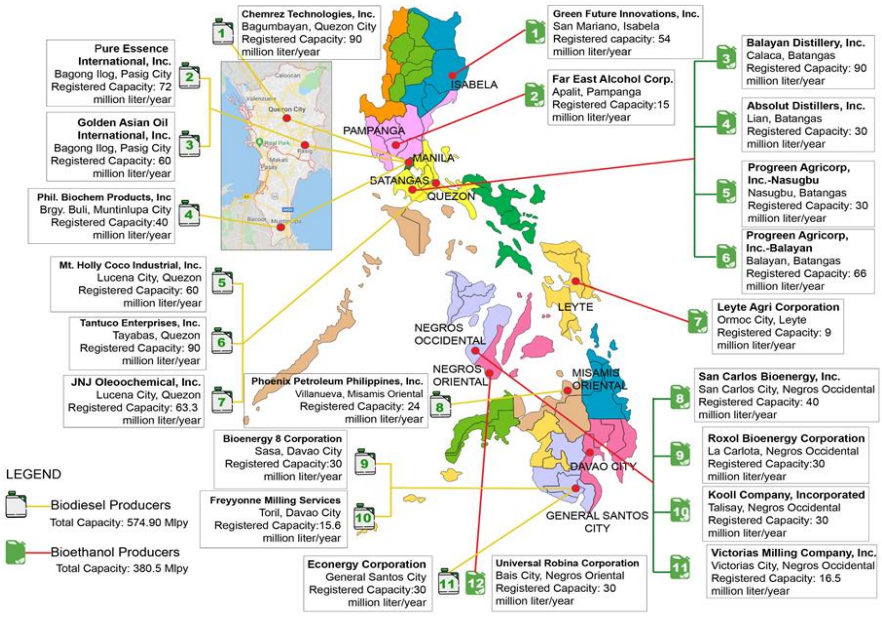
Research and development on other alternative biofuel feedstock sources including second generation is a continuing undertaking of the DOE. The second-generation biofuels, also known as advanced biofuels, are fuels that can be manufactured from various types of non-food biomass.

Full-grown Bana Grass in Romblon

Implementation of demonstration project using biomass gasification technology for household electrification has also been pursued. The 18.0-kW Sitio Bagong Silang Biomass Gasifier Demonstration Project in Barangay Alad, Romblon, Romblon using biomass gasification technology for household electrification has already completed its final testing and now up and operational. The Gasifier was specifically designed for the locally available feedstock, such as bana grass, coconut husk and shell.

Biofuels. Pursuing the development of biofuels has been one of the ongoing activities of the DOE in compliance with the Biofuels Act of 2006 or RA 9367. As of 2018, there are 11 biodiesel and 12 bioethanol accredited producers in the country as shown in *Figure 50* with total production capacity of 574.9 million liter per year (Mlpy) and 380.5 Mlpy, respectively.

Figure 50. EXISTING BIOFUELS PRODUCERS (2018)



In 2017, the DOE, in coordination with Department of Science and Technology - Philippine Council for Industry, Energy and Emerging Technology Research and Development (DOST-PCIEERD), Technological University of the Philippines–Integrated Research and Training Center (TUP-IRTC), and the University of the Philippines–National Center for Transportation Studies (UP-NCTS)

initiated the conduct of an actual on-road using B5[61] and employing dedicated test vehicles (Toyota Innova and Hilux) procured in 2014. The test completed the 13,431-km (Hi-Lux) and 14,234-km (Innova) distance covering flat and high altitude/elevated terrains with varying weather conditions. Initial results showed a mileage increase of about 10.0 percent for B5 as compared to B2. However, the DOE needs to complete the remaining 16,596 kilometers by 3rd quarter of 2019 for a more conclusive result on mileage savings.

On the other hand, the mandated 10.0 percent (E10) bioethanol blend is also being reviewed wherein a series of consultative meetings with stakeholders were held to discuss high inventory levels, as well as maintaining the 10.0 percent strategic reserves and logistics.

