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Review Article

Drivers Roadblocks and Status of Renewable Energy Development in the Philippines: A Literature Review

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ABSTRACT

One of the dire consequences of Philippine economic advancement is environmental deterioration due to unfavorable upshots brought by fossil fuels as the main drivers of its electricity generation. To thwart this impeding dilemma, the Philippines is currently decarbonizing its system and transitioning into a more sustainable Renewable Energy (RE) game plan conforming to United Nations' Sustainable Development Goals. This review article discusses the Philippine government's enablers, challenges, and initiatives toward its goal of a 50% renewable energy power mix by 2040. It also delineated the impacts of significant government renewable energy laws and programs on the current setting. A semi-systematic review was conducted among the peer-reviewed research articles and substantial private and government assessment reports relative to renewable energy development in the Philippines, with the date of publishing from 2017 to the present. Results showed that significant roadblocks to renewable energy deployment are political impediments, government support for coal, policy implementation, permitting process, environmental setbacks, foreign ownership, grid connection challenges, and misperceptions. On the contrary, major drivers are depreciating cost, intermittency and seasonality solutions, investment risks on fossil fuel technology, employment creation, streamlined regulatory processes, and absence of transportation cost, among others. Initiatives were taken to strengthen domestic and foreign partnerships to maximize subsidies, grants, donations and investments. Given the enabling factors and current government mechanisms, the country has great potential to attain its 35% renewable energy target by 2030 and 50% by 2040 through a coordinated national RE target.

Keywords: Renewable energy; Fossil fuels; Energy development; Electricity generation; Energy policy; Geothermal energy; Hydroelectric energy; Solar and wind energy

INTRODUCTION

Energy independence is the core of energy policy development in the Philippines to ensure sustainable, reliable, secure, sufficient and accessible energy. Energy security is essential as the Philippines have experienced numerous outages in 2019 up to the present, and coal-based electricity has not coped with the burgeoning energy demand. Fossil fuels constitute most of the Philippines' total primary energy supply accounting for 71%, and renewables constitute 29%, mostly hydroelectric and geothermal [1]. Explicitly, the main energy supply comprised of oil (16.1%), coal (41.6%) and natural gas (13.1%), as well as renewable energy sources including hydroelectric (14.4%), geothermal (7.3%), biomass (1.8%), solar (3.98%) and wind (1.7%). 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 Mega Watts (MW) to 15,304 MW. This was established in the National Renewable Energy Program (NREP), which serves as the blueprint for implementing the Renewable Energy Act of 2008.

The Philippines has three major electricity grids connecting the islands of Luzon, Visayas and Mindanao [2]. About 132 Small Isolated Island Grids (SIIG) are powered by diesel generators [3]. Many islands are still without access to 24-hour electricity or have no electricity supply at all. Additionally, Philippine electricity prices are the highest in Southeast Asia at Php 10 per kWh [4].

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With so many islands, electrification is still an enormous task, and electricity needs to be affordable. On the road toward energy security, the Department of Energy (DOE) established the country's goal for renewable energy to reach 35% of its power generation mix by 2030 and 50% by 2040, as specified in its Philippine Energy Plan 2020-2040.

As a net fossil energy importer and a country whose energy infrastructure is inevitably exposed to tropical storms, the Philippines have constantly battled with energy insecurity problems. Climate change induces demand for air conditioning and lower hydroelectric energy supply, while earthquakes and typhoons wreak power infrastructure. While gearing its target to supply electricity to the cities, rural areas have lagged. This approach has catalyzed higher electricity rates, urban and rural inequality in electricity distribution, and substantial environmental impact. The intermittent reliability of fossil fuel plants has led to frequent power outages and unanticipated maintenance. In the first half of 2021, 17 power-generating companies went offline. They breached their plant outage allowances due to manual load dropping to preserve power grid stability [5]. The National Grid Corporation of the Philippines (NGCP) has warned of rotational power interruptions in the Luzon grid during the summer due to higher demand and when several power plants go on an unplanned outage, disrupting school and work for millions [6]. With these currently existing energy crises, the government turned its head into renewable energy as a viable solution to meet both ends. Environmental hazard vulnerabilities and the goal for electrification across the many islands underscore the necessity to decentralize and diversify to renewable energy, energy storage and increase energy efficiency to improve the capacity for supply to meet demand [7].

