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Evaluating the Feed-in Tariff Policy in the Philippines

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ABSTRACT

To address the problems of climate change and energy security, the Philippines enacted the Renewable Energy (RE) Act of 2008. The law mandated the Feed-In Tariff (FiT) policy, which was designed to provide a guaranteed fixed price to RE investors for 20 years to develop renewable technology. This paper aims to evaluate the effectiveness of the FiT policy in promoting renewable energy development in the Philippines by assessing its costs and benefits. Data show that while the FiT has led to an increase in RE generating capacity, the share of renewable energy in the country has been declining since 2011. The findings also suggest that the Philippines has incurred a net social cost from its implementation of the FiT.

Keywords: Feed-in Tariff, Electricity, Policy Evaluation, Philippines, Renewable Energy
JEL Classifications: Q40, Q48

1. INTRODUCTION

Energy is a critical component in the Philippines' pursuit of sustained economic growth and development. Economic expansion and the rapid population growth have raised concerns on how the increasing energy demand will be met. The Asian Development Bank (2018) estimates that the country's energy consumption will double by 2035.

The Philippine energy mix is dominated by fossil fuels, with the power sector relying on imported coal to power its baseload generation capacity. This highlights the problem of resource depletion and CO2 emissions. The Philippines is also vulnerable to price volatility and supply disruptions. These inherent risks of an energy importer and the gradual depletion of the Malampaya gas field forced the government to find other energy sources. Confronted with the challenges of energy security and environmental sustainability, the Philippines has sought to develop and utilize renewable energy sources.

With the passage of Republic Act No. 9513, also known as the Renewable Energy (RE) Act of 2008, together with Republic Act No. 9367 also known as the Biofuels Act of 2006, the Philippines intends to address the problems of energy security and environmental sustainability by increasing the development of renewable energy sources. The enactment of the RE Law is vital for the low-carbon emission development strategy of the Philippines

The RE Law mandates the Feed-in Tariff (FiT) scheme, a nonfiscal incentive mechanism that grants renewable energy developers a guaranteed price for the purchase of their power generation over a mandated period. Institutionalizing the FiT for renewable energy sources assures potential investors of the financial viability of energy projects and the development of the targeted RE technologies.

The latest data from the National Grid Corporation of the Philippines (NGCP) show that FiT-eligible plants contributed an additional 1,409.54 megawatts (MW) of installed capacity from 2014 to 2020, which is significant for a country facing problems of energy security. Although the FiT mechanism increases investments in RE technology, it burdens consumers with higher electricity prices due to the additional cost of the Feed-in Tariff Allowance (FiT-All), which is a fixed charge (Php/kWh) to all on-grid consumers. Moreover, the current FiT rates are higher compared to the average price in the Wholesale Electricity Spot Market (WESM). If electricity prices in WESM continue to go down, then Filipinos are burdened with additional costs of the feed-in tariff.

This study aims to assess the FiT policy in the Philippines. According to the literature, there are several criteria to measure the failure or success of an RE promotion policy. Effectiveness and efficiency are used as the main criteria. The research objective is to answer the following: (1) How effective has the FiT been in promoting RE technology? (2) Considering its costs and benefits, what is the net impact of the policy?

2. FEED-IN TARIFF POLICY: LITERATURE REVIEW

Feed-in Tariff is a price-based support mechanism for RE developers which sets a guaranteed price to be paid to RE developers per kilowatt-hour (kWh) of electricity generated. It involves a purchase obligation on distribution utilities to buy the electricity produced by FiT-eligible RE generating plants. To date, FiT is recognized as the most efficient policy mechanism for promoting renewable energy (Menanteau et al., 2003). In Europe, FiT is responsible for the large-scale deployment of wind, solar, and biomass (Sijm, 2002).

Compared to quantity-based policies like the renewable portfolio standard (RPS), FiT is more attractive to investors as it poses lower investment risk due to the provision of long-term financial support. Purchase agreements for the sale of electricity under the FiT usually last from 10 to 25 years. Other design features of the FiT include differentiated FiT rates (to account for the level of maturity for each technology), installation targets, and degression rates to encourage technological change (Couture et al., 2010). FiT is considered a subsidy to producers and the costs are covered by electricity consumers.