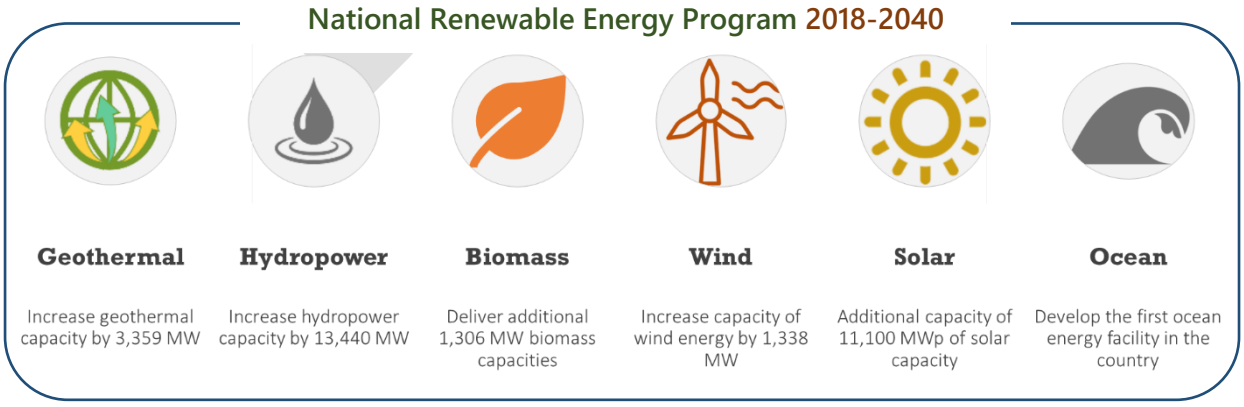
B. PLANS AND PROGRAMS

There has been a growing global call urging governments and financial institutions to increase investments on RE as a clean source of energy to reduce risks from burning fossil fuels to human health and environment. Increasing the share of renewables allows the displacement of carbon-intensive energy sources, and thus reducing greenhouse gas (GHG) emissions while sustaining the country's energy supply base.

In support of this goal, the government has set forth a national commitment to intensify the use of renewable energy resources as a major policy. The DOE has been encouraging private entities to mobilize more investments for the development of renewable resources and technologies. To strategically guide prospective investors, the DOE has updated the National Renewable Energy Program (NREP) and revised the RE Roadmap containing the targets and deliverables necessary to further progress the expansion of renewables in the energy system.

NATIONAL RENEWABLE ENERGY PROGRAM (NREP) 2018-2040

The draft NREP provides an indicative interim capacity targets for each RE technology within the new timeframe covering 2018 to 2040 (*Figure 4*) to reach the total aspirational **RE capacity target of 30,723 MW by 2040** (from the original target of 15,304 MW of installed capacity by 2030). The program foresees that an additional 20,000 MW capacity is expected to be mainstreamed and integrated into the grid in addition to the existing RE capacity.



[61] 5.0 percent biodiesel blend

New capacities of 1,453 MW, in addition to the existing ***geothermal*** capacity of 1,906 MW, are seen to be installed within the planning period bringing the total capacity to 3,359 MW by 2040. This is based on the inventory and assessment of geothermal resource, as well as from research and studies on geothermal potentials in the country.

A total of 13,440 MW additional capacities from ***hydropower*** resources are likewise expected to be in place by 2040. Of the total, Luzon hosts 10,722 MW, Visayas claims 894 MW, and Mindanao holds 1,824 MW. The target capacity additions are dependent on the development and completion of identified hydropower potentials in the medium- to long-term period.

The awarded ***biomass*** operating contracts (as of December 2017) indicate that new capacities totaling 1,305.7 MW is foreseen to be added in the energy system within the planning horizon. About 192.0 MW of biomass projects are to be installed in the short-term period (2018-2020), 313.4 MW in the medium-term (2021-2025), and 800 MW in the long-term.

