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***Abstract:***

Nearly a decade after the Philippines began promoting renewable energy through legislation, the country has seen gains and encountered roadblocks in its transition to low carbon. This paper examines the Philippines' experience in attempting a governed energy transition. The Philippines is a developing country with substantial economic growth aspirations, yet it cannot ignore climate change, because it has already begun suffering the phenomenon's early impacts. It is among the most vulnerable to climate change, so it has great interest in mitigating global carbon emissions. Yet, the country itself is heavily dependent on imported coal for its energy needs. In the context of its existing regulatory and techno-institutional landscape, the authors examine the Philippine experience in a decade of governing its energy transition. The paper discusses challenges in balancing the trilemma of energy security, equity, and sustainability. It then identifies some priorities for the Philippines as it attempts to accelerate its transition to low carbon. The authors consider developments beyond the energy sector, particularly the early entry into force of the Paris Agreement, as a tool to tip the scale in favor of the trilemma's sustainability pillar. The Philippine case may provide lessons for other developing countries undergoing their own transitions.

***Keywords:*** Philippines; energy transition; trilemma; climate change

# NAVIGATING THE TRILEMMA: ENERGY SECURITY, EQUITY, AND SUSTAINABILITY IN THE PHILIPPINES' LOW-CARBON TRANSITION

## 1. Introduction

Scholars like Sovacool, Kern and Rogge posit that future energy transitions can take place much faster than past ones, which were largely left to market forces and, consequently, dependent on the pace of technological innovations [1], [2], [3]. 'Historical' [2] or 'emergent' [3] transitions were generally driven by opportunities for economic gain. In contrast, future transitions could be driven by global problems that need addressing, like climate change and resource scarcity [2], [3]. To meet these challenges, States envision an energy future, then enact policies and legislation to realize that vision. This way, States try to govern their transitions. A State's active management of energy transition through laws, policies, and incentives that shape markets helps accelerate the pace of these transitions [2]. This paper examines the Philippines' experience in attempting to govern its energy transition to accommodate low-carbon sources in its energy mix. Nearly a decade after it first passed a law in 2008 to promote renewables, the country has seen some gains and encountered roadblocks, which this paper attempts to unpack through the lens of energy trilemma and path dependency.

This section sets the context and provides a background on the Philippines; *Section 2* describes the research method; *Section 3* lays down the Philippine regulatory framework for energy and discusses the techno-institutional complex and path dependencies that policymakers must contend with in formulating transition policies; *Section 4* discusses challenges the Philippines has encountered in shifting its energy landscape to accommodate renewables; *Section 5* briefly identifies key priorities in managing the transition; *Section 6* discusses possible opportunities for the future of Philippine energy policy; and *Section 7* provides a concise conclusion.

### 1.1. The Philippines

The Philippines is an archipelago of 7,107 islands in the Western Pacific, with a population of 100.98 million as of August 2015 [4]. Its population grows at an average of 1.85% annually [5], higher than the world average of 1.182% [6]. It is currently a lower middle-income country [7], [8]; however, it has been one of the fastest growing economies in Asia [9], [10]. Over the past six years, the Philippine economy grew by an average of 6.2%, with growth expected to continue at 6.5 to 7.5% in 2017 [11]. The Asian Development Bank expects the Philippines to graduate into an upper middle-income country by 2020 [12].

To support the growing population and economy, the Philippine Department of Energy (DOE) anticipates the need for a total installed capacity addition of ~12,307 megawatts (MW) by 2030, with ~7,335 MW for Luzon, ~2,872 MW for Visayas, and ~2,100 MW for Mindanao [13]. This total capacity addition comprises 1,700 MW as peaking, 5,000 MW as mid-merit, and 5,607 MW as baseload capacities. In Luzon, new capacity additions for peaking and mid-merit are needed beginning 2021, while baseload addition is needed by 2025. In the Visayas, additional mid-merit capacity is needed starting 2018, baseload by 2019, and peaking by 2027. In Mindanao, additional mid-merit capacity is needed by 2023, baseload by 2025, and peaking by 2030 [13] (*See Figure 1 below*).

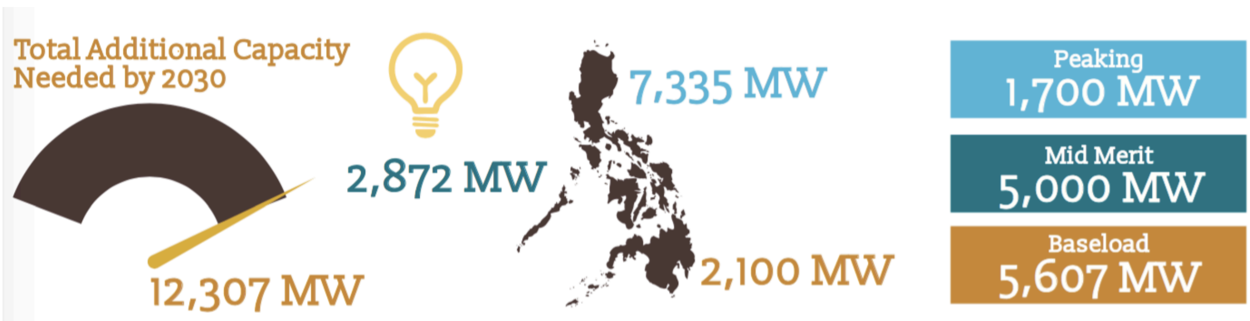


**Figure 1. Total Additional Capacity Needed by 2030**
**(Luzon, Visayas, and Mindanao; Baseload, Mid-Merit, and Peaking)**
Source: DOE (2015)

At present, the Philippine energy mix is characterized by high dependence on fossil fuels and fuel imports [14], comprising 44.51% coal, 25.44% RE, 22.91% natural gas, and 7.14% oil-based technologies [13]. In governing the transition, the Philippines aims to increase the share of renewables in its energy mix.