The Renewable Energy Act (RA 9513) adoption in 2008 was intended to accelerate the deployment of RE technologies in the country [3]. High expectations were put on the RE Act, given the encouraging number of fiscal and non-fiscal incentives accompanying it [8]. Renewable energy is essential to the country's low emissions development strategy and is vital to addressing the drawbacks of energy security, affordability, and sustainability (energy trilemma). The transition to renewables offers an opportunity to meet energy needs, reduce dependence on fossil fuel imports, decarbonize and reduce climate impacts while making progress to meeting Paris Agreement commitments and Sustainable Development Goals [9]. From this context, this review article critically probes the drivers, barriers and current schemes initiated by the government for the massive deployment of renewable energy in the Philippines. Also, it provides a justifying lens on whether it can attain its 50% renewable energy power generation mix by 2040.

LITERATURE REVIEW

To provide a holistic and in-depth perspective on the current transition of the Philippines toward a cleaner and sustainable energy system, the central theme of the paper delves into scrutinizing the enablers, constraints, and status of its renewable energy development. This is since the energy transition plans towards a sustainable energy system have always been a tug-of-war between the impending challenges and motivating factors leading to the current energy status of the country.

For this paper, a semi-systematic review was conducted among the peer-reviewed research articles and substantial private and government assessment reports relative to renewable energy development in the Philippines, with the date of publishing from 2016 to the present. To further corroborate government data, findings were verified through extensive literature reviews and rigorous evaluation of independent organizations like Greenpeace, IBON Foundation, International Renewable Energy Agency and other similar groups. Moreover, validated, credible and contemporary news related to the theme was analyzed and accounted for. Emphasis was also given to case studies on existing and previous collaborations with other countries (like China, Germany, Australia and Indonesia) on the elusive pursuit of 100% renewable energy deployment in the Philippines.

DISCUSSION

Challenges

The Philippines has a hankering goal of supplying 100% of its power with renewable energy as part of its allegiance to the Climate Vulnerable Forum countries [10], but has not pursued this goal actively through its energy policy. Similarly, the Green Energy Option Program (GEOP), which allowed commercial and industrial energy users to opt for 100% renewable energy, has remained unenforced for over a decade [5].

Renewable energy development in the Philippines faces several technical constraints related to intermittency and variability, season-dependency, grid integration, and site-specificity. Variable Renewable Energy (VREs), such as solar, cannot provide a reliable and continuous supply of electric power 24/7 since it is mainly dependent on solar irradiance at a given time; hence its capacity factor or efficiency results in lower values [1]. The renewable energy transition in the Philippines faces the following major gaps and barriers in policy making and implementation:

Political impediments

There is restricted leadership and buy-in from the past Duterte administration, with an increased reliance on coal for power generation [2]. Some innovations in political commitment to renewable energy are evident in the Renewable Energy Act in 2008 and the recent Green Energy Tariff Program. Nevertheless, the government calls for increased renewable energy investment but then expresses concerns about the high capital costs of renewable energy and its variability [2]. The priorities of each succeeding administration change creating investor uncertainty for renewables. For example, the Department of Energy focused on the optimal energy mix in 2014, but after the 2016 national election, priority moved towards capacity requirements and energy security [3]. In addition, several energy plans lack coherent strategies. Attesting to this, the Department of Energy and the electricity sector's institutional framework lacks effective coordination with the Climate Change Commission (the national entity dedicated to decarbonization) [2]. The government needs to relay consistent support rather than mixed signals to stakeholders.

Government support for coal

Investments in renewable energy are spoiled by the low price of fossil fuels, the exorbitant start-up costs and low renewable energy feed-in tariffs [4]. The amount of coal production is projected to increase by 170% from 2017 to 2040 [1]. Support for coal invites investor uncertainty for renewable energy projects. The government's target to increase the capacity of coal-fired power plants is a barrier to renewables. Increasing the capacity for coal locks the Philippines into a fossil fuel-intensive future. It increases the growing risk of stranded coal assets, leading to higher consumer electricity prices and investor losses [5].

