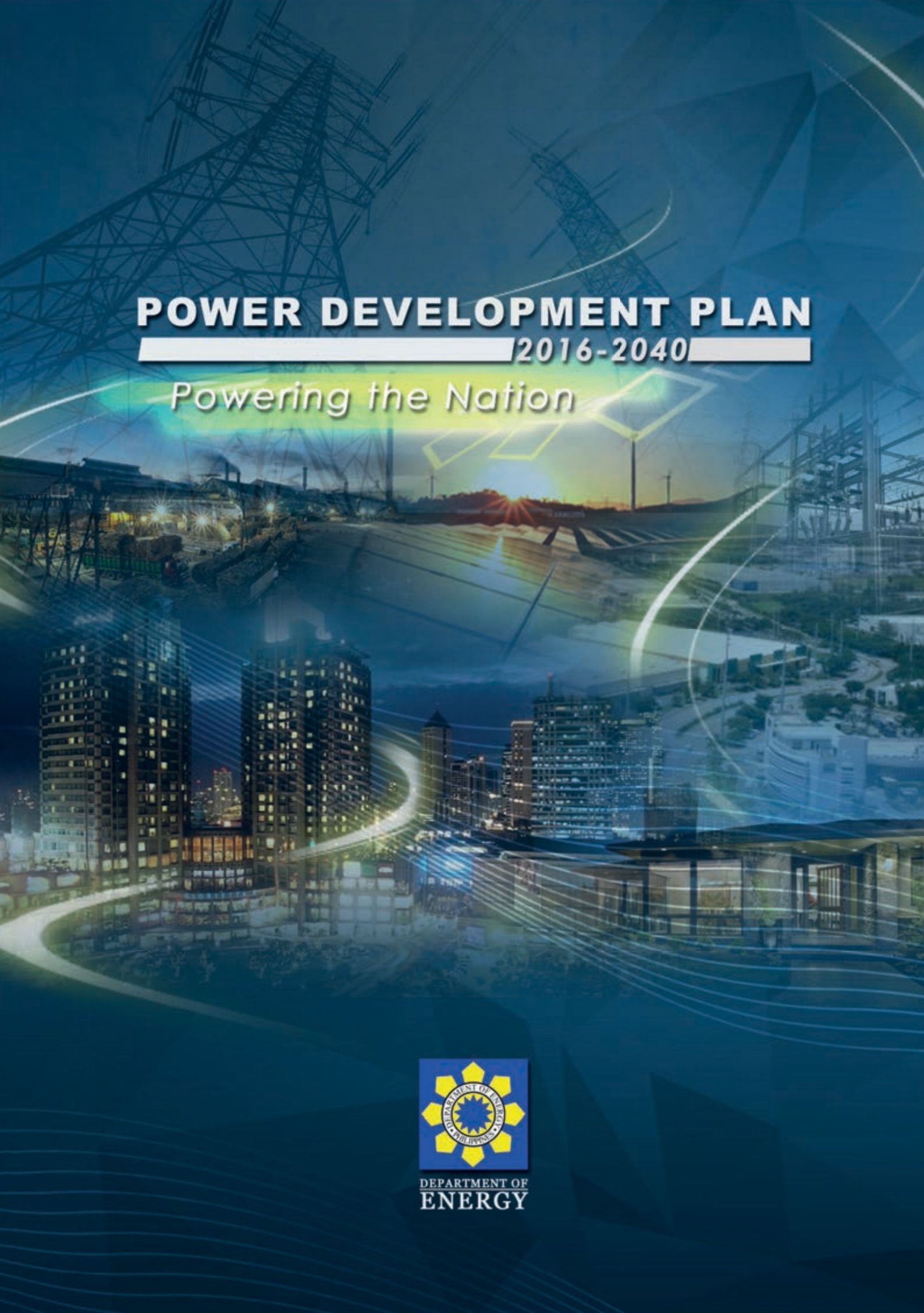
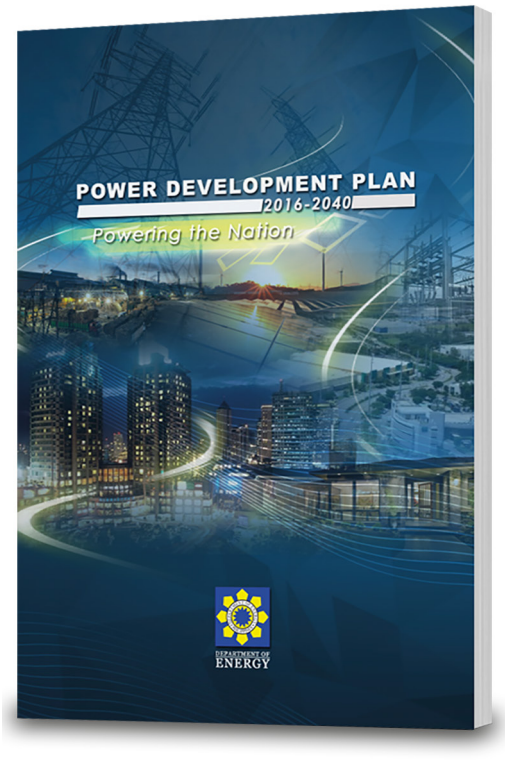

