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An Assessment of the Renewable Energy Sector of the Philippines through SWOT Analysis

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Abstract

The Philippines has adopted measures to increase its renewable energy (RE) generation since the early 2000s, as it faced issues on energy security and aimed to transition to a low carbon economy. However, despite the country's potential for RE and the legislations and policies enacted to support this, the RE sector has not yet fully developed, and the country still largely depends on fossil fuels. This study reviews the current state of the RE sector of the Philippines and evaluates the internal and external factors that affect it through SWOT (strengths, weaknesses, opportunities, and threats) analysis. Results reveal that positive indicators include the country's high potential for RE generation, successful implementation of local and international projects, and geographic suitability to harness RE. Meanwhile, negative indicators include the continued dominance of fossil fuels in the energy mix, political instability, and lack of institutional support. To create a robust framework for RE, energy leaders need to monitor RE policies' implementation and effectiveness strictly and extensively promote localized RE generation. A participatory approach in energy planning and policy design is also recommended.

Keywords: Strategic analysis of renewable energy sector, Philippine energy outlook, energy policy, energy sustainability, clean energy, green strategies

Introduction

Global energy consumption will increase by about 40% in the next 20 years, with fossil fuels accounting for 80% of the total demand (IEEJ, 2016). As a result, energy-related carbon emissions will also peak in the next decade (IEEJ, 2018). With these projections, the promotion of sustainable and cleaner energy sources is needed now more than ever.

Renewable energy sources (RES) are naturally available and inexhaustible. Their use promotes energy security by diversifying a country's energy mix and decreasing its dependence on imported energy fuels (Brahim, 2014). Renewable energy (RE) can also be produced in small quantities, and RE technologies can be installed close to consumers (Roxas & Santiago, 2016). However, despite the flexibility, benefits, and significant decrease in RE costs, it still has not taken off significantly over the past years (IEEJ, 2016). This is because appropriate policies and regulations on RE noticeably lack in countries that use this type of energy generation. It should be noted that even if the RE market is policy-driven, policies and regulations apply differently to each country's energy landscape. Its success also depends on the country's commitment to RE implementation, socio-economic structure, geographical characteristics, climate conditions,

and environmental provisions (Djiby, 2011).

In the case of the Philippines, interest in RES has been evident since the early 2000s. In 2004, the Philippine Energy Agenda called for the reduction of coal importation and a 100% increase in RE capacity (Lee, 2011). From then on, several legislations in support of RE were enacted. Among these is the Biofuels Act of 2006, which required gasoline fuel manufacturers to include ethanol in their gasoline mix and exempted taxation on biofuel production costs (Kumar et al., 2013). Then followed RA 9513 in 2008, which laid out policies and further incentives to boost the RE industry. However, even after a decade, the RE industry has not fully developed and remains mired in difficulties (DOE, 2019). Despite the abundance of RES, fossil fuels remain as the country's primary source of energy. The share of RE in the primary energy supply almost remained constant since 2008, while the energy from coal almost tripled (Barroco & Herrera, 2019). Therefore, there is a need to formally assess the state of the RE sector to sort out what the issues are and where further developments need to be done. Towards this, a strategic analysis has to be conducted involving an informed understanding of all factors affecting the system's operation and reducing risks, and enhancing system effectivity through wiser utilization of resources (Zanoni, 2012). Given the potential contribution of RE generation to national growth and capacity building, it is necessary to have a holistic approach in assessing the sector's current state.

This study proposes to review and evaluate the factors affecting the Philippines' RE landscape using the SWOT matrix (strengths, weaknesses, opportunities, and threats). The SWOT analysis is a strategic planning and decision-support tool that evaluates the structure of an industry or sector based on internal and external criteria (Spender, 2014; Madsen, 2016). This has been widely used as a strategic tool to assess the RE sector, both at the country level (Kamran et al., 2020; Dogan, 2015; Jaber et al., 2015; Terrados et al., 2005) and in multi-country settings (Madurai Elavarasan et al., 2020; Niyibizi, 2015; Shi, 2015; Chen et al., 2014). While studies that have employed SWOT analysis differ in important ways, they demonstrate that this is a useful tool for assessing the RE sector (particularly in RE development, policies and regulations, and availability of local resources) and evaluating RE generation contributions to society.

The study will investigate both the internal and external elements of the RE sector in the Philippines. Specifically, it aims to 1) review the country's RE policies, roadmaps, and green energy strategies; 2) assess the RE sector's outlooks, challenges, efforts, and potential through SWOT analysis; and 3) identify key points from the SWOT matrix to provide recommendations in energy planning and policy development. The study results should help policymakers, government agencies, investors, RE manufacturers, developers and researchers, and energy leaders understand the current situation, limit inconsistencies, and provide direction for the future of the RE industry in the Philippines.