Resulting from the resource assessment and awarded service contracts, ***wind*** capacity is likely to increase by 1,337.7 MW. On the other hand, the capacity target of 5,870.46 MW for ***solar*** is anticipated from existing awarded service contracts, committed and indicative projects.

RE ROADMAP

Moving towards the realization of the NREP goals, the DOE has intensified the strategies and implementing mechanisms as reflected in the revised RE Roadmap *(Figure 51),* which encompasses medium- to long-term period. The Roadmap encapsulates new policy directions and programs that need to be institutionalized and strengthened, as well as positive stance on new initiatives. It seeks to provide an inclusive approach to mainstream the **targeted 20,000 MW RE capacity by 2040**.

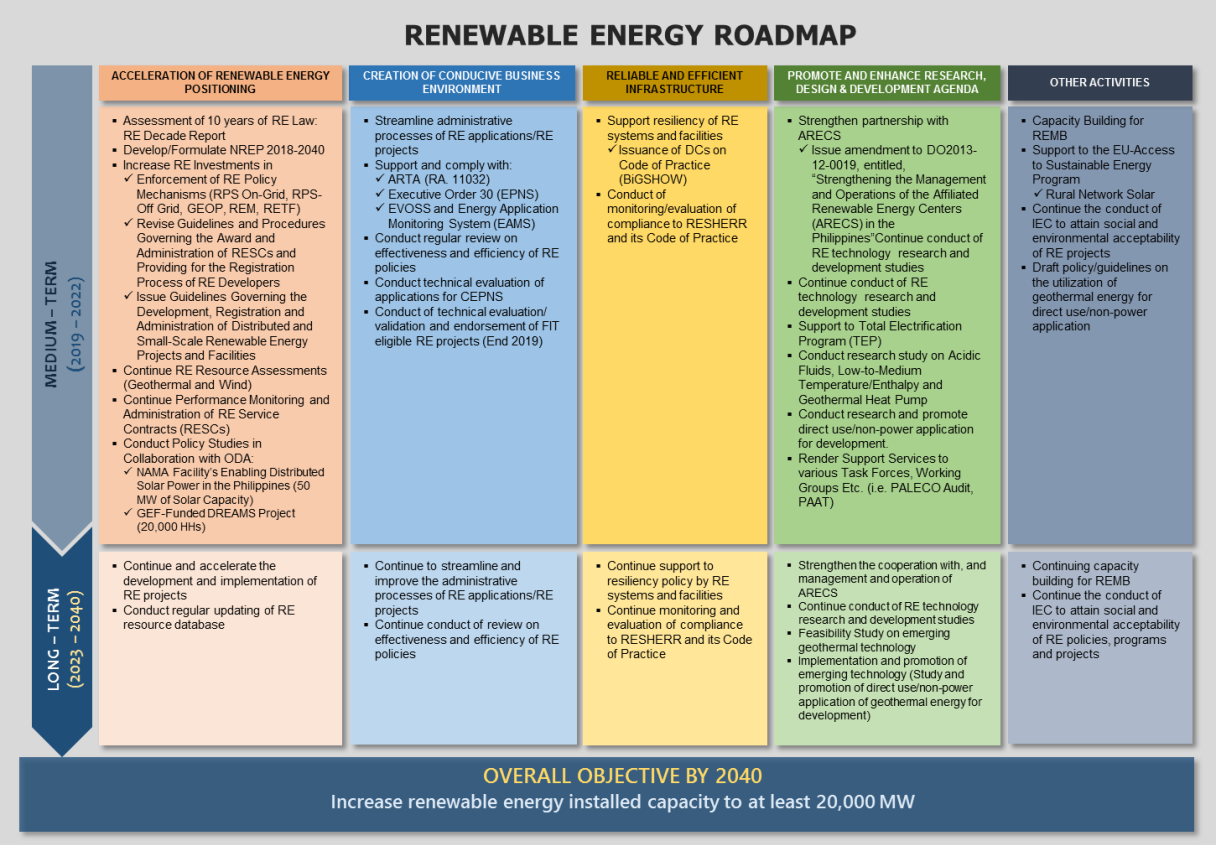
1. Accelerate RE Positioning

With government pursuing its commitment to accelerate the position of RE into a higher level, enforcement and fast tracking of all policy mechanisms as required under the RE Law should be put in place to fully realize objectives of the Law. Upcoming issuances to strengthen RE development include: (a) Renewable Energy Safety, Health and Environment Rules and Regulations (RESHERR) Code of Practice; (b) Operational Guidelines for the RE Trust Fund; (c) NREP 2020-2040; (d) Guidelines for RE Suppliers under GEOP; (e) Enhanced Net Metering;(f) Green Energy Pricing; and, (g) Updated Guidelines on the Duty-Free Importation and Monitoring of the Utilization of RE Machineries, Equipment, Materials and Spare Parts.

The DOE also recognizes that streamlining of existing guidelines and procedures for the awarding and administration of Renewable Energy Service Contracts (RESCs) and registration process of RE developers will facilitate expeditious implementation of RE projects. This also includes the governing guidelines for the development, registration and administration of all distributed and small-scale renewable energy projects and facilities.

Continued assessment of renewable resources and regular updating of RE database remain to be part of the long-term strategy of DOE to improve prospective investors' access to data and information on the country's renewable potentials. This also facilitates the mapping of new potential renewable resources in the country.

Figure 51. RENEWABLE ENERGY ROADMAP



2. *Creation of a Conducive Business Environment*