POWER DEVELOPMENT PLAN
2016-2040
Powering the Nation
DEPARTMENT OF
ENERGY

ABOUT THE COVER



POWERING THE NATION

This Power Development Plan serves as the path in powering the nation from 2016 and beyond. The cover depicts the invaluable role of the electric power industry in fuelling and sustaining the country's economic growth and development.

The Department of Energy (DOE) envisions for the Philippine energy industry to be globally competitive in utilizing energy in Filipino communities through clean, efficient, robust and sustainable systems in order to create wealth and transform the lives of the Filipinos. Recognizing its role, the DOE reaffirms its commitment - to ensure quality, reliability, security, and affordabiliity of the supply of electric power.

Through an integrated approach, the Power Development Plan 2016-2040 encompasses all subsectors - generation, transmission, distribution and supply; as well as the development of the market, other institutional support mechanisms and electrification roadmaps.

POWER DEVELOPMENT PLAN

2016 - 2040

MESSAGE FROM THE SECRETARY

ALFONSO G. CUSI
SECRETARY

The Department of Energy (DOE) is honored to present its Power Development Plan (PDP) 2016-2040. This blueprint will shape and redefine the future of the Philippine electric power industry.

In line with the country's long term national vision to be a middle-class society contained in the AmBisyon 2040, the PDP exemplifies the DOE's aspiration to be a globally-competitive agency powering up Filipino communities through clean, efficient, robust and sustainable energy systems. The DOE aims to create wealth, propel industries and transform the lives of men and women and the future generations.

The power demand and supply outlook discussed in the PDP will guide investors, economic planners and stakeholders of the power sector's future landscape in terms of electricity consumption, demand and capacity requirements in the advent of an industrialization-driven economic growth and development. Anchored on the DOE's mandate to ensure quality, reliable, accessible, sustainable and reasonably-priced energy, the DOE envisions to implement the policies embodied and programs identified in this PDP over the short-, medium- and long-term horizons.

Holistic on its approach, the DOE formulated the power sector roadmaps encompassing the generation, transmission, distribution and supply subsectors infused with market development and institutional support mechanisms. As a result, electrification roadmaps to increase energy access down to households, off-grid and missionary areas are also embraced in this plan.

Widening and diversifying the supply base of the country to satisfy the growing demand for electricity remains the DOE's priority. This entails the upscale of power generation capacities in Luzon, Visayas and Mindanao which must be primarily complemented by the Transmission Development Plan covering in detail the expansion and upgrading of the transmission system and its connection to the Distribution Development Plan that provides the distribution infrastructure.

Thus, the DOE envisions the transformation of the current system into an integrated, climate-resilient, technologically-advanced and fully competitive electric power industry. It will resolve concomitant issues and challenges, foster stronger ties with its attached agencies, the energy regulator, the private sector, the government agencies and other stakeholders. The DOE will likewise engage in international collaborations to realize the plans and programs in the PDP.

