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The cost structure of electricity in the Philippines and other Asian countries: A Comparative Note

BY

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Abstract

This paper compares electricity cost structure in the Philippines vis-à-vis other Asian countries. The electricity prices in the Philippines are high by regional standards. From the comparative assessment, there is room for cost reduction from the various segments of the power supply chain in the Philippines. First is the utilization of an optimal mix of fuel sources based on the least-cost rule, where cost takes into account the environmental and health costs. The coal and petroleum excise taxes in the 2017 tax reform were a step in the right direction. As the costs of intermittent renewables, especially solar and storage, continue to fall, they may be increasingly attractive, especially in remote areas that use diesel-powered generators. Improvements in the thermal efficiency of coal-fired power plants could also help decrease the cost of fuel. Transmission and distribution losses in the Philippines are also high by regional standards. An assessment of the national grid code and technical audit may be warranted. Finally, the value-added tax in the Philippines is also high. Consumers in the Philippines are also taxed for systems losses and subsidies. Reevaluation of the tax base is also recommended.

Keywords: Electricity price, Philippines and Asia, deregulation
JEL: Q41, Q48, L4

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1. Context and introduction

The wave of electricity market deregulation started in the late 1990s and early 2000s in the Organization for Economic Cooperation and Development (OECD) countries. The United Kingdom was the first to deregulate its electricity industry in 1990 (Al-Sunaidy & Green, 2006). The US and Germany started their deregulation in 1998. Regulatory reforms and policies differ widely across countries, ranging from partial to complete deregulation. From 1991 to early 2000, the power industries in Indonesia, Malaysia, Thailand, Singapore and the Philippines were vertically integrated and highly subsidized in Southeast Asia. Only the Philippines and Singapore have deregulated their electricity industry. Other countries in the region may be observing the experiences and outcomes of the reforms in Singapore and the Philippines before pursuing complete deregulation reforms.

The deregulation reform in Singapore started as early as 1995 (Chang, 2004). The generation market was open to competition, while the wholesale and retail markets were gradually open to competition. Its retail electricity market has progressively opened to competition starting in 2001, with 75% and 80% of the total electricity demand being covered by contestable customers by the end of 2003 and 2014, respectively (Chang, 2004; Loi & Jindal, 2019). By 2018, the open electricity market was extended to all customers (Energy Market Authority, n.d.-b). Since then, residential customers have had the option of buying electricity from a retailer with their preferred price plans.

The electricity industry in the Philippines went through a major restructuring after a series of power crises starting in the early 1990s (Alonzo & Guanzon, 2018). With the passage of the Electric Power Industry Reform Act (EPIRA) in 2001, generation was privatized, and a transition to more competitive retailing was mandated. On the other

hand, transmission and distribution were left as regulated monopolies. As of 2022, the Philippines has already deregulated its generation sector, but the process for the retail sector is still incomplete due to implementation delays. The EPIRA has the well-intentioned objective of opening up access to and fostering competition in the electricity retailing to lower consumer prices. The reforms were designed to be implemented in phases, but many aspects of EPIRA have been delayed and fraught with regulatory cases requiring Supreme Court rulings.

Indonesia started its reforms in early 1985 but only liberalized its power generation with the monopsony of Perusahaan Listrik Negara (PLN), the sole buyer of generated electricity (Sharma, 2005). In 1994, another policy reform was introduced that geographically and functionally divided PLN and changed its status from a public utility to a corporate entity. This policy reform aimed to improve transparency in Indonesia's power industry and allow the efficient entry of private enterprises. By 2009, a new reform was introduced, allowing the access of independent power producers (IPPs) into the generation sector. Currently, PLN runs the electricity industry in Indonesia (Yokota & Kutani, 2017). It has the monopsony over purchasing generated power from its subsidiaries and IPPs.

Moreover, it has a monopoly over the transmission and distribution sectors. The sale of power from IPPs to PLN undergoes public tender. As a company, PLN's business units are separate legal entities that are expected to operate independently and profitably. PLN has two generations of subsidiaries in the Java-Bali grid area, where its most extensive operations are located. The government is involved in setting prices across all sectors of the industry and can provide subsidies to lower the cost of fuel supply (Yokota & Kutani, 2017).

2. Comparison of electricity cost structures

The primary reason for deregulating any industry is to achieve efficiency and competitive prices by allowing markets to work and opening the sector to more products

and services. Innovative ideas and solutions decrease costs and provide customers with more competitive prices. More than two decades after the reforms, how do the Philippines and Singapore fare relative to other Asian countries? Comparing key indicators of power supply and demand across select countries reveals a limited power supply in the Philippines vis-à-vis consumption (Table 1). Electricity consumption per capita in the Philippines is the lowest, followed by Indonesia, compared to the other ASEAN countries. The lower electrification rates in the Philippines and Indonesia partly explain the low per-capita consumption in these two countries (Yokota & Kutani, 2017). The Philippines had a 26.2 GW capacity serving 111 million Filipinos. In comparison, its neighbors Thailand, Malaysia, and Indonesia had 45.3 GW, 34.2 GW, and 66.8 GW of power capacity serving their populations of 70 million, 33 million, and 276 million, respectively. Transmission and distribution losses have also been relatively high (9.4% of the total electricity output), suggesting an inefficient grid and distribution system.