Methodology

A strategic analysis was used to analyze the Philippines' status and potential in RE generation, capability to translate RES into viable energy projects, and efforts in creating policies and regulations to support such projects. The study initially explored the Philippines' RE industry by looking at its historical energy landscape. This was done by identifying legislation, laws, regulations, and green energy strategies that the Philippine government implemented to strengthen the RE industry.

A SWOT analysis followed to review the RE sector, looking into its internal and external criteria or factors. Economic, environmental, social, political, and geographic factors in RE implementation were considered in the analysis. These factors were plotted in a 2x2 matrix, as shown in Figure 1. The matrix was used to identify and present the internal (S/W) and external (O/T) performance indicators that may be beneficial (S/O) or detrimental (W/T) to the RE industry.

After the SWOT analysis, crucial SWOT components were analyzed and discussed. Existing gaps in schemes and critical issues were identified, and suitable strategies and recommendations to overcome such challenges were created. The framework was designed to eliminate weaknesses and threats by leveraging on strengths and opportunities.

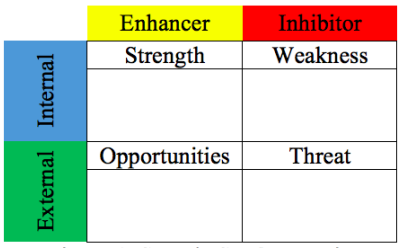

Figure 1. Sample SWOT matrix

All data used in this research were acquired from published resources and statistics on energy. The Philippine energy plans, power plans, and annual reports were also used. Other local and international research studies, energy reports, and news articles on RE development and policies were also used.

Results and Discussion

RE Policies in the Philippines

Before the 21st century, the Philippines' energy supply primarily relied on oil (IEA, 2020a). Consequently, it is at risk from uncertainties and price spikes in the global oil market. Because of this and the growing global concern on climate change, the country started to shift its perspective on sustainable energy sources (Brahim, 2014). After the ratification of the Kyoto Protocol in 2005, various countries pledged to reduce their emissions and implement policies on climate change. As a signatory of this protocol, the Philippine government created various policies and laws to ensure that targets in emissions reduction would be met, focusing its efforts on restructuring the energy sector and promoting RE.

Some of the initial RE policies implemented in the country focused on the electricity market, RE generation, and clean fuels. In 2001, President Gloria Macapagal-Arroyo signed the Electric Power Industry Reform Act (RA 9136). It restructured, decentralized, and privatized the energy industry, and promoted competition in the electricity market (DOE, 2019). From 2004 to 2010, the objectives of the Philippine Energy Agenda included the reduction of coal importation and a 100% increase in RE capacity (Lee, 2011). The Philippines was also one of the first countries to enact a law that promotes biofuels. The Biofuels Act of 2006 required gasoline fuel manufacturers to include at least 10% ethanol in their gasoline mix. It also exempted costs incurred in biofuel production from government tax (Kumar et al., 2013).

One of the most significant laws on RE development was the Renewable Energy Act of 2008, or RA 9513. It consisted of fiscal and non-fiscal policies and incentives that aimed to boost the RE industry of the country (DOE, 2009). Shown in Table 1 are the policies created under this act. Several support mechanisms to RA 9513 were also put in place. One was implementing "Waste to Energy Technologies," which aimed to convert particular agricultural wastes to valuable energy (DOE, 2010). Another was the National Renewable Energy Program (NREP) which served as the official document containing the interim targets for RE generation from 2011 to 2030. It aimed to triple the country's RE capacity from 5,438 MW to 15,304.3 MW, mainly from hydro, geothermal, and wind power (DOE, 2010). The NREP also contains four sub-programs. First is the RE Industry Service, which focuses on RE market development, and advisory and monitoring services. Second is Resource Development, which focuses on feasibility, optimization, impact studies, and resource assessments of RE. The third sub-program, R&D Demonstration, includes demonstration projects and technology development. Finally, RE Technology Support covers capacity expansion, quality assurance, and standards development (DOE, 2010).

In 2012, the Department of Energy (DOE) published the RE Safety, Health, and Environment Rules and Regulations. It aimed to limit RE generation pollution and ensure the safety of operation in RE facilities safety (DOE, 2019). A circular supporting the promotion of Solar Home Systems (SHS) was created in 2014. Under this policy, distribution utilities were given the authority to install SHS. In return, they would be able to avail a monthly fee for service and a capital subsidy for procurement and capital costs depending on the number of installed SHS (IEA, 2020a). In 2016, President Benigno Aquino III signed Executive Order No. 206 that facilitated the sustainable resource management of RE (Official Gazette, 2016). In the following year, DOE released the DO2017-04-0005 entitled "Prescribing the New Guidelines in the Processing of Applications for Renewable Energy Service/Operating Contracts". It shortened the evaluation period for RE proposals from 15 days to five days (DOE, 2017a).