Moreover, the Philippines' policy of neutrality in power generation technology also means not discouraging any technology such as coal-fired plants. New coal and natural gas plants established since the promulgation of the RE Law have higher capacities and have eventually reduced renewable energy's share in the power mix [6]. Department of Energy (DoE) data shows that, under the Duterte administration, power generated from coal rose from 43,303-Gigawatt hours (Gwh) in 2016 to 57,890 Gwh, which is over half of total power generated (106,041 Gwh) in 2019. Only 22,044 Gwh of power was generated from renewable energy [7]. There are 28 operating coal plants, with several expected to go online within the next several months. Greenpeace Philippines (2020) reported that another 22 plants are in the pipeline [8]. Likewise, there are five natural gas plants, two of which started their operations in April 2016 [9].

Policy implementation

The Philippines' electric power industry was liberalized in 2001 with the enactment of the Electric Power Industry Reform Act of 2001 (EPIRA Law) under Republic Act No. 9136. From a vertically integrated and government-owned- and -controlled power system, it was transformed into a competitive and private-sector-dominated industry. EPIRA restructured the power industry into four primary sectors: generation, transmission, distribution, and supply. The country's liberalized power sector makes RE planning, policymaking, development, and integration more difficult and complex. In the power generation, distribution, and supply sector, the number of private companies accounts for more than a hundred each. Hence, the government, energy agencies, and regulators must consider and balance all these competing interests and characteristics of power industry players in power system planning, policymaking, and implementation in a bureaucratic and consultative manner.

Further, the consistency of laws, rules, and regulations must be carefully, regularly checked, and updated to ensure that everything is aligned and in order. These, along with other factors, make the whole process of energy and RE planning, policymaking, and implementation in the country longer, tedious, and delayed. For instance, the implementation of the policies and programs like the FIT, net-metering, RPS, GEOP, and REM, were all delayed as opposed to the provisions outlined in the country's RE Law [1]. At the same time, it is difficult to access finance because of the scope of small companies that cannot compete with big energy companies because they do not have sufficient assets or guarantee to entitle them to a loan. Instead of attracting investors in renewable power projects, the current regulatory environment has only deterred foreign capital and even pushed them to other countries where the renewable energy investment climate is more conducive.

Permitting process

The country's complex and lengthy permitting process remains one of the major bottlenecks for RE development and all power-related infrastructures. Approvals are required across different levels of government, such as in the barangay, municipal, provincial, regional, and departmental agencies and authorities. According to Senator Sherwin T. Gatchalian, chairman of the Senate Committee on Energy of the Philippines, it takes about 1,340 days or more than three and a half years to secure all the necessary permits. These permits involve 359 signatures from 74 different agencies on average. This long and tedious process of securing permits delays the commercial operation of RE projects and discourages potential investors from entering the RE power generation business. Because of these, the DOE has dramatically focused on cutting the approval process through various policies, programs, and monitoring schemes. A Renewable Energy Service Contract issuance must undertake a competitive selection process. Also, incentives for renewable energy such as income tax reduction and duty-free importation can be accessed only after the issuance of the contract to the project. The transaction cost and time for such lengthy regulatory processes can make smaller renewable energy projects unattractive to investors [2].

Environmental setbacks

Land use is one of the major concerns with large-scale solar farms because it requires a considerable amount of space to produce enough electricity. This vast area displaced by solar farms could have been animal habitats or used for other activities such as agriculture or industries [2]. Further, proper waste disposal is another pressing issue in solar power development since solar panels contain toxic and harmful chemicals. Besides, constructing hydropower stations could adversely affect wildlife and plants and lead to geological disasters. Local people and environmental protection organizations oppose constructing hydropower stations and developing geothermal energy [3]. Due to its geothermal potential, the hot spring water used as a tourist attraction in Laguna is estimated to consume a large volume of groundwater which could result in over-extraction, decreasing groundwater quantity and quality [4]. Using this geothermal energy for a hot spring area can also result in environmental damage because the wastewater affects aquatic ecology near the geothermal power plants [5].

Foreign ownership

Renewable ventures such as solar and wind are subject to foreign ownership restrictions as they are considered to utilize a national resource. Coal and natural gas are not included. Foreign ownership of a company operating a renewable energy project in the Philippines is restricted to 40% [6]. There are also analogous limitations on the foreign ownership of land. Foreign investors can spearhead appropriate structuring arrangements with local partners to resolve this issue. However, they should be vigilant

of compliance with the country's anti-dummy laws in respect of foreign holdings which target artificial ownership [6].