### 1.2. Climate vulnerability

As an archipelago in the Western Pacific Ocean, the Philippines lies within the typhoon belt and the Pacific ring of fire [8], [15]. It is especially vulnerable to extreme weather events such as typhoons, floods, and rising sea levels [16], [17]. The Global Climate Risk Index 2017 ranks the Philippines as the world's fifth most affected by extreme weather events and other natural hazards like earthquakes [18], even while we are still at +1°C above preindustrial levels. In the last decade, for example, record-breaking tropical cyclones like Super-typhoon Haiyan have devastated the country, resulting in substantial losses of life and property and affecting the country's productivity [15]. Moreover, the Intergovernmental Panel on Climate Change (IPCC) predicts that more intense and more frequent precipitation events will result from an increase in global mean surface temperature, especially in the tropics [19]. Thus, the Philippines cannot afford to ignore climate change despite its substantial economic growth aspirations. It must include climate considerations in developing its national energy and economic development policy agenda.

As Silveira and Johnson suggest, "[t]he global transition to an environmentally sustainable economy will require radical re-organization in the structure of energy systems [20]." Since energy production and consumption are substantial sources of greenhouse gases, contributing about 65% of global emissions [21], energy policy changes are critical to achieving environmental sustainability. "Energy is at the heart of the problem and so must be integral to the solutions [22]."

## 2. Methods

Mixed methods were used to gather data for this study. Data were collected from both written and oral sources using archival research, desktop reviews, key informant interviews, expert workshops, and a multi-stakeholder policy dialogue.

The research team conducted an extensive literature review on energy policy and governance, and held key informant interviews, supplemented by archival data collection of official government records, throughout a six-month research period, from May to October 2016. Desk-based research was conducted on the current regulatory framework for energy, supplemented by validation interviews with select high-level officials involved in national policy planning and implementation. The team conducted a total of 28 interviews with key officials from fourteen national government offices, three international organizations with development cooperation projects in the Philippines, and two development specialists with expertise on the Philippines, *viz*:

| *National government offices* | |
|---|---|
| 1. DOE Office of the Undersecretary | 2 |
| 2. DOE Energy Policy and Planning Bureau | 2 |
| 3. DOE Electric Power Industry Management Bureau | 2 |
| 4. DOE Renewable Energy Management Bureau | 1 |
| 5. National Renewable Energy Board | 1 |
| 6. Energy Regulatory Commission | 2 |
| 7. Climate Change Commission | 4 |
| 8. Senate | 2 |
| 9. House of Representatives | 2 |
| 10. Office of the President | 1 |
| 11. Department of Transport | 1 |
| 12. Department of Environment and Natural Resources (DENR) Office of the Undersecretary | 1 |
| 13. DENR Environmental Management Bureau | 1 |
| 14. DENR Climate Change Office | 1 |
| *International organizations* | 3 |
| *Development specialists* | 2 |

**Table 1. Research Participants**

Research participants were identified by selecting government agencies involved in the formulation, planning, and implementation of energy and climate policies at the national level. Thereafter, the snowball method was employed, with the research team interviewing specialists and other resource persons recommended by research participants.

Most of the persons contacted agreed to be interviewed, and the interviews were completed over four months. The interviews employed an initial, semi-structured portion involving a series of relatively standard questions about current energy and climate policies and those that were being discussed or planned, followed by an unstructured, open-ended segment where research participants were invited to speak freely about the challenges they encountered in energy and climate policy planning and implementation in general, and in handling energy transition in particular.

Findings from the study were presented and extensively validated in expert workshops attended by representatives from the private sector (representing both fossil fuels and renewables), from government/regulatory agencies, and from aid agencies involved in the formulation of climate change mitigation plans for the Philippines (*e.g.*, USAID-Building Low Emission Alternatives to Develop Economic Resilience and Sustainability/B-LEADERS Project). This was capped by a high-level multi-stakeholder policy dialogue with representatives from the legislative and executive departments, the private sector, civil society organizations, and the academe. Inputs gathered from the expert workshops and policy dialogue were incorporated in this study.

In addition, the paper also relies on appropriate scientific literature, data provided by relevant government agencies, results of studies commissioned by government agencies and international organizations, information provided by industry association reports, and data from veteran negotiators for the Philippines in the international climate negotiations.

## 3. Regulatory and techno-institutional landscapes

Regulatory and techno-institutional landscapes can result in path-dependency or lock-in. This means that the extant architecturally-linked systems of laws, technologies, and institutions that allow energy to be produced, and transported to consumers seamlessly, create "systemic market and policy barriers to alternatives [23]: 818." In other words, well-entrenched and developed systems make it difficult for new technology to come in quickly, at large scale. This section discusses the Philippine regulatory framework for energy regulation, and then examines the techno-institutional landscape, focusing specifically on the different energy sources, that any transition strategy will have to consider.

### 3.1. Regulatory framework

Severe power shortages and unstable energy supplies in the late 1990s spurred the Philippine government to fundamentally restructure and liberalize its electricity sector [14]. This led to the passage of an energy reform law that became the core of the national legal framework on energy. It is this system that the RE Law sought to transform, through the promotion of RE, to compete with the dominant fossil fuel sources.