Table 1. Incentive grants under RA 9513

Type of Incentive	Description
Renewable Portfolio Standard (RPS) (Off grid)	Inclusion of RE in the total annual generation of small-scale generation utilities and qualified third parties
RPS (On grid)	Incorporation of a 35% share of RE from 2030 to 2040 by generation facilities connected to the grid
Green Energy Option (GEO)	Consumer option to use power generated from RES
Feed-in-tariff (FIT)	Provision of a guaranteed fixed price to RE generators for 20 years
Net Metering	Consumer option to sell or offset privately produced RE
Income Tax Holiday	Income tax exemption for RE developers
Duty Free Importation on RE Machinery	Tax exemption of imported RE machineries and materials for 10 years
Special Realty Tax Rate on Equipment and Machinery	Charging a maximum of 1.5% tax on construction works, repairs, and equipment maintenance of RE facilities
Net Operating Loss Carry-Over	Cost deductions from the gross income tax for the first three years of operation, valid for seven years
Zero Percent Value Added Tax (VAT) Rate	VAT exemption of power generated from RES, locally acquired RE items and services, and costs incurred from RES exploration
Tax Exemption on Carbon Credits	Tax exemption of all revenues gained from carbon emission credits
Tax Credit on Domestic Capital Equipment	Full tax credits of RE facilities purchased from domestic suppliers
VAT exemption for Farmers of Biomass Resources	VAT exemptions for farm owners who harvest biomass resources such as jatropha, coconut and sugarcane
Tax Rebate on RE Components	Tax rebates on RE equipment used for residential, industrial and community applications
Financial Assistance Program	Financial packages awarded to RE projects approved by DOE
Cash Incentive for RE Projects towards Missionary Electrification	Provision of a cash-generation-based scheme equivalent to 50% of the universal charge for power generated towards missionary electrification
Payment of Transmission Charge	Option for RE developers to pay a transmission charge equivalent to the average per kWhr cost of electricity flowing through the grid
Grid Priority Dispatch	Grid priority dispatch for power generated from intermittent RES

Source: DOE, 2019; DOE, 2009

In June 2017, incumbent President Rodrigo Duterte signed Executive Order No. 30 entitled, "Creating the Energy Investment Coordinating Council to Streamline the Regulatory Procedures Affecting Energy Projects" (DOE, 2017a). The Renewable Energy Trust Fund (RETF) was established a year after. This fund would finance various training, scholarship grants, and research projects in RE (REN21, 2019). The most current policies include the Energy Virtual One Stop Shop and Ease of Doing Business and Efficient Government Service Delivery Act or RA 11032, making RE services transactions faster and more efficient (DOE, 2019).

At present, the Philippine RE Roadmap is in its medium-term phase of implementation. Based on this roadmap, the energy sector should continuously provide financial assistance to RE investments and accelerate RE development in off-grid regions. It should also improve

RE project implementation and coordination among local government units, enhance energy infrastructures, and prioritize local RE suppliers and manufacturers (DOE, 2017b).

SWOT Analysis

A. Strengths

Since the Philippines has abundant natural resources, its potential for RE generation is very high. It even ranks higher than other Asian and European nations in the percent share of RE (Roxas & Santiago, 2016). In terms of geothermal energy production, the Philippines ranks third globally, next to the US and Indonesia. Its overall potential for hydropower production is 11,223 MW. It also has a radiation rate of 5.1 kWh/m^2 (Bakhtyar et al., 2013), comparable with the radiation rates of the top countries in solar generation today. Radiation rates in China, Japan, the USA, and Germany are at 7.5 kWh/m^2, 4 kWh/m^2, 7.8 kWh/m^2, and 3.5 kWh/m^2, respectively (Solargis, 2020). The country can also generate up to 76,600 MW of wind energy, which is the highest among all types of RES (Lidula et al., 2007). DOE has identified 1,038 sites across the country with a wind power density of at least 500 W/m^2. The Philippines also leads globally in biomass energy production due to the abundance of farms and agricultural lands.

At present, the Philippines has one of the highest numbers of implemented RE policies, laws, and directives in Asia (REN21, 2019). It is also the only country in Southeast Asia where the use and regional development of RES are regulated. As a result, the country's oil importation was reduced by 12.18 million barrels of oil equivalent (DOE, 2019). RE policies also improved private sector participation and public financing schemes. As seen in Figure 2, solar and wind projects accelerated in 2016 and 2014, respectively, after the approval of FIT rates in 2012. A total of 862 RE service contracts have also been awarded through the RE Act of 2008. Once commissioned, these projects will provide a total capacity of about 24,000 MW (DOE, 2019).