Keeping up with the trends

The Philippines suffers from a lack of capabilities and resources. Project installations do not match the capacity available within government institutions [2]. Also, policymakers struggle to determine how technological advancement will affect the policy landscape, creating restrictive policies or an absence of policy altogether [3]. It highlighted the lack of policies on distributed energy generation, battery storage, floating solar, microgrids, and community renewable energy [3]. Philippines is challenged by its limited infrastructure capacity that hinders effective renewable energy deployment, due to its being archipelagic in nature, resulting in fragmented electricity grids [7].

Misperceptions

Interviewees at the Department of Energy highlighted that Filipinos perceive coal as a cheap and reliable energy source. In contrast, renewables are perceived as unaffordable and unreliable, delaying the renewable transition, [8] despite solar and wind energy prices decreasing globally. The public strongly influences political commitment; therefore, public awareness of renewable energy benefits as a cost-effective option would improve and sustain political commitment [2]. The incentive of lowering the cost of bills would appeal to many Filipinos.

Grid connection barriers

The country's power grid is government-owned through the National Transmission Corporation (Transco) but managed by the National Grid Corporation of the Philippines (NGCP), a private body subject to regulation. With the growth in renewables, grid-related technical issues have resulted in the curtailment of solar and wind power in certain instances. In addition, particularly for larger-scale projects, there is often a lack of congruence between the schedule that NGCP needs to obtain approval and establish the necessary grid infrastructure and the investor's desired project timetable [6].

Offtake and financing

Conventional non-recourse project financing for solar and wind projects in the Philippines is not typical, with most renewable projects initially being funded on a corporate basis. For solar or wind projects that may not avail of the FiT incentives, an offtake agreement can partake with a distribution utility, industrial user, or the power can be sold directly to the country's wholesale power market. With the lowering costs of renewable technology and the country's forward-looking regulatory approach, there may be a growing appetite for project financing from local lenders for renewables, who largely dominate the power market [6].

Enablers

With the country's high population rate, marginal power reserves, and intense projected power demands, the macro-economic conditions are favorable for developing renewable energy projects in the Philippines. The country's geographic location provides it with abundant potential renewable energy resources, including geothermal and hydropower. Wind and solar conditions are also considered highly favorable [6]. The Philippines' current power failures and the associated energy supply and security challenges have signaled the alarm to transform the country's energy system. Also, the island nation remains at risk of the havoc of climate change. In the last few years, climate action and mitigation have become a salient issue for energy supply, security and job creation. Renewable energy offers the Philippines' many islands the opportunity to provide clean and affordable energy (SDG7) in microgrid or stand-alone off-grid systems [5]. There are several reasons for renewable energy optimism in the Philippines.

Depreciating cost

Since 2010, solar power's cost has dwindled by 85%, and wind power by 49% [9]. Solar facilities are now more economical than constructing new coal power plants in two-thirds of the world and all ASEAN countries [3]. Solar is also quicker than coal in getting up and running. Also, a considerable reduction in the cost of renewable energy battery storage was observed in the last decade. It is predicted that installing solar Photo Voltaic systems (PVs) and storage batteries will gain momentum as the economy improves in the coming years [1]. Renewable energy offers an alternative to the volatile prices of diesel. Diesel's price and transportation costs to islands make diesel generators expensive to run. Transport can increase prices to 60 times more than the average, causing a limited service [2].

Intermittency and seasonality solutions

Tested solutions include flexible baseload plants like geothermal power and combined-cycle gas turbines, which are capable of operating 24/7 and offering flexibility to counter renewable energy intermittency. Such flexibility is advantageous to the country prone to rain, cloud cover, and wind irregularities. As pointed out by Lee [1], other solutions include "fast-acting, simple-cycle gas-fired turbines that can operate within minutes of starting up; pumped storage hydro; putting battery storage in key areas of the grid, homes, and establishments behind the meter; building a transmission network that expands the geographic coverage of wind and solar to smoothen the viability of the sun and wind over wider areas; and ice storage that complements air conditioning system, compressed air storage, and flywheel storage devices". Time of usage, pricing, and demand response programs are also solutions that can be leveraged to deal with intermittency issues. The Internet of Things sensors, artificial intelligence proliferation, and robotics technologies have further improved energy efficiency programs.

