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Comparative Analysis of Power Prices in the Philippines and Selected ASEAN Countries

Edited by
Emiri Yokota & Ichiro Kutani

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Foreword

Affordable power supply is one of the energy policies pursued by every country. Each aims to formulate better policies to reduce power price while ensuring supply security and environmental sustainability. Here is where a comparison of cost structures amongst countries can bring out useful insights. A country that finds differences between its power generation costs and that of its neighbours may, for instance, realise the areas that its energy policies should target and resolve.

It is our hope that the outcomes from this study will serve as a good reference to policymakers in the Philippines and other ASEAN member states on effective management of electricity costs.

Ichiro Kutani

Team Leader

June 2018

Acknowledgements

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Mr. Ichiro Kutani

Team Leader

June 2018

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List of Project Members

MR. ICHIRO KUTANI (LEADER): Senior Economist, Manager, Global Energy Group 1, Assistant to the Managing Director, Strategy Research Unit, The Institute of Energy Economics, Japan

MR. KIMINORI MAEKAWA (COORDINATOR): Senior Coordinator and Manager of International Cooperation Group, New and Renewable Energy and International Cooperation Unit, The Institute of Energy Economics, Japan

MS. EMIRI YOKOTA: Senior Researcher, Global Energy Group 1, Strategy Research Unit, The Institute of Energy Economics, Japan

MS. TOMOKO OHIRA Senior Researcher, Nuclear Energy Group, Strategy Research Unit, The Institute of Energy Economics, Japan

MS. KEI SHIMOGORI: Researcher, Nuclear Energy Group, Strategy Research Unit, The Institute of Energy Economics, Japan

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List of Abbreviations and Acronyms

DUs	Distribution utilities
EGAT	Electricity Generating Authority of Thailand
EPIRA	Electric Power Industry Reform Act (the Philippines)
ERC	the Energy Regulatory Commission (the Philippines)
FIT	Feed-in-Tariff
IEEJ	The Institute for Energy Economics, Japan
IPPs	Independent Power Producers
LNG	Liquefied natural gas
MEA	Metropolitan Electricity Authority (Thailand)
Meralco	Manila Electric Company (Philippines)
MOF	Ministry of Finance (Indonesia)
NGCP	National Grid Corporation of the Philippines
NPC	National Power Corporation (The Philippines)
PEA	Provincial Electricity Authority (Thailand)
PEMC	Philippine Electricity Market Corporation
PLN	Perusahaan Listrik Negara (Indonesia)
PSALM	Power Sector Assets and Liabilities Management Corporation (The Philippines)
PPA	Power Purchase Agreement
PV	Photovoltaic
RES	Retail Electric Suppliers (The Philippines)
SESB	Sabah Electricity Sdn. Bhd. (Malaysia)
SESCO	Syarikat SESCO Bhd (Malaysia)
SPPs	Small Power Producers
T&D	Transmission and distribution
TNB	Tenaga Nasional Bethad (Malaysia)
VAT	Value-added tax
VECO	Visayan Electric Company (Philippines)
VPPs	Very Small Power Producers
WACC	Weighted average cost of capital
WESMs	Whole Electricity Spot Markets

Executive Summary

This study compares the electricity supply costs in the Philippines with that in three ASEAN member countries: Indonesia, Malaysia, and Thailand. The comparative analyses found the following differences in each cost component:

Table 1. Summary of Factors of Electricity Cost in Philippines

Electricity demand increase		• Compared with other countries, the Philippines has room to expand its power demand; this may require larger investments and can make cost reduction relatively difficult to achieve.
Power generation	Power generation mix	• Use of coal (thermal) power is already high. • Power generation cost can be reduced by using more coal (thermal) power. Careful consideration over the environmental impact is required, however. • Renewable energy could be a cheaper option in remote areas where residents predominantly use diesel generators.
	Fuel cost	• Prices of coal and natural gas for power generation are relatively high. Coal and gas are respectively 6%-23% and 8%-43% higher than comparator countries in the study. • There is room to further drive fuel cost down.
	Thermal efficiency	• The efficiency of gas thermal power is extremely high, but that of coal (thermal) power is very low. • If one assumes 10 percentage points higher thermal efficiency for CPP, Meralco could have reduced its coal consumption by US$235 million (in 2015). • A 60% efficient gas power plant with US$9.06/MMBtu gas can compete with a 32% efficient coal power plant with US$105/ton coal.
Transmission and distribution	T&D loss	• The Philippines' T&D loss is 2.61% points larger than Thailand's. • If T&D loss was 4% points lower, per-unit electricity supply cost could be 4% less.
	Demand density	• Compared with Thailand's MEA, Meralco has a demand density that is 40% higher; this presents a good environment for the company to operate efficiently.
	Electrification rate	• Electrification rate is lower in the Philippines. • Larger investment requirements for electrification would

		make cost reduction more difficult in the Philippines.
Cost of capital	WACC	• WACC in the Philippines is 3 percentage points–8 percentage points higher than the others. • Cost reduction is possible by lowering WACC.
Tax and levy	VAT	• Fixed-rate multiplier (i.e. sum of WACC and VAT) to electricity cost is 9 percentage points–11 percentage points larger than those in other countries.
	Others	• The Philippines has specific surcharges not observed in other countries (3% of universal charge, 1% of other subsidies in 2016) • As the total electricity rate goes down, the proportion of surcharges becomes bigger.

CPP = coal power plant; GPP = gas power plant; T&D = transmission and distribution; MEA = Metropolitan Electricity Authority; Meralco = Manila Electric Company; VAT = Value-added tax; WACC = weighted average cost of capital.
Source: Author.

The study presents seven recommendations pertaining to the Philippines' electricity supply chain, ranging from fuel supply to electricity distribution.

Table 2. Recommendations to Reduce Electricity Cost in the Philippines

		Effect to Reduce Cost
1	Coordinate open tender for power plant development	
2	Shift back to economic dispatch	✓
3	Reduce fuel cost	
4	Adopt thermal efficiency standard for power generation	✓
5	Consider renewable electricity as an economically feasible option	
6	Reduce transmission and distribution loss	
7	Create good business environment to reduce WACC	✓

WACC = Weighted average cost of capital.

Source: Author.

Recommendations to 'shift back to market-based load dispatch', 'adopt thermal efficiency standards for power generation', and 'create good business environment to reduce WACC' could have larger effects on cost reduction than the other recommendations. Thus, it is suggested that promotions should focus on the most impactful policy recommendations.

Chapter 1

Introduction

1.1 Objective

All countries' energy policies aim to supply energy at an affordable price. Electricity as a secondary energy source is used in all economic activities by industries, institutions, and households. Thus, electricity prices will considerably affect these industries' competitive edge in the global market. In developing countries, the impact on the low-income groups is an important consideration as well, making it imperative that electricity rates be kept affordable. Power supply at affordable prices has, in fact, become an important political agenda.

Since economic development stages, national income levels, and industrial structures are different across the Association of Southeast Asian Nations (ASEAN) region, the level of acceptable electricity rate also differs. In addition, due to the differences in the procurement cost of power generation fuels and power generation mixes, the power supply cost will naturally differ. The electricity rates in the Philippines, in particular, are relatively higher than those in other countries. Such relatively expensive electricity rates are not the problem of the Philippines alone; they are also the concern of the entire ASEAN area that is aiming for economic integration. An extreme difference in energy cost will hinder the realisation of a well-balanced economic development in the ASEAN region.

This study compares the power supply cost structures of selected ASEAN member countries and explores the possibility for cost reduction. It particularly focuses on the reduction of power supply cost in the Philippines, comparing it with that in Indonesia, Malaysia, and Thailand. It aims to make a policy proposal that will contribute to the reduction of the power supply cost.

It should be noted that the analysis handles cost but not price. Price includes factors that cannot be compared with those of other countries, such as cross-subsidies amongst sectors. Therefore, this study directs its analysis not on the design of prices or tariffs, but on the comparison of power supply costs and the possibility of reducing these.

1.2 Study Method

This study is composed of three major steps: (i) data collection; (ii) breakdown of cost factors; and (iii) comparative analyses.

1.2.1 Data Collection

Information on the power supply cost in the Philippines as well as in Indonesia, Malaysia, and Thailand from 2012 to 2016 was collected. Data collected were for over a five-year period as single-year data only could distort the analysis due to factors specific to each relevant year. Specifically, the survey of literature covers (i) annual financial reports of major power companies; and (ii) Customs statistics (e.g. cost of imported fuels).

For information that could not be obtained from existing literature, the research team turned to regulatory bodies, power utility companies, and research institutes in each of the countries in this study.

1.2.2 Breakdown of Cost Factors

Next, power supply costs are broken down into factors. The team also analysed underlying factors that could influence each cost factor. In actual business operations, power supply costs are further subdivided into smaller factors, and a wide variety of underlying factors are dealt with. However, this study's results rely on published information, and the study thus bases its analysis on as much information available.

Cost Factors	Underlying Factors
Power generation cost	● Growth of power demand ● Power generation mix ● Fuel cost ● Generating-end thermal efficiency
Power transmission/distribution/retail cost	● Power transmission/distribution loss rate ● Electrification rate

Capital cost	● Weighted average cost of capital
Tax, surcharge	● Value-added tax (VAT) ● Other taxes

1.2.3 Comparative Analyses

From the data obtained, the power costs' structure and underlying factors in the Philippines as well as Indonesia, Malaysia, and Thailand were analysed and compared.

Key questions in the analyses are as follows:

- Overall
  - * What are the largest cost factors?
  - * Can the cost differences amongst countries be explained in a convincing manner?
  - * Is there any room to reduce the power supply cost? How can the cost be reduced?
- Power generation cost
  - * What is the share of power generation in the total cost?
  - * What impact does the difference in power generation mix have?
  - * What impact does the fuel cost have on power generation cost?
  - * What is the generating-end thermal efficiency of existing thermal power generation plants? Is there any room for improving the efficiency?
- Power transmission/distribution/retail cost
  - * How much is the difference in the power transmission/distribution loss rate between the selected countries?
  - * How much is the current electrification rate?
  - * How much investment is expected to be required in the future? And how will that expectation influence the cost?

- Capital cost
    * How much is the approved weighted average cost of capital (WACC) of each country?
    * What is the level of WACC compared with the long-term prime rates?
    * Is cost reduction possible?
- Tax, surcharge
    * How much is the difference in value-added tax?
    * Isn’t there any difference in other tax or surcharges?

Chapter 2

Power Industry and Power Price in the Philippines

This chapter looks at (i) the power industry structure in the Philippines, and then compares it with that of Indonesia, Malaysia, and Thailand; (ii) the power price in the Philippines; and (iii) power rate setting in the Philippines.

2.1 The Power Industry in the Philippines

There are various policy measures that can reduce power supply costs, but their effectiveness varies depending on the power industry structure and regulations per country. In this subsection, the power industry structures (i.e. generation, wholesale, transmission, and distribution/retail) in the Philippines and its comparative nations (Indonesia, Malaysia, and Thailand) are reviewed. The overview is summarised in Table 2-1.

Table 2-1. Overview of Power Sector Structure in Four Countries

Indonesia	● The state-run Perusahaan Listrik Negara is the main player. ● The generation sector has been liberalised, and IPPs have entered the market. ● The wholesale market takes the single buyer system, and PLN buys all the generated electricity. ● Power transmission, distribution, and retail are monopolised by PLN.
Malaysia	● Tenaga Nasional Bhd (TNB), Sabah Electricity Sdn. Bhd, and Syarikat SESCO Bhd are the main players in Peninsular Malaysia, Sabah State, and Sarawak State, respectively. ● The generation sector has been liberalised, and many IPPs exist. ● The wholesale market takes the single buyer system. ● Power transmission, distribution, and retail are regionally monopolised – i.e. by TNB Transmission Network and TNB Distribution in Peninsular Malaysia, by Sabah Electricity Sdn. Bhd. in Sabah State, and by Syarikat

	SESCO Bhd in Sarawak state.
The Philippines	● The generation sector has been liberalised, and the state-run National Power Corporation and many IPPs have entered the market. However, IPPs are the main entities in power generation, and the National Power Corporation only manages small-scale power sources for rural electrification. ● Although wholesale electricity spot markets exist, distribution/retail companies procure power mainly through long-term bilateral transactions with power generator. ● The power transmission sector is monopolised by the National Grid Corporation of the Philippines. ● The power distribution sector is regionally monopolised by multiple private enterprises. Main enterprises are Manila Electric Company (Luzon), Visayan Electric Company (Visayas), and Davao Light and Power (Mindanao). ● The retail sector has been partly liberalised (contestable consumers are 750 kW or higher).
Thailand	● The state-run Electricity Generating Authority of Thailand is the main player. ● The generation sector has been liberalised, and many IPPs exist. ● The wholesale market takes the single buyer system, except small-scale power sources with 90 MW or below. ● The power transmission sector is monopolised by the Electricity Generating Authority of Thailand. ● The power distribution/retail sector is regionally monopolised, where the Metropolitan Electricity Authority takes charge for the metropolitan area; and the Provincial Electricity Authority, for other areas.

Note: IPPs = Independent Power Producers.

Source: Japan Electric Power Information Center.

The regulatory structure of the power industry (power generation, transmission, and distribution/retail) is shown in Table 2-2. In all the countries in this study, the generation sector has been liberalised and brought Independent Power Producers (IPPs) into the market. In fact, the power development using IPPs has been increasing, most notably in the Philippines.
The power development rendered by the state-run National Power Corporation (NPC) has been limited to small-scale power plant for rural electrification after the market reform in 2001, and IPPs are the main entities in developing new power plants.

For wholesale markets, the three countries other than the Philippines adopt the single buyer system, where a state-run enterprise purchases electricity generated by IPPs, etc. and monopolistically sells it to transmission and distribution (T&D) sector/business operators. However, in Thailand, Small Power Producers with an output of 10-90 MW and Very Small Power Producers with an output of less than 10 MW directly sell power to distribution business operators.

In the Philippines, the main form of power trading is through long-term bilateral transactions between a power generator and a distribution/retail company. In addition, trades are also carried out through Wholesale Electricity Spot Markets (WESMs), which are ran by the Philippine Electricity Market Corporation (PEMC),[1] in Luzon and Visayas Islands.

In a single buyer system, it is possible for a state-run enterprise to select the power source as a single buyer. However, in the Philippines, long-term bilateral transactions amongst private enterprises as well as transactions in wholesale markets give little room for the government to be directly involved in such processes.

The T&D or retail sectors are regulated in Indonesia, Malaysia, and Thailand. In the Philippines, partial liberalisation of the retail sector started in 2013. The contestable consumer segment has been widened in stages, and the currently 750 kW or higher consumers can choose their electricity supplier.

[1] Established by the Philippines' Department of Energy.

Table 2-2. Regulatory Structure in the Four Countries

<table>
<tr><th rowspan="2">Country</th><th colspan="3">Market Structure</th></tr>
<tr><th>Power generation</th><th>Transmission</th><th>Distribution/retail</th></tr>
<tr><td>Philippines</td><td>Liberalised</td><td rowspan="4">Regulated</td><td>Partly liberalised</td></tr>
<tr><td>Indonesia</td><td rowspan="3">Liberalised
+
Single buyer</td><td rowspan="3">Regulated</td></tr>
<tr><td>Malaysia</td></tr>
<tr><td>Thailand</td></tr>
</table>

Source: Author.

The structures of the power industry in all four countries are shown in Table 2-3. In this study, due to limited data, the cost structure will be analysed by focusing on the power supply in a metropolitan area of each nation. That is, the structure of the Manila Electric Company (Meralco) in the Luzon Island of the Philippines (where Manila is located) will be compared with the Java-Bali area (where Jakarta is located), Malay Peninsula (which includes Kuala Lumpur) and the network of Thailand's Metropolitan Electricity Authority (MEA), which includes Bangkok. In particular, for the power generation sector, the study will look at the IPPs from the Philippines; PT Indonesia Power and PT Pembangkitan Jawa-Bali from Indonesia; Tenaga Nasional Bhd (TNB) from Malaysia; and Electricity Generating Authority of Thailand (EGAT) from Thailand. For the transmission sector, a comparison will be made on how the following work: the National Grid Corporation of the Philippines (NGCP), P3B Jawa Bali from Indonesia, TNB from Malaysia, and EGAT from Thailand. For the distribution/retail sector, a comparison will be made on the processes of the Meralco from the Philippines, P3B Jawa Bali from Indonesia, TNB from Malaysia, and the MEA from Thailand.

Table 2-3. Company Structures in Four Countries

	Philippines			Indonesia		Malaysia			Thailand	
	Capital	Other areas		Capital	Other areas	Capital	Other areas		Capital	Other areas
	Luzon	Visayas	Mindanao	Java-Bali		Malay Peninsula	Sabah	Sarawak	Bangkok	
Generation	IPP	IPP/NPC		Indonesia power /IPP	PLN/IPP	TNB/IPP	SESB/ IPP	SESCO/ IPP	EGAT/IPP	
Transmission	NGCP			P3B Java-Bali	PLN Batam PLN Tarakan	TNB	SESB	SESCO	EGAT	
Distribution/ Retail	Meralco	VECO	Davao light	P3B Java-Bali		TNB	SESB/ Local Distributors	SESCO/ Local Distributors	MEA	PEA

IPP = independent power producer; NPC = National Power Corporation (The Philippines); NGCP = National Grid Corporation of the Philippines; VECO = Visayan Electric Company (Philippines); PLN = Perusahaan Listrik Negara (Indonesia); TNB = Tenaga Nasional Bethad (Malaysia); SESB = Sabah Electricity Sdn. Bhd. (Malaysia), SESCO = Syarikat SESCO Bhd (Malaysia), EGAT = Electricity Generating Authority of Thailand, MEA = Metropolitan Electricity Authority (Thailand), PEA = Provincial Electricity Authority (Thailand)

Note: Shaded sections indicate the subjects of comparative analysis in this study.

Source: Author.

Note, however, that the Philippines consists of numerous islands, and the type and cost structure of power generation for islands may significantly differ from that for a metropolitan area. The comparative analysis thus takes this into consideration.

2.1.1 The Philippines

a) Electric power policies

In 1990, the Philippines enacted the Build-Operate-Transfer Law to resolve the power shortage from the late-1980s to late-1990s, prioritising infrastructure investment above all. The government first decided to allow IPPs to enter the power generation sector that had been monopolised by the state-run power authority, the NPC. To facilitate the entry of new IPPs, the Power Purchase Agreement (PPA) between IPPs and the NPC offered preferable conditions to IPPs, including long agreement terms of 20-25 years, high power purchase prices

from IPPs, and 'take or pay' clause.[2] This initiative resulted in an increase in the investment in power plants, which was what the initial policy had hoped to achieve. However, it also caused NPC's power procurement cost to rise sharply.

Affected by the soaring procurement cost and the currency devaluation during the Asian Financial Crisis, the NPC's financial conditions rapidly deteriorated. In response, the government started the power industry's reform. In June 2001, it released RA 9136 – or the Electric Power Industry Reform Act (EPIRA). Under this act, the government established the main entities involved in the reform of the power industry:(i) the Energy Regulatory Commission (ERC), which has the authority to regulate and supervise the generation, transmission, distribution and retail sectors; and (ii) the Power Sector Assets and Liabilities Management Corporation (PSALM), which would manage the power generation assets of NPC and promote the privatisation of NPC itself.