Table 1. Power supply and demand indicators in select countries.

	Per capita electricity generation (kWh/cap), 2020[a]	Per capita electricity consumption (MWh/cap), 2019[b]	Net installed electricity capacity (GW), 2019[c]	Share of renewables in electricity production* (%), 2020[d]	Population (million), 2021[d]	Per capita GDP (constant 2015 US$), 2021[d]	Electricity transmission & distribution losses** (% of output), 2014[d]
Philippines	885.6	0.90	26.2	23.5	111.0	3,412.6	9.4
Indonesia	1,004.5	1.00	66.8	13.2	276.4	3,855.8	9.4
Thailand	2,531.4	2.90	45.3	14.8	70.0	6,270.4	6.1
Malaysia	4,695.1	5.10	34.2	12.2	32.8	10,827.3	5.8
Singapore	8,597.8	9.50	12.6	2.0	5.5	66,176.4	2.0
China	5,368.8	5.10	2,064.7	28.3	1,412.4	11,188.3	5.5
Japan	7,436.8	7.90	346.5	24.6	125.7	35,278.4	4.3
S. Korea	10,746.6	10.90	132.1	8.9	51.7	32,644.7	3.3
New Zealand	9,279.9	8.40	9.4	78.8	5.1	40,779.0	6.5

Notes: * Renewables include electricity production from hydropower, solar, wind, biomass & waste, geothermal, wave, and tidal sources. ** Electric power transmission and distribution losses include losses in transmission between sources of supply and points of distribution and in the distribution to consumers, including pilferage.

Sources:

[a] Our World in Data. https://ourworldindata.org.

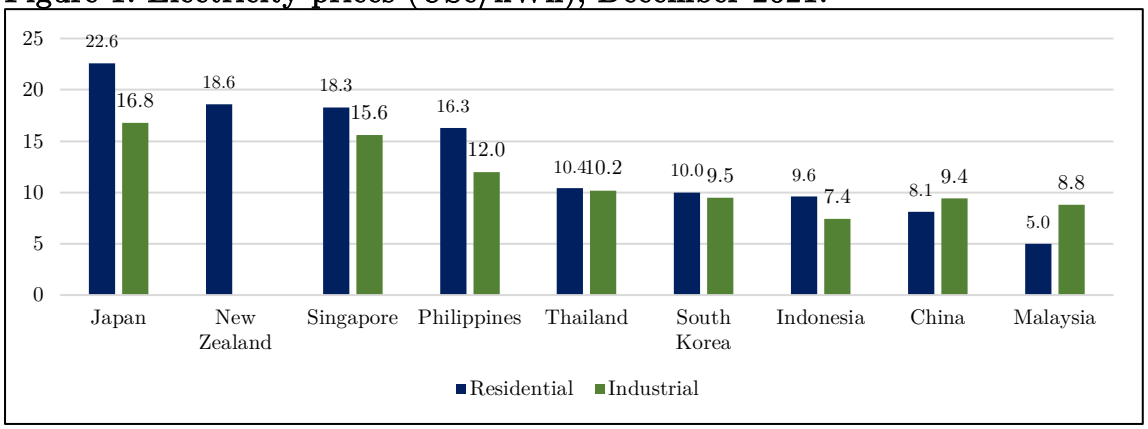
[b] International Energy Agency. https://www.iea.org.

[c] United Nations Data. http://data.un.org. UN Statistics Division. https://unstats.un.org.

[d] World Development Indicators. https://data.worldbank.org

Electricity prices in the Philippines remain among the highest in Southeast Asia, along with Singapore (Figure 1). In December 2021, the Philippines' residential rate was $0.16/kWh, second to Singapore ($0.18/kWh) and higher than Thailand ($0.10/kWh), Indonesia ($0.10/kWh), and Malaysia ($0.05/kWh). Meanwhile, the Philippines' industrial rate ($0.12/kWh) was also second to the highest rate, after Singapore's ($0.16/kWh). While Singapore and the Philippines are the two countries with deregulated electricity industries, the per-capita GDP of Singapore in 2021 was the highest at USD 66,176 (constant 2015 US$ prices), and its per-capita electricity consumption in 2019 was 9.50 MWh (Table 1). In contrast, the Philippines' per-capita GDP of USD 3,413 (constant 2015 US$ prices) and per-capita electricity consumption at 0.90 MWh for the same years were the lowest in the region (Table 1).

Figure 1. Electricity prices (USc/kWh), December 2021.