Investment risks on fossil fuel technology

Carbon Tracker's study suggests that by 2030, it will be cheaper to build new renewable energy sources than to continue to use existing coal in Southeast Asia. Given that the Philippines has a balance of trade deficit of USD 37 billion in 2019, of which 7% was from coal importation), a shift to clean power is good for energy security. It ensures businesses and consumers are not held hostage to the global price volatility of fossil fuel supplies. The government declared that it would no longer approve new coal power plant applications [3]. The IEEFA gauges that the new policy could help bring $30 billion worth of clean energy projects

onstream by 2030. If realized, the country's 2020 moratorium on new coal power plants is perhaps its most significant GHG-reduction step to date. There is evidence that businesses are seeing the need to divest away from coal. The Philippines oldest and most significant conglomerate, Ayala Corporation, announced it would offload all coal-fired power development investments by 2030 [3].

Employment boost (50% more jobs than coal)

Geothermal is the most accessible sector for former coal workers to shift to because the skills needed for drilling and exploration are similar. The renewable energy sector has already hired 11 million people worldwide as of 2018. A 2020 report by McKinsey showed that government investment in renewables and energy efficiency creates thrice more jobs than spending on fossil fuels [5]. Geothermal is currently the topmost job creator in the renewable sector requiring 25 people for every MW during construction, resulting in a 50,899 job totality as of 2020 [4]. IEEFA reported that solar power plants employ 11,540 people. However, if the planned 11,190MW worth of installations is actualized in the coming decade, employment will prosper, with 151,748 jobs available by 2030. Wind energy currently employs the fewest people (4,240), but if its 4,324 MW capacity is anchored by 2030, the number of jobs could soar to 47,181. According to IEEFA, the result of the coal moratorium could add at least 212,145 renewable energy employments during the project's construction to the present jobs and 31,595 new jobs in operation and management of clean energy capacity. IEEFA's rough calculations are based on the number of people employed per MW in each sector [3].

Streamlining and recalibrating the regulatory processes

President Duterte signed Executive Order 30 establishing the Energy Investment and Coordinating Council to simplify approvals and permit processes. The order allows the Department of Energy to stimulate huge investment in the energy sector by identifying energy projects of national significance, where projects worth over USD70 million are processed in 30 days [1]. The Renewable Energy Act 2008 aimed to increase the development and utilization of renewable energy sources (Republic of the Philippines 2008). The Act included the Renewable Portfolio Standards (RPS), the Feed-in-Tariff (FiT), a Green Energy Options Program and Net Metering. After the experience of a nationwide shortage of electricity supply lasting for an entire decade (the 1990s), the restructuring of the power sector was initiated [5]. The once entirely state-owned electricity sector was reformed and privatized mainly in 2001 with the Electric Power Industry Reform Act (EPIRA) (RA 9136, 2001). The EPIRA and RE act are policies aiming at stimulating private sector involvement in supplying the off-grid areas besides the on-grid sector. Therefore, two basic schemes for private sector investment were designed: The Qualified Third Party (QTP) scheme and the New Power Producer (NPP) scheme. The QTP scheme allows for power generation and distribution in an off-grid area. In contrast, the NPP scheme enables the private sector to take over power generation from NPC-SPUG (National Power Corporation Small Power Utilities Group), the residual unit of the former state-owned monopolist.

The Renewable Portfolio Standards (RPS) mechanism requires the electricity industry to source a specified fraction of their energy from renewables for on-grid energy [1]. The Renewable Energy Act mandates a Renewable Energy Market (REM) to facilitate RPS. The FiT intends to accelerate renewable energy by reducing the risk of buying solar PV or other renewable energy by offering a fixed price for renewable energy to be fed back to the grid. [6], Farias Rocha et al., found that FiT solar projects are profitable. However, Agaton, concludes that a higher rate is needed to spur renewable energy investment [4]. The Philippines discontinued its Feed-In-Tariff (FIT) program and switched to reverse auctions. This goal is to ensure better assistance for large-scale solar energy projects [3]. This technique resulted in more competitive solar and wind generation costs at a grid level. Presently, the country has the lowest bid within the region-USD 0.044 per 50 MW solar plants. Net metering is when distribution utilities can enter agreements with end users who install renewable energy. It is aimed at small-scale PV generation as a deduction from electricity bills [6]. Farias-Rocha et al., found net metering profitable as it avoids the high retail costs of electricity. The Green Energy Option Program (GEOP) aims to empower energy users to choose renewable energy. End users can choose renewables as their energy source [6]. The government has also initiated a framework of fiscal and non-fiscal incentives. Among these are an income tax holiday, a duty-free importation of equipment and VAT-zero rating, tax credits on domestic capital equipment, tax exemption on carbon credits, priority connection to the grid, and the Green Energy Option Program (GEOP) [3].