#### 3.1.1. Prioritizing energy security through EPIRA

In 2001, Congress enacted the Electric Power Industry Reform Act (EPIRA)[24], which privatized important the industry [14]. The law divided the once vertically integrated sector into four: generation, transmission, distribution, and supply. The government declared that it would completely divest from the generation sector in favor of the private sector. Although generation remained of public interest, it was deregulated. As of December 2016, however, the DOE reported that the divestiture was still underway, with 650 MW of generation assets and 230.75 MW of independent power producer contracts still with government [25]. The transmission sector remained a state-owned monopoly under the National Transmission Corporation (Transco). However, in 2009, the maintenance, operation, and further expansion of the national grid were awarded to a private concessionaire, the National Grid Corporation of the Philippines (NGCP), for 50 years, through a legislative franchise [26]. Nevertheless, the Energy Regulatory Commission (ERC) retains regulatory power over the tariffs the NGCP can impose. The distribution sector is considered a public utility and remains regulated. Distribution utilities (DUs), which can either be private DUs or electric cooperatives, need Congressional franchise to service a particular area. Finally, the supply sector purchases and sells electricity to consumers.

#### 3.1.2. Promoting Renewables through the RE Act

In 2008, with the reforms under EPIRA still underway, Congress passed the Renewable Energy Act (RE Act) to encourage the development of renewables [27]. Considered a milestone law [28], the RE Act provided the national directive to move towards the use of renewable energy (RE) sources by attracting RE developers through fiscal incentives or structural policy. Today, fiscal incentives, which include the feed-in-tariff (FIT), income tax holidays, tax credits, and cash incentives, have already been implemented. On the other hand, most of the structural policies such as the renewable portfolio standards (RPS), RE market, and green energy option have been relegated to the backburner. The only one already in place is the must-dispatch rule for all intermittent RE that enters the grid [29]. The RPS requires a portion of electricity to be procured from renewables, while the RE market is intended to be the trading platform for RE. The green energy option is envisioned to provide contestable customers the option to purchase electricity from RE sources.

### 3.2. Techno-institutional complex

In addition to its regulatory landscape, a country's technologies and the complex infrastructure, systems, and institutional knowledge built around them also create path dependency. As returns to scale are gained for embedded technologies, it becomes increasingly difficult for new, external sources to penetrate an energy system. This section examines the different fuel types that characterize the Philippine energy mix, and identifies key considerations for each fuel.

#### 3.2.1. Coal

Coal-fired power plants primarily serve the baseload demand of the Philippines. Presently, it is the cheapest fuel, with a contract price ranging from Php2.90-3.50 per kilowatt-hour (kWh) [30]. However, if a coal plant is not operating at 60% or more dispatch capacity (which is often the case whenever coal plants are not used as baseload), the actual generation cost becomes higher than the contract cost. Thus, the actual cost charged can range from Php4.00-4.80/kWh [30]. This does not yet reflect the social costs of coal. Grausz calculates the total external cost of coal as USD57-58 per megawatt-hour (MWh) compared to USD30/MWh for natural gas, USD2/MWh for wind, USD6/MWh for solar, and USD11/MWh for biomass [31]. Once these externalities are internalized, coal becomes more expensive than natural gas, wind, and biomass.

Apart from the social costs of coal, in the Philippines, there is also the issue of import dependence. DOE data show that around 68% of the country's coal is imported, and 95.80% of the importation is from only one country: Indonesia [32]. Power generation alone uses 79.77% of the Philippines' total coal stock, which includes local production and importation. The dependence (a) on imported coal and (b) on coal as a major power source highlights the exposure of electricity prices to international market fluctuations. Table 2 illustrates the variation in the benchmark thermal coal price of Indonesia from 2012 to 2017. As can be seen, the coal price in February 2017 is at USD 83.32 per ton. A year ago, in February 2016, it was only USD 50.92 per ton.

**Table 2. Indonesian Government's Benchmark Thermal Coal Price (in USD/ton), various years**

| Month | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|
| January | 109.29 | 87.55 | 81.90 | 63.84 | 53.20 | 86.23 |
| February | 111.58 | 88.35 | 80.44 | 62.92 | 50.92 | 83.32 |
| March | 112.87 | 90.09 | 77.01 | 67.76 | 51.62 | |
| April | 105.61 | 88.56 | 74.81 | 64.48 | 52.32 | |
| May | 102.12 | 85.33 | 73.60 | 61.08 | 51.20 | |
| June | 96.65 | 84.87 | 73.64 | 59.59 | 51.87 | |
| July | 87.56 | 81.69 | 72.45 | 59.16 | 53.00 | |
| August | 84.65 | 76.70 | 70.29 | 59.14 | 58.37 | |
| September | 86.21 | 76.89 | 69.69 | 58.21 | 63.93 | |
| October | 86.04 | 76.61 | 67.26 | 57.39 | 69.07 | |
| November | 81.44 | 78.13 | 65.70 | 54.43 | 84.89 | |
| December | 81.75 | 80.31 | 69.23 | 53.51 | 101.69 | |

Source: Indonesian Ministry of Energy and Mineral Resources (2017) [32]

### 3.2.2. Renewable Energy

RE is attractive for the Philippines because it is (1) indigenous, and (2) environmentally sustainable. However, costs and challenges vary for each renewable resource. Conventional renewables, such as geothermal and hydropower, are cheaper to generate than emerging renewables such as wind, solar, biomass, run-of-river hydro, and ocean, especially since the price of the latter is pegged to their designated feed-in-tariff. Also, conventional renewables can serve as baseload and, with hydropower, also as peaking. The National Renewable Energy Program (NREP) [33] states that indicative geothermal projects (expected to run 2014-2026) have a potential capacity of 1,425 MW. However, the World Energy Council [34] has stated that these projects face one substantial barrier: the high financial risk (which includes development uncertainties arising from drilling and well tests) in comparison with other energy sources.