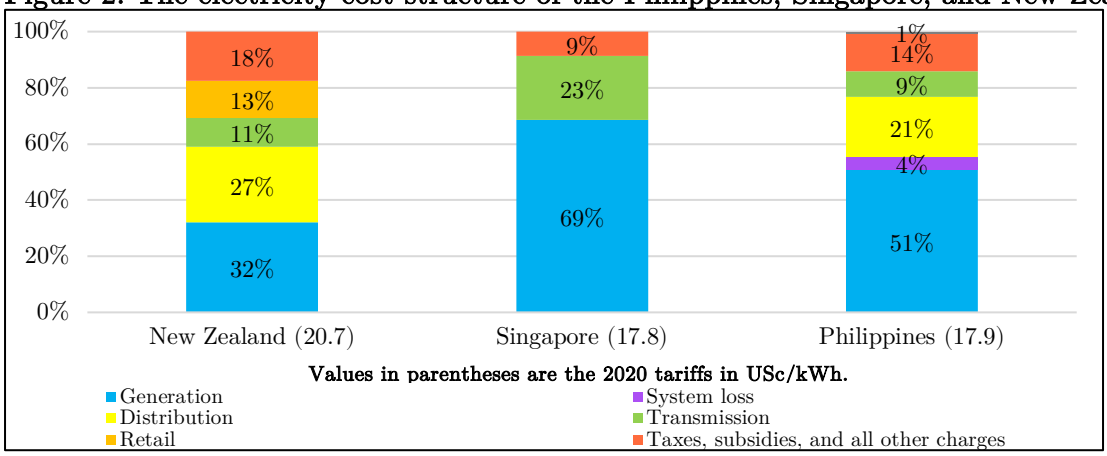
Source of primary data: Global Petrol Prices. https://www.globalpetrolprices.com.

How does the cost structure of electricity prices in the Philippines compare with other countries? Figure 2a compares the breakdown of electricity tariffs between the Philippines and Singapore– the two deregulated industries in Southeast Asia. New Zealand, also a deregulated industry and advanced economy, is included to provide additional context and perspective for comparison.

For the Philippines, electricity rates are for 101-200 kWh consumers and are computed by averaging the monthly rates for 2020. A residential customer with 200 kWh a month in Meralco's franchise area had a monthly bill of about $36, using the average

price of USc 17.91/kWh in 2020. This household would typically have a refrigerator, electric fan, flat iron, TV set, and radio. In 2020, generation charges comprised 51% of the bill, followed by distribution charges, including supply and metering, at 21%. Transmission charges, on the other hand, made up about 9%. Transmission losses were about 4%. As previously noted, the Philippines has a high system loss by regional standards. Taxes (12%) and subsidies (2%) include universal charges, lifeline subsidies, and senior citizen subsidies. Universal charges are unique to the Philippines. The feed-in tariff (FIT) allowance was 1%.

Figure 2. The electricity cost structure of the Philippines, Singapore, and New Zealand.



Sources of primary data: New Zealand Ministry of Business, Innovation, and Employment, New Zealand Electricity Authority, Electricity Networks Association (New Zealand); Singapore Power, Singapore Energy Market Authority (Singapore); Meralco (Philippines); Exchange rates used: NZD 1: Php 34.10; SGD 1: Php 36.20; USD 1: Php 48.06 (Bangko Sentral ng Pilipinas, December 28, 2020 rates)

In Singapore, energy generation constituted a more prominent share at 69%. Generation includes both fuel and power generation costs. Transmission or network costs, including the distribution charge, constituted 23%. This network cost is lower than Meralco's Philippines (30%), reflecting a more efficient transmission and distribution network. Taxes and other charges include the 7% goods and services tax (GST), market support services fees (for billing, meter reading, data management, retail market systems), and market administration and power system charges.

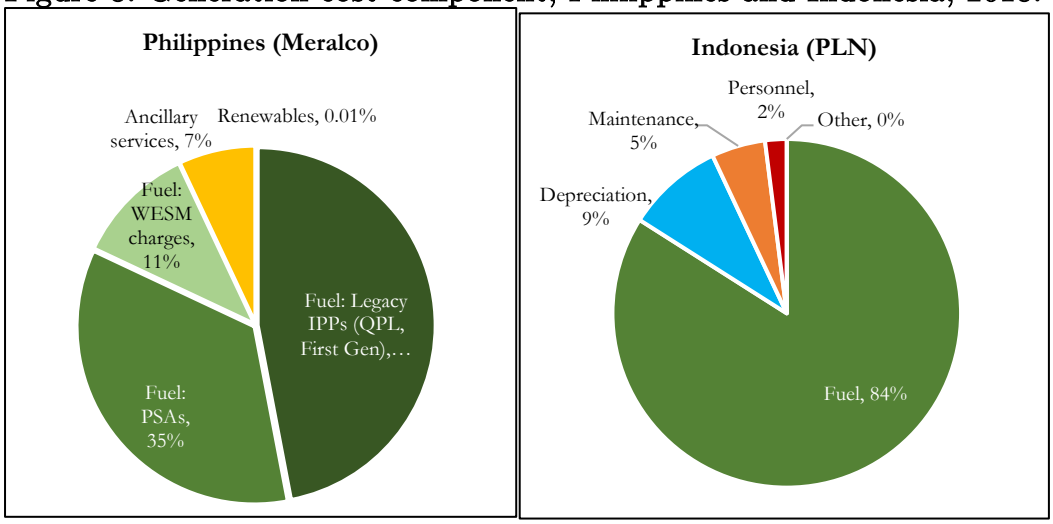
For New Zealand, the values were computed using the nominal residential rate (NZc 29.11/kWh). The average share per component was 32% for generation, 11% for transmission, 27% for distribution and 13% for retail in 2020. Taxes, subsidies, and other

charges were at 18%, including the retail, metering, market governance charges and GST (13%). In terms of percentage share, the transmission and distribution shares of New Zealand is close to the Philippines. However, its generation share was the lowest among the three countries, mainly due to hydropower constituting 56% of New Zealand installed capacity.