In light of the power price surge in the past, the government also introduced a policy that excluded new long-term PPAs between NPC and IPPs. According to the EPIRA, the liquidation of NPC's assets was to be completed in over 25 years from 2001, but an extension of the liquidation completion period by 10 years is currently under deliberation. The NPC's facilities are to be sold to private companies in stages, starting from power generation plants with higher profitability, while the Small Power Utility Group of NPC is to control and operate the remaining power generation plants in areas where privatisation is difficult.

In 2003, the Philippine government separated the power transmission sector of NPC and established the transmission authority TransCo. In 2007, the government sold a 25-year business right for the power transmission lines of TransCo to a private company through a public tender. The private business operator that won the tender established the NGCP in February 2008, and officially acquired the rights to the power transmission business in January 2009. TransCo supervises and guides NGCP in terms of business operations to ensure that the latter is appropriately carrying out the country's plans on the transmission grid.

[2] Under the take of pay clause, a buyer (NPC) of commodity (electricity) shall pay certain amount of money to a seller (IPP) regardless of actual off take of commodity. The clause is designed to reduce risk of investor by ensuring his income.

As part of the power reform, WESMs were opened in Luzon (in 2006) and in Visayas (in 2010). Plans to open a WESM in the Mindanao Island are currently under consideration.

In the retail sector, the EPIRA started to liberalise the retail market in June 2013. The scope of contestable customers was initially at 1 MW or higher and was later expanded in stages. Starting June 2017, customers with 750 kW or higher were able to select their power supplier.

It was, however, as early as April 2016 that the ERC introduced the Retail Competition and Open Access to enable large consumers to freely select their power supplier company and thus promote competition in the retail market. Through this, ERC announced a rule to restrict power procurement by Retail Electric Suppliers (RES) to a maximum of 50% of the generation capacity of affiliated generation companies. This way, other RES could have the chance to procure power from that same generation company. The rule also prohibits one RES from providing 30% or more of the peak power demand.

The ERC defined other rules, such as banning power distribution companies from engaging in power retailing business in areas where multiple power suppliers exist.[3]

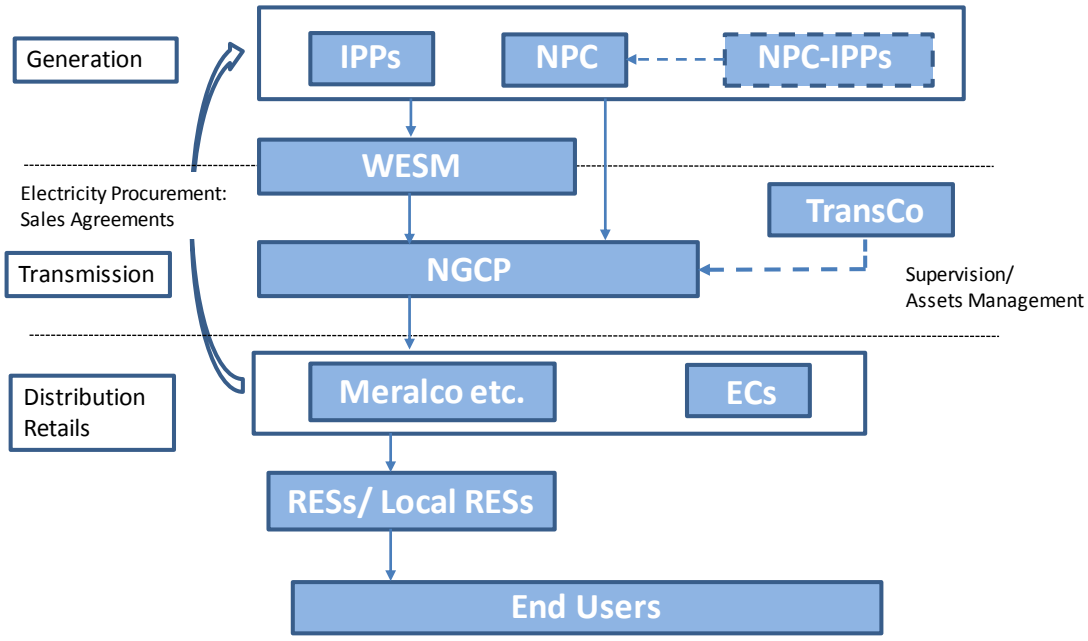
b) Electric power market structure

In the Philippines, NPC and IPPs take charge of the power generation business while the NGCP handles the power transmission business. All the generation facilities that NPC owned had been transferred to PSALM except those assigned for NPC's Small Power Utility Group that were poorly performing or unprofitable – hence, difficult to sell to private investors. The IPPs consist of regular IPPs and NPC-IPPs that operate power plant sold by PSALMA to private enterprises.

The ratio of IPPs that directly close bilateral contracts with distribution companies but do not enter into a contract with NPC has nearly reached 100% in the Luzon Islands, indicating that the operation of the power generation business has been completely transferred from the state-run NPC to private IPPs.

[3] Energy Regulatory Commission, 'Retail Competition and Open Access', 8 September 2016
NNA – Philippines, 12 April 2016.

Figure 2-1. Electric Power Market Structure in the Philippines



EC = Electric Cooperative, IPPs = Independent Power Producers, NGCP = National Grid Corporation of the Philippines NPC = National Power Corporation, RES = Retail Electric Suppliers, WESM = Wholesale Electricity Spot Market.

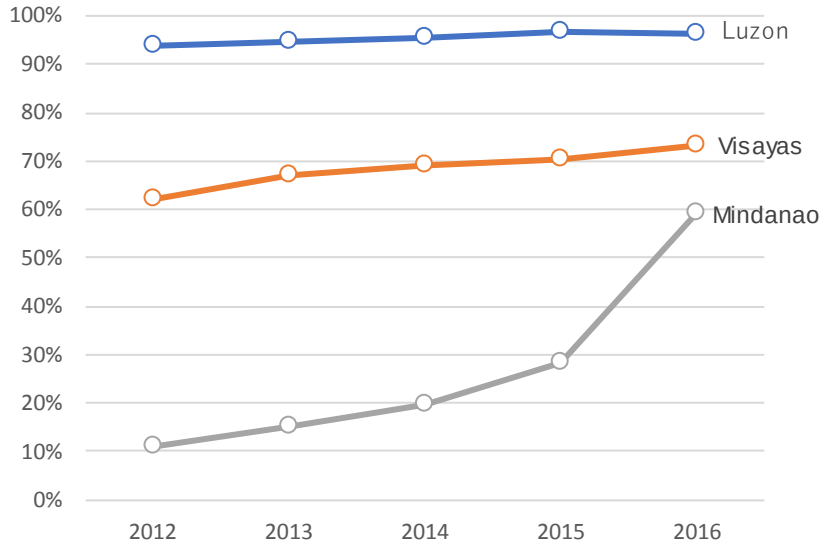
Source: Power Sector Assets and Liabilities Management Corporation.

The ratio of IPPs in the Mindanao Islands without NPC contract has also risen in the last five years, approaching the ratio for the Visayas Islands. This indicates that the entry of private IPPs into the power generation sector gained traction in general, albeit some degree of difference across the major island groups. Based on the number of participants, a competitive environment is slowly evolving.

The power distribution sector consists of various small and large distribution utilities (DUs), including about 15 private DUs such as Meralco, the largest private DU in the Philippines; eight local government-operated distributors; and about 120 small-scale electric cooperatives.

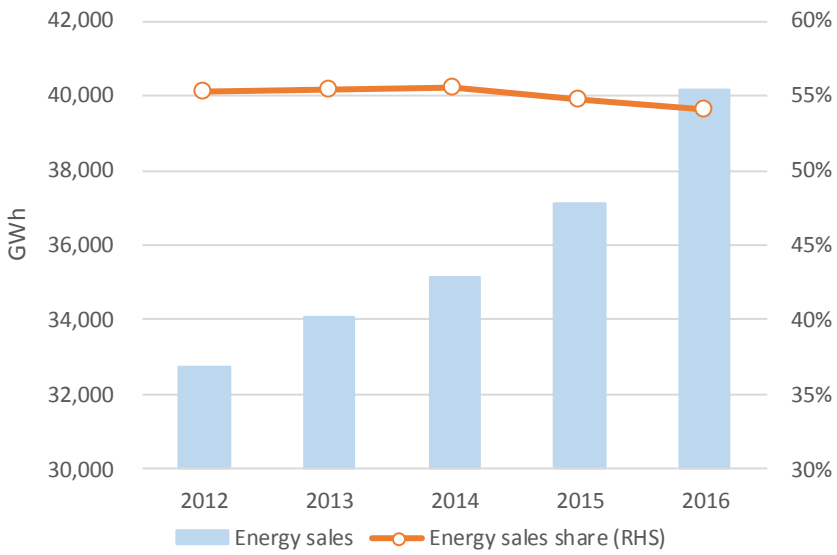
Meralco accounts for about 55% of the DUs as of 2016. In isolated islands and other areas without power transmission systems, the power is supplied by NPC's Small Power Utility Group.

Figure 2-2. Share of IPP Without NPC Contract Against Total Generation (kWh term)



Source: Data provided by Department of Energy, government of the Philippines.

Figure 2-3. Meralco's Energy Sales and Share in the Philippines



Source: Meralco Annual Report (2016).

Distribution utilities procure power through bilateral transactions with power generators or by trading at a WESM and selling the power to consumers at supply locations. When WESM was opened in 2006, trading through this market accounted for about 40%[4] of all traded power. The share subsequently dropped to 10% due to various factors, including when Meralco started bilateral contracting with NPC. Although EPIRA stipulated that 'spot trading is to account for 10% or more of the total trading volume for five years after the establishment of WESM (2006)', the volume of spot trading has not reached 10% of the total trading volume since 2011, the last year of the five-year term specified by EPIRA. The low ratio of spot trading at WESMs and an increase in the number of bilateral contracts suggest that the wholesale market has become stiff, and competition is not functioning in practical terms.

The EPIRA has other future plans, though, including an open access to T&D lines and a plan to realise active power trading.

In the retail market, the contestable consumers currently are with contracted electric power of 750 kW or higher. As of September 2016, there were 1,482 contestable consumers, with a peak demand of 4,643 MW (about 38% of the total peak demand).[5]

c) Governmental involvement in power industry

This subsection summarises the possibility of governmental involvement along the power supply chain. Although this report suggests using policies to reduce the power supply cost, the degree of governmental involvement depends on the market structure.

In the Philippines, many sectors in the power supply chain face many competition amongst private enterprises; hence, the room for the government to be involve is small in general.

In the power generation sector, the government can exercise its influence in the granting of permits and approvals. After all, many IPPs have entered the generation sector following its liberalisation. Although the government cannot control the wholesale market, it can establish a competitive environment. For the T&D sectors, wheeling charges and retail rates in the non-liberated sectors are regulated, and the government can potentially reduce the costs further

[4] Theoretically, 100% of electricity including that from PPA supplied to WESM. However, after that, electricity form PPA exempted from bidding, thus to make actual competitive transaction in WESM become smaller.

[5] Energy Regulatory Commission, 'Retail Competition and Open Access', 8 September 2016.

through regulations.

Table 2-4. Government's Involvement in the Power Industry (the Philippines)

Fuel supply	● The government has little room to influence the fuel supply as private IPPs choose and make the decision.
Generation	● The government can control the power plant development of NPC-SPUG although its role is limited to rural electrification. ● The government can be indirectly involved in power plant development by IPPs through licensing procedures.
Wholesale	● Both bilateral transactions and trading at WESMs are between private enterprises only; thus, the government has limited room for intervention.
Transmission	● This is a regulated sector, and room for the government to involve exists in its review of rates.
Distribution	● This is a regulated sector, and room for the government to involve exists in the review of rates.
Retail	● This is partly liberated, and room for the government to involve is small.

NPC-SPUG = Nation Power Commission–Small Power Utility Group.

Source: Author.

2.1.2 Indonesia

a) Electric power policies

To cope with the sudden rise in the demand for power in the late 1980s, private capital (e.g. IPPs) was injected into Indonesia's power sector starting 1992.

In August 1998, the government announced its power market policy reform, wherein it would geographically and functionally divide Perusahaan Listrik Negara (PLN). The reform aimed to introduce the market mechanism, improve the transparency in the power industry, and allow the efficient entry of private enterprises.

The draft New Electricity Law, which was meant to deregulate the power industry and promote competition in the generation sector, included allowing the central and state governments to

grant permits and approvals for the power industry under the control of the central government.

In September 2009, the New Electricity Law was passed by the House of Representatives, paving the way for IPPs to enter the power business that used to be monopolised by PLN.

In 2015, the Business Plan for Electricity Provision was issued. This aimed to increase the IPP ratio to 75% by 2034. In addition, the Ministry of Energy and Mineral Resources Regulation 01/2015 required access of the power transmission network to be opened to the private sector.

Administrative organisations involved in the power sector include the *Dewan Energi Nasional* (or the National Energy-Management Committee), which formulates comprehensive policies in the development and utilisation of energy; *Badan Perencanaan Pembangunan Nasional* (Bappenas, or the Ministry of National Development Planning), which is in charge of national development planning; and *Kementerian Energi dan Sumber Daya Mineral* (or the Ministry of Energy and Mineral Resources), which manages the resources and energy sector in general.

The basic guidelines and plans in Indonesia's energy policies are formulated based on the Energy Law passed in August 2007. The Energy Law included provisions on the establishment of the National Energy Management Committee, promotion of resource development, and prioritisation of domestic supply of energy. It stipulated that the National Energy Management Committee is to formulate *Kebijakan Energi Nasional* (or national energy policies), and the Ministry of Energy and Mineral Resources will be the agency responsible for the formulation and execution of individual energy and mineral resources policies.

In September 2009, the New Electricity Law was enacted. While following the old Electricity Law in principle, the New Electricity Law stipulated a new power supply system in which the national government was to take responsibility for power supply while local governments are also given a certain level of authority. Previously, the minister of the Ministry of Energy and Mineral Resources or the president had the authority over the *Rencana Umum Ketenagalistrikan Nasional* (General National Power Plan) and the revision of electricity rates. Today, the New Electricity Law has to acquire approval from the Assembly.

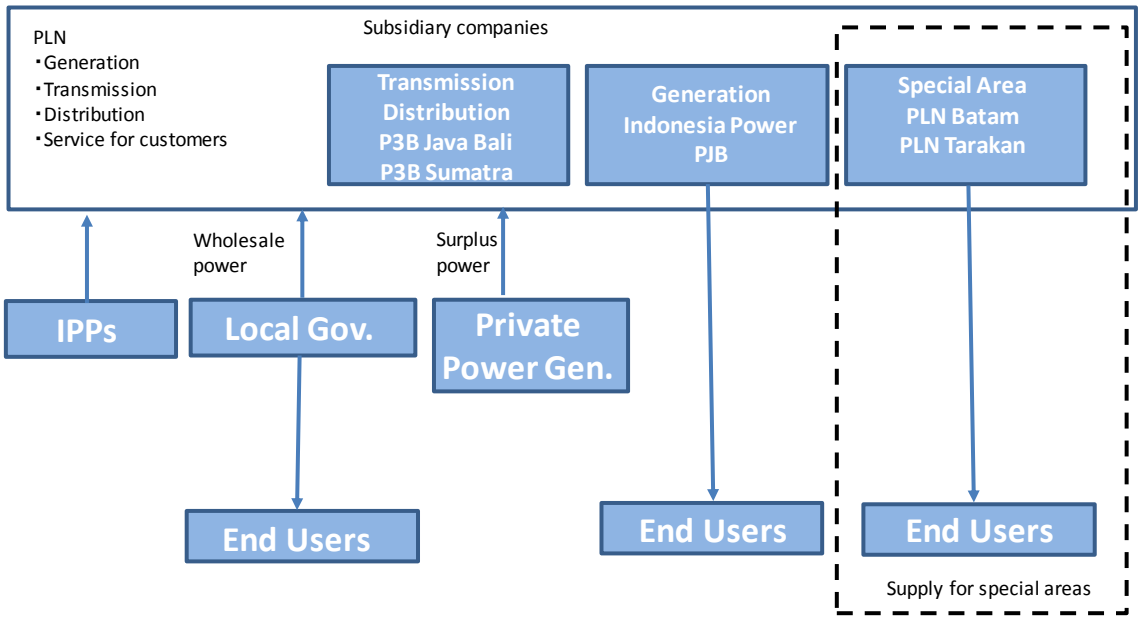
In addition, presidential decrees and ministerial decrees for utilisation of renewable energy, promotion of introduction of IPPs, and urgent development of coal-fired thermal power plants were issued.

b) Electric power market structure

The current power industry system is ran by the fully government-owned stock company PLN and its subsidiaries or IPPs in the generation sector. The PLN has monopoly over the T&D sectors. It has power generation subsidiaries as well as other subsidiaries in charge of transmission and distribution in special development areas. As a company, it has divided its business units into separate legal entities, each intended to operate independently and profitably. Its largest operations is the Java-Bali grid area, where PLN has two generation subsidiaries.

Sale of power from IPPs to PLN undergoes public tender in principle. However, the government has adopted a system that allows PLN to directly appoint a supplier without tendering for power generated from renewable energy, surplus power, and for power supplied to crisis areas.

Figure 2-4. Electric Power Market Structure in Indonesia



Source: Kementerian Energi dan Sumber Daya Mineral.

c) Governmental involvement in power industry

Many segments in the power sector remain regulated; thus, there is still room for the Indonesian government to be involved directly when compared to the case of the Philippines. Only Indonesia's power generation sector has been liberalised (i.e. the IPPs), although there is still some extent of governmental control. For instance, procurement of power from IPPs remains to

be through public tender.

Table 2-5. Government's Involvement in the Power Industry (Indonesia)

Fuel supply	• A state-run enterprise is in charge of supplying fuel for generation. The government can also be involved in cost reduction through fee regulations for fuel suppliers.
Generation	• Through the PLN, the government can dictate its policy regarding costs in power plant development. • Selection of IPPs is by public tender, where the development year and development amount by fuel type are specified. Therefore, the government can remain involved directly (although it can only be indirectly involved, through public tendering, in the area of cost reduction).
Wholesale	• Electric power generated by IPPs is purchased by PLN based on long-term PPAs. Competitive wholesale markets do not exist.
Transmission	• This is a regulated sector, where the government can be involved in the rates review process.
Distribution	• This is a regulated sector, where the government can be involved in the rates review process.
Retail	• This is a regulated sector, where the government can be involved in the rates review process.

Source: Author.

2.1.3 Malaysia

a) Electric power policies

Since the 1980s, the Malaysian government's policy has been aiming to promote the privatisation of the power business. The nation has introduced a controlled market model aiming to establish a power wholesale market while maintaining the incumbent power supply and electricity rate level.

The Malaysian Development Plan of the Economic Planning Unit under the Prime Ministers' Department includes policies and guidelines not just for the economy as a whole, but for the nation's power sector as well. The Ministry of Energy, Green Technology and Water formulates plans specifically for the energy sector.

Malaysia has region-specific reforms for Peninsular Malaysia, and the Sabah and Sarawak States. In the Sarawak State, the state government is responsible for issuing licenses. Power auditors are appointed in the state government based on the Sarawak Power Supply Proclamation.

Regulations in the energy sector for Peninsular Malaysia and the Sabah State are handled by the Energy Commission, which was reorganised based on the Energy Commission Act 2001.