Hydropower's share in power generation has been decreasing over the years but NREP [35] is targeting a 3,161 MW of hydropower capacity addition by 2016 to 2020, and another 1,891.8 MW addition by 2021 to 2025. Hydropower, just like geothermal power, requires large capital costs and a long gestation period. Yet, unlike geothermal, hydropower is season-dependent and the water supply may decrease to a level where the plant cannot be operated. This is because the Philippines does not upcycle water, since hydropower dams are usually used for multiple purposes including irrigation and water quality management.

Intermittent emerging renewables, such as solar, wind, run-of-river hydro, and ocean, are must-dispatch technologies. Biomass, although a non-intermittent emerging renewable, is considered as a priority dispatch resource. It also provides baseload capacity. Run-of-river hydropower is cheaper compared to traditional hydropower. However, there has been minimal investment in it because of its long gestation period compared to solar and wind. As for biomass, the challenge lies in sourcing the feedstock used to produce energy. The Biomass Renewable Energy Alliance has also mentioned two additional hurdles: (1) stricter requirements for biomass plants since they are considered waste-to-energy projects, and (2) the Department of Agriculture's moratorium on conversion of agricultural lands, as most biomass plants are located in agricultural lands [36].

### 3.2.3. Natural Gas

Natural gas plants are used in the Philippines as baseload and mid-merit. However, they are ideally mid-merit plants because they have more flexibility than coal plants in terms of ramp rates, minimum load, and startup time [37]. This makes natural gas the best complement for RE, to address the latter's intermittency [38]. Natural gas combined-cycle plants (both conventional and advanced) also have the second lowest levelized cost of energy (LCOE) among dispatchable technologies, next to geothermal. Moreover, it has a lower LCOE than biomass, wind-offshore, solar PV, solar thermal, and hydropower [39]. Natural gas is less expensive than coal if coal plants operate at less than 60% dispatch capacity.

However, the price of natural gas is still subject to international market volatility because it is linked to the foreign exchange. In terms of carbon dioxide ($CO_2$) emissions, natural gas is lower by about 2/3 per million ton compared to coal. In the Philippines, natural gas comes from two sources: the Malampaya gas field and the Libertad gas field. The former is expected to be depleted by 2024 to 2030, posing a big threat to power generation. The Lantau Group [40] estimates that the cost of replacing natural gas from Malampaya during outages alone is USD 230 million net present value. Natural gas plants are starting to prepare for this contingency through the creation of LNG terminals. Still, this would mean importing natural gas and exposing the country to the same risks as importing coal for power generation.

#### 3.2.4. Oil

An oil-fired power plant is best used as a peaking plant because of its rapid response – it is quicker than natural gas plants. An oil plant is also highly reliable, and can produce power non-stop. It has a special niche in the Philippine market because it serves the off-grid areas where the main source of energy is diesel. Still, oil is the most expensive among the fossil fuels and, like coal, its price is extremely volatile because of international market fluctuations. To illustrate, in November 2014, the average generation cost of oil was Php 24.72/kWh [41]. The next month, it almost doubled to Php 43.98/kWh [42]. When January 2016 came, it plummeted downward to Php 15.42/kWh [43]. Thus, reliance on oil means the Philippines remains vulnerable to extremely volatile energy prices.

#### 3.2.5. Institutions and Systems

Most electricity generated from the foregoing energy sources are fed into the transmission and distribution grids that form the backbone of the Philippine electricity delivery system. This entire system has embedded physical, institutional and technological features that took years to build, with large capital investments, and will consequently take long to replace.

## 4. Challenges in governing the transition

In theory, EPIRA and the RE Act were created to complement each other. EPIRA provided the general framework for the power industry while the RE Act provided the policy direction for the use of RE resources. Nevertheless, the implementation of both laws has been fraught with challenges and has revealed some incongruity in the national energy policies.

### 4.1. Navigating the Trilemma

These policies should balance the differing, overlapping, and sometimes contradicting, objectives of the energy trilemma of security, equity, and sustainability. The World Energy Council defines energy security as the "effective management of primary energy supply from domestic and external sources, the reliability of infrastructure and the ability of participating energy companies to meet current and future demand;" equity as the "accessibility and affordability of energy supply across populations;" and environmental sustainability as the "achievement of supply and demand-side energy efficiencies and the development of energy supply from renewable and other low-carbon sources [44]." Sovacool and Saunders posit that affordability and sustainability are already incorporated in energy security, along with availability, resilience, and governance [45]. They argue these five "dimensions can create distinct priorities and risks," making energy security "intrinsically relative" to each country [45]. Hughes acknowledges the multifaceted and unique nature of energy security for each jurisdiction and proposes four "Rs" for policymakers to easily identify and discern what falls within its ambit: (1) review existing sources, suppliers, and supplies of energy, infrastructure, energy services, energy intensities, and potential secure energy supplies; (2) reduce energy demand through energy conservation and/or energy efficiency; (3) replace insecure energy supplies with secure ones through diversification and/or changing infrastructure; and (4) restrict new demand to secure sources [46]. These 4Rs show the complexity of achieving energy security with equity and sustainability since it will require demand- and supply-side interventions amidst changing technologies and global and local economic conditions.