The archipelagic and topographical characteristics of the Philippines are favorable for RE generation. Studies indicate that a hybrid RE system best fits archipelagic countries where problems in grid connection persist (Roxas & Santiago, 2016). A photovoltaic-diesel-battery hybrid system was also proven to be a suitable, economical, and cheap RE-based grid option for island grids in the Philippines (Ocon & Bertheau,

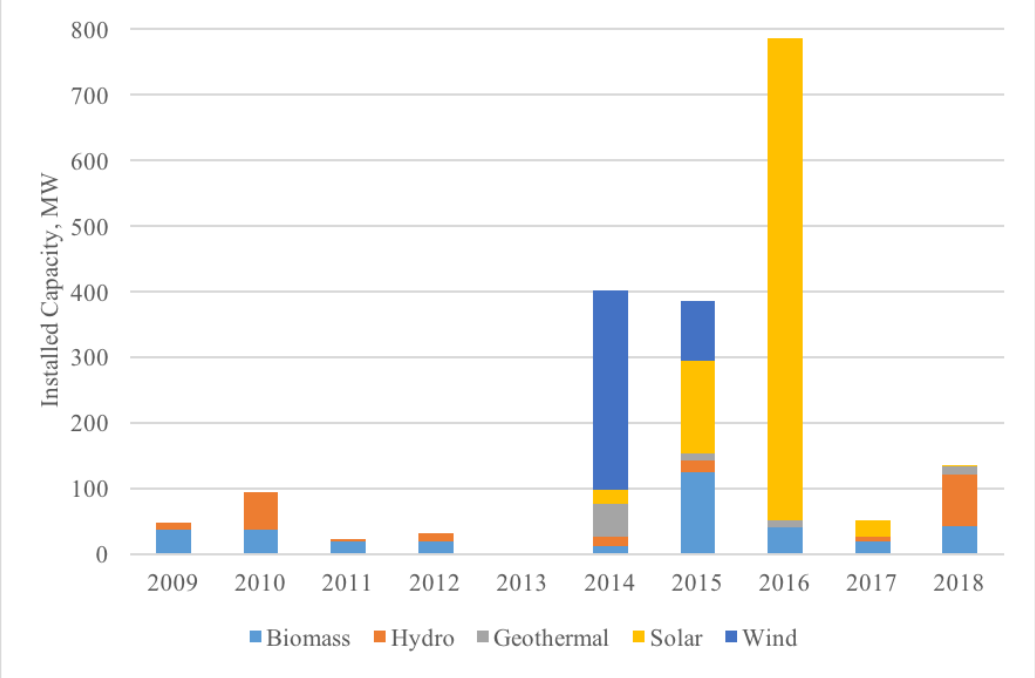

Figure 2. Additional capacity installations from RES
Source: DOE, 2019

2019). DOE (2010) also claimed that solar power systems are suitable for off-grid rural areas. Furthermore, a total of 888 sites for mini-hydro generation and around 10,000 potential sites with a wind power capacity of 300 W/m^2 across the Philippine islands have been identified by DOE.

B. Weaknesses

Fossil fuels continue to dominate the country's primary source of energy. For instance, coal for energy generation increased three times in the last decade (Barroco & Herrera, 2019). From 2013 to 2015, five additional coal power plants were commissioned (DOE, 2017b). Diesel generators also remain as the primary source of electricity in rural areas despite the ability of RE technologies to go off-grid (Marquardt & Meller, 2013). Government programs on fossil fuel promotion have also hindered RE development. For instance, the Philippine Conventional Energy Contracting Program fast-tracked the time to process and award contracts in fossil fuel exploration. The Philippine National Oil Company has also finished its coal drilling program and asset evaluation in Isabela and Zamboanga under the Coal Operating Contract. International agreements such as the Association of South East Asian Nations (ASEAN) Forum on Coal also continue to promote coal development among its country members (DOE, 2017b).

Political tension and inconsistent governance also affect the implementation of RE projects and policies. A study claimed that the government support to RE investors is still ambiguous (Bakhtyar et al., 2013). In addition, the delay in the release of FIT rates was mainly caused by disputes among political parties and legality issues (Bakhtyar et al., 2013; Katz, 2012). This four-year delay cost a total of 2.5 billion USD (Roxas & Santiago, 2016). Furthermore, some policies and incentives in RA 9513 are yet to be implemented, even after 12 years since its enactment. For instance, the RE Market and Registrar were supposed to be established one year after implementing the act but are still evidently missing.

Despite the high number of RE policies implemented, support mechanisms to ensure their effectiveness and success are still lacking. Issuing permits and contracts for RE projects are more complicated than coal and oil projects. Tax incentives also sent false price signals and only supported investors but not consumers (Sovacool, 2010). The FIT scheme also failed to meet payment obligations to RE investors in 2016 and 2017. Issues on unexpected curtailment, lack of ancillary services, delayed release of approved rates, and underfunding of the FIT Allowance (FIT All) Fund due to market underperformance were also identified (ADB, 2018). Table 2 shows that the approved and revised tariff rates were lower than the proposed rates. Consequently, the reduction in rates affected the interest of investors in RE (GMA News, 2012). This is most evident in solar generation where the tariff was reduced by almost half.