In Peninsular Malaysia, the National Electricity Board that used to have monopoly over the power industry was split and privatised as part of the system reform and then renamed as Tenaga Nasional Bhd (TNB). From the latter half of 1990s, subsidiary companies of TNB such as a thermal generation company, transmission company, distribution company and hydroelectric generation company have been established. These companies are still positioned as subsidiaries of TNB since the bill for electricity liberalisation was shelved in 2001. These firms are divided into core businesses in electric power generation, transformation/transmission and distribution.

In the Sabah State, the Sabah Electricity Board was incorporated in 1998 and became the Sabah Electricity Sdn. Bhd. Its largest shareholder is TNB, which has 80% of the total stocks issued. The Sabah State government holds the remaining 20%.

The Sarawak State established the Syarikat SESCO Bhd (SESCO) in 2005 to conduct the generation, transmission and distribution of power. All SESCO stocks are held by the Sarawak State government.

Triggered by the shortage in power supply capability in 1993, the government decided to introduce IPPs. As a result, the power supply in Peninsular Malaysia started to rely on IPPs. For PPAs between TNB and IPPs, reviews/evaluations such as those that aim to reduce prices had been made since 1993. Unlike the regulatory system in Peninsular Malaysia and Sabah State, Sarawak State does not issue licenses to IPPs. Instead, electric power generation is handled by two IPPs wholly owned by SESCO and two IPPs from the Sarawak Enterprise Corp. Bhd (SECB) group.

To stabilise the supply of energy, the government tries to balance the utilisation of coal and LNG

and to promote hydroelectric power generation. In Peninsular Malaysia in recent years, there have been periods when TNB and IPPs were unable to receive sufficient amounts of natural gas from natural gas supplier Petronas. In such a case, TNB adapts by shifting from natural gas to oil products or by increasing coal use, although TNB shoulders as well the fuel procurement cost. In addition, the government is trying to slowly bring the natural gas price, which is kept low by subsidies, closer to the market price; this, thus, increases the electricity rates.

b) Electric power market structure

Figure 2-4 shows the electric power industry structure in Malaysia. Tenaga Nasional Bhd, Sabah Electricity Sdn. Bhd., and SESCO engage as vertically integrated business operators in the regions of Peninsular Malaysia, Sabah State and Sarawak State, respectively. The other players are the many IPPs licensed by the Energy Commission of Malaysia.

In the power generation sector, the government introduced the IPP system to inject private investments as a response to the rapid increase in power demand. The first PPA with an IPP was concluded in 1993.

Plans to unbundle vertically integrated power business operators and completely liberalise the power market were suspend in 2001, following the impact of certain factors such as the California electricity crisis in 2000.[6]

In the distribution sector, the number of distribution companies other than the large companies – TNB, SESB, and SESCO – rose from 42 in 2006 to 138 in 2010 (most recent available data). They receive electricity form TNB in the case of the Malay peninsula and resell it to local demand centres such as industrial complexes.

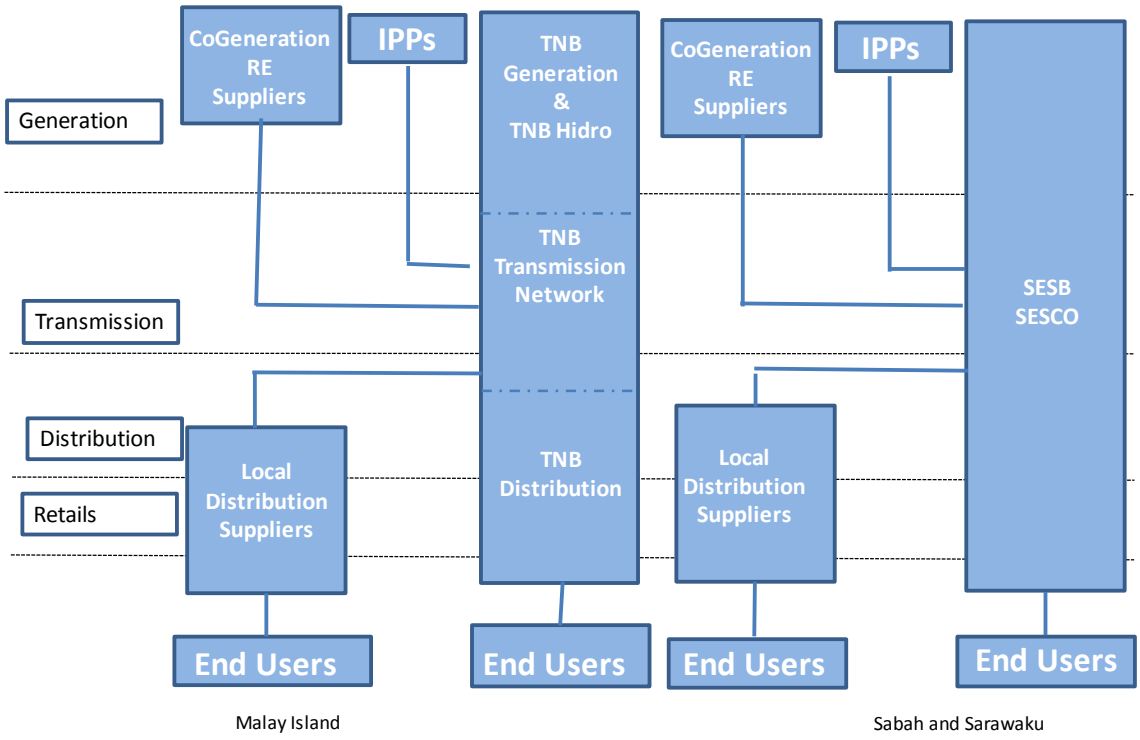
c) Government's involvement in the power industry

The situation in Malaysia's power sector is similar to that in Indonesia, although the former's government has a larger capacity than the Philippines to be involved at each stage of the power supply delivery. The generation sector is the only sector that has been

[6] Japan Electric Power Information Center, Inc. (2011) 'The Electric Power Industries in the World 2011, Vol 1, Supplement Version 2'

liberalised (i.e. IPPs), although governmental control can be in terms of specifying the type of plant during the power procurement process of IPPs through public tender.

Figure 2-5. Electric Power Market Structure in Malaysia



IPP = Independent Power Producers, SESCO = Syarikat SESCO Bhd, TNB = Tenaga Nasional Bhd, SESB = Sabah Electricity Sdn. Bhd.

Source: Energy Commission, 'Energy Commission Profile Booklet'.

Table 2-6. Government's Involvement in the Power Industry (Malaysia)

Fuel supply	• A state-run enterprise, Petronas, takes charge of fuel supply for generation. There is room for the government to help reduce costs through fee regulations for fuel suppliers. Oil and natural gas through pipelines are regulated; LNG and coal are bought at market prices.
Generation	• TNB in Peninsular Malaysia, SEBC in the Sabah State, and SESCO in the Sarawak State are ran by the national or state government; the government has a huge potential to intervene. • Selection of IPPs is conducted by public tender. Here, the government

	can be involved directly in specifying the development year and development amount of power generation capacity by fuel type. On the other hand, it can only indirectly intervene in cost reductions through the public tender process.
Wholesale	• Electric power generated by IPPs is purchased by TNB/SEBC/SESCO based on long-term PPAs. Competitive wholesale markets do not exist.
Transmission	• This is a regulated sector; the government's involvement is in the electricity rates review.
Distribution	• This is a regulated sector; the government's involvement is in the electricity rates review process.
Retail	• This is a regulated sector; the government's involvement is in the electricity rates review process.

Source: Author.

2.1.4 Thailand

a) Electric power policies

Thailand's Ministry of Energy is in charge of the energy sector, including price regulation of energy resources, fair trading in the energy industry, and promotion of alternative energy. The ministry has the Energy Policy and Planning Office and the Department of Alternative Energy Development and Efficiency under its structure. The state-run EGAT, the Metropolitan Electricity Authority (MEA), and the Provincial Electricity Authority (PEA) engage in the provision of power under the guidance of the Ministry of Energy.

Thailand has radically reformed the power industry structure since the 1980s. Affected by the Asian Financial Crisis, the government was forced to receive the International Monetary Fund's support and drew up the Master Plan for State Sector Reform. The Master Plan included establishing a power pool market and complete liberalisation that centred on the division and privatisation of EGAT, although this plan was called off due to concerns over foreign capital ownership for EGAT and other factors.

(b) Electric power market structure

In 1992, the government of Thailand encouraged participation of private enterprises such as IPPs and Small Power Producers into the power generation sector to promote competition. Until then, EGAT monopolised the power generation and transmission sectors; and MEA and PEA, the power distribution sector. However, EGAT had difficulties developing enough power generation capacities to keep up with the rapid increase in power demand. Its investment burden in building power plants grew, which led the government to introduce private funds.

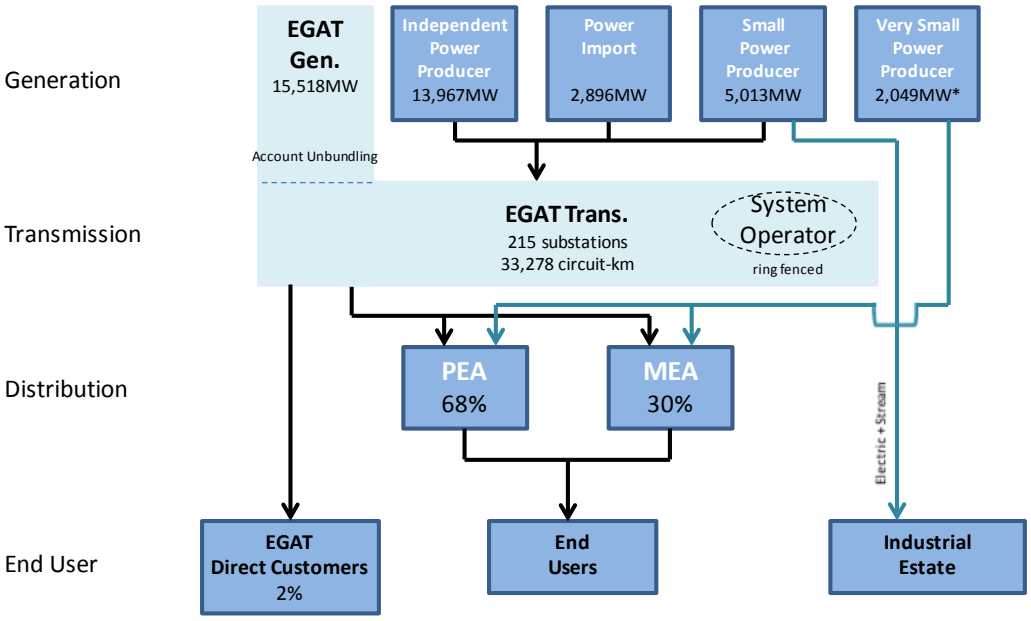
The clamour to privatise was a factor that paved the way for private funds to flow into the power generation sector. Thus, IPPs and Small Power Producers (i.e. those with power sale capacity of 90 MW or less) started to enter the scene.

In 2006, Very Small Power Producers (i.e. those with capacity of less than 10 MW) were permitted to sell power to MEA and PEA. Today, EGAT procures electricity from IPPs, Small Power Producers, and neighboring countries (Lao PDR and Malaysia) and sell it wholesale to the distributors (PEA and MEA), as well as direct sales to large consumers. It also owns and operates transmission systems.

(c) Governmental involvement in power industry

The state of Thailand's power industry is similar to that of Indonesia and Malaysia. Compared to the Philippines, however, Thailand has more capacity to get involved at each stage of the power supply delivery. It has liberalised only its generation sector, although there remains room for governmental intervention via IPP's public tenders, wherein the former can specify the fuel type.

Figure 2-6. Electric Power Market Structure in Thailand



Remark: As of Aug 2015 *ERC Data
(ERC: Energy Regulation Commission) (MEA: Metropolitan Electricity Authority) (PEA: Provincial Electricity Authority)

EGAT = Electricity Generating Authority of Thailand; MEA = Metropolitan Electricity Authority; PEA = Provincial Electricity Authority.

Source: Electricity Generating Authority of Thailand, as of August 2015.

Table 2-7. Government's Involvement in the Power Industry (Thailand)

Fuel supply	•	State-run PTT takes charge of supplying fuel for power generation. There is room for the government to be involved in cost reduction through fee regulations for fuel suppliers.
Generation	•	For power development directly conducted by EGAT, the government has a huge opportunity to be involved.
	•	Selection of IPP is conducted via public tenders and EGAT's decision. Therefore, the government can directly be involved in fuel selection. When it comes to cost reduction, the government can only indirectly intervene through public tendering.
Wholesale	•	Electric power generated by IPPs is purchased by EGAT based on long-

		term PPAs. Competitive wholesale markets do not exist.
Transmission	•	This is a regulated sector; the government's involvement is in the rates review process.
Distribution	•	This is a regulated sector; the government's involvement is in the rates review process.
Retail	•	This is a regulated sector; the government's involvement is in the rates review process.

Source: Author's summary.

2.2 The Power Price in the Philippines

The power prices in the Philippines differ by demand sector, year, and region.[7] In terms of demand, its industrial sector enjoys lower prices compare to the residential sector, as is the case for many other countries. This is mostly because of the difference in T&D costs. In general, industrial consumers connect to high voltage lines. Thus, the low voltage distribution line cost is not factored in their electricity bill.

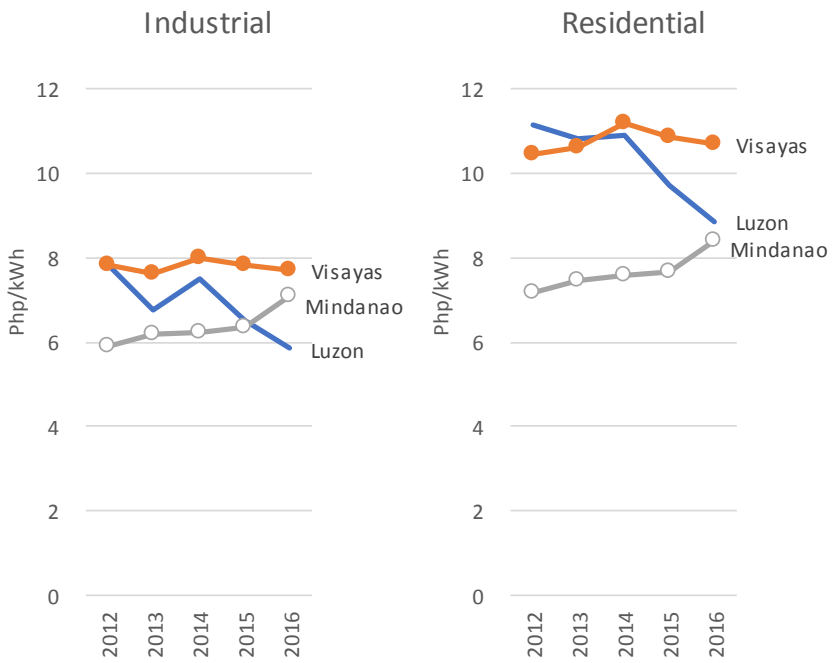
The Luzon grid has experienced a remarkable reduction in power price since 2012, eventually becoming the country's lowest-price power supplier for industrial consumers in 2016. Visayas, meanwhile, has the highest price amongst the regions, while Mindanao has raised the price for both industrial and residential consumers.

The sharp decline in the power price at the Luzon grid can be explained by the reduction in the power generation cost during the period. Since the fuel cost of thermal power generation is pass on to consumers, the steep drop in crude oil price after mid-2014 is a possible reason.

Figure 2-8 below shows how distribution companies apply different strategies to power generation pricing. In the Visayas and Mindanao, the same power generation price is charged to both industrial and residential consumers. On the other hand, the company in Luzon charges less to industrial consumers.

[7] In section 2.2, Luzon, Visayas, and Mindanao are represented by Manila Electric Company (Meralco), Visayan Electric company (VECO), and Davao Light and Power, respectively.

Figure 2-7. Comparison in Power Prices by Region



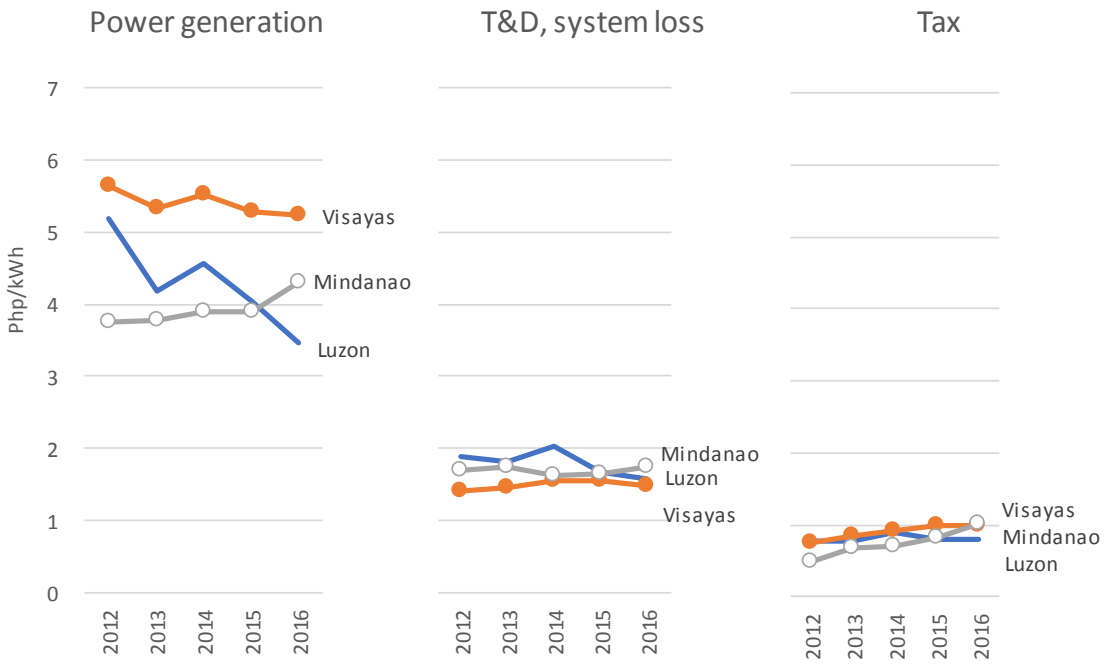
Note: Luzon, Visayas, and Mindanao are represented by Manila Electric Company, Visayan Electric company, and Davao Light and Power, respectively.

Source: Data provided by Department of Energy, government of the Philippines.

Figures 2-8 and 2-9 show that the sums of the transmission, distribution, and system loss charges have wider deviation in the residential prices than in industrial prices.

Taxes tend to increase in every demand sector and region.

Figure 2-8. Comparison of Power Price by Component and by Region (Industry)



T&D = transmission and distribution.