By 2016 and beyond, the electric power industry will boost the necessary changes in firming up the Philippines' growth and development momentum.

ALFONSO G. CUSI
Secretary

CONTENTS

TABLES

FIGURES

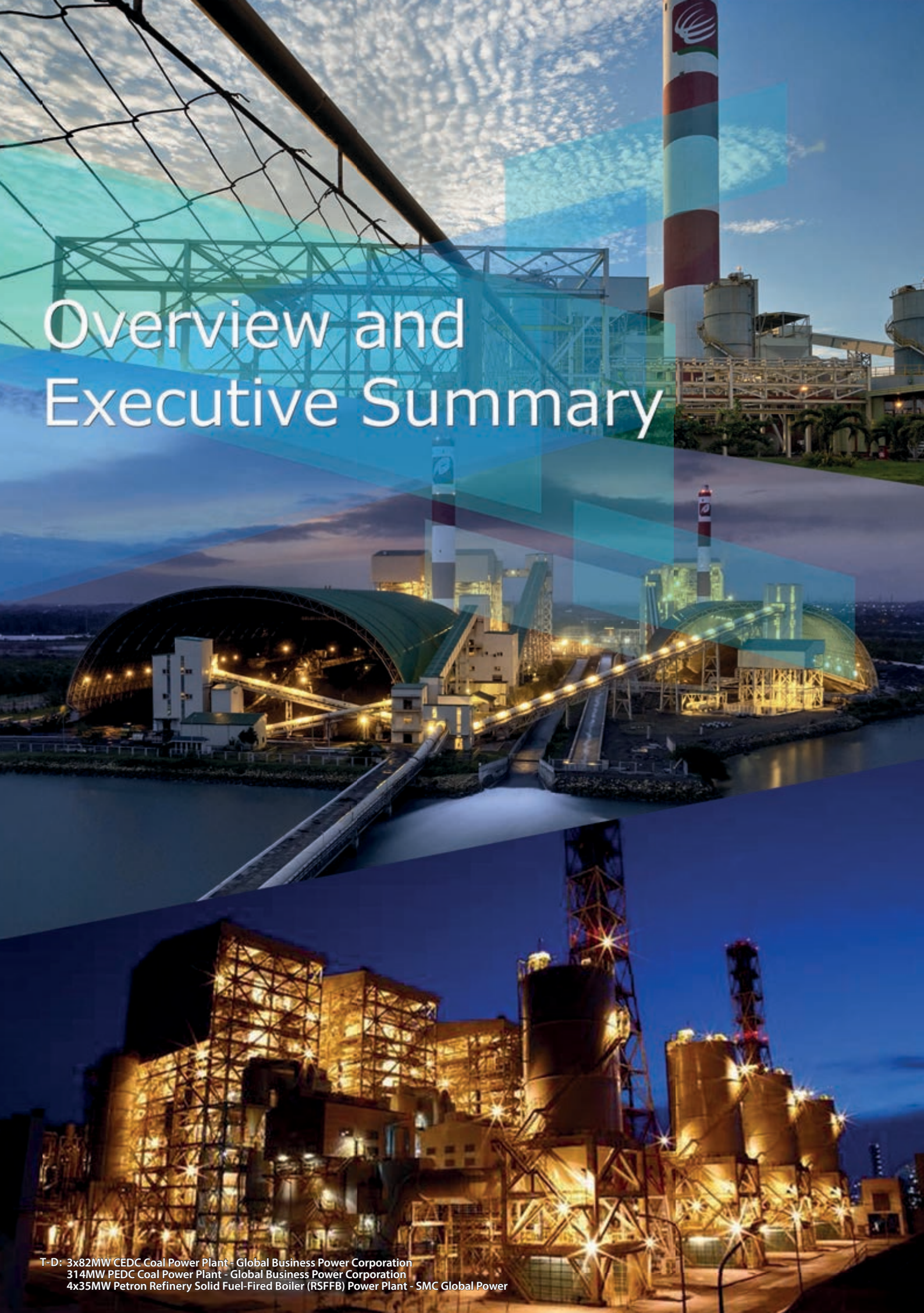
ANNEXES

ABBREVIATIONS

AAGR	Annual Average Growth Rate
AJCEPA	ASEAN-Japan Comprehensive Economic Partnership Agreement
AKFTA	ASEAN-Korea Free Trade Agreement
ANECO	Agusan del Norte Electric Cooperative, Inc.
ASEAN	Association of South East Asian Nation
BPO	Business Process Outsourcing
BSP	Bangko Sentral ng Pilipinas
CAPEX	Capital Expenditure
CC	Contestable Customers
CSP	Competitive Selection Process
DANECO	Davao del Norte Electric Cooperative, Inc.
DBCC	Development Budget Coordination Committee
DBM	Department of Budget and Management
DC	Department Circular
DDPs	Distribution Development Plans
DOE	Department of Energy
DOF	Department of Finance
DOST	Department of Science and Technology
DU	Distribution Utilities
ECs	Electric Cooperatives
EGAT	Electricity Generating Authority of Thailand
EMA	Energy Market Authority-Singapore
EPC	Engineering, Procurement and Construction
EPIRA	Electric Power Industry Reform Act
ERAV	Electricity Regulatory Authority of Vietnam
ERC	Energy Regulatory Commission
GDP	Gross Domestic Product
GenCos	Generation Companies
GHG	Greenhouse gas
GOU	Government Owned Utility
GRDP	Gross Regional Domestic Product
GST	Goods and Services Tax
GW	Gigawatt
GWh	Gigawatt Hour
IEA	International Energy Agency
ILP	Interruptible Load Program
IMEM	Interim Mindanao Electricity Market
IMF	International Monetary Fund
IMO	Independent Market Operator
IPP	Independent Power Producers