As Figure 2 shows, aggregate generation costs are the most significant component of the electricity rates. How does the structure of generation cost in the deregulated industry of the Philippines compare with that in the subsidized sector of Indonesia? Figure 3 compares the breakdown of generation costs between Meralco of the Philippines and PLN of Indonesia in 2018. In 2020, Meralco's generation charge was USc 9.11/kWh compared with Indonesia's generation charge of USc 7.05/kWh (Baker McKenzie, 2021).

PLN Indonesia's generation costs constitutes 84% fuel, 9% depreciation, 5% maintenance, and 2% personnel (Yokota & Kutani, 2017). Fuel costs take up the largest part of the generation cost. It is determined mainly by the country's energy policy and whether fuel is imported or domestically produced. Domestically produced fuels are often cheaper, e.g., coal in Indonesia. Fuel costs are also controlled and subsidized by the Indonesian government so that actual fuel prices at which generation companies purchase power are set lower than the market price.

Figure 3. Generation cost component, Philippines and Indonesia, 2018.



Sources of primary data: International Energy Consultants (2018) and Yokota & Kutani (2017).

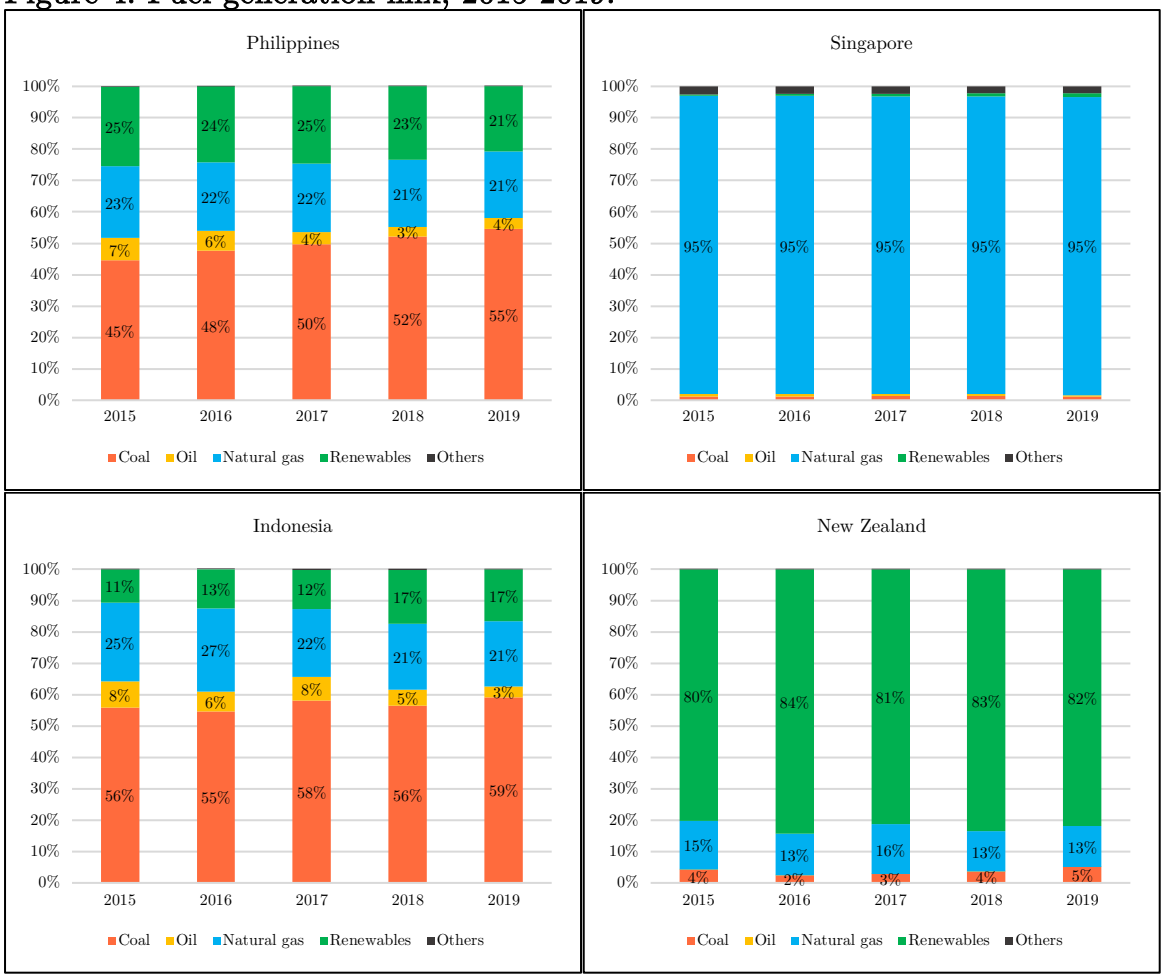
For Meralco, aggregate fuel costs take up about 93%, as represented by Meralco's purchase of power via bilateral contracts (legacy IPPs, power supply agreements or PSA) and from the Wholesale Electricity Spot Market (WESM). The largest of these are the legacy IPP take-or-pay contracts with First Gen's natural gas power plants in Pagbilao, Quezon and the coal-fired power plant of Quezon Power in Mauban Quezon. On average, Meralco procures power with relatively low-priced contracts at ₱4.47/kWh. However, there were months when it had an extremely high-priced contract at ₱20.2/kWh. While these high-priced contracts only account for 1.8% of its total power supply procurement in kWh in a month, they account for 7% in monetary terms (Yokota & Kutani, 2017). In 2015, the annual average of these high-priced contracts was ₱10.99/kWh, mainly with oil-based generation companies. A two-part tariff typically characterizes Meralco's PSAs with fixed and variable components. Ancillary services take up about 7%, which are included in the transmission component of the published tariff but are ultimately paid to generators.