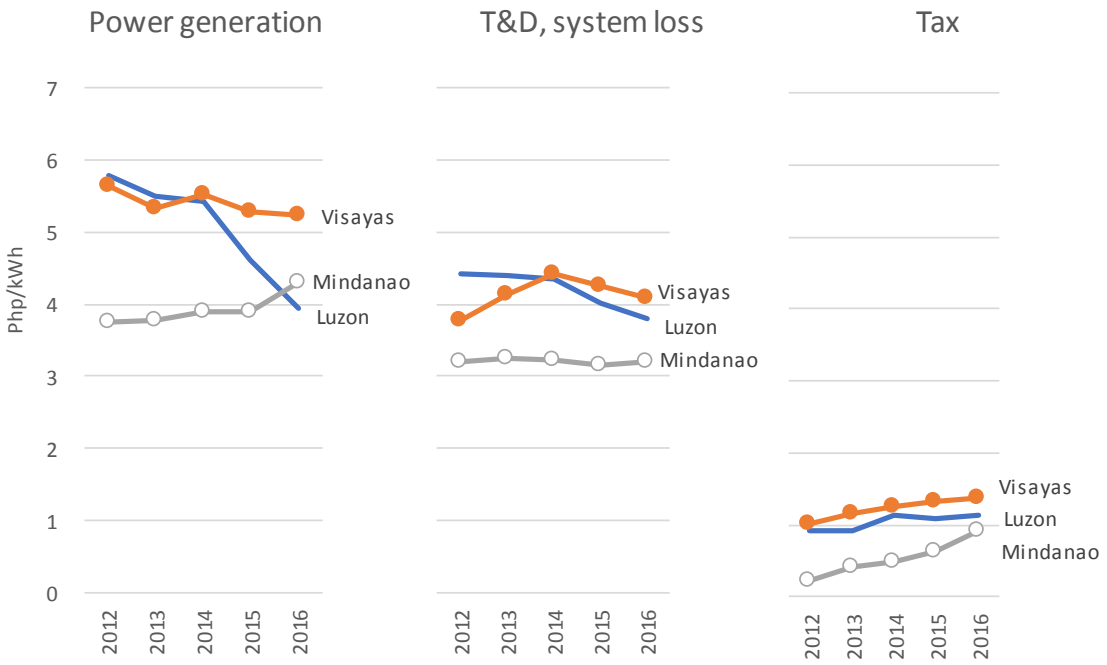
Note: Luzon, Visayas, and Mindanao are represented by Manila Electric Company, Visayan Electric company, and Davao Light and Power, respectively.

Source: Data provided by Department of Energy, government of the Philippines.

Based on the most recent (April 2018) numbers, the Visayan Electric Company (VECO) has the highest average generation charge at ₱5.9036/kWh. On the other hand, Meralco and Davao Light and Power have an average generation charge of ₱5.3612/kWh and ₱5.1669/kWh, respectively.

A further look at the generation charges shows that the power procurement portfolio differs by distribution company. While Meralco procures electricity with relatively low-priced contracts of around ₱5.0/kWh, it also has an extremely high-priced contract at ₱20.2/kWh. The share of this high-priced contract in Meralco's total level of power supply procurement (kWh) is as small as 1.8%, but accounts for 7.0% of the procurement amount in monetary terms. If this high-priced contract can be switched over to an average price contract (₱5.3612/kWh), the average generation charge will be reduced to ₱5.09/kWh (-5%).

Figure 2-9. Comparison of Power Price by Component and by Region (Residential)



T&D = transmission and distribution.

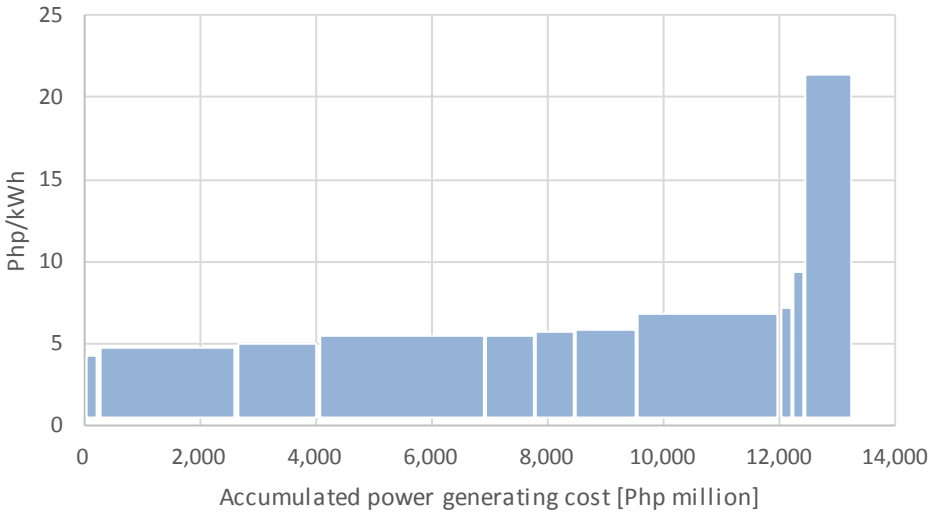
Luzon, Visayas, and Mindanao are represented by Meralco, Visayan Electric company, and Davao Light and Power, respectively.

Source: Data provided by Department of Energy, government of the Philippines.

In certain cases, procuring even an expensive electricity supply may be called for during tight supply-demand balance periods to avoid supply shortage. Although a careful assessment is required, some of the reasons to keep the high-cost power plant in the market are:

- Reserve margin of power generation is too small
- Competition in the wholesale market is not effective enough

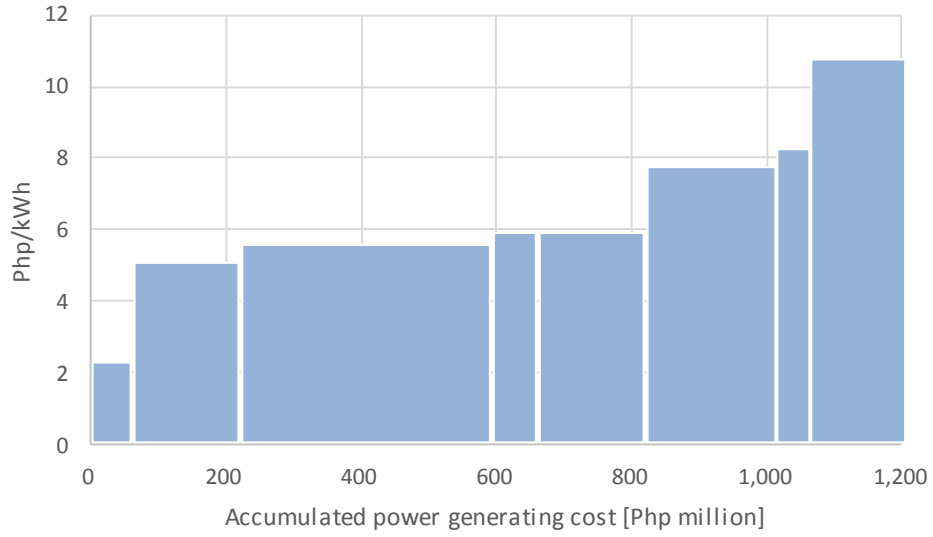
Figure 2-10. Power Purchase Cost Curve of Meralco (April 2018)



Source: Meralco's website.

Although VECO's power procurement portfolio has no extremely high-priced contracts – about a half of its contracts have prices of ₱6/kWh or higher – its average generation charge is relatively high. These high costs can be partly explained by the capital tie-up between the power generation company and VECO, which defeats any incentives for market competition and thereby, cost reduction.

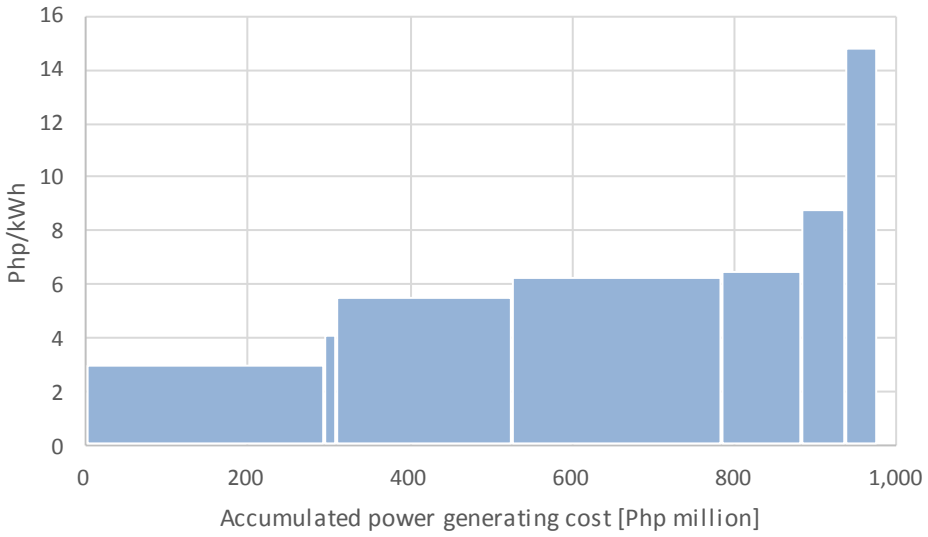
Figure 2-11. Power Purchase Cost Curve of Visayan Electric Company (April 2018)



Source: Visayan Electric Company's website.

About half of the power procured by Davao Light and Power consists of low-priced (₱3.08/kWh) contracts from NPC, thus partially offsetting the high-priced procurement contracts. As a result, Davao Light and Power realises the cheapest average generation charge amongst the three distribution companies.

Figure 2-12. Power Purchase Cost Curve of Davao Light and Power (April 2018)

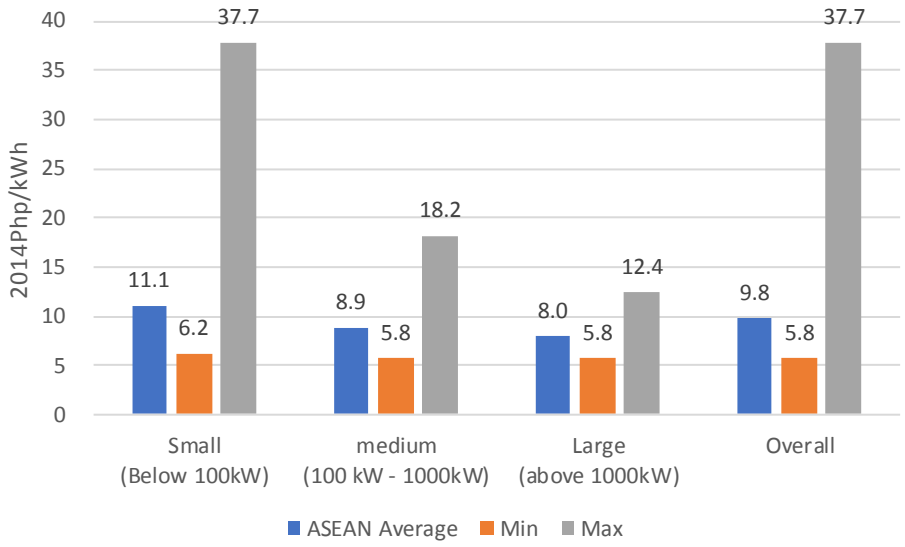


Source: Davao Light and Power's website.

Meanwhile, the study also looks at the cost of renewable energy. Figure 2-13 indicates the average costs in the ASEAN region, and while these may not necessarily be applicable to the Philippines' case, important lessons can be inferred.

The overall levelised cost of electricity from solar photovoltaic (PV) is calculated at ₱9.8/kWh, which is cheaper than the high-range power purchase portfolio of Meralco, VECO, and Davao Light and Power. The cost of solar PV varies by projects. For example, in a large solar park that has a capacity of more than 1 MW, the cost of solar PV is at around ₱5.8/kWh to ₱12.4/kWh – almost the same cost incurred by some existing thermal power plants.

Figure 2-13. Levelised Cost of Electricity for Solar PV in ASEAN Countries in 2014



Source: ASEAN Center for Energy, November 2016.

2.3 Power Rate Setting in the Philippines

The power rate is regulated by the ERC in the Philippines. The commission employs a few different types of methodologies for different power rate.

Table 2-8. Methodology of Power Rate Regulation in the Philippines

Transmission charge		Performance based regulation
Distribution charge	Private distribution company	Performance based regulation
	Electric cooperative	Benchmarking methodology Cash flow methodology

Source: Energy Regulatory Commission, 8 September 2018.

Performance-based regulation is a combination of the revenue cap regulation and incentive regulation to improve the performance of a utility company.

In determining the revenue cap, the annual revenue requirement for the next four years' regulatory period is first estimated. Annual revenue is calculated by multiplying rate base by the

WACC. Rate base includes operating expenses, depreciation of asset, and taxes. When a company betters the efficiency of its operation, profit improves. In this way, the revenue cap regulation helps reduce the utility company's cost.

However, in the revenue cap regulation, there is the concern that any improvement in a company's efficiency will be attained at a cost to its service quality. This problem is mitigated by another part of the performance-based regulation. The incentive regulation sets certain criteria for service quality: e.g. system average interruption frequency index; and customer average interruption duration index. When a company's service quality performs better than the threshold, the company will receive a reward (i.e. more revenue). When the performance falls below the threshold, the company will be penalised (i.e. with less revenue). Thereby, a company is incentivised to sustain its quality service.

Benchmarking methodology (or yardstick regulation) is often used to regulate the utility companies that has business entities with diverse profiles. Electric cooperatives in the Philippines, for instance, consist of around 100 small entities with 10,000 customers to large ones with 150,000 customers. These are divided into seven groups by size (i.e. based on sales and number of customers). A different electricity rate will be applied to each group: higher rates for smaller electric cooperatives and lower rate for the larger entities. The rate is adjusted by an efficiency factor and performance incentive during the regulatory period. The efficiency factor reduces the rate to improve operational efficiency. The performance factor increases the rate to improve the quality of services.

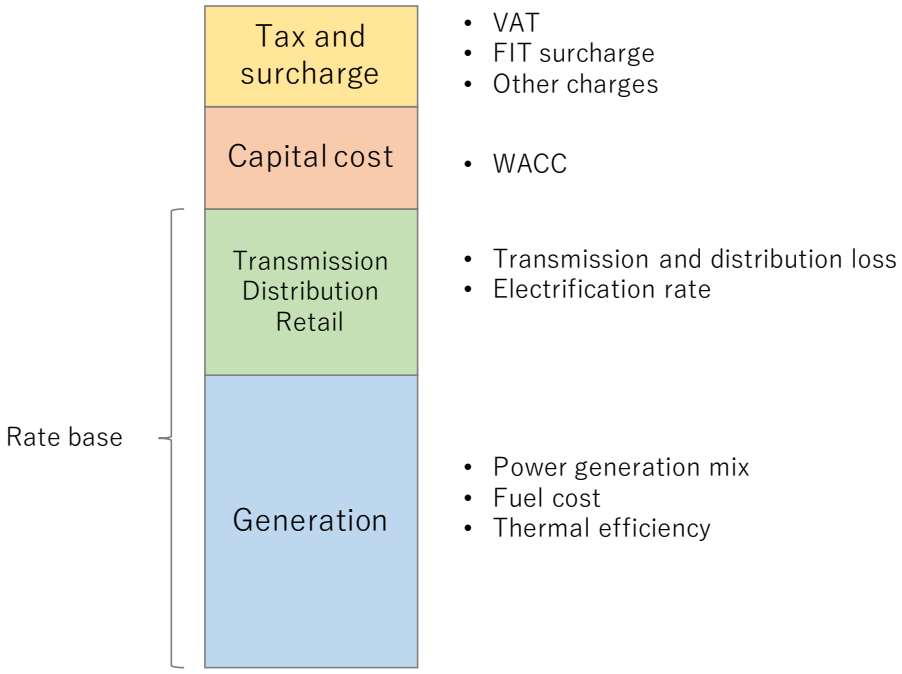
Chapter 3

Comparing Electricity Cost Structures

3.1 Cost Structure and Analysis Items

Figure 3-1 shows the components of the power supply cost. These components are divided into the rate base (i.e. generation, transmission, and distribution and retail), capital cost, and taxes. Factors that affect the magnitude of components are extracted. Finally, results of the analysis for each of this study's countries are compared.

Figure 3-1. Cost Structure of Power Prices



Source: Author.

3.1.1 Generation Cost

In general, fuel cost takes up a large portion of the generation cost. Therefore, reducing fuel cost is likely to bring down the generation cost. This subsection thus presents a comparative analysis on the gross thermal efficiency, which represents the efficiency in fuel use; and the power

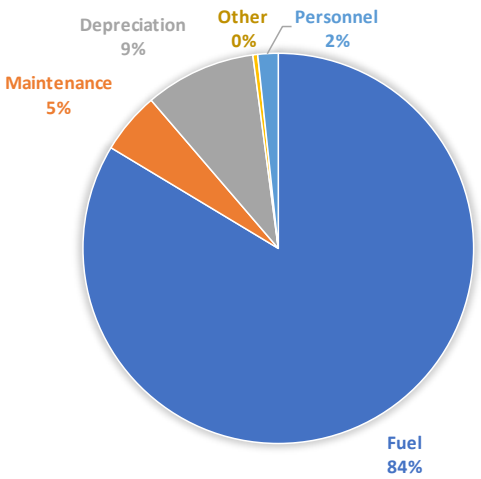
generation mix, which represents a ratio of low- and high-cost fuel used, in addition to the cost of fuel for power generation.

Fuel costs vary depending on whether the fuel is domestically produced or imported, and on each country's fuel policy, including that on pricing. For example, domestically produced coal and natural gas are often cheaper than imported ones. In some cases, the actual fuel prices at which power generation companies procure may be set lower than the market price by government subsidies. For this study's purpose, the actual fuel prices at which power companies procure are compared to the extent possible.

When the gross thermal efficiency is high, the amount of fuel that has to be spent to obtain the same power output will be smaller – hence attaining a lower generation cost. In countries where the gross thermal efficiency is relatively low, the generation cost can be reduced by repairing existing power plants, replacing them with high-performing plants, or improving the operation of power plants to enhance efficiency.

Controlling the power generation mix will also lower the generation cost. Generation costs are lessened when cheaper power sources are used for generation. In general, the most promising sources of power in reducing generation cost are those from hydroelectric and coal-fired thermal plants. In contrast, the generation cost is likely to be high when one relies on small diesel generators or imported natural gas.

Figure 3-2. Generation Cost Structure of PLN in Indonesia (Reference)



Source: PLN, 8 January 2018.

3.1.2 Transmission and Distribution/Retail Cost

For the transmission and distribution sectors, analysis will focus on the T&D loss, demand density, and electrification rates.

If generated electricity can be sent without a loss, cost per electric energy (kWh) can be reduced. Transmission and distribution loss varies depending on the geographical conditions of the country. Simple comparisons can gives insights on the possibility of cutting cost in the T&D sectors.

Demand density (length of distribution power lines per kWh of electric energy sold) represents the efficiency of the power distribution business. If this value is small, it means power is sold by shorter distribution lines – i.e. electricity is sold efficiently at less cost.

Electrification rate is used to measure the degree of need for T&D investment in the future. When the electrification rate is low, a country's investment requirement for T&D in the future will be higher than that of most countries, which indicates that reducing the cost in the T&D sectors would remain relatively difficult.

3.1.3 Capital Cost

For the capital cost, the weighted average cost of capital (WACC) across countries will be compared.

Weighted average cost of capital is a weighted average of loaning cost (interest rate, %) and stock procurement cost (expected rate of return, %) operated with debt-equity ratio. It represents how much cost (%) is needed for financing. In general, the sum of 'business operation cost (rate base)' and 'the amount derived by multiplying rate base by WACC' is regarded as the total cost of a power company. Therefore, WACC is an important factor which affects the electricity cost. Because of this formula, a smaller WACC reduces profits for the business operator; hence, lowers the power supply cost.

3.1.4 Tax

Taxes heavily rely on the policies of the country, and it is inappropriate to simply compare them in numbers. They also have a significant influence on electricity cost.

All the countries in this study impose value-added tax (VAT). Some levy other charges such as the universal services charge and renewable energy charge.