Determining the level of price that will stimulate investments in RE is the most important component of a FiT policy. A price that is too low discourages RE developers from availing the FiT and a price that is set too high poses an additional burden to society. FiT payment design policies can either be independent or dependent on electricity price. Under a market-independent FiT, more commonly known as the Fixed-Price Policy, RE developers are guaranteed a price for a fixed period independent of electricity price volatilities in the market (Figure 1). In contrast, under a premium price FiT policy, RE developers are paid a premium plus the market price (Figure 2). Fluctuations in prices affect the amount of FiT received by producers. RE investors lose profit when market prices are low, while developers are rewarded with additional rent with higher market prices.

Several studies have analyzed FiT policies in different countries and evaluated their efficiency and effectiveness in promoting renewable energy. Sijm (2018) assessed the impact of FiT on several European countries. In Germany, FiT was introduced in 1991 with the passage of the Electricity Feed Law (EPL). Under the EPL, RE developers receive a feed-in tariff equal to a percentage of the annual average electricity rate per kWh. The corresponding

Feed-in tariffs for solar and wind were set at 90 percent while other RE technologies received 65 to 80 percent of the average electricity price. The EPL was responsible for doubling the capacity of wind energy in Germany from 1990 to 1995. Similar results were found in Denmark and Spain. However, despite these impressive gains, the German FiT scheme was criticized for its failure to promote other renewable energy sources and provide enough incentives to encourage cost reductions and innovations (Frondel et al., 2010).

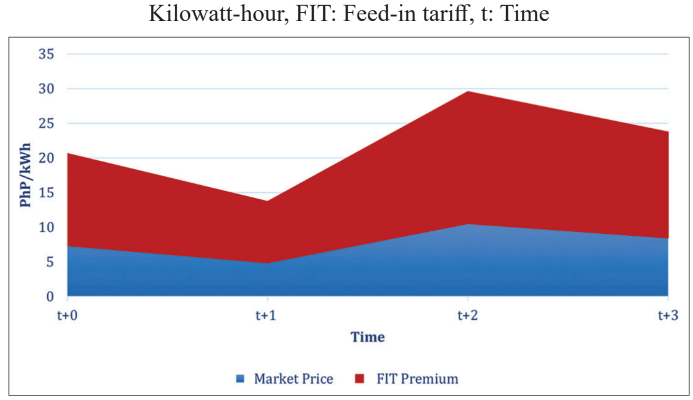
An empirical assessment of the Spanish FiT policy was carried out by Del Río and Gual (2007). They found that there was a significant increase in the deployment of renewables in Spain, mostly from onshore wind. Although the moderate level of subsidies has not resulted in excessively high electricity rates, it has highlighted several challenges facing the Spanish RE industry, including the unequal distribution of the cost of the FiT subsidy.

The FiT mechanism accounts for a greater share of RE deployment in China compared to the RPS policy. However, Yan et al. (2016) pointed out that implementation of FiT in China was hindered by (1) uneven resource distribution, (2) reluctance of supply companies and power generators to get involved in RE, and (3) insufficient FiT price to provide incentives to developers to invest in renewables.

Figure 1: Fixed-rate FiT policy. Php: Philippine peso, kWh: Kilowatt-hour, FIT=Feed-in tariff

Source: van Kooten (2013)

Figure 2: Premium price FiT policy. Php: Philippine peso, kWh: Kilowatt-hour, FIT: Feed-in tariff, t: Time



Source: Authors' calculations

In Southeast Asia, the Philippines is one of the first countries to adopt the FiT policy, although studies on its impact are scant. Guild (2019) compared the implementation of FiT in the Philippines and Indonesia and found that the former has been more successful in developing the RE industry as seen in the rapid growth in installed capacity of its RE technologies. Pacudan (2014) studied the impact of FiT on electricity rates and found that the FiT-All, a uniform charge to consumers meant to cover payments for RE developers, is regressive for households with lower electricity consumption. De La Vina (2015) assessed the impact of the inclusion of FiT-qualified resources such as wind and solar in the Wholesale Electricity Spot Market (WESM) and found that although the system receives a net benefit through the merit order effect, the impact to end-users may be a net cost.