Absence of transportation cost. The low-carbon transition will help thwart climate change, reduce the carbon intensity of the Philippines' power sector, and improve its energy resilience. Since the Philippines are an archipelago, Distributed Renewable Energy (DRE) systems that are not dependent on fuel transportation are complementary to the country's geographic contour. This reduces the need for extra-long storm-prone transmission lines. These DREs, especially those backed by batteries, can provide fast backup power during calamities, making the energy system more resilient [5].

Current initiatives

The country's target is to achieve mass electrification by 2022, with international support playing a crucial role. The REN21 report confirmed 7.1 GW of renewable energy capacity in the Philippines. Half of it, or 4.3 GW, came from hydropower, with a further 896 MW sourced from solar energy. In the coming years, solar demand is predicted to rise dramatically. This is credited to a significant channel of projects approved or under development. This year 2022, solar energy in the Philippines is projected to rise to 3 GW, while wind energy only makes up 427 MW. Despite having an estimated potential of up to 76 GW, the current administration targets just 2.3 GW by 2030 [3].

Foreign partnerships

Currently, the country is actively engaged in the USD 23 million "Access to Sustainable Energy Project" in cooperation with the

World Bank. It also concluded the "Market Transformation through Introduction of Energy-Efficient Electric Vehicles Project" worth USD 405 million in alliance with the Asian Development Bank. If implemented as planned, Luzon's coal generation share will be over 75% by 2030, and many coal plants will be uneconomic [3]. Similarly, Asian Development Bank and the Philippines launched a new partnership to establish an Energy Transition Mechanism (ETM) in Indonesia and the Philippines. The ETM Southeast Asia Partnership aims to help accelerate Southeast Asia's clean energy transition. ETM, the first of its kind in Asia, is a transformative, blended-finance approach that seeks to withdraw existing coal-fired power plants on an accelerated schedule and replace them with clean power capacity [7].

Foreign partnerships are continually pouring investments into the country. Global Energy Alliance for People and Planet (GEAPP), pioneered by the Rockefeller Foundation, eyes renewable energy projects in the Philippines, committing an initial US$10 billion to help accelerate the implementation of clean energy projects. Finance Secretary Carlos Dominguez III discussed with Dr. Rajiv Shah, the president of the Rockefeller Foundation, the decommissioning and repurposing of coal-fired power plants in Mindanao and how the GEAPP can assist in this initiative [3]. Meanwhile, the US Agency for International Development (USAID) launched its five-year Php1.6-billion Energy Secure Philippines (ESP) project to promote the country's critical energy sector priorities and support its climate mitigation goals. The US government will also fund more than Php36 billion ($740 million) in private sector investment and help generate at least 500 megawatts of clean energy generation capacity [9].

On the other hand, British Ambassador Laure Beaufils said a team from the Ilocos Norte government presented a strong investment plan that offers enormous opportunities for investors in the northern gateway of Luzon. Accordingly, the UK government will partner with the Ilocos Norte government on climate change mitigation and adaptation [4].

Correspondingly, Southeast Asia's first tidal power generation plant embeds and rises in remote Capul Island of Northern Samar along the San Bernardino Strait, as announced by Energies PH Inc. (EPHI) Co-chairman and CEO Antonio Ver. It embarks on the Philippines' pioneering and first-ever tidal power plant with the intent of replicating this in several off-grid sites all over the country to provide electricity in the hinterlands [4].