The promulgation of the *"Ease of Doing Business Act"* demonstrates the government's commitment in providing a conducive environment for investors, making doing business in the country easier and faster. It streamlines and improves government services by reducing processing time, cutting bureaucratic red tape and eliminating corrupt practices. The adoption of simplified requirements and procedures expedites business and non-business-related transactions in government.

Said Law complements the EO 30 and the Energy Virtual One-Stop Shop Act (EVOSS)[62], which further eases the processing, evaluation and monitoring of energy projects including RESC applications. The DOE will ensure compliance to these policies.

3. *Reliable and Efficient Infrastructure*

It is the primary focus of the DOE to continuously improve the reliability, availability, and resilience of energy infrastructure and facilities in the countryside. As such, it is the policy of the DOE to incorporate energy resiliency in the planning and programming of the energy sector as part of its long-term strategies in mitigating the potential impacts of disasters.

Also forming part of the DOE's medium- to long-term strategy is the intensification of Renewable Energy Safety Health and Environment Rule and Regulations (RESHERR) or the *"Code of Practice"* to all RE operators. This is to ensure safety and protection against hazards to health, life and property, as well as pollutions (air, land and water) in all the RE projects.

[62] President Duterte signed the EVOSS Act or RA 11234 on 08 March 2019.

4. *Promote and Enhance Research, Design and Development Agenda*

The DOE continues to explore and conduct research development studies on RE technologies, including the viability of new technologies. This is one of the government's strategic approach to further increase and diversify energy supply mix to fuel the country's industrialization and urbanization, while simultaneously being mindful of its environmental responsibility.

Research studies on acidic fluids, low-to-medium temperature/enthalpy and geothermal heat pump will be the focus in the medium-term plan (2019-2022). Corresponding policy guidelines for the development of low-to-medium enthalpy geothermal energy resources for small-scale power generation, agro-industrial and direct use/non-power application will also be undertaken.

To strengthen partnership with Affiliated Renewable Energy Centers (ARECs), the DOE facilitated the amendment of DO 2013-12-0019[63] through the issuance of DO 2019-03-0007[64]. This is to streamline the criteria, requirements, process of selecting and establishing ARECs, which shall be need-driven and conducted in a competitive and cost-effective manner.