Since fuel costs take up the most significant part of the generation cost, they are determined by the fuel mix, the corresponding prices of the fuels (which are also influenced when fuels are imported or domestically sourced), and the thermal efficiency by which the fuels are utilized. Figure 4 compares the fuel mix in the Philippines, Indonesia, Singapore, and New Zealand. In the Philippines and Indonesia, low-priced coal accounts for the largest share, followed by renewables and natural gas. All indigenous natural gas supplies from Malampaya constitute a third of the fuel to generate electricity in Luzon Island in the Philippines. The coal used in power generation is from both domestic and imported sources. For Indonesia, both natural gas and coal are sourced domestically.

In contrast to the Philippines and Indonesia, the fuel mix in the relatively advanced economies of Singapore and New Zealand is mainly natural gas and renewables, respectively. Using pipelines, Singapore imported a considerable portion of natural gas from Indonesia and Malaysia. In 2013, it started importing liquefied natural gas (LNG)

for diversification and energy security (Energy Market Authority, n.d.-a). Singapore now has four storage tanks, bringing its LNG capacity from 3.5 to 11 million tons per annum from 2013 to 2018 (Energy Market Authority, n.d.-a). In contrast, New Zealand uses mainly renewable energy from hydropower and geothermal and, progressively, wind energy. New Zealand has the lowest carbon dioxide emission from electricity generation, with 82% of its electricity generated from renewable sources as of 2019 (Ministry of Business, 2020).

Figure 4. Fuel generation mix, 2015-2019.



Notes: Renewables include hydro, solar PV, wind, geothermal, and biofuels. Others have waste and chemical heat. Source of primary data: International Energy Agency (2022).

To reduce the cost of generation, utilizing the optimal mix of fuel sources over time-based on the least-cost rule while considering the environmental and health concerns would be efficient (Jandoc et al., 2018; Ravago, Fabella, et al., 2018). For the integrated Luzon and Visayas grids, our previous analysis suggests that optimal use patterns would have existing coal plants continuing to serve the baseload period, new and existing combined-cycle gas turbine (CCGT) plants serving the mid-merit period, and existing diesel plants operating the peak period. (Jandoc et al., 2018). Generation costs are decreased when cheaper fuels are used. Coal and hydroelectric power sources are generally more affordable than diesel and imported natural gas (Ravago, Fabella, et al., 2018). However, when coal and other fossil fuels are used, pollution and health costs should be incorporated to level the playing field (Jandoc et al., 2018; Roumasset et al., 2018). While, on average, domestically produced natural gas is cheaper than Japan's CIF reference price, natural gas in the Philippines is relatively expensive compared with its neighbors (Table 2). This is partly due to the significant investment requirements and the high risk associated with developing the Malampaya deepwater gas field, including its 500 km subsea pipeline (Yokota & Kutani, 2017). Fuel costs are also affected by the structure of contractual arrangements. Meralco's current agreement with existing gas power plants is in the form of take-or-pay contracts that require consumers to pay for capacity even if it goes unused.

Table 2. Delivered cost of natural gas and coal, 2015 and 2021.