Domestic partnerships

The 2020 Renewable Energy Program for the Agriculture and Fishery Sector (REP-AFS) aimed to sustain solar, wind, hydro, small-scale geothermal, and biomass for fuel and power generation within those industries [3]. Last June 2022, the Department of Energy (DOE) awarded 19 winning bidders delivering 2,000 megawatts of renewable energy capacity under the Green Energy Auction Program (GEAP). The winning bids will be conferred 20-year Power Supply Agreements (PSAs), which are expected to commence operations between 2023 to 2025 (Power Philippines) [4]. The majority of the winning bids, 1,380 MW, were awarded to the subsidiaries of Leandro Leviste's Solar Philippines. Solar Philippines (SP), the parent company of Solar Philippines Nueva Ecija Corp, won 70% of the renewable energy capacity that was up for auction in the first round of the Department of Energy's (DoE) Green Energy Auction Program (GEAP) [3]. The capacity granted to SP also represents 91% of the total solar capacity awarded in this round of GEAP bidding. It was awarded three PV projects with capacities of 200 MW, 280 MW, and 450 MW, in the Luzon region. It also won a 300 MW solar project in the Visayas region and a 200 MW scheme on the island of Mindanao [4].

For the Luzon Grid, 11 companies will be granted PSAs with a capacity of 80 megawatts for hydropower, 1070 MW for solar power, and 360.8 MW for wind power. This would bring a total capacity of 1,511.18 MW. Among the winning projects in Luzon include PAVI Green Renewable Energy Inc.'s 40.4 MW Naga solar power project and CleanTech Global Renewables Inc.'s 100.8 MW Kalayaan 2 Wind Power Project [5].

Two companies, meanwhile, were awarded under the Visayas Grid, totaling 313.2 MW in capacity, including Petrowind Energy Inc.'s 13.2 MW Nabas 2 Wind power project. Six projects with a total capacity of 142.55 MW in Mindanao were bestowed [6]. Cebu-based Vivant Energy Corporations has allotted PHP25 billion in capital expenditures for renewable energy projects from 2023 to 2026. Vivant chief executive officer Arlo Sarmiento said this capex would be spent to build 196 megawatts of wind, 212 MW of solar and 62 MW of hybrid wind and solar projects [4].

Future roadmap

The country has a dualistic plan to change its generation stack. First, it's planning to increase gas-fired generation as a transitional fuel, particularly Liquified Natural Gas (LNG) [8]. To actualize this, a substation was built to connect Energy World Corporation's Pagbilao LNG terminal to a 650-MW power plant. Also, First Gen constructed a floating storage regasification unit on the Luzon coast of undisclosed capacity [3]. The Department takes a technology-neutral approach to investment, with Liquified Natural Gas (LNG) projects listed as a priority as the Malampaya gas facility is set to be depleted by 2024 [1]. Furthermore, an LNG terminal and regasification unit operated by Excellent Energy Resources was constructed. This is supported by a 20-year Power Purchase Agreement (PPA) with Meralco, the largest power distributor in the Philippines, for 1.2 GW of output. It is the first LNG project in the nation, backed explicitly by a Power Purchase Agreement (PPA).

The country's second primary strategy is to increase renewables to 35% of the power generation mix by 2030 by including wind and solar photovoltaic power. Contracts have been awarded for various renewable technologies. Also, in 2020 an energy efficiency program mandated 10% savings by government agencies, yielding power demand reductions of nearly 2.4 million kWh [2].

On the other side, the National Renewable Energy Program (2011-2030) anticipates that the generation capacity of renewable energy will triple by 2030 [7]. This has led to the development of policies including carbon taxes, the improvement of energy efficiency in both generation and consumption, and

diversification of the energy supply mix [3]. Under its updated Nationally Determined Contribution (NDC), the Philippines aim for a 75% reduction in GHG emissions from a 2020 baseline by 2030. However, this goal comes with a big asterisk: it called only 2.71% of the unconditional reduction, aided by government programs. The remaining 71.29% of the reduction is conditional based on financial support from other national governments and international investors. The conditional elements depended on funding, technical assistance, and capacity development which developed countries will provide [6].

On the policy level, DOE issued new rules for green auctions intended to give preference to renewable energy, support its development and increase financing access for renewables. Firm goals for renewables will be incorporated in the auctions to keep the country on track for its 35% target [8]. In 2018, the Department of Energy (DoE) issued guidelines establishing a "Renewable Energy Trust Fund" to expedite the renewable energy transition through research and development. The game plan is funded through several sources, including grants, donations, emission fees and contributions [3]. The Philippines discontinued its Feed-In-Tariff (FIT) program and switched to reverse auctions. This goal is to guarantee support for extensive and competitive solar and wind energy projects with low generation costs at a grid level. Currently, the country has the lowest bid within the region-USD 0.044 per 50 MW solar plants. The DoE has other ongoing projects supporting smart-grid technologies across the country's islands. Southeast Asia's largest markets for off-grid solar energy are the Philippines and Myanmar. They have sold 30,000 to 40,000 units as of the second half of 2019 [3].