5. *Other Activities*

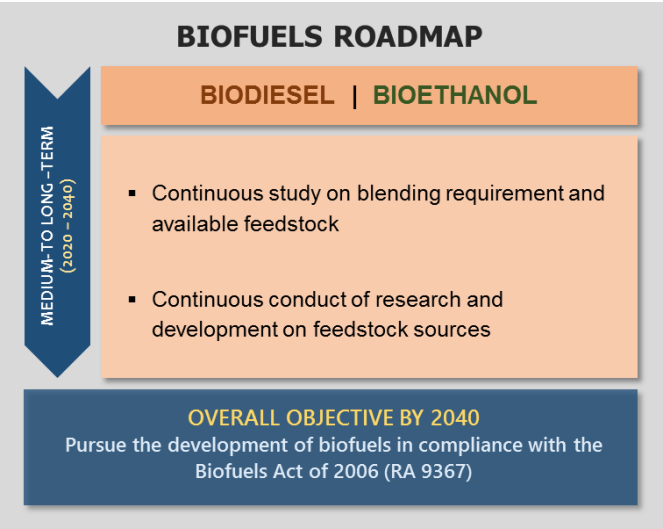
Enabling policy guidelines on the utilization of geothermal energy for direct use/non-power applications will also form part of the medium-term plan. The conduct of Information, Education and Communication (IEC) campaign to convey the benefits of RE will also increase awareness and social acceptance.

Biofuels Roadmap

In addition to the production capacity of the existing 11 biodiesel producers in the country, a total of 115 Mlpy capacity expansion is expected to be in place by 2020. Further, four (4) additional facilities are foreseen to be operational by 2020-2022 with combined capacity of 292.65 Mlpy. With continued R&D and resource assessment, additional 400 Mlpy is targeted for the long-term period.

On the other hand, a total of 113 Mlpy production capacity is likely to be added by 2020 from the existing capacity of the 12 accredited bioethanol producers. For the period 2023-2040, possible additional capacity can reach 400 Mlpy based on available feedstock.

Figure 52. BIOFUELS ROADMAP (2020-2040)



While maintaining the current blend for biodiesel (B2[65]) and bioethanol (E10) until 2019, the DOE along with National Biofuel Board (NBB) and other stakeholders will revisit the biofuel blend requirements and available feedstock. Continuously research study and development on potential feedstock sources will also be conducted.

[63] Strengthening the Management and Operations of the Affiliated Renewable Energy Centers (ARECs) in the Philippines
[64] Amending Department Order No. DO2013-12-0019 entitled, "Strengthening the Management and Operations of the Affiliated Renewable Energy Center (ARECs) in the Philippines".
[65] 2.0 percent biodiesel blend

An economic impact study relating to GDP need to be updated if the mandated biodiesel blend (B2) increases to B5 by 2020. The study will assess the economy-wide impacts of biodiesel expansion on household welfare, other sectors of the economy, rural development, employment and income generation, which redound to better energy supply security and incremental growth in the economy. Higher blend rate can intensify agriculture production, and agriculture crop prices.

A sensitivity analysis will also be conducted for the determination of the break-even price per kilogram of copra and per liter of coconut oil. This could be evaluated if the mill gate / farm gate prices of copra to coco-methyl Ester (CME) are reasonably competitive and beneficial to the farmers. Further deliberation on price and its effect on the final pump price will also be considered.

C. INVESTMENT AND EMPLOYMENT OPPORTUNITIES

With government's aggressive promotion and adoption of cost-competitive sustainable RE technologies, the scale of investment into clean energy has been encouraging. As the country is abundant with these resources, investing in renewables propels a sustainable and lucrative future. The DOE also deems that increasing the investment from low-carbon sources allows the eradication of climate-damaging greenhouse gases thus protecting public health.