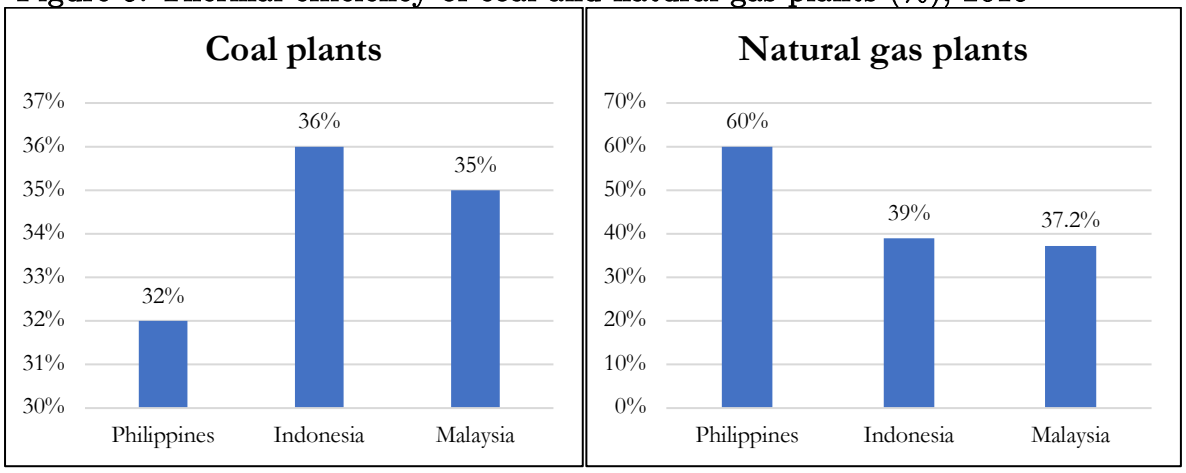
	Nat Gas (in USD/MMBTU)		Coal (in USD/ton)	
	2015	2021	2015	2021
Philippines	9.06	7.24	68	
Indonesia	7.96	6.00	52	70
Malaysia	5.16		64	
Thailand	8.36	6.27		

Data sources for natural gas: All countries, 2015: Yokota & Kutani (2017);
The Philippines, 2018-2021: Freedom of Information (2021); Indonesia, 2020-2021: Iswandi et al. (2021; Thailand, 2021: Praiwan (2021).
For coal: All countries, 2015: Yokota & Kutani (2017); Indonesia, 2018-2021: Bridle et al. (2019)

Another factor affecting the costs of fuel is thermal efficiency, which affects the amount of fuel consumption. When the gross thermal efficiency is high, a smaller fuel is required to achieve the same power output. Thus, a lower generation cost is incurred. Improving the gross thermal efficiency necessitates repairing existing power plants, replacing them with high-performing plants or improving the operation of power plants to enhance efficiency. The Philippines has a low generating-end thermal efficiency for coal, with only 32% in 2015 (Figure 5). If this could have been improved by 10%, it could have made US$235 million in savings in Meralco's power generation cost (Yokota & Kutani, 2017). Measures to improve the thermal efficiency of ageing coal-fired plants have not been sufficient. There is an incentive-incompatibility problem for operators since they can profit by continuing to operate at a minimum cost.

On the other hand, Figure 5 shows the thermal gas efficiency in the Philippines is higher than that in Indonesia, Thailand and Malaysia mainly because it was the high-efficiency gas plant introduced in the Philippines in 2000 (Yokota & Kutani, 2017). Moreover, while coal has lower fuel costs, its thermal efficiency in the Philippines is lower. Gas has higher fuel costs but greater thermal efficiency. Thus, the variances between the fuel costs and thermal efficiencies offset each other and should be considered when planning for the optimal fuel mix.

Figure 5. Thermal efficiency of coal and natural gas plants (%), 2015



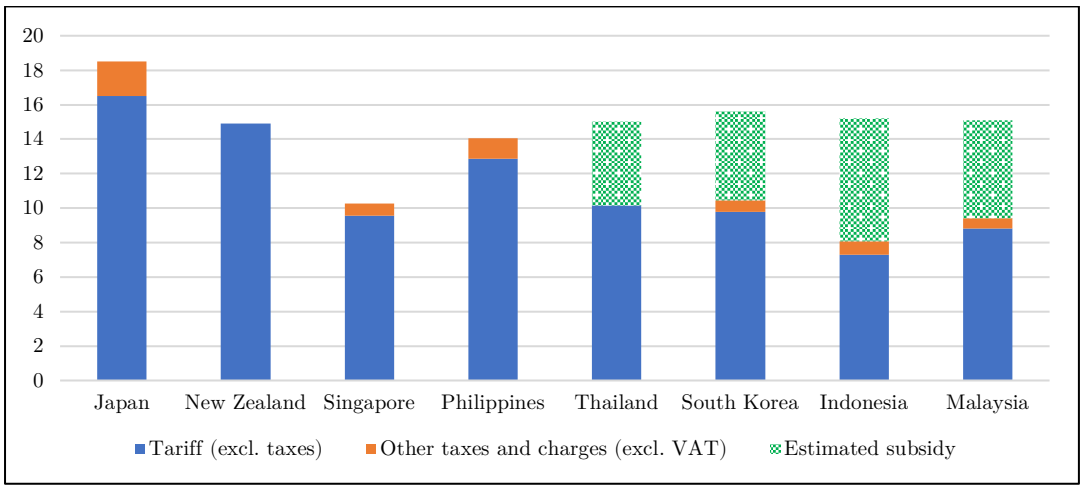
Note: Data estimated from Yokota & Kutani (2017).