Synthesis

Most of the persisting constraints in developing renewable energy in the Philippines lie in the conflicting features of the government's energy plans, policies, programs, and regulations. These should be coherently aligned to encourage the private sectors to participate in the renewable energy business of providing electricity services to remote areas in the Philippines. Other challenges are on the off take and financing, misconceptions of consumers, environmental hurdles, grid connection concerns, lengthy permit process, foreign ownership, keeping up with technological innovations and government support for coals. To resolve these setbacks, the government should review its regulatory processes to facilitate the favorable transition to renewables. The government introduced fiscal and non-fiscal incentives to attract local and foreign investments. As discussed, enabling factors for RE deployment involve the country's promising geographical location, the falling cost of renewable energy in the market, and tested solutions to some renewable energy's intermittency and seasonality issues. Likewise, renewables have the potential to create employment and the transition will likely thwart climate change and reduce carbon intensity, thus improving its energy system resilience. Current initiatives pivot on domestic public bidding of renewable energy capacities and partnership with foreign investors to maximize subsidies, grants, donations and investments, all for the extensive expansion of renewable energy in the Philippines. The prime energy companies in the Philippines are at the frontline of preparing the Philippines for the inevitable transition to a carbon-zero economy by first decarbonizing their own den.

CONCLUSION

The energy sector is currently facing several issues and challenges that hinder the extensive implementation of renewable energies in the Philippines. Strong leadership, governance, cooperation, and collaboration between and among all stakeholders would be necessary to offset this. The enabling factors should be given emphasis more than the hurdles. Though the government has enacted laws, namely the Biofuels Act and Renewable Energy Act, which aim to encourage investors to invest in the RE sector, thereby increasing the use of RE for power generation and rural electrification, other laws have grown loopholes despite their good intention. The EPIRA Law has encouraged monopoly in the energy industry, creating a non-coordinating energy structure and failing to provide an inexpensive supply of electricity in the country. On a large scale, a coordinated national RE target must be set once and for all. It must be reciprocally agreed upon by the government, energy agencies, and industry players to be properly communicated to concerned stakeholders and even the public. Public awareness also plays a significant role in influencing the political commitments, decisions and the orientation of public policies.

While the government centers its policy on energy security, it would be more favorable if it is framed from a sustainable standpoint. The government has welcomed more diversity in the energy portfolio, including renewables. However, energy security was geared towards only increasing generation capacity. Since conventional energies are already well-established, this makes it difficult for RE to compete. Instead of focusing on LNG as a transition fuel, the DOE should ramp up the implementation of the more than a decade-old Renewable Energy Act and collaborate with private sectors and communities to advance the energy transition in the country.

However, the country needs to move from import dependence to one of local power production obtained from its immense renewable energy potential. If sustained, this shifting energy situation in the Philippines will ultimately curtail fossil fuel dominance and eventually reduce everyday energy costs across the island nation. A decentralized energy system is also critical for increasing the country's electrification level, especially in rural and off-grid areas. While the government sets policy and direction, it is private sector capital, drive and ambition paving the way. Engaging with the private sector has provided insight into the current state and prospects for the Philippines' transition to a carbon-zero economy. Indeed, there seems to be a strong alignment of interest among partner countries and foreign companies, given their complementary renewable energy strengths and interests and associated strong business links.

In the coming years, whether or not the present Marcos government can achieve the 2030 RE targets remains to be seen. Though these targets might seem ambitious, it will largely depend on how competent the government will be in effectively resolving the issues and initiating the necessary mechanisms. A follow-up study should be done to assess future outcomes on whether the

country attained its 35% renewable energy target by 2030 and 50% by 2040. Though it is still premature to anticipate, this prospecting line seems promising, thereby crossing our fingers that it will not lead to a flash in the pan on the intended deadline.

CONFLICT OF INTEREST

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