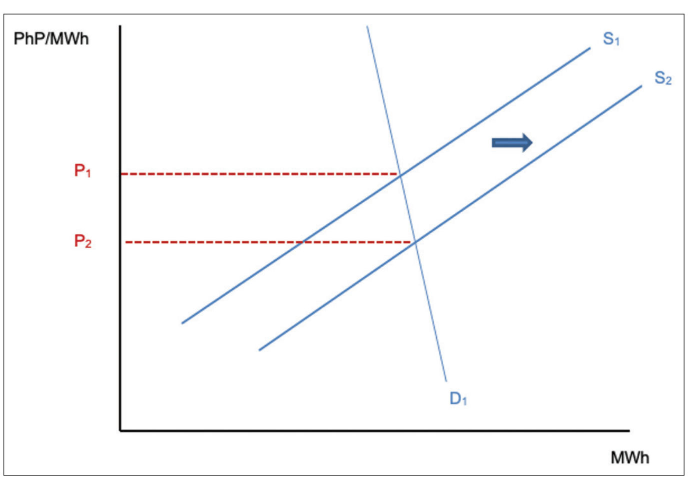
2.1. FiT: Basic Theory

Figure 3 illustrates how equilibrium price in the power sector is determined. Because electricity is an important necessity, its demand curve is highly inelastic as shown by a steeper demand curve (D1). Introducing RE sources into the generation mix increases the supply of electricity, moving the supply curve to the right (S2) and decreasing the equilibrium price (P2). However, van Kooten (2013) noted that the introduction of renewable energy sources affects the dynamics in the market, particularly when feed-in tariffs are introduced.

Consider an electricity spot market where generators offer to sell electricity in the market at a certain price. All information regarding prices and the amount of electricity to be supplied by power producers will be collected by the wholesale market operator who will then generate a "market merit order," which serves as the supply curve in the market as shown in Figure 4. Suppose the demand curve is given by D1, then the market-clearing price is given by the marginal cost of coal (coal 1) at P1.

Now, consider the introduction of feed-in tariff for renewable technologies. Figure 5 describes its impact on the supply of electricity in the market by moving the supply curve to the right

Figure 3: Supply and demand curves. Php: Philippine peso, MWh: Megawatt-hour, P1: Price 1, P2: Price 2, S1: Supply 1, S2: Supply 2, D1: Demand 1



Source: Authors' calculations

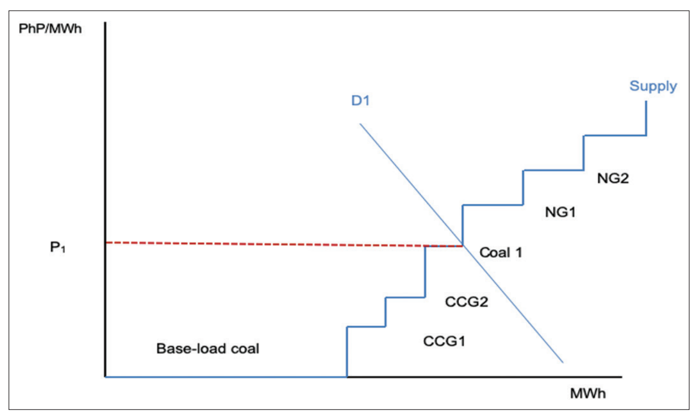
with the new market-clearing price decreasing to P2 given by the marginal cost of CCG2 (combined-cycle gas plants). The provision of the feed-in tariff to RE producers increases the supply of electricity in the market and exerts pressure on prices, pushing conventional energy sources further in the merit order in favor of RE. This impact is called the merit-order effect.

2.2. Feed-in Tariff Policy in the Philippines

The RE Law mandates the institutionalization of the FiT solar, run-of-river hydro, wind, and biomass. The Energy Regulatory Commission (ERC) released Resolution No. 16, series of 2010 followed by ERC Resolution No. 15, series of 2012, detailing the implementing rules for establishing the FiT system, the method to be followed in determining the optimal FiT rates and the administration of the FiT-All. According to the resolution, the FiT will follow a fixed-price policy design, with the National Renewable Energy Board (NREB) calculating the initial technology-specific FiT rates subject to ERC's approval.