kW	Kilowatt
kWh	Kilowatt Hour
LGU	Local Government Unit

MEF	Missionary Electrification Fund
MEIH	Malaysian Energy Information Hub
MERALCO	Manila Electric Company
MFSR	Monthly Financial and Statistical Report
MOR	Monthly Operations Report
MORESCO I	Misamis Oriental - I Rural Electric Service Cooperative, Inc.
MORESCO II	Misamis Oriental II Electric Service Cooperative, Inc.
MW	Megawatt
MWh	Megawatt Hour
NEA	National Electrification Administration
NEDA	National Economic and Development Authority
NGCP	National Grid Corporation of the Philippines
NMMS	New Market Management Systems
NPC	National Power Corporation
NPP	New Power Provider
NSCB	National Statistical Coordination Board
OP	Office of the President
OTEC	Ocean thermal energy conversion
PC	Participating Customers
PDP	Power Development Plan
PEMC	Philippine Electricity Market Corporation
PLN	Perusahaan Listrik Negara/National Electric Company
PNRI	Philippine Nuclear Research Institute
PSA	Philippine Statistics Authority
PSA	Power Supply Agreement
PSALM	Power Sector Assets and Liabilities Management
PV	Photovoltaic
RCOA	Retail Competition and Open Access
RD&D	Research, Development and Demonstration
RE	Renewable Energy
RES	Retail Electricity Supplier
ROW	Right of Way
RPS	Renewable Portfolio Standards
SIS	System Impact Study
SPUG	Small Power Utilities Group
SU	Station Use
SURNECO	Surigao del Norte Electric Cooperative, Inc.
TDP	Transmission Development Plan
TL	Transmission Losses
TransCo	National Transmission Corporation
TWG	Technical Working Group
WESM	Wholesale Electricity Spot Market
ZAMCELCO	Zamboanga City Electric Cooperative, Inc.