3.2 Data Source

The following data sources are used to analyse electricity costs in different countries.

3.2.1 The Philippines

a) Generation cost

i.	Power generation mix	IEA, World Energy Balance 2017
ii	Fuel cost	Meralco Annual Report 2014, 2016 https://company.meralco.com.ph/investor-relations/annual-reports
iii.	Gross thermal efficiency	IEA, World Energy Balance 2017

b) Transmission and distribution cost

i.	Transmission and distribution loss	PDOE, Power Situation https://www.doe.gov.ph/electric-power/2016-philippine-power-situation-report
ii.	Electrification rate	IEA, Energy Access Database

c) Capital cost

i.	WACC	Meralco and Philippines University Research data, Diliman 2014 https://www.youtube.com/watch?v=7ev1TR4SUg0

d) Tax, etc.

i.	VAT	The Philippine government's website https://www.gov.ph/philippine-government
ii.	Other taxes	Meralco Annual Report 2016 https://company.meralco.com.ph/investor-relations/annual-reports

3.2.2 Indonesia

a) Generation cost

i.	Power generation mix	IEA, World Energy Balance 2017
ii.	Fuel cost	PLN Annual Report 2016 https://ja.scribd.com/document/349077515/PLN-Sustainability-Report-2016
iii.	Gross thermal efficiency	IEA, World Energy Balance 2017

b) Transmission and distribution cost

i.	Transmission and distribution loss	PLN Annual Report 2014, 2016 http://www.academia.edu/33681752/PLN_Annual_Report
ii.	Electrification rate	IEA, Energy Access Database

c) Capital cost

i.	WACC	METI, Action plan for the Philippines' power sector, March 2017

d) Tax, etc.

i.	VAT	Indonesian government website http://www.indonesia.cz/the-government-of-the-republic-of-indonesia/

3.2.3 Malaysia

a) Generation cost

i.	Power generation mix	IEA, World Energy Balance 2017
ii.	Fuel cost	Energy Commission 'Peninsular Malaysia Electricity Supply Industry Outlook 2016'
iii.	Gross thermal efficiency	IEA, World Energy Balance 2017

b) Transmission and distribution cost

i.	Transmission and distribution loss	TNB Annual Report 2016
ii.	Electrification rate	IEA, Energy Access Database

c) Capital cost

i.	WACC	Energy Commission, 'Review on Electricity Tariff in Peninsular Malaysia under the Incentive-based Regulation Mechanism' (FY 2014-FY 2017)

d) Tax, etc.

i.	VAT	Ministry of Finance Malaysia website http://www.treasury.gov.my/?lang=en

3.2.4 Thailand

a) Generation cost

i.	Power generation mix	IEA, World Energy Balance 2017
ii.	Fuel cost	MEA Annual Report 2016 http://www.mea.or.th/en/e-magazine/detail/82/86/294
iii.	Gross thermal efficiency	IEA, World Energy Balance 2017

b) Transmission and distribution cost

i.	Transmission and distribution loss	EGAT Annual Report 2016 https://www.egat.co.th/en/information/annual-report MEA Annual Report 2016 http://www.mea.or.th/en/e-magazine/detail/82/86/294
ii.	Electrification rate	IEA, Energy Access Database

c) Capital cost

i.	WACC	Darryl S. Jarvis (2011). EGAT, Infrastructure Regulation

d) Tax, etc.

i.	VAT	Thailand government website http://www.thaigov.go.th/

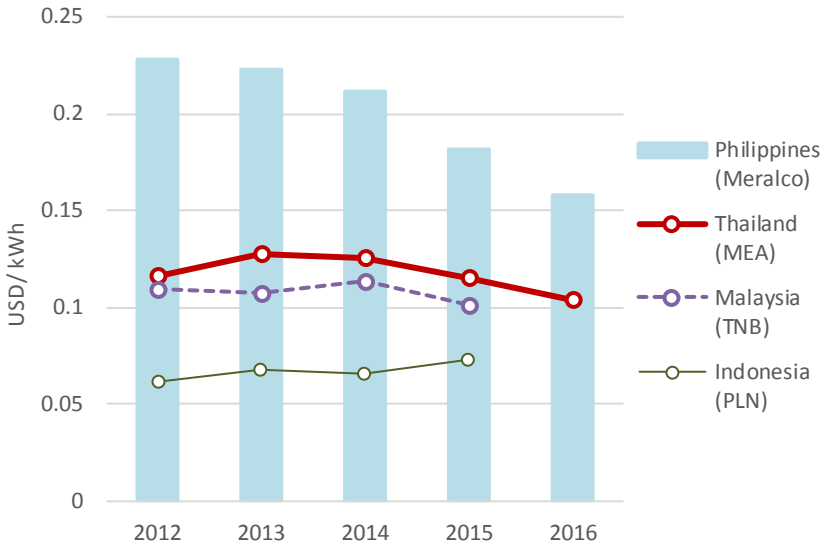
3.3 Comparison of Overall Structure

The Philippines responded to the power shortage since the latter half of 1980s and the financial difficulty facing the NPC by permitting IPPs to enter the power generation sector – a first amongst the countries in the Asian region. However, as the national government hurried to secure its power supply capacity and allowed high off-take prices from IPP as well as implied take or pay condition to NPC, the power supply cost increased, and the financial condition of NPC deteriorated.

Therefore, the government instituted the EPIRA Act (Republic Act No. 9136), which aimed to sell the assets of NPC so as to repay debts and introduce the principle of competition in the electricity market.

In spite of such efforts to lower electricity rates, the electricity rate in the Philippines remains high.[8] It is still about 1.5-fold than that of Thailand.

Figure 3-3. Comparison of Average Power Price

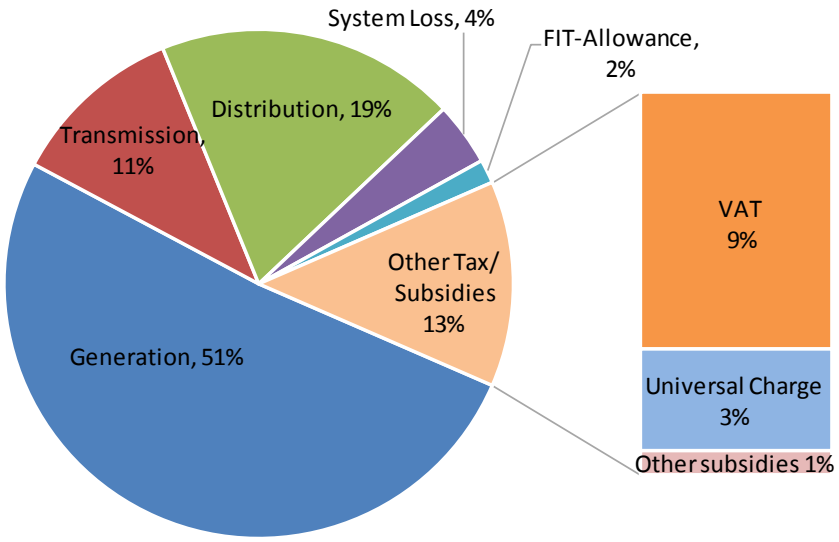


Source: Meralco Annual Report, PLN Annual Report, MEA Annual Report, Energy Commission, 'Electricity Supply Industry in Malaysia'

[8] It should be noted that electricity rates in Indonesia and Malaysia include subsidies.

The cost structure of the country's power distribution/retail companies shows that the power generation cost comprises the largest proportion at 51%. If the nation were to improve its standard of living and strengthen its industrial competitiveness, further cost reduction particularly in the power generation sector need to happen.

Figure 3-4. Structure of Annual Meralco Rate in 2016



Source: Meralco Annual Report 2016.

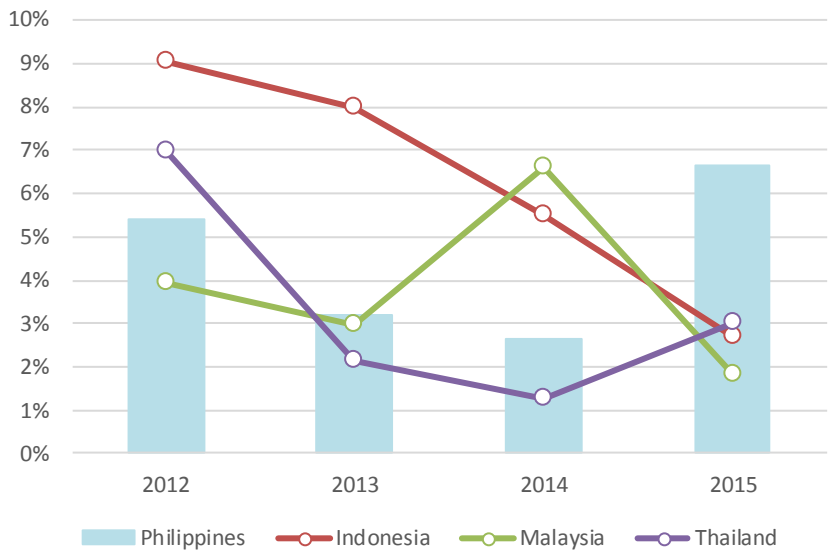
This section analyses the power supply cost structure in the Philippines in comparison with that of Indonesia, Malaysia, and Thailand. This comparative analysis aims to grasp the characteristics of the power supply cost in the Philippines and explores how to reduce costs.

3.4 Power Generation Cost

3.4.1 Increase in power demand

From 2012 to 2016, power consumption in the Philippines, Thailand, Malaysia, and Indonesia had increased. In 2015, in particular, the Philippines garnered the highest growth rate amongst these countries.

Figure 3-5. Year-on-Year Change in Power Demand

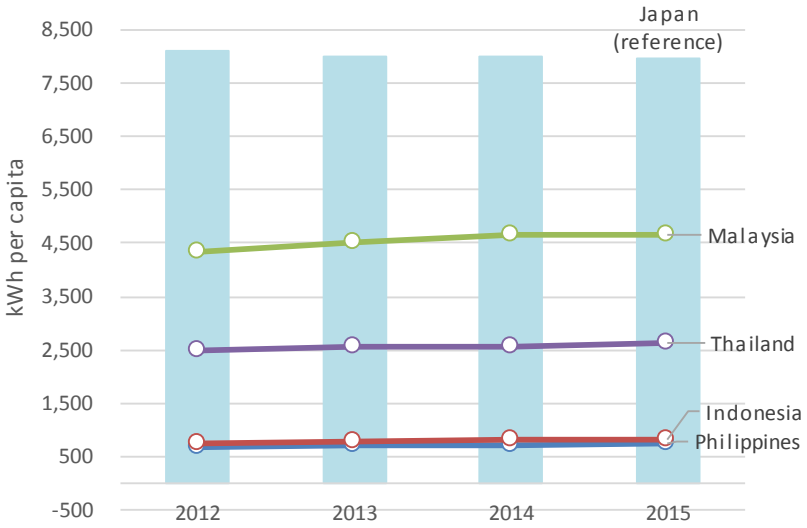


Source: IEA, World Energy Balance, 2017.

Per-capita power consumption rates in the Philippines as well as in Indonesia, however, are smaller than in Malaysia and Thailand (Figure 3-6). Although not the sole reason, the lower electrification rates in the Philippines and Indonesia partly explain this difference. In Thailand, the national electrification rate has reached 100%. In Malaysia, the rate is almost 100%. In contrast, while the electrification rate has reached almost 100% in the metropolitan areas of the Philippines and Indonesia, their national averages (which include their remote islands) are at a low 90%.

It is highly likely that electricity demand will increase steadily in the Philippines in the future. For example, the *IEEJ Outlook 2018* (Suehiro et al., 2017) forecasts that the average growth in electricity demand in the Philippines from 2015 to 2030 will be 5.7%. This exceeds the forecasted increase in demand in Indonesia, Malaysia, and Thailand for the same period (5.5%, 3.5%, and 3.0%, respectively).

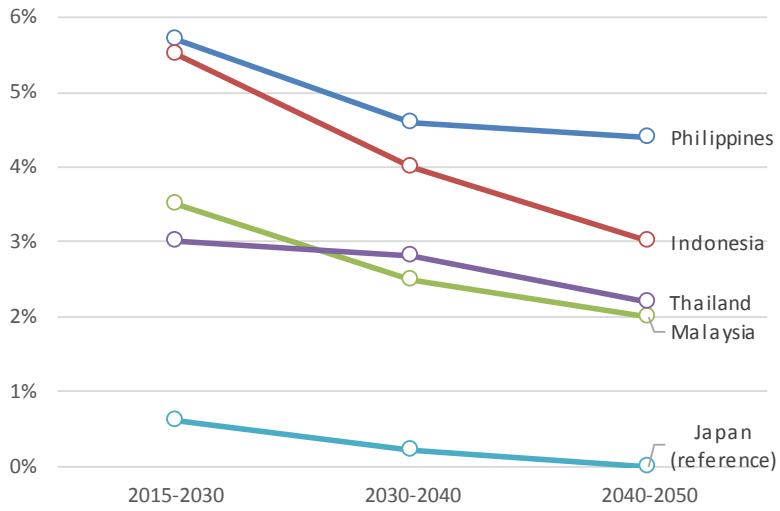
Figure 3-6. Comparison of Electricity Consumption Per Capita



Source: IEA, World Energy Balance (2017).

From a mid- to long-term perspective, the above forecasts indicate that a comparatively larger amount of investment will be required to increase the Philippines' power supply capacity and to expand or construct power transmission/distribution networks. From the viewpoint of power supply cost, the challenge to the country will come down to how it will control the cost through efficient investing.

Figure 3-7. Projected Electricity Consumption Growth Rate

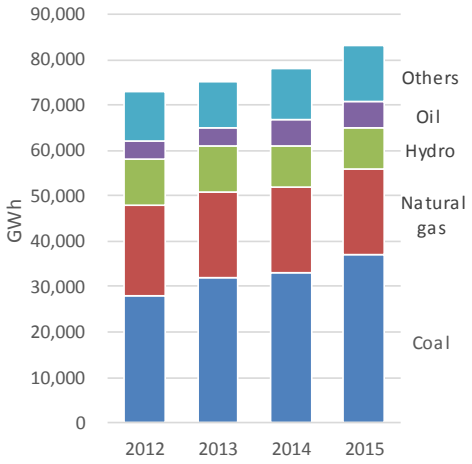


Source: IEEJ Outlook 2018 (2017).

3.4.2 Power Generation Mix

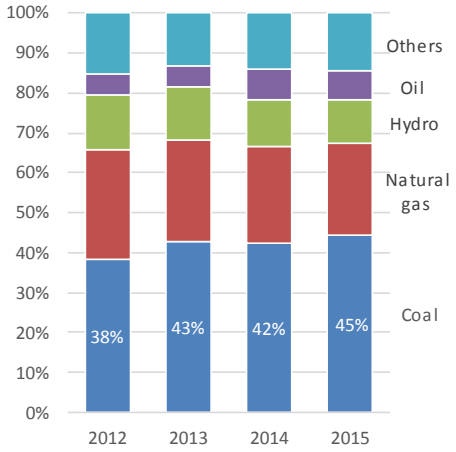
Among the fuel types used, low-priced coal accounts for the largest proportion, followed by natural gas, in the Philippines, Indonesia, and Malaysia. On the other hand, due to heavy opposition to coal (thermal) power, about 70% of Thailand's electricity is generated from natural gas.

Figure 3-8. Fuel Mix in the Philippines



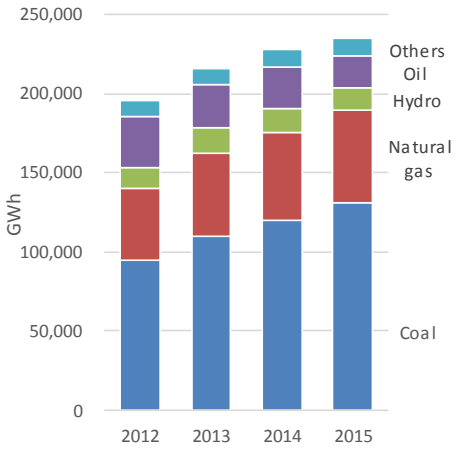
Source: IEA, World Energy Balance (2017).

Figure 3-9. Share of Fuel Types in the Philippines



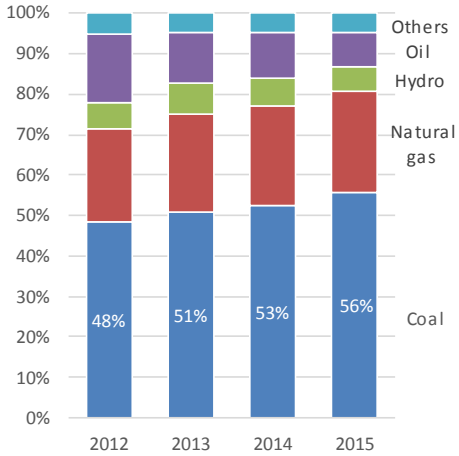
Source: IEA, World Energy Balance (2017).

Figure 3-10. Fuel Mix in Indonesia



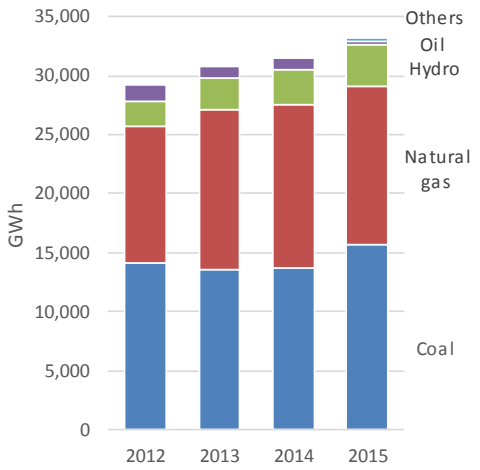
Source: IEA, World Energy Balance (2017).

Figure 3-11. Share of Fuel Types in Indonesia



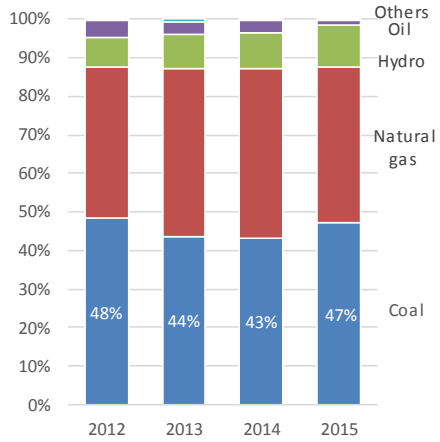
Source: IEA, World Energy Balance (2017).

Figure 3-12. Fuel Mix in Malaysia



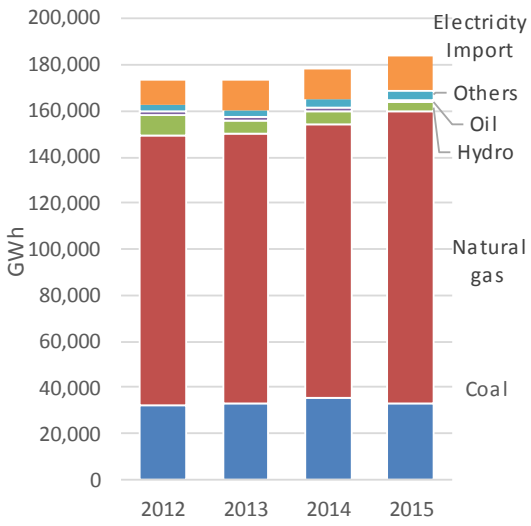
Source: IEA, World Energy Balance (2017).