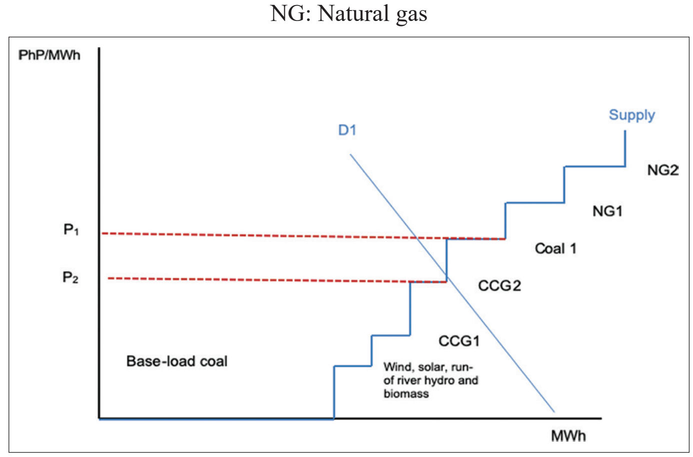
Table 1 shows the approved feed-in tariff rates with their corresponding installation targets as outlined in ERC Resolution No. 10, series of 2012. For the first round of FiT, Solar PV received the highest FiT price at PhP 9.68/kWh with 50 MW of installed capacity. This was followed by wind with an approved rate of PhP 8.53/kWh and a target capacity of 250 MW. Run-of-

Figure 4: Market merit order. CCG: Combined cycle gas, NG: Natural gas



Source: van Kooten (2013)

Figure 5: Market merit order and FiT. CCG: Combined cycle gas, NG: Natural gas



Source: van Kooten (2013

river hydro and biomass FiT rates were at PhP 6.63/kWh and PhP 5.90/kWh, respectively. Installation targets for both were capped at 250 MW.

ERC's Resolution No. 06, series of 2015, revised the installation target for solar energy generation from 50 MW

Table 1: Approved feed-in tariff rates

Technology	Approved Rates (PhP/kWh)	Installation Target (MW)
Biomass	5.90	250
Run-of-River Hydro	6.63	250
Solar PV (FiT 1)	9.68	50
Solar PV (FiT 2)	8.69	450
Wind (FiT 1)	8.53	250
Wind (FiT 2)	7.40	150

Source: National Transmission Corporation (TransCo)

Table 2: Approved FiT-all rate

Year	Rate as applied PhP/kWh	Approval	Date
2014-2015 (filed July 30, 2014)	0.0406	Provisional: PhP 0.0406/kWh Final: PhP 0.0406/kWh	January 2015 Billing Period December 10, 2015
2016 (filed December 22, 2015)	0.1025 or the updated amount at the time of evaluation	Provisional: PhP 0.1240 /kWh Final: PhP 0.1830/kWh	April 2016 Billing Period May 9, 2017 (docketed May 13, 2017)
2017 (filed December 1, 2016)	0.2291 or the updated amount at the time of evaluation	No Provisional Authority Issued to Date Final: 0.2563/ kWh	 Feb 27, 2018 (docketed May 11, 2018) effective June 2018 billing
2018 (filed August 29, 2017)	0.2932 or the updated amount at the time of evaluation	No Provisional Authority Issued to Date Final: PhP 0.2226/kWh	 March 12, 2019 (docketed March 29, 2019 (effective April 2019 billing
2019 (filed on July 27, 2018)	0.2780 or the updated amount at the time of evaluation	Final: PhP 0.0495/kWh (until Dec 2020)	Oct 28, 2019 (promulgated on Jan 28, 2020).
2020 (filed on July 30, 2019)	PhP 0.2278 or the updated amount at the time of evaluation	Final: PhP 0.0983/kWh (effective Jan 2021 billing)	Nov 23, 2020 (promulgated on Dec 29, 2020)
2021 (applicated docketed on August 4, 2020)	PhP 0.1881 (normal scenario) or PhP 0.2008 (COVID-19 scenario) or the updated amount at the time of evaluation.		

Source: National Transmission Corporation (TransCo)

Table 3: Number of FIT eligible plants and installed capacity (in MW)

Renewable Energy Source	2014		2015		2016		2017		2018		2019		2020		2021	
	No. of Plants	Installed Capacity	No. of Plants	Installed Capacity	No. of Plants	Installed Capacity	No. of Plants	Installed Capacity	No. of Plants	Installed Capacity	No. of Plants	Installed Capacity	No. of Plants	Installed Capacity	No. of Plants	Installed Capacity
Biomass	8	65.35	15	153.196	16	160.49	18	144.69	25	159.54	31	250.5	31	251.46	31	251.46
Hydropower	3	12.6	5	35.73	12	59.98	8	107.89	12	120.1	20	172.42	25	184.83	30	205.23
Solar	3	50	11	161.9	22	523.02	24	526.43	24	525.95	24	525.95	24	525.95	24	525.95
Wind	4	200	7	426.9	7	426.9	7	426.9	7	426.9	7	426.9	7	426.9	7	426.9
Total	18	327.95	38	777.726	57	1170.39	57	1205.91	68	1232.49	82	1375.77	87	1389.14	92	1409.54