Overview and Executive Summary



T-D: 3x82MW CEDC Coal Power Plant - Global Business Power Corporation
314MW PEDC Coal Power Plant - Global Business Power Corporation
4x35MW Petron Refinery Solid Fuel-Fired Boiler (RSFFB) Power Plant - SMC Global Power

The 2016-2040 Power Development Plan (PDP) provides the long-term outlook on the demand and supply requirements in the three major Grids, namely: Luzon, Visayas and Mindanao. The PDP also presents the holistic power sector roadmaps for the short-, medium- and long-term planning horizons. These roadmaps:

- Draw their foundation on the DOE's mandate to ensure the delivery of sustainable, stable, secure, sufficient, and accessible energy;
- Accord themselves with the DOE vision towards a globally-competitive energy industry that powers up Filipino communities through clean, efficient, robust and sustainable energy systems that will create wealth, propel industries and transform the lives of men and women and the generations to come;
- Encompass programs and policies for the generation, transmission, distribution and supply subsectors as well as market development and institutional support mechanisms outlined in the Power Sector Roadmap, 2016-2040 (Chapter IV); and,
- Align their plans with the national vision contained in the Ambisyon 2040[1] that the Philippines shall be a prosperous, predominantly middle-class society where no one is poor; hence, a "Matatag, Maginhawa at Panatag na Buhay" (strongly rooted, comfortable, and secure life).

The Missionary Electrification Development Plan and the Household Electrification Development Plan likewise form part of the roadmaps in order to present a more comprehensive perspective in the power development sector.

The realization of these roadmaps require the implementation of the policy thrusts and strategic directions of the DOE which are geared towards the full restructuring and reform in the electric power industry under RA 9136 [otherwise known as the Electric Power Industry Reform Act of 2001 (EPIRA)].

The PDP provides an analysis of the Philippine electric power industry in relation to other ASEAN countries (Chapter II); an assessment of the Philippines' five-year performance from 2011-2015 in terms of power statistics, challenges, and programs and policies implemented prior to the planning horizon (Chapter III). The Power Demand-Supply Outlook and Power Sector Roadmap from 2016 to 2040 and the roadmaps are presented in detail in Chapters IV and V.

The 2016-2040 Power Development Plan (PDP) provides the long-term outlook on the demand and supply requirements in the three major Grids, namely: Luzon, Visayas and Mindanao. The PDP also presents the holistic power sector roadmaps for the short-, medium- and long-term planning horizons.

[1] Ambisyon Natin 2040 provides the long-term vision for the Philippines formulated by the National Economic and Development Authority (NEDA). Accessible at http://2040.neda.gov.ph/

Philippine Electricity Profile

T-D: 430MW San Gabriel Combined-Cycle Power Plant - First NatGas Power Corp.
500MW San Lorenzo Combined-Cycle Power Plant - FGP Corp.
1200MW Ilijan Combined-Cycle Power Plant - KEPCO Ilijan Corp.

The Association of Southeast Asian Nations (ASEAN), including the Philippines, embarks on enhancing the generation, transmission, distribution and supply side as part of its national priorities because it recognizes its role in having a secured power demand-supply chain towards the attainment of economic and development objectives. As the ASEAN gears towards regional integration, it envisions an integrated electric power industry among its member-countries in terms of power demand and consumption structures, supply infrastructures, energy policy directions and regulations.

PEAK DEMAND, ELECTRICITY CONSUMPTION AND INSTALLED CAPACITY[2]

The direct and positive relationship between income, as measured by GDP per capita[3], and electricity consumption is established for the case of the ASEAN countries. In a similar manner, the installed capacity per unit of population also follows an increasing trend as the countries' income increase (Figures 1 and 2).