Even after the implementation of RA 9513, the RE capacity has been significantly low. Most of the 2030 capacity targets are still far from the capacity installed as shown on Table 3. This is most evident in geothermal and hydro technologies, reaching only about 5% and 4% of their targets, respectively. On the average, RE generation only saw a 3% annual growth since 2011.

The country's energy market structure also fails to reflect RE generation's economic, environmental, and social benefits. Promoting RE in power generation is hindered by the high cost of electricity in the country, which is considered one of Asia's highest. The disjointed structure of the energy market also affects the implementation of RE technologies. For the country's power system to be reliable and economically viable, it should

Table 2. Tariff rates under the FIT scheme

RES	Proposed Tariff Rate in 2011 (Php/kWh)	Approved Tariff Rate in 2012 (Php/kWh)	Revised Tariff Rate as of 2017 (Php/kWh)
Run of river hydro	6.15	5.90	5.87
Biomass	7.00	6.63	6.60
Wind	10.37	8.53	7.40
Solar	17.95	9.68	8.69

Source: DOE, 2010; DOE, 2019

Table 3. Target and actual installations of RE generation per RES under the NREP

RE Technology	Target Additional Installation (MW) from 2011 to 2030	Actual Installation (as of 2018)	
		Capacity (MW)	% Target
Geothermal	1495.0	72.00	4.82
Hydro	5394.1	213.04	3.94
Biomass	276.7	469.12	169.54
Wind	2345.0	393.90	16.80
Solar	284.0	953.18	335.63
Total	9794.8	2101.60	21.46

Source: DOE, 2010; DOE, 2019

serve only one electricity market. However, there are three distinct power markets in terms of demand, supply, and competition. Luzon has the most developed energy market, while the Visayas has problems with transmission and reliability. On the other hand, the bulk of RE potential is in Mindanao, which remains disconnected from the rest of the country (ESMAP, n.d.). The lack of environmental considerations in energy generation is also evident. Energy plans should consider climate and environmental conditions since these factors affect the energy consumption behavior of end-users, availability of existing energy sources, and investments in both renewable and conventional energy generation (ESMAP, n.d.). The problem of translating social benefits from RE generation also persists in the country. RE technologies are still more expensive than traditional energy sources such as diesel lamps for lighting and wood for cooking. Small-scale RE projects had problems in implementation and operation due to the lack of technical knowledge and experience and low support from the community. In Pangan-an Island, the installation of a centralized photovoltaic (PV) solar application was not supported by the community, resulting in debts and failure of operation of the facility (Hong & Abe, 2012).

C. Opportunities

There are several opportunities to develop RE in the Philippines. In terms of capital and power generation costs, RE technologies are now more competitive against fossil fuels. The levelised cost of electricity and installation costs of RE technologies, especially in solar generation, are also forecasted to decrease until 2030 due to economies of scale. Energy generated from fossil fuels also has high external costs (climate change, health, agricultural, and ecosystem losses) at 18.3 US cents/kWh while RES is at 0.34 US cents/kWh (Marquardt & Meller, 2013).

Several ASEAN projects and collaborations also provide opportunities for RE generation. The ASEAN Plan of Action for Energy Cooperation (APAEC) aims to promote intra-ASEAN cooperation on energy services and products. A 23% target of RE share in the region's energy mix by 2025 is also included in the APAEC 2016-2025 (ACE, 2017). More importantly, the Philippines has been identified to contribute to the RE initiatives of the program. Another program under the APAEC is the ASEAN Power Grid, allowing power interconnection and trade among its members (Shi, 2015). The Brunei Darussalam-Indonesia-Malaysia-Philippines East Association has also proposed a grid connection between Palawan and Sabah (ADB, 2018). These projects will likely boost the RE generation in the Philippines to provide the additional capacity needed for the inter-country electricity trade. The regional interconnection will also reduce intermittency in RE generation as peak hours may differ from one location to another. During the latest ASEAN Summit in April 2020, ASEAN leaders reasserted their commitments to include energy cooperation in their recovery plans against the pandemic. Efforts to create a conducive business environment for clean energy and decarbonization were also highlighted (ACE, 2020).

The success of local and international project collaborations also enables the expansion of the RE industry. The RE project in Paluan, Occidental Mindoro by Solar Philippines is set to be the world's biggest island solar-battery micro-

grid project. The 6 MW solar facility will not only provide a 24-hour electricity supply to 20,000 residents, but it will also reduce electricity prices by half. Solar Philippines now looks at expanding the project in Panay, Negros, Samar, and other parts of Mindanao (DOE, 2017b). The installation of off-grid PV systems and mini-hydro plants across the country are also some of the ongoing projects of the United States Agency for International Development in the country. Managerial, technical, and financial training for the operation and maintenance of these facilities are also provided (Katz, 2012). The Philippines also has a project collaboration with Japan called the "Introduction of Clean Energy Using Solar Power Generating System." It explores the option of incorporating the Net-Metering scheme in solar PV operation (DOE, 2017b). The Japanese government also provides micro-hydro demonstration projects in Mindanao. The National Grid Corporation of the Philippines has also partnered with China's State Grid for a solar project called "Brighten Up." The project aims to provide power to over 1,000 residents in Zambales by installing solar PVs (Lucas, 2019). The European Union-Access to Sustainable Energy Programme and World Bank also initiated the PV Mainstreaming Program in 2019 to electrify rural areas through RE. The project aims to install solar systems in 40,500 households across the country (Lagare, 2018; DOE, 2019).