These buttress the argument that the Philippine government cannot transition to low carbon without considering its economy-wide effects. In formulating national strategies for the transition, it must ensure energy security and equity alongside climate change impacts. This entails the identification of viable transition fuels to ensure that energy security and equity are not compromised, minimizing potential resistance against renewables. Emerging technologies must be given space to come in and exploit market changes in demand and supply, so that, ultimately, consumers can reap the benefits of competitive, cleaner technology. Scalable alternatives must be enabled to displace and eventually phase out fossil fuels as primary energy sources. Where price hinders the uptake of low-carbon sources, sufficient funding support must be mobilized to scale up and sustain the transition to renewables. To ensure that the policy changes are acceptable to diverse stakeholders, it is desirable for policymakers to engage the whole of society in developing low-carbon policies.

The must-dispatch rule provides that intermittent RE enjoys a preference in the dispatch schedule whenever generation is available. NGCP had to manage this at the onset of variable RE in the system, because the Philippine Grid Code [47] charges NGCP with the obligation to ensure grid reliability by maintaining the system frequency at 60 Hz under pain of penalty from the ERC. Given this and the inability of intermittent sources to provide energy at all times, there was a need to (1) provide sufficient regulating reserves, and (2) ensure the resources used as reserves can ramp up and down quickly enough to address the duck curve. Unfortunately, there appeared to be insufficient preparation for the arrival of variable renewables. In 2015, a year after their introduction, the frequency load violations of NGCP increased by 41.28%, compromising overall grid stability and reliability. Significantly, it cannot be said with certainty that the must-dispatch rule was the reason behind the fluctuations. Nevertheless, the experience brought to light two key considerations. *First,* it indirectly highlighted the need for certain fossil fuels such as natural gas and diesel to address RE's intermittency. Admittedly, hydropower and battery storage can provide the same services as natural gas and diesel; however, the rated capacity of hydropower plants is dependent on hydrologic conditions, while battery storage technology has not reached commercial viability in the Philippines. *Second,* the rule has, in certain instances, led to renewables displacing fellow renewables, as in the case of Negros Island where the oversupply of solar power has displaced geothermal power.

One of the policy objectives of the EPIRA is to ensure affordability in power supply. Yet, the implementation of the FIT under the RE Act has resulted in additional costs passed on to the consumer, which could have been avoided, or even lessened, because of the dwindling global RE prices. To illustrate, Lazard [48] estimates that the LCOE for solar in 2009 ranged from USD 323-394/megawatt hour (MWh). The five-year period thereafter saw a 78% decline in the LCOE so that by 2014 it ranged from USD 72-86/MWh. The continuing decrease is reflected in power supply contracts awarded in various parts of the world. In 2016, solar contracts were awarded after competitive bidding at Php 1.21/kWh in UAE, Php 1.46/kWh in Chile, Php 1.64/kWh in Mexico, Php 2.4/kWh in Peru, and Php 3.35/kWh in Zambia [49]. Even in the Philippines, the country's largest DU, the Manila Electric Company (or Meralco), was able to sign a power supply agreement with a solar developer at Php 4.69/kWh in 2016. Regrettably, however, despite the price of solar taking a nosedive globally, Philippine consumers were stuck with having to pay the FIT amounts allocated pursuant to the RE Act. In 2012, the FIT for solar was awarded at Php 9.68/kWh for 74.12 MW. This was followed by a second round in 2016 at Php 8.49/kWh for 451.83 MW [50].

Through the FIT regulations, the country had committed its consumers to paying fixed prices for solar technology, even if the FIT, which was meant to make solar competitive vis-à-vis other energy sources, was no longer warranted once global solar prices had dipped drastically. The impacts of policies on energy equity cannot be downplayed, because it is the consumers who ultimately bear the burden of subsidies. With the FIT, for example, consumers are burdened through mandatory payments for the FIT allowance, a component of the electric bill. Initially the FIT allowance was at Php 0.04/kWh, but it was increased to Php 0.12/kWh to accommodate the increase in installation targets and the low prices in the wholesale electricity spot market. Recently, the ERC approved a FIT allowance of Php 0.18 [51]. However, there is a pending application for a Php 0.22 FIT allowance to pay the outstanding Php 6.6 billion obligation to FIT-eligible developers [52]. The repercussions on cost will continue to be felt by consumers for approximately 20 more years due to the term of solar energy service contracts.

There is also the question of "stranded" solar projects – those built with the hope of being awarded FIT eligibility certificates but which have been unable to qualify. These projects amount to an estimated 300 MW, built at a price regrettably far more expensive than the present cost of solar [53]. The Philippine experience with the FIT confirms the effectiveness of a subsidy to spur investment in RE sources, particularly solar, but it also underlines the danger of government guarantees especially in a privatized industry highly vulnerable to rapid, disruptive technology changes.

### 4.2. Institutional challenges: regulatory instability and uncertainty

With the desire to transition out of a fossil fuel economy comes the necessity of attracting more RE developers whose decisions are largely influenced by regulatory stability and certainty. Government policy in the Philippines is largely dependent on the priorities of each administration and the direction provided by the Secretary of Energy, a presidential appointee. Thus, although the EPIRA and the RE law provide the guiding principles insofar as legislative policy is concerned, the direction of the implementation and the prioritization of programs is largely discretionary upon the Energy Secretary. To illustrate, in 2014 the DOE focused on having an optimal energy mix for the entire sector. Following the national elections in 2016, the new administration moved away from an optimal energy mix policy and instead emphasized the need to meet the capacity requirements of the country, thus prioritizing energy access, regardless of technology [58]. The changing priorities of each administration are also reflected in the country's numerous, varying energy plans, and accentuated by the lack of a single, coherent, long-term plan that different government administrations are bound to. While it may be tempting to consider this regulatory instability as an escape from lock-in conditions, the Philippine experience actually clearly shows institutional path dependencies as regards bureaucratic knowledge and capabilities. While heads of agencies may change, the bulk of the bureaucracy remains stagnant and growth in know-how has constantly lagged.