Renewable Energy Service Contracts (RESCs)

With the number of RE service contracts being awarded annually for the development of RE technologies, greater employment opportunities have also been favorable to Filipinos. Additional green energy projects and jobs are expected to be deployed within the planning period as 277 RESCs under pre-development stage were awarded as of end-2018 (*Table 27*). These contracts have warranted an equivalent potential capacity of 15,109.2 MW. Hydro has the greatest number of RESCs awarded with 119 providing an equivalent potential capacity of 6,798.9 MW followed by solar with 86 RESCs with an equivalent potential capacity of 6,464.7 MW. Awarded RESCs for wind totaled 39 with potential capacity of 1,239.70 MW while Geothermal has 25 RESCs with potential capacity of 585 MW. Ocean has 8 RESCs with capacity of 21 MW.

Table 27. SUMMARY OF INVESTMENT COST UNDER PRE-DEVELOPMENT STAGE (as of 31 December 2018)[66]

Resources	No. of RE Projects	Potential Capacity (MW)	Investment Cost (in Million PhP)	Jobs/Project	Jobs Generation
Hydropower	119	6,798.86	2,039,658.00	15	1,785
Ocean Energy	7	21	73.97	15	105
Geothermal	25	585	16,721.25	280	7,000
Wind	39	1,239.70	343.02	20	780
Solar	86	6,464.67	5,177.72	11	946
Total	**277**	**15,109.23**	**2,061,973.96**	**341**	**10,616**

Pre-developing these projects require a total investment of PhP 2,062.0 billion which could potentially create employment of 10,616. The biggest contribution to new investment has been made in hydro, geothermal, solar and wind farms. The falling costs of solar and wind is making more RE projects economically competitive. About 98.9 percent of the investments amounting to PhP 2,039.7 billion are from hydropower projects, while geothermal gets 0.8 percent share to the total potential investment or a total investment of around PhP 16.7 billion. Fabrication of solar and wind farms have estimated to have total investment of around PhP 5.5 billion.

[66] In 2019, additional 144 RE projects with total potential capacity of 7,420.3 MW were awarded. Pre-development of these new RE projetcs could generate an additional investment of PhP 459.5 billion while creating employment to 2,470 Filipinos.

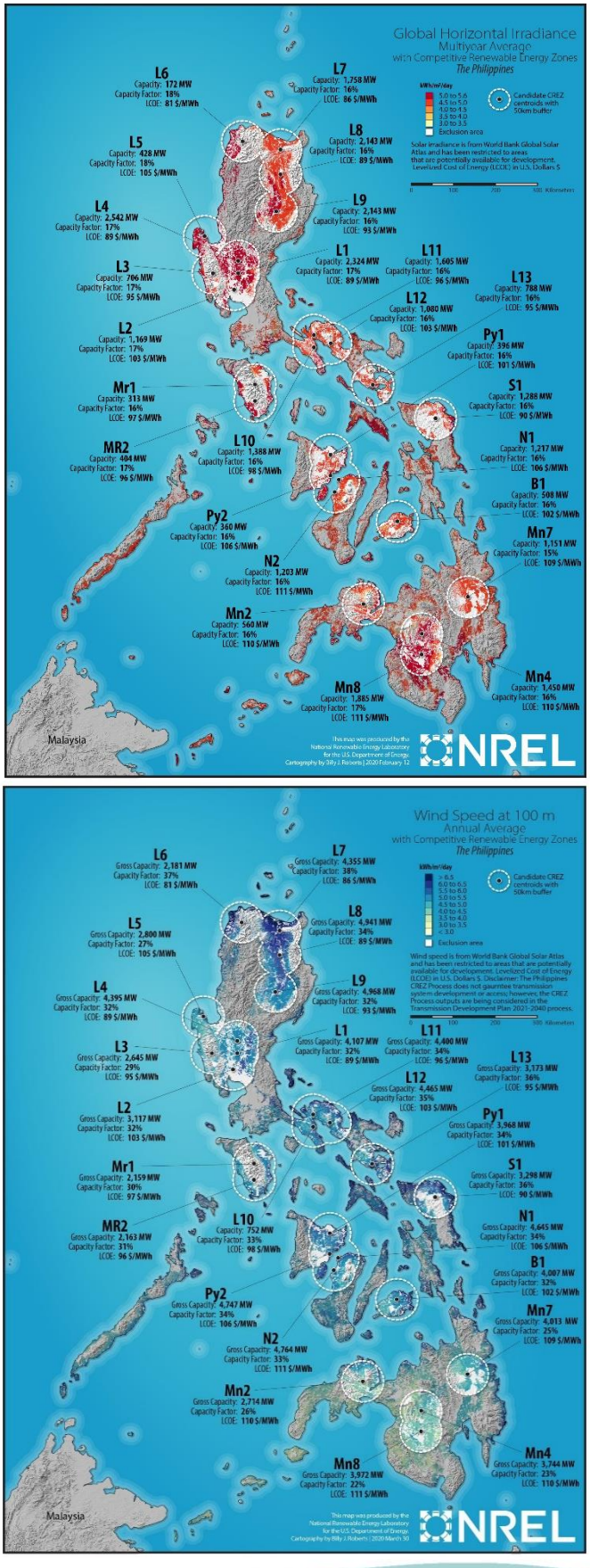
Competitive Renewable Energy Zones (CREZ)