The country's energy objectives also promise a bright future for the RE industry. Committed projects included in the Philippine Energy Plan are mostly hydropower installations in Visayas and Mindanao and solar projects in Luzon (DOE, 2017b). The Philippine Senate has also recently proposed creating the Philippine Energy Research and Policy Institute to promote energy reform, advance the research and development in energy resources, and identify existing gaps in policies. Total funding of Php200 million will be given to the research body to support its operational requirements and energy programs (Reganit, 2018). As stated in the Power Sector Roadmap, sophisticated planning and operational tools will be used to expand the power system and accommodate the power generated from variable RES (DOE, 2017b). This is in line with the plan to launch the RPS in 2021, which will add 2 GW of capacity from RE technologies (Shani & Yurnaidi, 2020; DOE, 2020). The RE Roadmap is also set to create a conducive business environment by incentivizing local producers of RE products and services. The NREP also contains several support programs that are set to be implemented by 2030. One of them is the RE One-Stop-Shop which will serve as the contact hub for all RE services, licensing, and contract applications. A RE Information Exchange will also be established to remove information barriers and provide accurate market information and technical data. The Integrated RE Monitoring and Evaluation System will also assess the effectiveness and extent of the impact of both the RE Act of 2008 and NREP. Affiliated Renewable Energy Centers will also serve as DOE's counterpart in regional areas. They will be in charge of project monitoring, policy development, research activities, and resource inventory (DOE, 2010).

Threats

Despite the favorable conditions for RE generation, several threats are also identified. Studies show that fossil fuels will continue to be the primary energy source in Southeast Asian countries until 2035 (Shi, 2015). At the same time, coal consumption in the Philippines is projected to increase five times in the next two decades (ADB, 2018). The threat of a looming power crisis also favors fossil fuels in power generation to secure the energy supply. This is especially after the power crisis in 2010 that left the country on a nationwide power outage. The Philippine Energy Roadmap also includes the government's intention to increase the local production of oil, gas, and coal until 2030 (DOE, 2017a). Unexplored coal deposits in the country also pose a threat to RE development. Extensive coal deposits in Semirara Island, Cagayan Valley, South Cotabato, and Sultan Kudarat have been identified. There is also a plan to re-examine and revise the existing tax exemption rules on imported coal and petroleum to streamline their use in energy production even more (DOE, 2017b). The depletion of natural gas reserves in the Malampaya Gas Field has also stirred the possibility of expanding fossil fuel production for energy security (ADB, 2018).

Since the start of his administration, incumbent President Rodrigo Duterte has expressed his support for nuclear energy generation. The Philippine government has agreed to construct nuclear plants in the country through cooperation with the Russian government. The Rosatom State Atomic Energy Corporation has also been interested in building floating nuclear power plants (Santos, 2019).

The Philippine Nuclear Research Institute (PNRI) is also set to conduct a feasibility study called "Assessing the Development of Nuclear Power Program in the Philippines" to further explore nuclear energy generation. PNRI has even requested the technical assistance of the International Atomic Energy Agency to help them with this project (DOE, 2017a).

Political disputes remain a leading threat to the RE sector. For instance, the implementation of RE projects will not be successful if the government will favor the development of one technology over the other. The same argument goes for the process of bidding and awarding RE contracts. The Philippines' political issues on graft and corruption have also projected a negative impression and an unstable business environment for RE investors. The lack of transparency in transactions and policy design and inconsistencies in regional energy management also discourage RE investments (Brahim, 2014).

Impacts of the COVID-19 pandemic on the energy industry can adversely affect the RE sector of the Philippines. The number of new installations and funding opportunities for RE projects can decline as the country prioritizes its health sector first. The payment of existing RE subsidies and commitments can also be affected by the economic downturn due to the lack of funds. For instance, the Energy Regulatory Commission (ERC) has postponed the collection of the FIT component to lower electricity bills during the pandemic (ERC, 2020). The creation of new RE policies in the country can also be delayed to prioritize the pandemic-related policies first. Supply chain disruptions in the RE industry can also slow down investments. Reports claim that factory shutdowns and operation interruptions in China, one of the biggest RE technology manufacturers, will have a "ripple effect" on global RE projects (IRENA, 2020). The decline of energy demand in the transport sector also threatens the use of biofuels (IEA, 2020b). Studies also show that demand has shifted from commercial and industrial to residential use as more people stay at home. At the same time, peak prices shifted from early afternoon to early evening when solar and wind energy are low (Ravago & Roumasset, 2020).