Figure 3-13. Share of Fuel Types in Malaysia



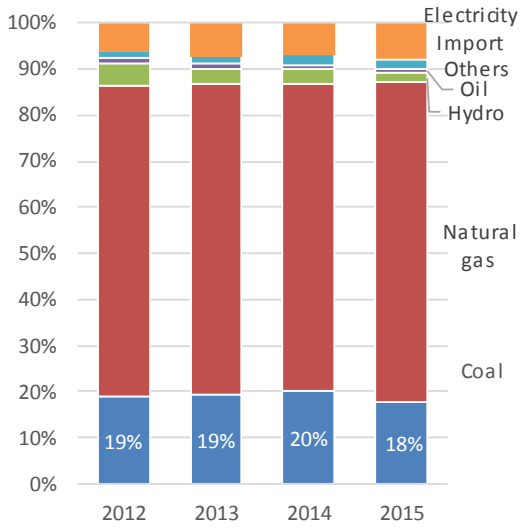
Source: IEA, World Energy Balance (2017).

Figure 3-14. Fuel Mix in Thailand



Source: IEA, World Energy Balance (2017).

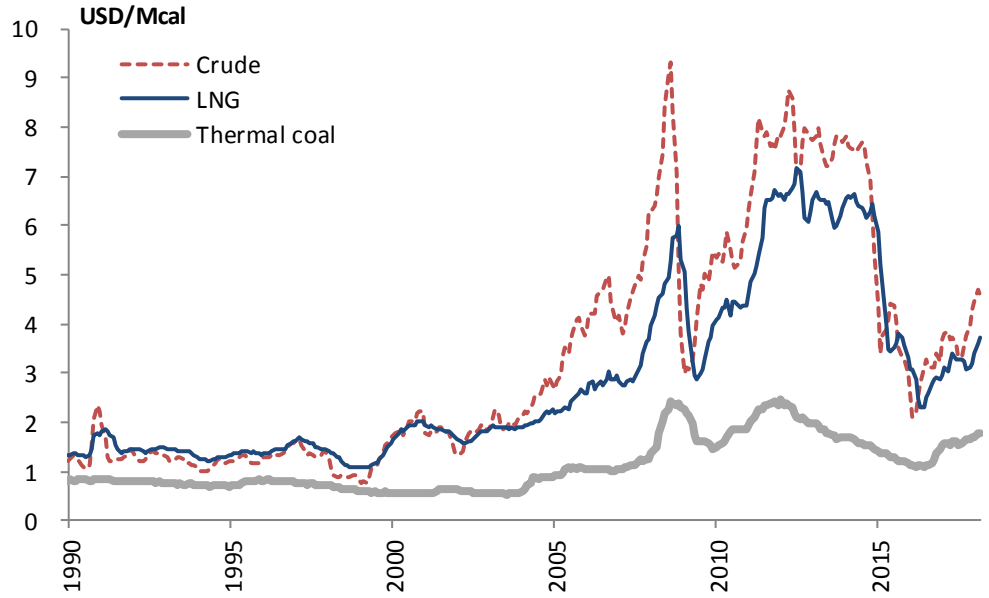
Figure 3-15. Share of Fuel Types in Thailand



Source: IEA, World Energy Balance (2017).

What are the differences in natural gas and coal prices in international markets? Taking the trend in Japan's import prices as an example, one notes that coal has consistently been priced lower than natural gas in the past. Since the price of liquefied natural gas (LNG) is often linked to the price of crude oil under current commercial practices, the gap in the prices of natural gas and coal widens whenever the crude oil price soars. While the capital investments in coal (thermal) power is larger than in gas thermal power, the power generation unit price is generally lower for thermal coal because of its lower fuel cost.

Figure 3-16. Japan's Fossil Fuel Import Price (Price per Unit Heat Content)



Mcal = Mega calorie.

Source: IEEJ, EDMC data bank.

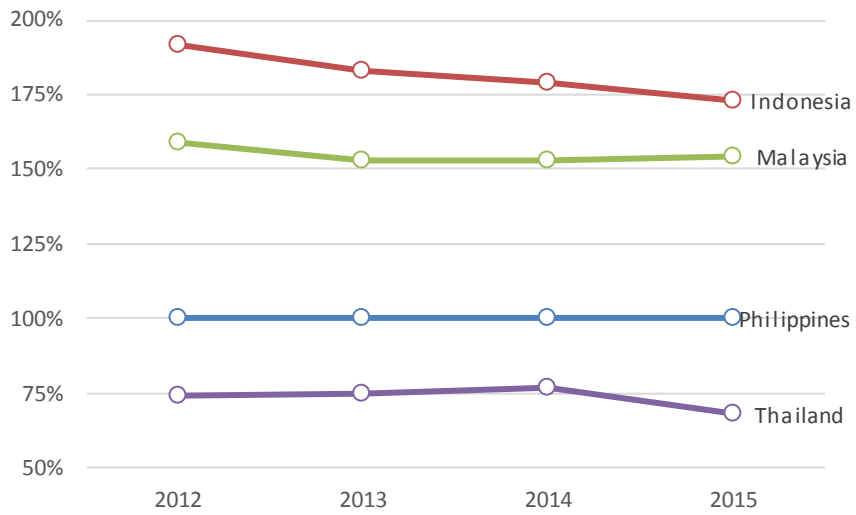
As shown in Figure 3-16, thermal coal is generally one of the lowest-cost power sources but is already used in the Philippines at a rate comparable with other countries. In 2015, the share of coal (thermal) power in the total power supply within each country is as follows: 45% in the Philippines, 56% in Indonesia, 47% in Malaysia, and 18% in Thailand. Should coal plants' operation increase and that of natural gas plants decrease, the power generation cost could drop. It has been noted, however, that excessive use of coal-fired power plants will place a burden on the environment.

3.4.3 Fuel Cost

As shown in the previous section, the share of natural gas and coal in the four ASEAN countries surveyed accounts for about 80% of the total power supply, and the prices of natural gas and coal have a considerable impact on the fuel cost. This section now analyses the trends in natural gas price and coal price across these four nations.

First, in terms of their source for natural gas, Indonesia, Malaysia, and the Philippines – where the self-sufficiency rate exceeds 100% – use domestically produced gas. On the other hand, Thailand's self-sufficiency rate for natural gas is about 70%. The remaining 30% relies on imports, mostly via pipelines from Myanmar.

Figure 3-17. Self-sufficiency on Natural gas



Source: IEA, *World Energy Balance* (2017).

The fall in natural gas prices in recent years had been experienced by all the countries in this study. While prices have improved in recent years, that of the Philippines is still at its highest level. As of 2015, the differences between the Philippines' price and that of Indonesia, Malaysia, and Thailand were US$1.1/MMBtu, US$3.9/MMBtu, and US$0.7/MMBtu, respectively. Compared with the 2015 gas price for power generation in the Philippines was US$9.06/MMBtu, prices in Indonesia, Malaysia, and Thailand were lower by 12%, 43%, and 8%, respectively.

Note that the largest price difference was between the Philippines and Malaysia's. The higher

gas price in the Philippines can be partly due to the large investment requirements and the high risk in developing the Malampaya deep water gas field, which includes 500 km of subsea pipelines. Meanwhile, the gas price for power generation in Malaysia is subsidised by its government.

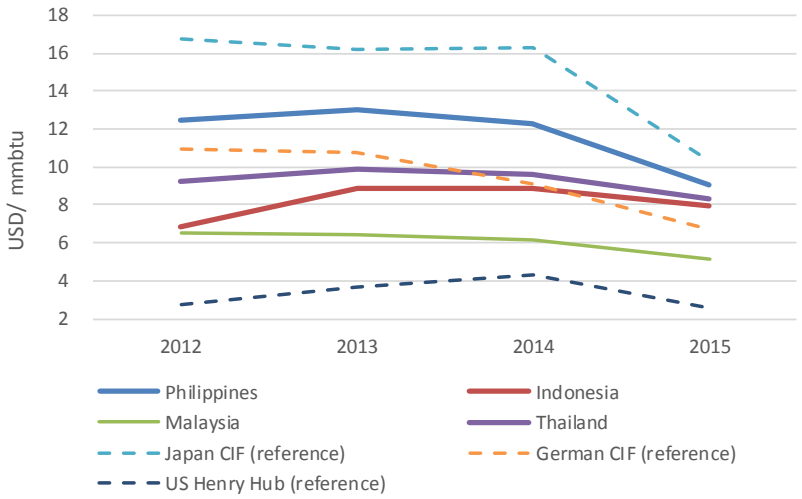
As its domestically produced natural gas resources tend to be running dry, the Philippines would have to rely on imported natural gas to secure its supply in the future. Should the Philippines import natural gas, it will inevitably use LNG.

Figure 3-18 below shows Japan's price for imported LNG as a reference case for the four other Asian countries. Note that its imported price has always been higher than the price of domestic natural gas in the Philippines. Although actual prices will depend on contracts, a nation that starts to use imported LNG will generally experience a rise in the price of natural gas for power generation. Therefore, any future dependence on LNG could possibly widen the difference between the Philippines' power generation cost and that of the three other countries.

Liquefied natural gas prices in international markets vary depending on various factors such as the change in demand-supply balance and the emergence of risk factors. Furthermore, any change in these prices can occur quickly and in a larger scale than that of domestically produced natural gas. Recently, for example, the spot price soared when China imported a huge amount of LNG during the winter peak season. The generation cost of gas thermal power stations in the Philippines will become vulnerable to such changes in international LNG prices in the future.

To reduce the procurement cost of natural gas, two measures can be considered. One is to make the most of domestically produced natural gas to the extent of economic rationality. The other one is to reduce price fluctuation risks by diversifying the LNG procurement portfolio. This LNG procurement portfolio should not only include the import partner countries for LNG but the period of procurement contracts and price formulas as well.

Figure 3-18. Comparison of Natural Gas Price for Power Generation



mmbtu = million British thermal unit

Source: Annual report of each company; BP, Statistical review of world energy (2017).

In terms of coal supply, imports account for more than half of the total supply in Malaysia, the Philippines, and Thailand. Meanwhile, Indonesia has a self-sufficiency rate as high as 600%.

Although the Philippines produces coal, a large portion is exported. As a result, the nation's actual self-sufficiency ratio for coal dropped to around 10%[9] compare to 30% of apparent self-sufficiency. In addition, it has been observed that the Philippines' dependence on imports has been growing significantly in recent years.

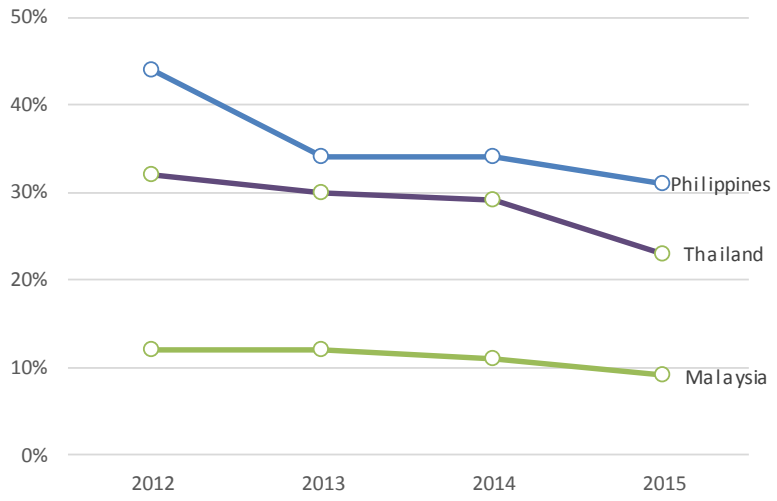
Coal prices dropped from 2012 to 2015. This may have been in response to the decline in the global price of thermal coal.

As of 2015, Indonesia, Malaysia and Thailand's coal prices for power generation were lower than the Philippines' price of US$68/ton by US$16/ton (23%), US$4/ton (6%), and US$11/ton (16%), respectively. Here, the price difference with Indonesia was the widest.

It is highly likely that the coal supply in the Philippines, where the actual self-sufficiency rate is no more than 10%, will continue to depend on imports in the future; thus, it will be influenced by price changes in the global market. The measures to mitigate such impact is the same as that suggested above for natural gas, including diversifying the coal procurement portfolio.

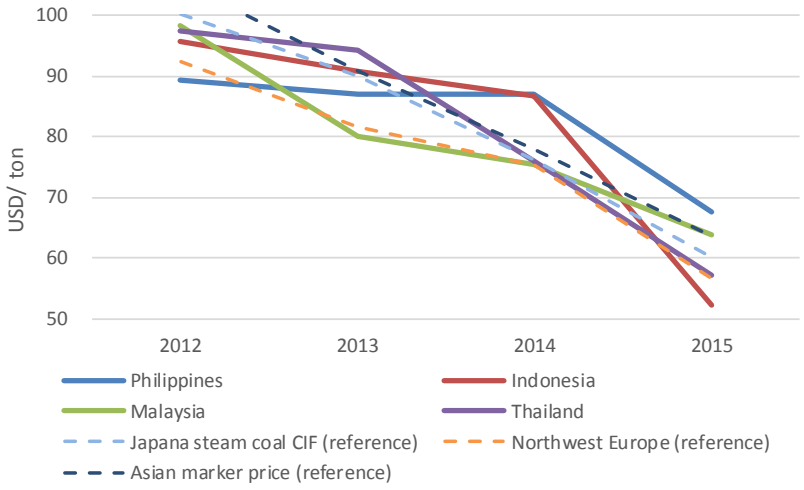
[9] Interview with the Department of Energy, Government of the Philippines.

Figure 3-19. Self-sufficiency in Coal



Source: IEA, World Energy Balance (2017)

Figure 3-20. Comparison of Coal Price for Power Generation

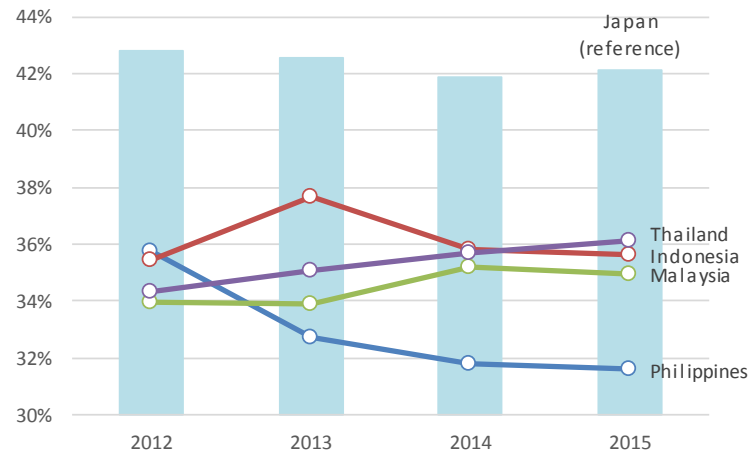


Source: Annual report of each company; BP Statistical Review of World Energy (2017).

3.4.4 Thermal Efficiency

The thermal efficiency (generating-end) of coal in Indonesia, Malaysia, and Thailand has either improved or remained around the same level. In the Philippines, however, the thermal efficiency of coal has gone down year after year. By 2015, the Philippines and the Indonesia have a difference of 4 percentage points in their thermal efficiency numbers.

Figure 3-21. Thermal Efficiency of Coal



Source: IEA, World Energy Balance, 2017.

Generating-end thermal efficiency is an important factor directly connected with the amount of fuel consumption, and thus, the power generation cost. If the generating-end thermal efficiency of coal in the Philippines had been 42% (i.e. not just 32% in 2015), a 10% reduction in coal consumption could have resulted in a US$235 million savings in Meralco's power generation cost.

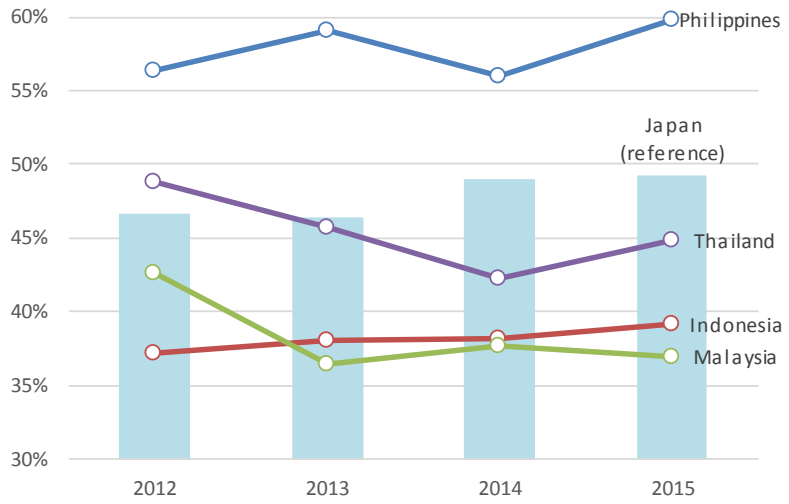
Table 3-1. Estimated Cost Reduction Effect of Thermal Efficiency Improvements

Electricity generated from coal (Meralco in 2015)	29,680 GWh
Assumed thermal efficiency improvement	10% points
Reduced fuel consumption	22,083 GWh
Heat content of coal	5,500 kcal/kg (23.0GJ/ton)
Saved amount of coal consumption	3.46 Mton
Average coal price in 2015	US$68/ton
Saved value of coal consumption	US$235 million

Source: Author.

In terms of the thermal efficiency of gas, on the other hand, it is the Philippines that had marked improvements amongst the four countries year after year. In 2015, the Philippines' score was 22.8 percentage points better than Malaysia's, which had the worst efficiency rating for gas power amongst the four nations analysed for this study.

Figure 3-22. Thermal Efficiency of Natural Gas



Source: IEA, World Energy Balance (2017).

In the Philippines, two factors could explain why the efficiency of gas (thermal) power is relatively high, while that of coal (thermal) power is relatively low. First, high-efficiency gas thermal power has been introduced to IPPs in the Philippines since 2000. Today, a greater part of its gas power generation capacity comes from high-efficiency plants.

Second, no sufficient measures seem to reverse the declining generating-end thermal efficiency of aging coal-fired power plants. If IPP operators aim to maximise their profits, their best strategy is to continue the operation of coal-fired power plants at a minimum cost. Unless there is some incentive or some promotion that aims to increase thermal efficiency, it will be difficult to hope for significant improvements to happen soon.

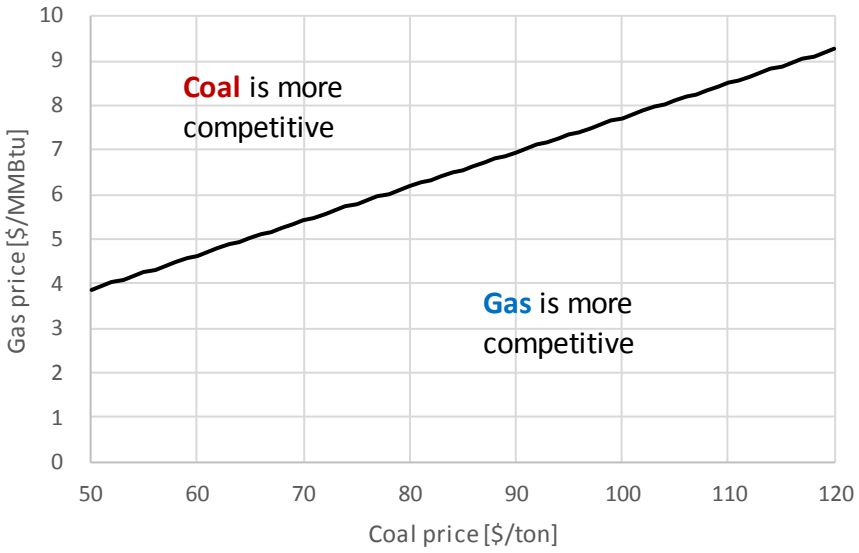
Table 3-2 compares the thermal efficiency-adjusted fuel costs of coal and gas. Coal has lower fuel cost but bears lower efficiency. Conversely, gas has higher fuel cost but offers higher efficiency. Therefore, it is possible for actual fuel cost to be reversed, depending on the difference in fuel cost and thermal efficiency.