Another prospective investment coming in from RE are the **25 candidate RE zones (REZ)** *(Figure 53)* with highest concentrations of high-quality wind and solar resources coupled with demonstrated interest from project developers. The CREZ process is a proactive transmission planning approach which aims to connect CREZ to the power system. Thus, opens opportunities for private sector development and reduces investment barriers by directing transmission development and RE developers to the country's most promising RE opportunities. Moreover, this supports cost-effective RE development given that CREZs are pre-screened for high-quality resources, suitable topography, potential land-use constraints, and demonstrated developer interest, thereby reducing overall feasibility assessment costs.

The CREZ process is a stakeholder-driven planning process chaired by the DOE with financial support from the United States Agency for International Development (USAID) and technical support from the U.S. National Renewable Energy Laboratory. This is in accordance with the DOE's issued DC 2018-09-0027, *"Establishment and Development of Competitive RE Zones (CREZs) in the Philippines"*. This initiative aims to encourage the transmission upgrades and expansion towards the optimal utilization of the country's indigenous RE resources.

The 25 selected CREZs across the Philippines have an estimated gross capacity of 152 GW of new wind and solar photovoltaics (PVs). The zones also include an estimated 365 MW of

Figure 53. 25 CANDIDATE CREZs



geothermal, 375 MW of biomass, and over 650 GW of hydropower capacity distributed across the Luzon, Visayas and Mindanao systems (*Table 28*). The gross RE resources represent an upper bound assessment for each zone and competition will drive the highest quality resources to be developed first. These zones provide opportunities for RE projects with high capacity factors and a lower cost per megawatt hour (₱/MWh), thereby, expected to result in maximum MWh for the invested capital, RE generation and transmission, reduced curtailment of RE generation and high capacity factors resulting in high utilization of transmission assets.

Initial results of the modeled transmission expansion scenarios that will provide transfer capacity to deliver power from the candidate CREZs to load throughout the country, have captured integration of more than 30 GW of new wind and solar in the CREZ by 2040.

Table 28. CREZ GROSS RE POTENTIAL CAPACITY

System	CREZ Gross Capacity Potential (MW)					Total (MW)
	Solar PV	Wind	Geothermal	Hydropower	Biomass	
Luzon	35,031	54,115	285	270,603	210	**360,244**
Visayas	11,876	25,429	40	1,917	71	**39,333**
Mindanao	11,203	14,443	40	382,514	93	**408,293**
Total	**58,110**	**93,987**	**365**	**655,034**	**374**	**807,870**