Source: National Transmission Corporation (TransCo)

Table 4: Actual RE generation of FiT eligible plants (in MWh)

Technology	Actual Energy Generation Billed (MWh)						
	2015	2016	2017	2018	2019	2020 (Up to Nov 2020 billing)	TOTAL (2015 to Jan 5, 2021)
Biomass	264,569	512,081	592,919	718,651	711,749	695,279	3,495,249.00
Hydro	85,760	94,323	149,094	262,754	337,167	449,371	1,378,469.00
Solar	102,079	571,791	660,721	693,258	671,072	646,610	3,345,530.00
Wind	763,120	952,836	1,074,849	1,135,082	1,026,702	826,408	5,778,996.00
Total	1,215,528	2,131,031	2,477,583	2,809,745	2,746,690	2,617,668	13,998,244.00

Source: National Transmission Corporation (TransCo)

Table 5: Power generation by source (in GWh)

Technology	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Coal	23,301	25,342	28,265	32,081	33,054	36,686	43,303	46,847	51,932	57,890
Oil-Based	7,101	3,398	4,254	4,491	5,708	5,886	5,661	3,787	3,173	3,752
Combined Cycle	1,202	124	227	247	515	276	694	405	522	728
Diesel	4,532	2,762	3,332	3,805	4,730	5,521	4,722	3,100	2,505	2,815
Gas Turbine	3	-	-	-	-	10	-	-	-	26
Oil Thermal	1,364	512	695	438	463	80	245	282	145	184
Natural Gas	19,518	20,591	19,642	18,791	18,690	18,878	19,854	20,547	21,334	22,354
Renewable Energy (RE)	17,823	19,845	20,762	19,903	19,810	20,963	21,979	23,189	23,326	22,044
Geothermal	9,929	9,942	10,250	9,605	10,308	11,044	11,070	10,270	10,435	10,691
Hydro	7,803	9,698	10,252	10,019	9,137	8,665	8,111	9,611	9,384	8,025
Biomass	27	115	183	212	196	367	726	1,013	1,105	1,040
Solar	1	1	1	1	17	139	1,097	1,201	1,249	1,246
Wind	62	88	75	66	152	748	975	1,094	1,153	1,042
Total	67,743	69,176	72,922	75,266	77,261	82,413	90,798	94,370	99,765	106,041
Share of coal (%)	34%	37%	39%	43%	43%	45%	48%	50%	52%	55%
Share of renewable energy (%)	26%	29%	28%	26%	26%	25%	24%	25%	23%	21%

Source: Department of Energy (DOE)

to 450 MW and set a Solar FiT rate of PhP 8.69/kWh ("Solar FIT 2"). A new wind FiT rate of PhP 7.40/kWh ("Wind FiT 2") was set under ERC Resolution No. 14, series of 2015, to be applied to three wind power projects— –San Lorenzo, Nabas, and Pililia Power. On February 24, 2018, the DOE endorsed the extension of the biomass and run-of-river hydropower installation targets eligibility until December 31, 2019, or upon successful commissioning of the run-of-river hydro and biomass power projects. The extension covers the remaining balance of the respective initial installation targets. The FiT mechanism also guarantees all eligible renewable energy plants a (1) purchase agreement for 20 years, (2) priority connection to the grid, and (3) priority scheduling and dispatch in the spot market. According to De La Viña (2015), these concessions are a departure from the market-based scheduling and pricing regime of WESM. ERC Resolution No. 15, series of 2012, mandates the designation of the National Transmission Corporation (TransCo) as the FiT-All Fund administrator, which will establish, manage, and administer the FiT-All Fund. The rules on the determination and imposition of the FiT-All Rate are outlined under the FiT-All guidelines released by the ERC on December 16, 2013. Under the FiT-All guidelines, TransCo must submit its proposed FiT-All Rate no later than July of each year for implementation in the following year. Table 2 shows the proposed and the approved FiT-All Rates together with the date of approval and billing period. TransCo failed to meet the July deadline for the submission of the proposed FiT-All rate for 2016-2017. In 2018, the ERC decreased the rate by PhP 0.0706/kWh to arrive at the FiT-All rate of PhP 0.226/kWh.