Table 3-2. Thermal Efficiency-Adjusted Cost of Coal and Natural Gas

	Coal 2015	**Coal [Breakeven with Gas 2015]**	**Gas 2015**	**Gas [Breakeven with Coal 2015]**
Fuel cost	US$68/ton	US$105/ton	US$9.06/MMBtu	US$5.85/MMBtu
Conversion factor	5,500 kcal/kg (23.0GJ/ton)	5,500 kcal/kg (23.0GJ/ton)	1.055 GJ/MMBtu	1.055 GJ/MMBtu
Fuel cost per unit heat content	US$2.96/GJ	US$4.57/GJ	US$8.59/GJ	US$5.55/GJ
Thermal efficiency	32%	32%	60%	60%
Thermal efficiency-adjusted fuel cost	US$9.25/GJ	US$14.3/GJ	US$14.3/GJ	US$9.25/GJ

Source: Author.

Figure 3-23. Breakeven Price Curve of Coal and Gas in the Philippines (Thermal Efficiency Adjusted)



Heat content of coal = 5500 kcal/ton, Thermal efficiency: coal = 32%, gas = 60%.

Source: Author.

Two important points can be seen from the study's results. First, at 2015 prices, coal (thermal) power is far less expensive even if the difference in efficiency is considered. While the thermal efficiency-adjusted cost per amount of heat produced by coal is US$9.25/GJ, the cost for gas is about 1.54-fold higher at US$14.3/GJ. Thus, while the initial investment and operating cost (excluding fuel cost) for thermal coal stations are higher than those for thermal gas, this is outweighed by the savings on fuel cost.

Second, it is possible that the thermal efficiency-adjusted fuel cost of gas can be lower than coal's. The efficiency-adjusted coal price derived from US$105/ton and the thermal efficiency-adjusted gas price obtained from the US$9.06/MMbtu price becomes equal at US$14.3/GJ. Also, the efficiency-adjusted gas price derived from US$5.85/MMBtu and the efficiency-adjusted coal price from US$68/ton become equal at US$9.25/GJ. If the thermal efficiency-adjusted cost is the same, the total cost will be lower for gas thermal power due to its lower initial investment and operating cost.

According to the BP statistical Review of World Energy (2017), the annual average coal price in Asia went beyond US$105/ton four times (i.e. in 2008, 2010, 2011, and 2012) in the past. Meanwhile, after 2011, the Asian LNG spot price went below US$5.85/MMBtu during off-peak season, spring of 2016 and 2017.[10] Thus, it is possible that the respective competitive edge of coal and gas could be reversed once the Asian coal price rises or gas price goes down.

3.5 Transmission, Distribution, and Retail

3.5.1 Transmission and Distribution Losses

Power T&D losses in the Philippines were high at about 12% in 2012, but the losses had been reduced to 8%, thanks to various nationwide efforts. By 2016, the T&D losses in the Philippines were sufficiently comparable with those of the three other ASEAN countries. However, when compared with Thailand, which has the least loss amongst the comparator-countries, there remains a T&D loss difference of 2.61 percentage points.

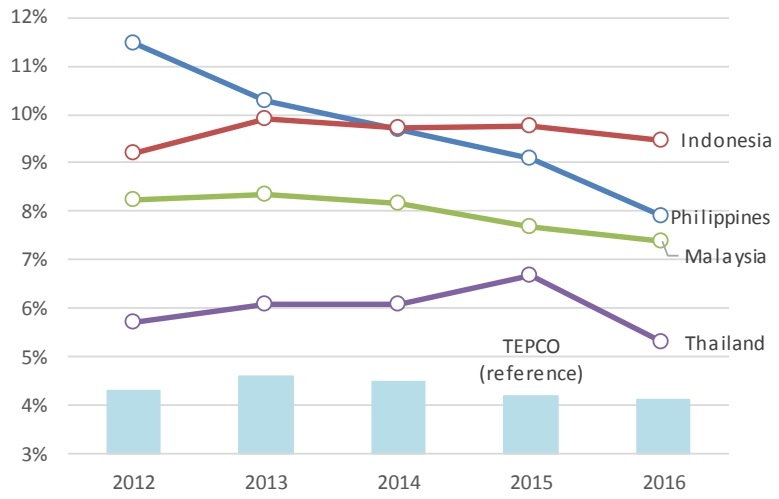
As transmission and distribution is a regulated sector, policies play a significant role in mitigating the T&D losses and providing incentives to players in the energy industry.

[10] World Gas Intelligence.

For instance, an act to reduce T&D losses was enforced in the Philippines under the EPIRA Act in January 2010. Currently, an upper limit of 8.5%/13% is set for DUs and electric cooperatives, respectively. In February 2018, the ERC submitted a resolution[11] setting an upper limit to distribution losses for electric cooperatives of 8.25% to 12.00% in 2022, depending on the category of the electric cooperatives.

On the other hand, as shown in Figure 3-25, the T&D loss of Tokyo Electric Power in Japan is considerably lower at about 4% each year (which was recently reduced further). Although the Philippines have different geographic features from Japan's, the Philippines can likely mitigate its T&D losses as well. Given its T&D losses of 8% (2016 data), its unit power supply cost [₱/kWh] could be reduced by 4% by increasing its power supply.

Figure 3-24. Comparison of T&D Losses



Source: Annual report of each company.

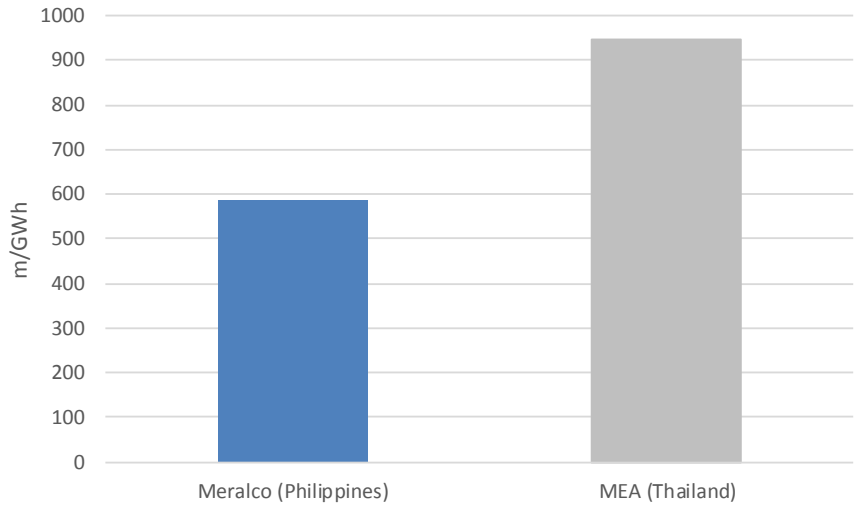
3.5.2 Demand Density

This study reviewed the length of power distribution lines per kWh supplied, of the Philippines' Meralco and Thailand's MEA (based on comparable data available). Results show that Meralco's power distribution line per kWh is shorter than that of MEA by about 40%. This means that the same amount of electricity is supplied through a shorter power distribution line. That is,

[11] Resolution No. 20, Series of 2017, 'A Resolution Adopting the ERC Rules for Setting the Distribution System Loss Cap and Establishing Performance Incentive Scheme for Distribution Efficiency'.

Meralco's distribution line has a higher power density – thus, higher power distribution efficiency. Meralco seems to be comparatively better off as a business as it is capable of operating at lower cost.

Figure 3-25. Length of Distribution Line per kWh Sales in 2015



Source: Meralco Annual report (2016); MEA Annual Report (2016).

3.5.3 Electrification Rate

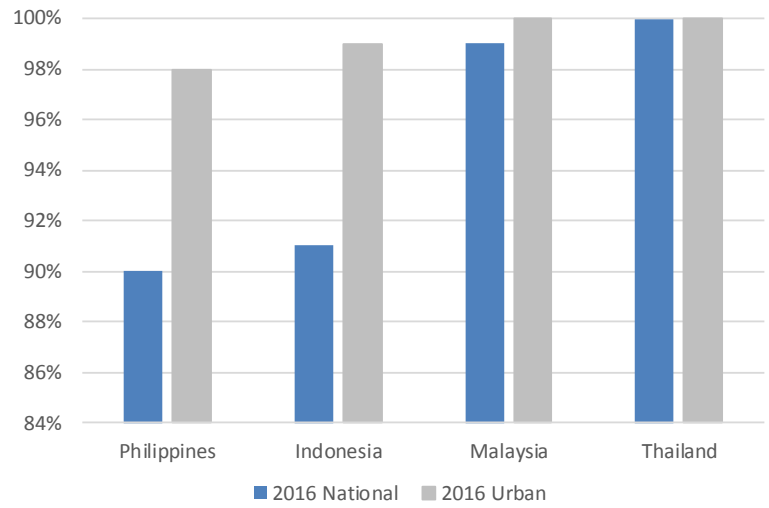
Except for Thailand, the electrification rates of the countries in this study failed to reach 100% in 2016. Even large cities in the Philippines and Indonesia were not 100% electrified.

As the construction of power grids in the Philippines started first in its metropolitan areas, particularly Luzon (where Metro Manila is located), there is a disparity between the electrification rates of Luzon and other areas such as Mindanao. Construction of infrastructure in small villages in mountainous areas may prove difficult, but such could be remedied by, for instance, installing small-scale solar PV power stations. The NPC has classified areas in the Philippines that need electricity into 21 districts, and announced its plan to construct small-scale facilities that combine renewable energy such as solar PV and wind power generation with diesel power generator sequentially by 2020.[12]

[12] Opinyon, 17 November 2015.

These efforts naturally have cost implications. In the Philippines, where the electrification rate is relatively low, investments on electrification will have to be on a larger scale when compared with those in Thailand and Malaysia. A higher spend on electrification because of the infrastructure requirements means that any reduction in T&D cost will be difficult to achieve in the short term.

Figure 3-26. Electrification Rate



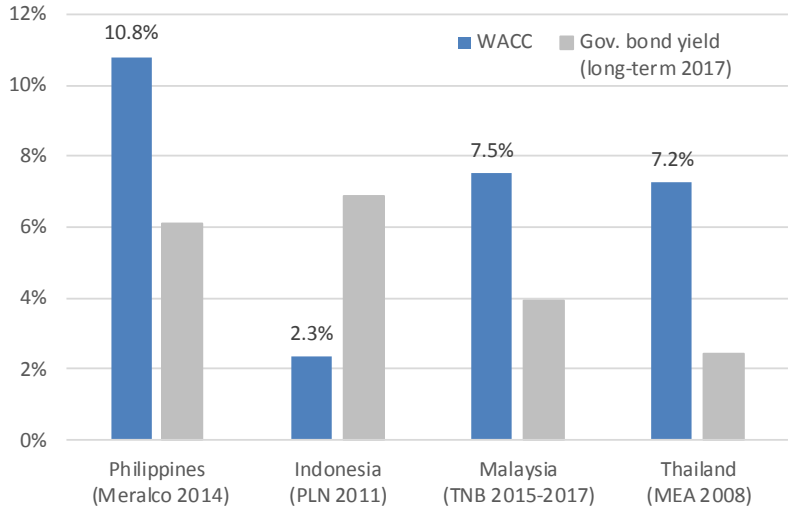
Source: IEA, Energy Access Database (2017).

3.6 Cost of Capital

The WACC of the Philippines is higher than that of the three other ASEAN countries. Its long-term national bonds have relatively high sovereign risk as expressed by the yield; the bonds' premium is also higher than other countries. For example, the WACCs of the Philippines and Malaysia/Thailand have a difference of at least 3 percentage points. If the rate bases are the same for three countries, the difference in WACC is calculated to raise the electricity cost of the Philippines by 3% more than Malaysia's and Thailand's.

When compared with that of Malaysia and Thailand, the difference with the Philippines' WACC is smaller – around 3 percentage points to 4 percentage points – but still significant enough. Such differences may be partly explained by the fact that Meralco, the distribution company in the Philippines, is a private company that requires higher financing than national companies in other countries. The difference in debt-to-equity ratios of these countries is also another factor.

Figure 3-27. Comparison of WACC



WACC = Weighted average cost of capital.

Source: Annual report of the companies, Trading Economics.

Various risk factors affect a nation's WACC. The Organization for Economic Co-operation and Development and credit rating agencies gave Malaysia the highest credit rating amongst the four countries, followed by Thailand. The evaluations on Indonesia and the Philippines are almost similar. Higher ratings mean smaller risks for a country. Therefore, the interest rate, bond yield, and the return on shares will be lower when financing is requested.

Table 3-3. Example of Country Risk Rating

	Indonesia	Malaysia	Philippines	Thailand	best	worst
OECD, Country risk classification	3	2	3	3	0	7
S&P, credit rating	BBB-	A-	BBB	BBB+	AAA	D
Moody's credit rating	Baa2	A3	Baa2	Baa1	Aaa	-

Source: OECD, country risk classification (January 2018), Trading Economics (S&P and Moody's credit ratings).

In terms of risks in business operations, the World Bank ranks the Philippines 113rd amongst 190 countries. This places the Philippines in the last place amongst the four countries in this study. Accumulation of such risks can lead to higher WACC. For this reason, it is a must to establish a favourable business environment.

Table 3-4. Risk Rating in Doing Business

	Indonesia	Malaysia	Philippines	Thailand
Overall	72	24	113	26
Starting a business	144	111	173	36
Dealing with construction permits	108	11	101	43
Getting electricity	38	8	31	13
Registering property	106	42	114	68
Getting credit	55	20	142	42
Protecting minority investors	43	4	146	16
Paying taxes	114	73	105	67
Trading across borders	112	61	99	57
Enforcing contracts	145	44	149	34
Resolving insolvency	38	46	59	26

Note: Assessment amongst 190 countries; the smaller the number, the better.

Source: World Bank, *Doing Business 2018*.

Natural disasters can also affect the risk evaluation. In countries where the risk of natural disasters is high, the risk on business continuity would also be high. According to an analysis done by United Nations University, the Philippines ranks third in 'Vulnerability' against natural disaster. Furthermore, its 'Exposure' to natural disasters is at 52.46%. Although Japan's 'Exposure' rating of 45.91% is almost as high as that of the Philippines, the former has significantly better ratings for 'Vulnerability', 'Susceptibility', 'Lack of coping capacities' and 'Lack of adaptive capacities' (Table 3-5).

Table 3-5. Natural Disaster Risk Rate

Rank	Country	World Risk Index	Exposure	Vulnerability	Susceptibility	Lack of coping capacities	Lack of adaptive capacities
3	Philippines	26.70%	52.46%	50.90%	31.83%	80.92%	39.96%
36	Indonesia	10.24%	19.36%	52.87%	30.09%	79.46%	49.04%
86	Malaysia	6.39%	14.60%	43.76%	19.02%	67.52%	44.73%
89	Thailand	6.19%	13.70%	45.22%	19.34%	75.53%	40.79%
17	Japan (reference)	12.99%	45.91%	28.29%	17.82%	38.04%	29.00%

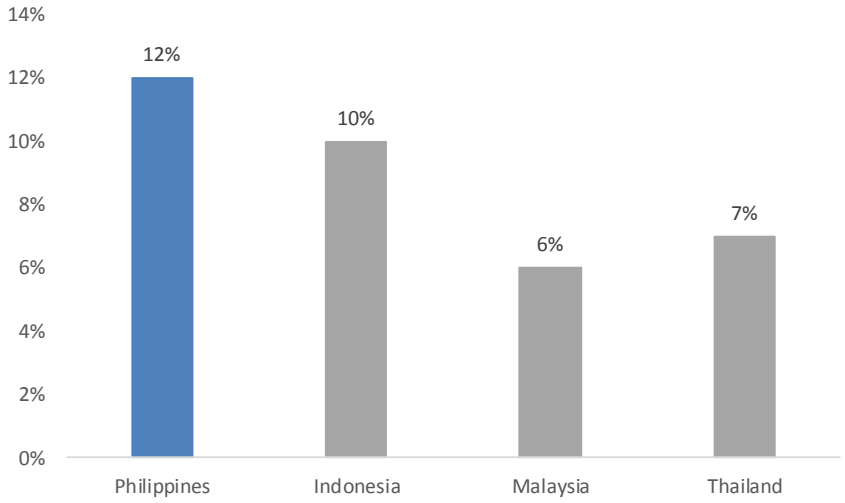
Source: United Nations University, *World Risk Report 2016*.

3.7 Tax and Surcharge

3.7.1 Value-added Tax

Value-added tax is now 12% in the Philippines, the highest of the four countries in this study. The Philippines' rate is 6 percentage points higher than Malaysia's, which has the lowest rate in this study. In Malaysia, the Goods and Services Tax was introduced in April 2015. In Thailand, the VAT was scheduled to be increased from 7% to 10% on 1 October 2016, but did not push through. Indonesia applies a 10% VAT.

Figure 3-28. Comparison of VAT



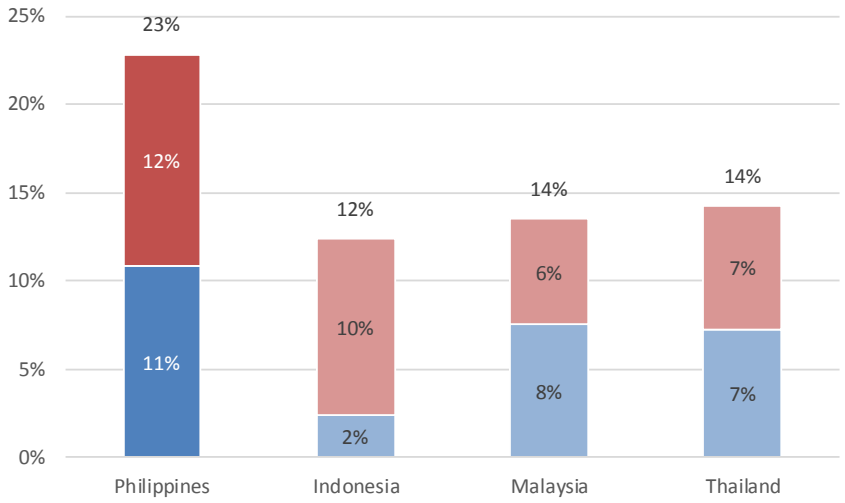
VAT = value-added tax.

Source: Website of each country.

Like WACC, value-added tax is added to all costs. In this section's review of the total values of WACC and value-added tax, care had to be taken because of the difference in the year(s) when relevant data were applicable.

In the Philippines, both WACC and VAT are high; thus, the fixed-rate multiplier is considerably higher than those of the other three countries. In the calculation in Figure 3-31, for example, as much as around 23% of the rate base is always added in the Philippines. In contrast, in the other three countries, the total rates are from 12% to 14% only.