In addition to constantly changing policies, the bureaucratic red tape at the national and local levels displace the much needed assurance that investments will be protected by stable regulations and that investors will be given time to recoup their investments. For one, the permitting process for both conventional and renewable generation projects is laden with challenges. To illustrate, the procurement of permits for a hydropower plant has been estimated to take 1,300 days and require 165 signatures from different government agencies [54]. This duration is for the permitting process *alone*, it does not yet count the time needed to construct the plant.

Another challenge is the differing processes and requirements in the local government units (LGUs) starting with the barangay, then the municipality or city, and lastly the province. RE sources also face a distinctive barrier which may not be present in most hydrocarbon technologies. Many RE-viable areas are found in the ancestral domains and lands of indigenous peoples (IPs) to whom the Philippine Constitution has granted special rights over these lands. There is no assurance that IPs will give the required free, prior, and informed consent even after consultations have started. Furthermore, the consent of *all* IPs in the affected area is required. Thus, even if only one out of ten indigenous tribes refuses, no free, prior, and informed consent certificate can be issued. All these, to a certain extent, can discourage greenfield RE generators from entering the Philippine market.

### 4.3. Techno-institutional challenges: difficulties in responding to rapid technological developments

Limited investment in renewables cannot be attributed solely to the lack of stability and certainty in government policies. There are also technical limitations that bar the entry of new RE developers, such as the insufficiency of the grid infrastructure and difficulties in keeping up with rapid technological developments.

#### 4.3.1. Grid infrastructure

The best illustration for this shortcoming is the situation of the national grid. The Philippines has two main unitary grids the Luzon-Visayas grid, and the Mindanao grid. There are plans to integrate both by connecting Visayas to Mindanao The lack of connection between Luzon-Visayas and Mindanao has proven costly at times, particularly when there is a shortage in one area and an oversupply in the other. There are also limitations within the Luzon-Visayas grid itself. It is expected that the capacity of the drawdown substations serving Metro Manila, the load center of the Luzon grid, will no longer be adequate in the coming years due to increasing demand. Furthermore, there is just a single transmission line from these drawdown substations to Metro Manila. The need for augmentation through new transmission lines, new substations, new double lines, and most importantly, a loop system has been recognized by NGCP because the current condition not only compromises reliability, but also inhibits the entry of new developers in Luzon. In the Visayas, it is essential to establish the Cebu-Negros-Panay backbone, and develop the Cebu-Bohol link. Currently, there is excess supply from solar power in Panay, Negros, and Cebu that cannot be brought to the Bohol and the other neighboring areas because of the capacity restrictions of the extant transmission lines. These highlight to the inadequacy of the current grid to accommodate the increasing energy supply, and the transmission provider to expediently construct the necessary infrastructure to accommodate additional energy supply, and/or replace it with a smart grid. The lag between the construction of new generation projects and reinforcements to the grid can be attributed to the absence of a firm policy on the location of new plants vis-à-vis the available capacity of the grid. NGCP can only recommend new sites to developers, but the latter have the ultimate decision on where to locate. Based on developers' preferences, NGCP is then obliged to arrange for the necessary grid connection.

Significantly, efforts to increase and boost inter-island connections do not include missionary areas. These are either off-grid, far-flung, remote, or unviable areas. Considering the Philippines' archipelagic nature, both the EPIRA and the RE law have promoted off-grid solutions to address what Alstone *et al.* call "energy isolation barriers" arising from the geographic and economic remoteness of these areas [55], leading to energy poverty. The National Power Corporation–Small Power Utilities Group (NPC-SPUG) is responsible for ensuring missionary electrification and providing power generation in these localities. Missionary electrification remained at 62.03% as of December 2016 [56]. Off-grid areas, numbering 238, are primarily served by bunker-fired diesel generators and are subsidized by on-grid customers through the universal charge for missionary electrification (UC-ME) [56]. The UC-ME, at Php 0.1561/kWh, covers a part of the generation charge and provides a cash incentive for RE developers. Despite this, there has been little uptake in off-grid areas. While an analysis of the reasons for this is beyond the scope of this paper, the small RE uptake in missionary areas indicates a need to push for community energy.

#### 4.3.2. Rapidly evolving technology

Apart from the inability to keep up with supply and demand, policymakers have also been unable to foresee how advancements in technology may affect the current policy landscape. This exemplifies the classic case of regulators having to play catch-up with technological innovations. This results in either an absence of a policy issuance on new technologies or, where there is a written policy, a tendency for these policies to become too restrictive. The Philippine Solar Alliance [57] has stated that it takes three months to a year to acquire a net meter for rooftop solar, and the buy-back rate is pegged only to the blended generation rate of the DU. In addition, there are no policy instruments governing distributed generation, battery storage (both as a generation source and as regulating reserve), and floating solar. These new technologies have already entered the Philippine market, albeit in relatively small quantities. However, investors need guidance on how to proceed. If this continues, the Philippines may be foregoing opportunities for a quicker transition to low carbon.

## 5. Priorities in governing the transition

The foregoing challenges underscore to five points for energy governance. *First*, the Philippines urgently needs a clear, stable government direction on sustainable energy transition policy, to spur implementing agencies and local government officials to act and to stimulate private sector investment in low carbon energy technology. *Second,* implementation of that direction must consider economy-wide effects and must provide flexibility to make space for disruptive technologies in the future. *Third*, low hanging fruits that affect stability and certainty must be addressed as soon as possible. *Fourth,* the kind of energy resource for future supply and how it will be used to meet capacity requirement are critical and must be seriously evaluated. *Finally*, the energy mix must not be dependent on just one external resource, or be dominated by imported resources. The government must therefore prioritize finding indigenous energy sources. A stable, sustainable energy transition policy that considers the nation's economic growth in the short and long-term is absolutely critical in driving a transition to an energy future that addresses security, equity and sustainability issues.