The Philippines, despite having a higher GDP per capita over Vietnam, has the lowest consumption and installed capacity per unit of population among the ASEAN. Meanwhile, the highly developed economy of Singapore places itself as the lead in terms of (high) income level, consumption and installed capacity per capita despite its limited natural resources and small land area. On the other hand, the Philippines has higher supply margin by 34% over its peak demand with a 6,122 MW difference based on installed capacity. This margin is higher compared to Thailand and

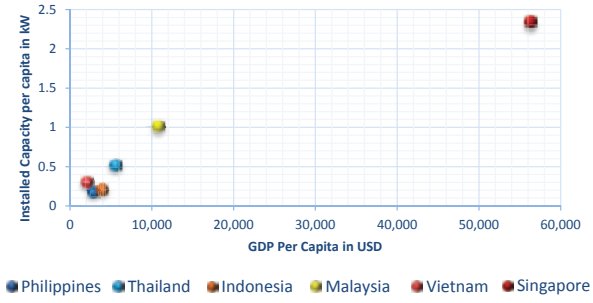


Figure 1. Installed Capacity per capita (in KW) vs. GDP per capita

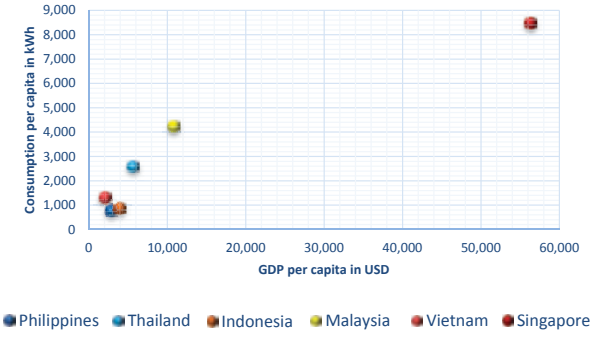


Figure 2. Electricity Consumption per capita (in KW) vs. GDP per capita

Vietnam with 22% and 28%, respectively. The Philippines, however, has a lower available capacity over installed capacity at 28%, thus resulting to a net supply margin of 8%. These margins are reflective of the ASEAN's need for continuous capacity addition to be able to meet future electricity demand which is projected to grow thrice as much by 2040[4].

The Association of Southeast Asian Nations (ASEAN), including the Philippines, embarks on enhancing the generation, transmission, distribution and supply side as part of its national priorities.

[2]a.) Analysis are based on 2014 figures due to available data, except for Vietnam which is based on 2013 values
b.) Electricity Data Sources: Philippine Department of Energy (DOE), Electricity Generating Authority of Thailand (EGAT), Ministry of Energy and Mineral Resources/Perusahaan Listrik Negara/ National Electric Company (PLN), Malaysian Energy Information Hub (MEIH)/ Economic Planning Unit, Ministry of Industry and Trade General Directorate of Energy Energy/Electricity Regulatory Authority of Vietnam (ERAV), Energy Market Authority-Singapore (EMA)
[3]GDP per capita = GDP/Population, data on population sourced from Asian Development Bank (ADB)
[4]International Energy Agency (IEA), Southeast Asia Energy Outlook 2015

Table 1. ASEAN-6 Peak Demand, Installed Capacity and Electricity Consumption

Country	Population in million	Peak Demand* in MW	Electricity Consumption in GWh	Installed Capacity in MW	Installed Capacity per capita in kW	Electricity Consumption per capita in kWh
Philippines	99.88	11,822	77,261	17,944	0.18	774
Thailand	67.00	26,942	168,620	34,668	0.52	2,591
Indonesia	252.16	33,321	221,296	53,066	0.21	878
Malaysia	30.26	19,845	128,418	30,875	1.02	4,244
Vietnam	89.70	19,772	118,942	27,323	0.30	1,326
Singapore	5.47	6,869	46,403	12,863	2.35	8,483

* Total non-coincident peak

POWER GENERATION MIX

Among the ASEAN-6 countries, the Philippines and Indonesia have the most diverse power generation mix with the majority coming from coal, followed by natural gas, oil, and renewable energy (which include hydro, geothermal, wind, solar and biomass among others).

Natural gas and oil-based sources are present in the power generation mix of all ASEAN countries with varying shares. Natural gas is next to coal for being the major fuel source of power generation for the Philippines. The huge share of natural gas in the power generation mix of the ASEAN can be attributed to the abundance and availability in the region aside from its lesser emission by-product relative to fossil-based fuels like coal.