3. Subsidy vs reforms in the electricity industry

One of the principal goals of reforms in the electricity industry is to decrease the price-cost margins. Primarily, this is achieved by the increased efficiency and competition in the industry that cascades down to prices reflecting the actual costs of electricity. In general, competition in the generation and the retail sectors is introduced at the beginning of the reform, which induces players to operate at their lowest costs and drives out those that cannot operate profitably at the prevailing market prices. In the longer term, the reformed market structure attracts new entrants with more efficient technologies that put additional downward pressure on prices. Thus, the combined effect is expected to manifest in market prices reflective of costs, which reduces electricity price-cost margins (Erdogdu, 2011).

Two decades after EPIRA, the electricity rates in the Philippines are still among the highest in the region. Should the Philippines go back to subsidizing its electricity industry? Electricity prices in neighboring countries benefit from effective subsidies of up to 50%. A more nuanced comparison of the electricity prices is the inclusion of subsidies in countries where the electricity industry is vertically integrated. These subsidies are in the form of cash grants to state-owned enterprises, subsidized fuel or deferred expenditure (fuel cost carried forward to be written off in future periods). A Meralco-commissioned study by the International Energy Consultants puts Indonesia's subsidy at an estimated USc 7.14 per kWh, Malaysia's at Usc 5.67 per kWh, Thailand's at Usc 4.83 per kWh, and South Korea's at Usc 5.14 (Figure 6). Nonetheless, even with subsidies, electricity prices have also been increasing in these countries due to growth in demand and rising fuel prices.

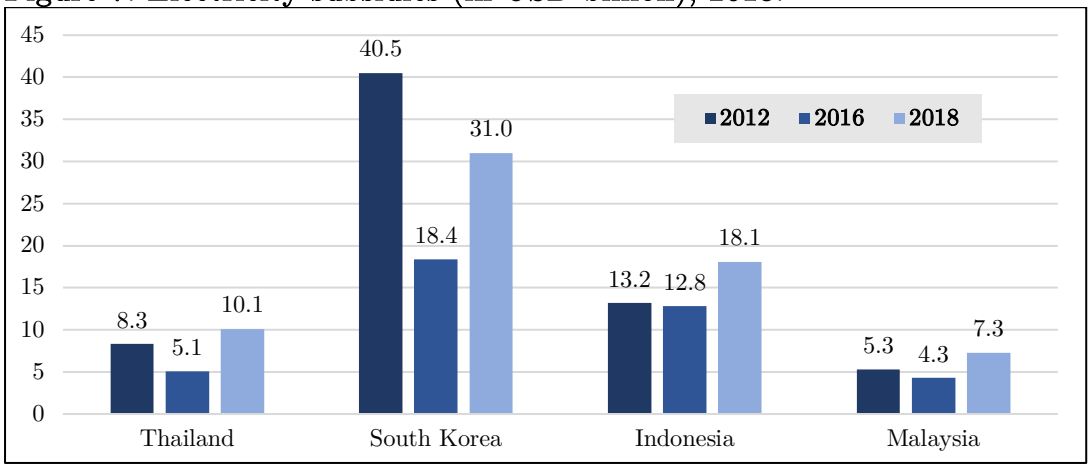
Figure 6. Electricity prices (USc/kWh), January 2018.



Source of primary data: Meralco-commissioned study by the International Energy Consultants (2018).

To cope with increasing electricity prices, the annual subsidies have been on the rise (Figure 7) but are still insufficient to offset both the demand growth and increases in fuel prices. In 2018, these four countries are projected to subsidize their tariffs by an estimated 34% for a combined implied subsidy of USD 66.5 billion. Consumers in these countries are only paying, on average, about 66% of the actual cost of supply (International Energy Consultants, 2018).

Figure 7. Electricity subsidies (in USD billion), 2018.



Source of primary data: Meralco-commissioned study by the International Energy Consultants (2018).
Note: The implied subsidy is calculated by subtracting the actual tariff from the long-run marginal cost curve plus network charges and multiplying the result by the annual sales volume.