Table 6: Total environmental benefit from using re instead of coal

Computation of Benefit from Using RE instead of Coal	Amount
Actual Generation of FiT-Eligible RE, in MWh	13,998,244
CO_2 emissions (metric ton per MWh)	0.98
Amount of CO_2 Avoided by use of RE (in metric tons)	13,718,279.12
Social Cost of Carbon[1] ($ per metric ton)	50
Average Exchange Rate, 2015-2020(Peso per 1$)	49.58
Social Cost of Carbon (Pesos per metric ton) =50 x 49.59	2,479.00
Benefit from Using RE instead of coal (Pesos)	34,007,613,938.48

Source: Authors' calculations

3. DATA ANALYSIS AND RESULTS

To evaluate the Feed-in Tariff policy, this study will follow the methodology of Del Río and Gual (2007). Due to data limitations, the assessment of the FiT will focus on two criteria: effectiveness and efficiency. The main objective of implementing the FiT is to promote the development of RE technologies in the Philippines. Table 3 presents the number of FiT-eligible plants per technology and its corresponding total installed capacity. From 2014-2021, 92 new renewable energy plants were developed, providing a total of 1409.54 MW of additional installed capacity to the grid. Of the four technologies, only run-of-river hydropower

1 The social cost of carbon used is from the United States Environmental Protection Agency. With an average discount rate of 3 percent, the social cost of carbon is $ 50.00 per metric ton of CO2 in 2030. Skeptics of climate change effects use a higher discount rate. At an average discount rate of 5%, the social cost of carbon falls to USD 16.00 per metric ton of CO2 in 2030.

Table 7: FiT- All Fund Cashflows (as of January 5, 2021, in million pesos)

Year	2015	2016	2017	2018	2019	As of Jan 5, 2021	Total
Total Cash Inflow	3,058.40	10,235.10	18,006.70	26,271.60	31,555.00	14,795.00	103,921.80
Total Cash Outflow	2,738.00	10,106.70	17,641.30	26,197.80	20,984.00	24,150.00	101,817.80
Excess of Collection over Disbursement	320.40	128.40	365.40	73.80	10,571.00	(9,355.00)	2,104.00
Cash, Beginning		320.40	448.80	814.20	888.00	11,459.00	2,104.00
FiT-All Fund Balance	320.40	448.80	814.20	888.00	11,459.00	2,104.00	2,104.00

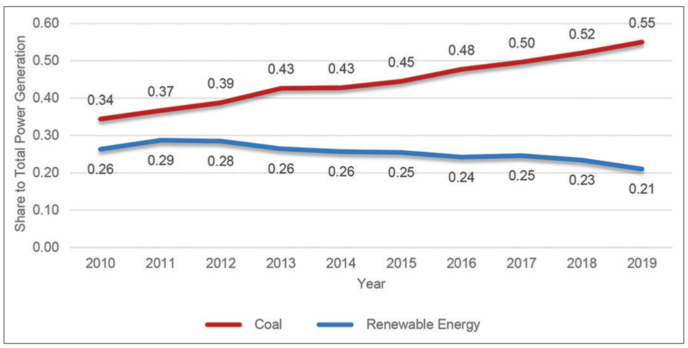
Source: National Transmission Corporation (TransCo)

Table 8: Over-all net social cost of FiT in the Philippines

Computation of Net Social Cost	Amount
Total Benefit	PhP 83,807,613,938.00
Environmental Benefit	PhP 34,007,613,938.48
Merit Order Effect (from 2015-2020)	PhP 49,800,000,000.00
Total Cost	PhP 103,922,000,000.00
Total Amount of FiT-All Collected from Consumers	PhP 103,922,000,000.00
Net Social Cost	PhP 20,114,386,062.00

Source: Authors' calculations

Figure 6: Share of coal and renewable energy in the Philippines



Source: Authors' calculations

Has undersubscribed its installation target while both solar and wind energy have exceeded their approved installation capacity. Table 4 shows that RE generating power plants contributed a total of about 13,998,244.00 MWh of electricity from 2015 until January 2021. About 41 percent of actual generation comes from wind energy, with biomass and solar providing 25 percent each to the total share of FiT-eligible plants. The remaining 10 percent comes from run-of-river hydro.