## 6. Opportunities for energy policy

The government plays a critical role in addressing the trilemma because regulatory frameworks will determine whether investment decisions are steered towards low-carbon development, or whether they incentivize investments in the cheapest technology regardless of environmental impacts [58]. Other key actors like RE developers, financial institutions, environmental organizations, and civil society must also be considered [3]. As Fouquet (2016) recognized, markets could take the lead in transitioning certain sectors to low-carbon energy [59]. In governing the transition, the Philippines could pursue two categories of reform simultaneously, to facilitate the transition to a low-carbon economy: rationalization and diversification.

### 6.1. Rationalization

According to the World Energy Council, "policymaker choice is a key discriminating factor of energy performance [44]." As Foxon and Pearson [60] have noted, "Given that different low carbon technologies are at different stages of technical and commercial development, a completely 'technology-neutral' policy framework is probably impossible [60]." Thus, governments need to establish credible long-term frameworks that provide incentives for investment [60]. The Council further recognizes that coherent and predictable sustainable energy transition policies and a stable regulatory and legal framework for long-term investment are interconnected [61]. The rationalization of government policies and procedures will not only reduce political and regulatory risk, but will also encourage, support, attract, and retain investments to achieve energy security, equity, and sustainability goals [28]. This can be done by *first,* deciding on a firm and consistent government direction on energy policy through the creation of a long-term energy plan that can withstand changes in government administrations; *second,* adequately preparing the government to adapt to and accommodate advancements in energy technology by removing unnecessary subsidies tied to specific energy sources while keeping abreast of developments in the international energy platform; and *third,* increasing government-private sector coordination and processing by using energy mapping systems that show optimal areas for energy development vis-à-vis available energy sources and transmission lines. Moreover, red tape in permitting and licensing and delays in regulatory approval must be minimized. Ultimately, rationalization implies a shift from liberalization (or a market-led approach) to a hybrid of government regulation and market-led approach, giving government a greater role in directing energy policy [60].

### 6.2. Diversification

Reducing the country's overdependence on *one, imported* resource, coal, entails two courses of action: *first,* optimizing coal's share in the energy mix, and *second,* reducing the use of imported coal. Currently, the role of coal power plants as baseload plants is crucial and cost-effective because of insufficient renewable sources that can serve as baseload. The problem lies in having a supply of coal plants beyond baseload needs, forcing some coal plants to serve the mid-merit requirement. Efficiency dictates that mid-merit plants are better suited for sources other than coal [62]. To address this, a cap on approved coal endorsements using a portfolio-based regional energy plan detailing the baseload, mid-merit, peaking requirements in each of Luzon, Visayas, and Mindanao is necessary. This prevents an oversupply of coal plants beyond baseload needs, and, for the long-term, contractual lock-in of coal supply beyond what is economically, socially, and environmentally acceptable.

However, simply limiting the entry of new coal plants to the baseload needs of the country will not meet sustainability goals. A gold standard for both old and new coal plants also has to be established to control GHG emissions and atmospheric pollutants. The gold standard may be in the form of rigid requirements for new plants such as (1) requirements to use the best available technology (BAT), and (2) stricter emissions standards [63]. The current BAT for coal is the ultra-supercritical plant, which is 20-30% more expensive than a subcritical plant but with higher efficiency, resulting in lower fuel costs and emissions [64]. However, the absence of any legislation or executive mandate on the BAT means that subcritical plants are still being built. With regard to stricter emissions guidelines, a review of the Clean Air Act is imperative. The standards for sulfur oxide, carbon dioxide, nitrogen oxide, and particulate matter have not been updated since 1999. Furthermore, the current method of direct testing of these emissions has been prone to manipulation, since operators are notified in advance. An alternative to this would be the use of emission factors, continuous emissions monitoring systems, or predictive emissions monitoring systems [63]. This way, inefficient and highly polluting technology in coal plants can eventually be phased out by their inability to compete with newer and cleaner technology. Brazil's experience with diversification of energy supply, which resulted in large macroeconomic benefits for the country [20], provides a model for Philippine policymakers to follow and adapt as appropriate.

Once the share of coal has been optimized, policymakers will be able to take advantage of rapid market developments in RE. A portfolio-based approach that utilizes available and indigenous energy sources should be developed and prioritized across the grid, with energy security, equity and sustainability in mind. Investments in both renewable and non-renewable energy can be considered together because of the interrelationship between the two [65]. For example, natural gas can complement RE to address the latter's intermittency [38]. Maintaining natural gas's share in the current energy mix should be the minimum objective, considering the depletion of the Malampaya reserves by 2024 to 2030. Moreover, a comprehensive natural gas policy and legislative framework must be formulated. The heart of this framework should be the role of natural gas in the energy mix, followed by mechanisms to bolster support for the industry. To illustrate, the construction of liquefied natural gas (LNG) terminals is critical if LNG will be imported after the Malampaya depletion. The policies governing this undertaking and the truck loading of LNG have to be in place. In terms of exploration and development of additional natural gas reserves, DOE can swiftly undertake and fasttrack the award of contracts arising from the Philippine Energy Contracting Rounds (PECR). In 2014, there was a PECR for coal, petroleum, and natural gas. Until now, the contracts have not yet been approved and awarded by DOE. One cause of the delay is the hesitation of DOE to award any new contracts pending the legal dispute on who bears the burden of the income tax between the Malampaya consortium and the government. The resolution of the dispute would not only provide clarity for interested developers but would also allow exploration of possible reserves to commence.