SWOT Matrix

Results of the SWOT analysis are summarized in Table 4. A total of 14 performance indicators were identified as either enhancers or inhibitors of the Philippine RE sector.

Strategies for RE development

Based on the W-T components of the SWOT matrix, this paper has identified that the expansion of the Philippine RE sector is hindered by the combination of a decentralized energy system, strong dependence on fossil fuels, and ineffective implementation of regulatory schemes. From the S-O components, we propose a framework that will expand the Philippines' RE generation by taking advantage of its RE potential, international connections, and national and regional policies that effectively fit the energy system and market structure.

Table 4. SWOT matrix of the RE sector of the Philippines

Strengths	**Weaknesses**
Abundant RE capacity High number of RE policies and incentives Topographical characteristics fit RE generation	Continued extensive use and promotion of fossil fuels Limited policy framework and poor governance Failure to translate economic, environmental and social benefits of RE generation
Opportunities	**Threats**
Competitive RE prices due to economies of scale Increased ASEAN cooperation Increased investments from local and international companies and organizations Realization of national goals	Projected dominance of fossil fuels in the energy mix Pro-nuclear energy generation government Political unrest Impact of COVID-19

A. Strengthen institutional support

The analysis reveals the significant role of institutional support in developing the RE industry in the Philippines. It was identified that issues on political disputes had discouraged investments in the RE industry. Reform in fossil fuel use and subsidies also requires strong political will, as shown by several planned and ongoing coal and oil programs. Governing bodies of the energy sector also face issues on accountability, transparency, and proper management. For instance, the delay in incentive applications and transactions and the complex permitting process of RE contracts are linked to the absence of support services in energy management. These are also affected by inconsistent implementations of national policies. There has also been an absence of a monitoring scheme for fiscal incentives available to the public. Initiating national government should then be a top priority in the agenda. To guarantee transparency, sustaining checks and balances in transactions will be needed. For instance, a public platform for monitoring the RETF and FIT All Fund could be established. The coordination between the energy sector and other government agencies such as the Department of Environment and Natural Resources and the Department of Agriculture is also necessary. This is to ensure an integrated approach in implementing RE projects and the design of RE policies. The government should also honor its current commitments to RE developers to lock in the benefits gained for the past decade.

The high number of RE policies implemented in the country also proves an "initiative" to promote RE. However, there is also a gap in "action and response." Proper management and regulation of policies should then be strongly established in the energy sector. It also includes employing competent and credible officials who will extensively and fairly implement and monitor RE policies and incentives. At the same time, the distribution of responsibilities among governing agencies will be necessary to prevent the overconcentration of power. A bottom-up approach in policy design is also recommended to include feedback from end-users and RE developers. It will also promote a sense of shared national responsibility in energy planning. In addition, the NREP and RE roadmap need to be carefully reviewed every year to check if targets are met. This will also inform both the public and policymakers of the effectiveness and validity of energy action plans.

B. Augment the energy market and power system

The different energy market structures of the three main islands continue to be a challenge to creating a RE market in the country. However, with an appropriate action plan, an effective RE market can be established. For one, the interconnection of the three main islands to a single power grid should be the top priority. The construction of additional energy infrastructures, and expansion of the power system, especially in transmission and distribution, must also be in place to accommodate intermittent RE. This interconnection will not only allow the adaptation of the market design of Luzon in Visayas and Mindanao, but it will also maximize the RE capacity by pooling the resources of RES-rich islands.

The RE industry can also expand through the integration of successful RE projects in the power system. Stand-alone hybrid RE systems can serve as medium-term solutions for the lack of energy access in hard-to-reach areas. Recent solar-diesel hybrid projects have been successfully installed and operated in island grids and rural areas, especially in Visayas and Mindanao. Installing on-grid RE plants in resource-rich areas can also generate additional income for the region through a nationwide energy trade.

C. Pursue more public-private project collaborations

The SWOT analysis shows that various RE projects have been successfully implemented in the country over the years. The economies of scale in the global RE market also opens the opportunity for further cost reductions in RE generation. These precedents show the importance of continuous collaborations with private institutions to acquire more funding and support for RE. Information exchange is also a key strategy to expand the industry, as reflected by the limited technical breakthroughs in recent years.

The industrialization of the country will require a stable energy supply. There is then a need for the government to collaborate with local and international RE companies to capitalize on the country's RE potential, especially in geothermal and hydropower generation. The support from these institutions will be necessary for developing countries like the Philippines

since high costs and affordability constrain RE technologies. This move can also generate enough profit to eventually fund the installation of the more expensive technologies like wind and solar.