Despite the increase in renewable energy sources, data from the Department of Energy (DOE) reflects the continuing dependence of the Philippine energy sector on coal. Table 5 shows that the share of coal to total power generation increased by 2 percent every year. From 2017 to 2019, almost half of the total power generated in the Philippines is supplied by coal, with the share of renewable energy sources decreasing to 21 percent in 2019. Figure 6 shows the growing gap between the share of coal and renewables in the Philippines. Even with the passage of FiT, renewables failed to take over some of the share of coal in total power generation.

The efficiency of the FiT can be evaluated using a static efficiency approach where the benefits from the policy are compared to their costs. Due to data limitations, quantifiable benefits from FiT considered in this study are the (1) merit-order effect and (2) the environmental benefit of using renewable energy from FiT.

The merit-order effect is a result of the downward pressure on prices due to the increase in supply of renewables in the market. Using WESM data from November 2014 to October 2015, De La Viña (2015) estimated that the FiT merit-order effect results in savings of PhP 8.3 billion per year. To estimate the environmental benefit of the FiT, the actual generation of FiT-eligible plants from 2015-2020 (Table 4) is used to calculate the amount of coal displaced by using RE. Table 6 presents the parameters used in the estimation. The total amount of CO2 emissions avoided from using RE is 13,718,279.12 metric tons. To compute for the monetary benefit of avoiding CO2 emissions, the amount of CO2 emissions avoided is multiplied by the social cost of carbon, yielding an estimated benefit of PhP 34,007,613,938.48.

To estimate the cost of the FiT policy, actual data on FiT-All Fund Cashflow from 2015 to 2021 are used as presented in Table 7. The FiT-All is the amount paid by end-users to cover the payments to RE investors who availed of the FiT. As of January 2021, the total amount collected from consumers is PhP 103,922,000,000.00.

Combining the total estimated environmental benefit from the FiT and the merit-order effect, Philippine society received an estimated total gain of PhP 83,807,613,938.00. Since the estimated total cost is greater than the total benefits from the policy, it suggests that the Philippines is incurring a net social cost of about PhP 20,114,386,062.00 from its implementation of the FiT as shown in Table 8.

4. OTHER CONSIDERATIONS

Apart from its net social cost, RE has certain unintended consequences such as the "missing money problem" which is the result of the decrease in prices because of the impact of merit-order. Investors in conventional energy may not recoup their capital costs because of the drop in prices. Not only will existing investors be adversely affected, but future investment in conventional energy will also be discouraged.

ADB (2018) described a related problem known as "curtailment risk and price dislocation". It cited the experience of Negros Island which experienced an overcapacity during March and April 2016 with an additional generation of 279 MW of solar power. This has led the NGCP to reduce geothermal and coal generating capacity to prevent grid congestion because RE technologies are given priority dispatch under the RE Law.

Variable RE has therefore crowded out conventional energy—even traditional RE like geothermal—in terms of both price and quantity. if quantified, these items will add to the social cost. Hence, the estimated net social cost of PhP 20,114,386,062.00 from the implementation of the FiT can be considered a floor.

5. CONCLUSION

Energy security and climate change are among the major challenges affecting the Philippines today. The passage of the landmark RE Law and the Biofuels Act and the institutionalization of FiT are vital steps toward attaining self-sufficiency and promoting the use of sustainable energy. FiTs are considered the most effective support mechanism for the development of renewable energy.

Meanwhile, the added capacity of FiT-eligible generating plants did not translate to a growing share of RE in the power generation mix, with coal still contributing half of the total mix. The trend also shows that coals' contribution to the power mix is increasing by almost 2 percent annually. Considering the total benefit and cost of the FiT, the net effect of the policy is estimated to be a burden to society in the amount of PhP 20,114,386,062.00. The allotment of the FiT-All also raises questions on the equity of the policy. According to the Mindanao Development Authority (2014), Luzon and Visayas received 70.4 percent and 26 percent, respectively, of the total FiT-All availment while Mindanao only had a share of 3.6 percent.

Based on the analysis in this study, the FiT has not addressed its intended purpose of helping the Philippines create a low-carbon development strategy. With the continuing increase in electricity prices, the FiT is turning out to be an additional short-term burden to Filipinos.

6. ACKNOWLEDGEMENTS

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