To increase the RE share, the RE Act must be fully implemented, specifically the RPS. A draft circular on the RPS was issued last June 2016; however it has not been finalized to date. The draft circular calls for a national energy mix with at least 35% RE by 2030, and a minimum annual increase of 2.15%. Before a percentage of RE penetration and a minimum annual increment can be declared, a study must be conducted to take stock of available RE plants and the supply portfolios of distribution utilities. This was highlighted by industry stakeholders who expressed concerns that the available RE in the country may be insufficient to meet a steady 2.15% annual increase in capacity. Large electricity consumers have raised concerns about RE's ability to catch up with the country's growing energy demands.

Following this is the drafting of an RPS cost recovery framework by the ERC, the eastablishment of an RE registrar to monitor the issuance and trading of RE certificates, and the establishment of the RE market to trade RE certificates. Notably, while other jurisdictions choose either just the FIT or just the RPS to stimulate RE investments, the Philippines included both in the RE Act [28]. Marquardt sees this mishmash of regulations from all over the world as being accepted in the Philippines because of donor pressure, despite their unsuitability for the country's circumstances [28].

RPS encourages competition among different RE sources because any technology can contribute to the quota [66]. As a result, RPS can produce the least cost, and if combined with efficiency measures, could add significant RE generation and fulfill emission cap levels [67]. With the decreasing costs of variable RE, the Philippine government can consider phasing out the FIT and enhancing efforts to finally implement the RPS.

Despite the worldwide trend of investing in variable RE, there is a niche for conventional RE that remains untapped. There is an estimated unexploited capacity of 8,724 MW for hydropower and 1,465 MW for geothermal power [68], [69]. To spur investments in these, government can consider providing loan guarantees, drilling failure insurance, lending support mechanisms, cooperative grants, and government-led exploration [70].

### 6.3. Demand-Side Management

Both the EPIRA and the RE Act comprehensively provide the legislative framework to enhance competition in energy supply and stimulate investment in indigenous energy sources. However, legislation on demand-side management is lacking. While electric utility demand-side management has been promoted through time-of-use and interruptible load programs in distribution utilities, the country is yet to launch consumer-level demand-side management measures like energy efficiency and conservation.

Energy efficiency is the "ratio of energy consumed to the output produced or service performed [71]". Thus measures to improve energy efficiency are those that yield higher outputs or services from the same volume of energy, such as: green building codes, minimum energy performance standards for equipment, minimum standards for fuel efficiency, electric vehicles, and energy management systems industries [71]. Currently, the Philippines is the only country in Southeast Asia with no law on energy efficiency and conservation. Consequently, there is no impetus for businesses to develop energy efficient technologies. Neither is there any urgency for residential and industrial/commercial consumers to purchase energy efficient appliances and/or to retrofit buildings to be energy efficient. It is essential that a law on energy efficiency be passed given that it is "the quickest and least costly way of addressing energy security, environmental and economic challenges [72]". This legislative measure should consider the EE policies recommended by the IEA, including mandatory building energy codes and minimum energy performance; energy audits and certification schemes; building energy labels; mandatory minimum energy performance standards and labels for appliances and equipment; phase-out of inefficient lighting products and systems; mandatory vehicle fuel-efficiency standards; fuel-efficient non-engine components; energy efficiency services for small and medium-sized enterprises; and energy utilities and end-use energy efficiency [72].

### 6.4 Using the Paris Agreement to catalyze the transition

Beyond the energy sector, significant global developments could provide further impetus for the Philippines' energy transition. In particular, the early entry into force of the Paris Agreement [73] sends a clear signal to the global community to reduce emissions [3]. As attention shifts from ratification to implementation, the Paris Agreement could be a powerful tool to tip the scale towards the sustainability pillar of the energy trilemma. This, because energy is the biggest contributor to carbon emissions, and so policymakers cannot escape energy policy reform if they wish to achieve Paris goals. The inextricable link between energy and climate provides an opportunity for a governed transition to low carbon.

## 7. Conclusion

In many developing countries, the transition to low-carbon energy requires major policy overhauls. This paper has explored the challenges and opportunities the Philippines has faced in attempting to accelerate its low-carbon transition. While the authors acknowledge that successes in a country depend on its particular circumstances and how well its policies are implemented [44], the Philippine experience may nonetheless provide lessons for other developing economies undergoing their own transitions.

As the Philippines prepares itself to become a high-income economy, it must endeavor to meet the concomitant increase in energy demand without compromising its ability to provide a quality, reliable, affordable, and more sustainable energy mix which can be easily adjusted to accommodate innovations in technology, and even unexpected changes in economic growth and population. This paper has examined energy policies in the Philippines and described the challenges the country has experienced in attempting to amend such policies to accommodate renewables. It has also provided possible ways forward, through rationalization and diversification, for the formation of a stable, long-term Philippine energy plan. Although the private sector plays a crucial role in the transformation of the country's energy landscape, particularly because the generation sector has been deregulated and since corporations make the decisions on where to invest substantial financial resources, this paper has shown that the national government plays a significant part in the formulation of the national energy landscape. That landscape will steer the direction of the country's energy future and provide the stimulus needed to prompt private sector's investment decisions. It is thus the responsibility of the national government to provide a clear, integrated, consistent and stable policy direction [74], to engage continuously with the private sector to attain economic growth while balancing the needs for energy security, equity, and sustainability. In parallel, the potential of socio-institutional change to bring about techno-economic changes that could accelerate the transition to low carbon should be pursued [2].

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