Strengthening the Philippines' cooperation with other ASEAN members is also necessary to achieve the goals set in the APAEC. The ASEAN interconnectivity across borders opens up many opportunities that could benefit the Philippine economy. It allows surplus energy to be traded and additional resources to be acquired without additional capacity costs. However, the government must balance maintaining national priorities and objectives and seeking common international interests.

D. Expand RE policies and community-based RE programs

It has been 12 years since the RE Act of 2008, and the share of local RE generation in the Philippine energy mix is still low. The existing incentives and subsidies for local RE generators, manufacturers, and suppliers may be a good starting point to promote RE, but these are mostly tax exemptions. Other options such as cash incentives and carbon credits could be explored. Expanding the benefits of RE generation to consumers is also recommended. At present, GEO and Net Metering are the only RE services offered to end-users.

The implementation of the NREP subprograms in research, training, and information dissemination can also boost public support and improve the expertise in RE technologies. In this way, both the community and employees become aware of the local RE generation's social and economic benefits. However, public acceptance may take time, so these strategies need to be initiated right away. Prioritizing community-based projects is also a way to promote RE. For instance, solar energy can be harnessed for street lighting, while government and public vehicles can use biofuels instead of gasoline and diesel. More environmental considerations should also be incorporated in the RE framework, such as defining emission standards and assigning value to green technologies.

The RE industry also faces uncertainties in policy implementation and project commitments due to the effects of COVID-19. This highlights the need to ensure the realization of indicative and committed RE projects included in the Philippine Energy Plan. Global supply chains in the industry are also disrupted due to the restrictions caused by the pandemic. Despite such challenges, RE generation can leverage the changes in the energy supply-demand patterns. As the country's electricity demand dropped by 30 to 45% (Domingo, 2020), power from RES may already be enough to balance the demand. RE technologies can also be used in post-pandemic recovery plans to secure the energy supply during lockdowns, especially in rural areas.

Conclusion

Based on the findings, issues on energy security and climate change paved the way for RE generation in the Philippines. However, the energy sector also faced issues of setting ambitious goals in reducing fossil fuel use and RE capacity targets. In response to these challenges, the RE Act of 2008 was enacted and the country's RE industry has slowly thrived ever since. This act included fiscal and non-fiscal incentives that intend to attract more investments in RE generation. Of these incentives, the FIT mechanism was considered as most effective, which resulted in several RE investments and projects. Support mechanisms for RE development were also created, such as the NREP. Ultimately, RE policies aim to triple the Philippines' RE capacity and attain a 70% reduction in GHG emissions by 2030.

Results of the SWOT analysis revealed that the Philippine RE sector's strengths include its large RE capacity, implementation of numerous RE policies and incentives, and topographical characteristics that fit RE generation. On the other hand, its weaknesses include the continued support for fossil fuels, limited policy framework, poor governance of the energy sector, and lack of economic, environmental, and social benefits from RE generation. External factors such as the emerging green trend in the energy market, increased ASEAN cooperation, new local project opportunities, international collaborations, and realization of national goals were seen as opportunities for RE development. Meanwhile, threats that were identified include the projected dominance of fossil fuel in energy generation, government support for nuclear energy, political unrest, and the looming impacts of the COVID-19 pandemic.

Overall, the study showed that inconsistencies and issues in the country's energy system and management, and policy implementation hinder

RE development. To create a robust framework for RE, a combination of technical and institutional strategies need to be implemented. The RE sector needs to activate its national government, seek more public-private partnerships, and establish an effective RE market. Strict monitoring of policy implementation and compliance, promoting a participatory approach in policy design, improving social awareness and public knowledge on RE, and endorsing localized RE generation were also identified as key solutions. In addition, economic and political factors mainly affect the Philippine RE sector. The absence of environmental and social considerations in the country's energy landscape was also evident. These observations further solidify the need for a holistic approach in solving the challenges that the Philippine RE sector faces.

While this study presented significant findings to improve the Philippine RE sector, there were also some limitations. First, the study considered secondary sources of published data and evidence. It is then recommended to acquire primary sources of information directly from energy leaders and managers, government agencies, RE developers, local banks, independent energy consultants, NGOs, the private sector, and most of all, the public. This could be conducted through surveys, questionnaires, or interviews to gain more detailed insights into the SWOT matrix's internal and external performance indicators. A participatory approach would also address the questions surrounding the responsiveness and impact of RE policies. Second, the study focused its assessment on the more established RE industries in geothermal, hydropower, biomass, solar, and wind engineering. Future studies should also consider newer RES such as ocean and hydrogen energy. In addition, a microeconomic analysis of a specific RE industry can also be conducted. This way, targeted economic actors can easily formulate strategies for energy planning that effectively fit the business environment. A third limitation is that policies under other government sectors that could play a role in RE development were not incorporated in this work. Finally, a quantitative assessment used in conjunction with the SWOT analysis to assess the Philippines' status of attaining the Sustainable Development Goals (SDGs) in Green Energy (SDG 7) is worth considering in future studies.

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