Figure 3- 29. Sum of WACC and VAT



WACC = Weighted average cost of capital; VAT = value-added tax.

WACC: Indonesia = Perusahaan Listrik Negara in 2011; Malaysia = Tenaga Nasional Bethad 2015-2017; Philippines = Meralco in 2014; Thailand = Metropolitan Electricity Authority 2008

Source: Annual reports of companies.

3.7.2 Other Surcharges

To promote renewable energy, the Philippines has introduced the Feed-in-Tariff (FIT) system. In 2010, the ERC announced that a part of renewable energy cost be added to the electricity bill for over 20 years.[13] Feed-in-Tariff surcharges started to be added in 2015, comprising about 2% of the electricity bill by 2016. Should the FIT system be applied widely in the future, the surcharge

[13] Japan Electric Power Information Center, Inc., 'Electricity Projects in Countries Overseas', volume 1, addendum version 2.

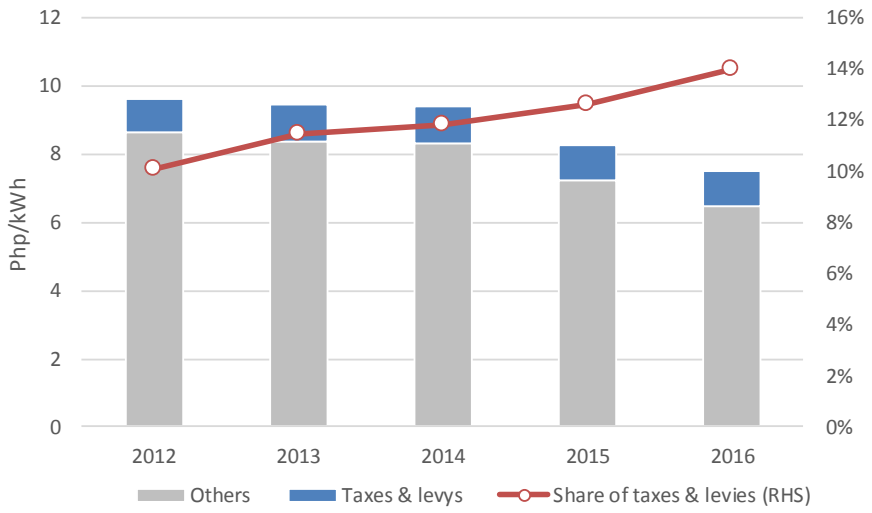
amount will naturally be larger and account for a part of the higher power cost in the future. In fact, in June 2018, the ERC approved the FIT-ALL increase from ₱0.1830 to ₱0.2563 to compensate for the deficit of FIT payment for renewable businesses.

Taxes peculiar to the Philippines, aside from the VAT and FIT, are also added to the electricity rate.

About 10% of the electricity rate is accounted for by the universal charge imposed on all final consumers. The universal charge is composed of stranded debts of NPC, electrification cost of localities, and environmental measures as well as subsidies for low-income groups. For example, the share of the universal charge and that of other subsidies in the entire electricity rate in 2016 were 3% and 1%, respectively. Such sorts of surcharges are peculiar to the Philippines, and cannot be found in the other three ASEAN countries.

In the example on Meralco, as the total electricity bill declines, the ratio of these taxes and surcharges rises.

Figure 3-30. Tax and Levy Portion in Electricity Rate (Meralco)



Source: Meralco Annual Report 2016.

3.8 Summary

Table 3-6 summarises the potential cost reduction from various points in the power supply chain.

Table 3-6. Summary of Analysis

Electricity demand increase		• Compared with other countries, the Philippines has a large room to expand its power demand; thus, this may require larger investments and could make cost reduction relatively difficult to achieve.
Power generation	Power generation mix	• Use of coal (thermal) power is already high. • Power generation cost can be reduced by relying more on coal (thermal) power, but there should be careful consideration on its environmental burden. • Renewable energy could be a cheaper option in a remote area where most are using diesel generators.
	Fuel cost	• Prices of coal and natural gas for power generation are relatively high. Coal and gas are respectively 6%-23% and 8%-43% higher than comparator-countries. • There is room to drive fuel costs down.
	Thermal efficiency	• The efficiency of gas thermal power is extremely high, but that of coal (thermal) power is very low. • If one assumes 10% points higher thermal efficiency for coal, Meralco could have reduced its coal consumption by US$235 million (in 2015). • A 60% efficient gas power plant with US$9.06/MMBtu gas can compete with a 32% efficient coal power plant with US$105/ton coal.
Transmission and distribution	T&D loss	• The Philippines' T&D loss is 2.61% points larger than Thailand's. • If T&D loss were 4% points lower, per-unit electricity

		supply cost could be 4% less.
	Demand density	• Compared with Thailand's MEA, Meralco's demand density is 40% higher, which presents a good environment for the company to operate efficiently.
	Electrification rate	• The electrification rate is lower in the Philippines. • Larger investment requirements for electrification projects would make cost reduction more difficult in the Philippines.
Cost of capital	WACC	• WACC in the Philippines is 3 percentage points–8 percentage points higher than the other comparator-countries in the study. • Cost reduction is possible by lowering WACC.
Tax and levy	VAT	• Fixed-rate multiplier (sum of WACC and VAT) to electricity cost is 9 percentage points–11 percentage points larger than that of the other countries.
	Others	• Specific surcharges not observed in other countries. (3% of universal charge, 1% of other subsidies in 2016) • As the total electricity rate goes down, the proportion of surcharges becomes bigger.

T&D = transmission and distribution; VAT = value-added tax; WACC = weighted average cost of capital.

Chapter 4

Policy Implication

This study presents seven recommendations aimed at reducing the Philippines' costs in the whole electricity supply chain, ranging from fuel supply to distribution.

Table 4-1. Recommendations to Reduce Electricity Cost in the Philippines

		Effect to reduce cost
1	Coordinate open tender for power plant development	
2	Shift back to economic dispatch	✓
3	Reduce fuel cost	
4	Adopt thermal efficiency standard for power generation	✓
5	Consider renewable electricity as an economically feasible option	
6	Reduce T&D loss	
7	Create good business environment to reduce WACC	✓

Source: Author.

Among the options, recommendations to 'Shift back to market-based load dispatch', 'Adopt thermal efficiency standard for power generation', and 'Create good business environment to reduce WACC' could have the most significant impact on cost reduction.

4.1 Coordinate Open Tender for Power Plant Development

To reduce the power supply cost, development of power sources should be implemented in a balanced manner and in accordance with a through plan on the onset. The development of power plants should first start with a power development plan – a plan that specifies the time,

location, the fuel and technology to be used, and the capacity of the plant, based on the potential power demand.

Thereafter, such plan must be implemented under a competitive environment.

Indonesia, Malaysia and Thailand's grid system operators (PLN, TNB and EGAT, respectively) recruit IPPs through open tender in accordance with their respective plan. In the tender of IPPs, the year of operation, plant capacity (MW), and type of fuel are indicated, and competitive bidding is conducted. Therefore, power sources in accordance with a long-term power development plan can be secured at minimum cost.

In the case of the Philippines, its government has formulated a power development plan; however, the country has no tangible means to implement it. Its power development is left to private companies' decision on investments. Thus, cases of inconsistency with the plan could arise in terms of the required year of operation, plant capacity, and type of fuel.

To address the problem, this study suggests that the Philippine government's requirements for new power plants should be defined in open tenders. The idea is to control the time, generation capacity, and fuel type – all of which are currently left to the judgment of its private companies. Through bidding, power development projects will be under pressure to control costs.

As long as power development is left to the judgment of private companies, it will be impossible to reduce the uncertainties and difficult to achieve economical power development projects.

4.2 Shift Back to Market-Based Load Dispatching

From the viewpoint of daily load-dispatch order, all power distribution companies must procure electricity from the wholesale market through competitive bidding rather than bilateral transactions. Capturing change in the power generation cost and reflecting it in the dispatch order would be ideal. In addition, the approach will be effective in that that it would urge high-cost power sources to withdraw from the market.

Table 4-2 lists examples of wholesale markets. Here, all participating power producers supply generated electricity to a single wholesale market, while retailers procure electricity from this wholesale market.

Table 4-2. Examples of Wholesale Markets

Germany	All market participants form a balancing group by region.
Nordic countries	All market participants sign a contract with the 'balancing responsible party' or become one themselves.
United Kingdom	All power producers and retailers with a capacity 50 MW or more are placed under the control of the TSO as 'units participating in supply-demand adjustment.'
United States	Under the PJM system, all market participants follow the transmission system operator's instructions.

TSO = transmission system operator, PJM = Independent system operator covering Pennsylvania, New Jersey, and Maryland

Source: Author's compilation.

Although the Philippines has WESM, a competitive wholesale electricity market, its actual utilisation rate remains approximately 10% of the total power demand. Therefore, the load-dispatch orders conducted by NGCP are each bound by a contract with a power generation company of each power distribution company, and are not necessarily cost-efficient.

In transitioning from the present electricity transaction/load-dispatch order to the ideal mechanism (i.e. market-based load dispatch), how to deal with the existing contracts between a power generation company and a power distribution company is a problem. Low-cost power generators will not be an issue as they will preferentially be dispatched under the proposed mechanism. However, dispatched orders for high-cost power generators will decline – to lower than the amount contracted in PPAs – exposing the power generators to potential shortages in investment recovery and operating losses.

The Philippines used to practice economic dispatch in principle in the past. However, due to this very problem mentioned above, the country shifted back to the maintenance of existing PPAs.

One of the solutions to this problem is to mandate newly built power plants to adopt the market-based dispatch mechanism, while allowing existing power plants to manage their power supplies per their PPAs. Although this solution will pave the way for a shift to the economic dispatch

system, it will take a long period for the transition to be completed, and high-cost PPAs will survive.

Possible methods to minimise the impact of high-cost PPAs include the following:

1) Set Capacity Charge as a minimum payment for high-cost power plants to allow them to recover their fixed costs (i.e. minimise the payment).
2) Review the PPA-contracted charges based on the present cost structure.

The country should fundamentally aim for option (2), although it is difficult to implement. The factors that affect power generation costs have now substantially changed since the time when each PPA was signed. Therefore, the new review of charges is justified.

4.3 Reduce Fuel Cost

The Philippines' power generation sector has been liberalised, and IPPs independently procure fuels. Thus, it is difficult for the government to intervene in this sector.

However, as the Philippines' coal and natural gas prices are higher than in other countries, the government is required to lower the prices. Given that the main actors in fuel procurement are the IPPs, it makes sense to obligate IPPs to reduce operating costs. In the present mechanism, earnings of each IPP are protected under a long-term PPA with a power distribution company. Therefore, it can be inferred that the IPPs' incentive to reduce fuel costs is weak. There needs to be a mechanism where IPPs autonomously take the initiative to reduce the power generation costs. One such mechanism is a load-dispatch order that reflects the power generation cost or full-scale competition in the wholesale electricity market. The fuel cost represents a great portion of the power generating cost. If the selling price of electricity is exposed to competition, IPPs will race to lower the fuel costs.

Assuming IPPs do strive to reduce the fuel costs, such costs could remain high in some cases. Their ability to drive down the fuel costs could depend on the fuel procurement expertise of each IPP and the market environment. The fuel procurement expertise of an IPP includes the company's ability, know-how or bargaining power. And these are the factors that are beyond government's oversight.

The market environment, meanwhile, may consist of trade practices, a supply-demand balance

specific to the region, and others. Take the trading of LNG as a straightforward example. Prices of LNG traded in Asia are higher than that in the Atlantic market. However, this price disparity cannot be resolved by a single company. To eliminate the disparity across markets, it is necessary to increase the liquidity of commodity trading. If energy products such as LNG are traded more frequently and more freely, the price disparity between markets will be reduced, in theory. By supporting the increase of the trading liquidity in the international market, the government can help Philippine IPPs procure fuel for power generation at more competitive prices.

4.4 Adopt Thermal Efficiency Standard for Power Generation

In countries with high fuel costs, an increase in the thermal efficiency will significantly reduce the fuel cost. The use of highly efficient technologies can likewise control the cost of power generation in many cases. It is, thus, high time to establish an efficiency standard for power plants.

Certain quarters have argued that high-efficiency power plants are expensive. The investment involved in such huge projects will simply offset fuel cost reduction efforts. Other studies, on the other hand, indicate that larger initial capital expenditure of high efficiency technology can be compensated by a reduction in fuel cost. For instance, Otaka et al.[14] estimated levelised cost of electricity for different combinations of coal price and plant cost. The study showed that in most cases, Ultra-Supercritical technology with 42.1% thermal efficiency can be less expensive than Subcritical technology with 38.2% thermal efficiency.

[14] Yasuo Otaka and Han Phoumin, *Study on the Strategic Usage of Coal in the EAS Region: A Technical Potential Map and Update of the First-Year Study*, 11 January 2016.

Table 4-3. Sensitivity Analysis of LCOE of Coal Power Plant

		Ultra-Supercritical (42.1%)			Supercritical (41.1%)			Subcritical (38.2%)		
		High EPC (USD 2,076 million)	Medium EPC (USD 1,941 million)	Low EPC (USD 1,867 million)	High EPC (USD 2,043 million)	Medium EPC (USD 1,908 million)	Low EPC (USD 1,796 million)	High EPC (USD 1,925 million)	Medium EPC (USD 1,796 million)	Low EPC (USD 1,688 million)
Coal prices	High (USD 60/ton)	5.39	5.27	5.20	5.46	5.34	5.23	5.68	5.55	5.45
	Medium (USD 50/ton)	4.87	4.74	4.68	4.93	4.80	4.69	5.10	4.97	4.87
	Low (USD 40/ton)	4.35	4.22	4.15	4.39	4.26	4.16	4.52	4.39	4.29

LCOE = levelised cost of electricity; USD = United States dollars.

Source: ERIA, 11 November 2016.

The section below introduces Japan's cases as reference. Its experiences can show nations such as the Philippines how to take the lead in requiring power producers to increase the energy efficiency in some form.

In Japan, electric utilities are required to implement the following energy-saving measures:

- Annual energy efficiency reporting
- Minimum thermal efficiency requirement for 'new' power plant
- Minimum thermal efficiency requirement for 'existing' power plant

Measure (1) requires each electric utility to record and report the energy efficiency of the whole company (including the power plant) and an improvement measure, every year.

Measure (2) stipulates a minimum standard that newly constructed thermal power plants should achieve for each fuel type. To observe this standard, any entity constructing a new power plant must adopt a high-efficiency technology.

Table 4-4. Efficiency Standards for Newly Built Power Plants in Japan

Fuel	Efficiency Standard	Basis for Establishment
Coal	42.0%	Established in the light of the value of USC, which has already started operation as a commercial plant with no problem in economic efficiency and reliability.
Gas	50.5%	Established in the light of the value of combined cycle power generation, which has already started operation as a commercial plant with no problem in economic efficiency and reliability.
Oil	39.0%	Generating efficiency of cutting-edge coal-fired and other thermal power generating equipment

USC = ultra-super critical water boiler technology.

Source: Ministry of Economy, Trade, and Industry, the government of Japan, 9 February 2016.

Measure (3) stipulates two index types. In Table 3-4, the figures 41%, 48% and 39% contained in the formula for Index A represent thermal efficiency values that existing coal-fired, gas-fired, and oil-fired thermal power plants should achieve, respectively. To achieve these values, it is necessary to maintain the efficiency of the existing thermal power plants and abolish low-efficiency thermal power plants. On the other hand, the target value 44.3% in Index B is based on the minimum thermal efficiency requirement (41%, 48% and 39%) of existing thermal power plants, and the power supply mix targets for 2030 (consisting of 26%, 27% and 3% for coal-fired, gas-fired and oil-fired thermal power plants) in the total electricity supply.

4.5 Consider Renewable Electricity as an Economically Feasible Option

Depending on the project, the utilisation of renewable energy may also help reduce the generation costs. In recent years, the decline in the cost of solar PV has been noticeable. As mentioned in Chapter 2, large solar parks are likely to compete with existing thermal power stations. In Luzon, where the demand is strong and the absorption margin for variable renewable energy is large, active use of renewable energy must be considered although the accompanying costs should be scrutinised, too.

Table 4-5. Efficiency Standards for Existing Power Plants in Japan

	Index A	**Index B**
Purpose	• Appropriately maintain and control the existing thermal power plants and the thermal efficiency achieved at the start of operation. • Urge retirement of low-efficiency, old thermal power plants.	• Urge constitution of a power supply mix for 2030, which the government should aim for.
Formula	$\frac{\eta_{coal}}{41\%} \times S_{coal} + \frac{\eta_{gas}}{48\%} \times S_{gas} + \frac{\eta_{oil}}{39\%} \times S_{oil} > 1.00$ η: annual average thermal efficiency [%] S: share amongst fossil power generation [%]	$\eta_{coal} \times S_{coal} + \eta_{gas} \times S_{gas} + \eta_{oil} \times S_{oil} > 44.3\%$ η: annual average thermal efficiency [%] S: share amongst fossil power generation [%]

Source: Ministry of Economy, Trade, and Industry, Government of Japan, 9 February 2016.

4.6 Reduce Transmission and Distribution Loss

Although the power T&D loss in the Philippines is on the downtrend, and the ERC has recently set a target for T&D losses, there is still room for improvement. Transmission and distribution losses are divided into (i) technical loss resulting from overloaded wires, dilapidated transformers, etc.; and (ii) commercial loss resulting from electricity theft, metering error, etc.

To reduce the technical loss, there is no other option but to continuously invest in improvements (e.g. enhancing lines or updating the transformer equipment) so as to keep up with the growth of power demand. For instance, in 2006, the United States provided incentives such as a higher pay rate and accelerated depreciation to investments to projects that meet political purposes such as investments in transmission, system enhancement associated with renewable energy power generation, and adoption of advanced technology. Provision of such an incentive in the review of transmission/distribution charges may also be helpful.

Meanwhile, there are many ways to reduce commercial losses. For instance, when Indonesia increased its electricity charge from 2000 to 2003, electricity theft increased. The distribution loss rose from 9.1% in 2000 to 14.4% in 2003. In response to this, PLN and the police jointly formed an electricity theft investigation team and took measures against violators. Partly due to this effort, the transmission/distribution loss went down to around 9% by 2015.

4.7 Create Good Business Environment to Reduce WACC

There are various risk factors affecting the WACC. One of these is the sovereign risk. Based on to ratings published by a credit rating agency, the ratings of the Philippines and Indonesia are lower than that of Malaysia and Thailand.

In addition, the Philippines ranked 113th amongst 190 countries in terms of its risk in doing business – the lowest ranking amongst the four countries covered by this study.

This indicates that in the Philippines, businesses may be exposed to higher risks at the start of their operation or funding than in other countries. To reduce the WACC, it is essential to establish a favourable business environment.

One of the notable risk factors in the Philippines is natural disasters. Although climates cannot be controlled, energy infrastructure's ability to withstand the wrath of natural disasters should be improved. Such readiness can reduce risks and positively impact the funding cost directly and indirectly. While countermeasures against natural disasters are naturally costly, well-built infrastructure may have lesser life cycle costs than vulnerable infrastructure.

In addition, government must not forget to build the capability of regulatory bodies' officers to conduct quality rate reviews. Officers need to be adequately trained to effectively negotiate a reduction in projects' rate bases and WACCs. They may, for instance, be sent on exchange programmes with counterpart regulatory bodies in other countries to gain the needed skills.

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