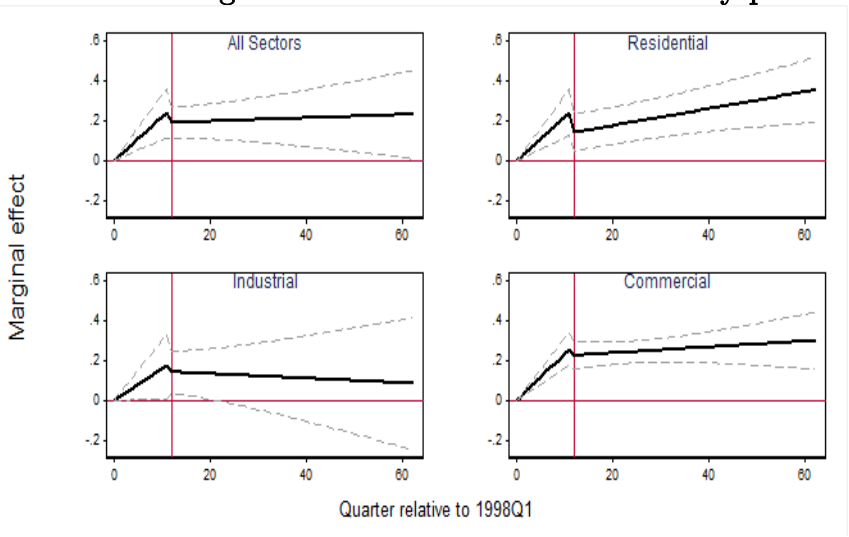
While these countries' electricity prices may be lower, blanket subsidies burden their economies. For example, in Malaysia in 2008, its spending on subsidies peaked at a level equivalent to 22% of the revenues from the total oil exports (Bergaoui, 2014). As a result, Malaysia's economy contracted by 1.5% in 2009, and the fiscal deficit ballooned to its highest level since 1982, leading to gradual reforms beginning in 2013 (Bergaoui, 2014). Some pundits are saying that the energy subsidy is one of the reasons why Malaysia could not escape the middle-income trap. Blanket consumer subsidies are not a cost-effective way of redressing poverty. As practised by many countries, small subsidies for manufacturing sectors may be warranted (see Cantore et al., 2021; Kunmakara, 2018). However, manufacturing subsidies should be funded from general revenue, not higher consumer prices. Moreover, providing subsidies to all consumers via lower tariffs is ultimately an unsustainable economic policy as the cost will be unaffordable, and the inevitable price shock will cause major socio-economic dislocations, as the Philippine experience has shown (Alonzo & Guanzon, 2018; Bacon, 2019; Toba, 2007).

Since the introduction of EPIRA in the Philippines in 2001, the reforms in the electricity industry are still incomplete. While the retail market has already been established, contestable customers are still limited to big electricity consumers. Given that the law prescribes a timeline for implementing the various elements of EPIRA, the impact of the reform may be evolutionary. Furthermore, the actual implementation of the multiple provisions has deviated from the prescribed timeline. Moreover, we may not be able to observe a one-time impact of the reform on electricity prices, as shown in our previous analysis (Ravago, Brucal, et al., 2018).

In general, post-EPIRA electricity prices are generally at higher levels (even after controlling for inflation). Across all customers, electricity prices are about Php 0.20/kWh higher than pre-EPIRA levels. The power rates for the commercial customers recorded the highest post-EPIRA price increase with Php 0.24/kWh relative to pre-EPIRA levels, followed by the industrial sector at Php 0.17/kWh and residential at Php 0.11/kWh (Ravago, Brucal, et al., 2018). However, the increase in post-EPIRA electricity prices is found to move at a much slower rate.

Figure 8 shows the marginal effect of EPIRA on the power rates for each customer class over time. On average, electricity prices are increasing every quarter before the enactment of EPIRA. In contrast, prices did not post a positive growth rate post-EPIRA. The decline in the prices of the industrial sector primarily drives the trend. This may be partly due to large consumers as contestable customers benefiting from RCOA. Residential sector power rates are growing faster under the EPIRA regime (Ravago, Brucal, et al., 2018).

Figure 8. The estimated marginal effect of EPIRA on electricity prices.



Source: Ravago, Brucal, et al., (2018)

4. Concluding remarks

The electricity prices in the Philippines are high by regional standards. As such, the country fails to attract foreign direct investments–one reason manufacturing growth has lagged in recent decades relative to its neighbors. The slower manufacturing growth relative to services was labelled as "development progeria" (Daway & Fabella, 2015), where services grew faster to developed-country levels in low-income countries. The perennially high electricity cost may have inhibited the country's more efficient structural

transformation (Ravago et al., 2019), a phenomenon known as *premature deindustrialization* (Rodrik, 2016).

From the comparative assessment of the cost structure of electricity rates, there is room for cost reduction from the various segments of the power supply chain in the Philippines. First is the utilization of an optimal mix of fuel sources based on the least-cost rule, where cost takes into account the environmental and health costs. The coal and petroleum excise taxes in the 2017 tax reform were a step in the right direction. As the costs of intermittent renewables, especially solar and storage, continue to fall, they may be increasingly attractive, especially in remote areas that use diesel-powered generators. While coal and natural gas fuels are relatively cheaper, their costs in the Philippines are high relative to other countries, which can be revisited. Improvements in the thermal efficiency of coal-fired power plants could also help decrease the cost of fuel. Following the energy efficiency and conservation law (RA 11285), non-fiscal incentives from the Energy Regulatory Commission (ERC) or the Department of Energy (DOE) may help improve thermal efficiency, or the country may adopt a thermal efficiency standard. Transmission and distribution losses in the Philippines are also high by regional standards. An assessment of the national grid code and technical audit may be warranted. Finally, as of 2015, the 12% value-added tax in the Philippines is also high compared to Indonesia's 10%, Malaysia's 6%, Thailand's 7% (Yokota & Kutani, 2017) and Singapore's 9%. Consumers in the Philippines are also taxed for systems losses and subsidies. A reevaluation of the tax base is also needed.

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