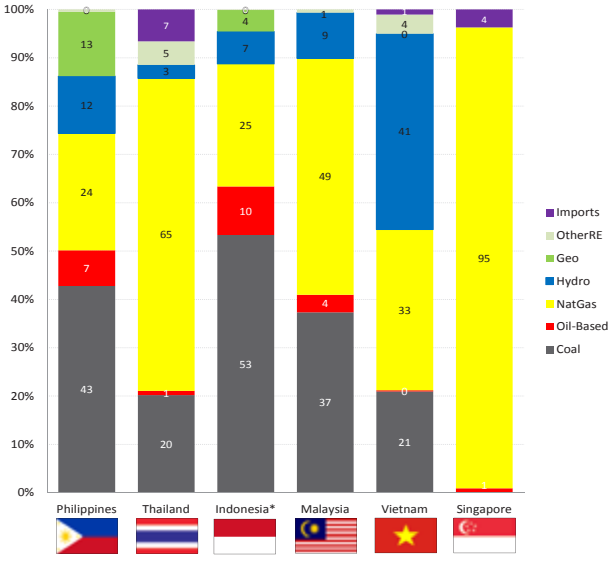


Figure 3. ASEAN-6 Power Generation Mix[5]

In contrast, oil-based sources constitute a meager share in the power generation mix of the ASEAN which only ranges from 0.3 to 10 percent.

In terms of renewable energy, electricity generated from hydro sources accounted for the highest average share among other renewables at 12 percent due to its abundance and availability in the region. Vietnam has the highest share of RE at 45 percent with majority coming from hydro sources (41 percent). Philippines follows Vietnam having a 26 percent RE share.

POWER RATES[6]

Philippine power rates across the three sectors are among the highest in the ASEAN but at par with the level of Singapore. A major reason for these higher prices is the absence of government subsidies. Thailand, Indonesia, and Malaysia arguably have subsidies. In addition, taxes, fees, and other charges are also levied on the power industry sectors composed of the generation, transmission, and distribution levels which constitute a portion on electricity rates in the Philippines.

In view of this, greater transparency of having

[5]Gas Turbine and Combined Cycle are classified under Natural Gas
[6]Sources: Philippines: Manila Electric Company, September 2015; Thailand: Metropolitan Electricity Authority, March 2016 Tariff Calculator; Indonesia: GSI Indonesia Energy Brief, January 2015; Malaysia: Tenaga Nasional Berhad, 1 January 2014, Singapore: Singapore Power, January 2016

reasonably-priced electricity rates through more unbundling of items in the energy supply chain remains part of the major thrusts of the DOE, its attached agencies, and the Energy Regulatory Commission.

Table 2. 2015 ASEAN Electricity Rates, in Peso/kWh

Country	Industry	Commercial	Domestic
Philippines	5.84	7.49	8.90
Thailand	5.37	5.37	5.52
Indonesia	1.66	2.15	1.29
Malaysia	4.71	4.97	6.02
Singapore	5.84	7.27	7.27

*Note: Rates include GST (Tax)

INDUSTRY STRUCTURE, DEVELOPMENT CHALLENGES AND KEY POLICIES

Majority of the ASEAN electric power industry is characterized by a vertically-integrated structure where the ownership, control, and management of the generation, transmission, and distribution networks are within the jurisdiction of the state. Although there are several private independent power producers (IPPs), state-owned power generation plants continue to dominate the generation sector for Thailand, Indonesia, Malaysia, and Vietnam. Likewise, the transmission and distribution systems for these countries, being natural monopolies, remain to be owned and operated by the state.

On the other hand, only Philippines and Singapore have a horizontally integrated power industry with the unbundling of the generation, transmission, and distribution systems in the 1990s. Moreover, only the Philippines and Singapore established its wholesale electricity market and are gearing towards retail and electricity future markets in pursuit of attaining full competition in the power industry. Vietnam is also heading towards a more competitive environment as it develops its wholesale electricity market.

In view of the prevailing market structure, transforming the electric power industry into a fully competitive one by encouraging greater private sector participation and the establishment of competitive markets remains a major platform for the ASEAN countries. In anticipation of the rapid increase in electricity demand, efficiency improvements in the entire network from generation, transmission and distribution still remains a priority for ASEAN energy agencies. Initiatives for region-wide interconnection thru the ASEAN power Grid that enables cross-border power trading is continuously being discussed, developed and improved.

Further, the inherent concerns on power security, fuel price availability and volatility and environmental considerations allow the ASEAN to continually intensify its efforts towards fuel mix diversification by reducing dependence on fossil fuels and expanding the share of renewable energy sources. Similarly, the ASEAN considers all technologies, including nuclear energy, as a source of power to augment supply especially in the long run and to provide baseload capacities at a more competitive cost.

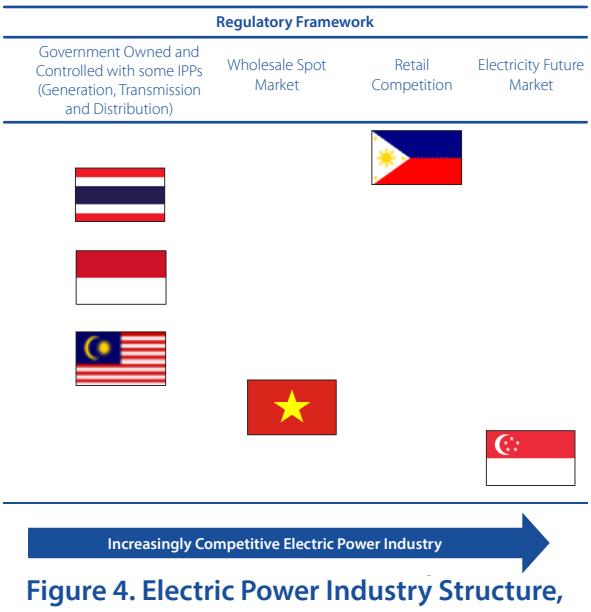


Figure 4. Electric Power Industry Structure, ASEAN-6[7]

[7]Adopted from Somani 2015 published under KPMG Report entitled "Overview of the Power Sector in the SEA Region" sourced from IMF World Economic Outlook 2014

Five-Year Performance Assessment, 2011-2015

T-D: 52MW Trans-Asia Diesel Power Plant - Trans-Asia Power Generation Corp.
18.6MW Tarlac Diesel Power Plant - Tarlac Power Corp.
103MW MPC Iligan Diesel Power Plant - Mapalad Power Corp.

DEMAND

Electricity Sales and Consumption

Despite the country's increased exposure to global risks and uncertainties including the detrimental impacts of natural calamities such as major typhoons, namely Sendong (2011), Pablo (2012), and Yolanda (2013), Bohol Earthquake (2013), and El Niño Phenomenon (2015-2016), electricity consumption grew by 19.14 percent from 69,176 GWh in 2011 to 82,413 GWh in 2015 or an annual average growth rate of 4.49 percent.

The increase is attributed to the impressive performance of the economy from 2010 to 2015 driven by the robust growth of the services, industrial and agriculture sectors, among others. Similarly, improvements in the supply side, specifically in the entry of power generation plants which augmented the total installed capacity of the country, is strongly linked with this demand-side expansion.

Sectoral Share

The share of each of the sectors comprising the total electricity consumption remained stable during the five-year period. The electricity-intensive industrial sector and the residential sector's share to total electricity consumption remained the largest with an average share of 27 percent. Meanwhile, the "others" sector which include public buildings, street lights, irrigation and others which are not elsewhere classified constitute the smallest share at 2.56 percent. The share of "own-use" consumption of power plants and distribution utilities and the power losses are maintained at an average share of 8 and 10 percent, respectively.

Sectoral Growth Rate

Positive growth rates of electricity sales and consumption were observed from 2011 to 2015. The aggressive performance of the residential sector resulted to 5.06 percent annual average growth rate. This growth level overtook the industrial and commercial sectors at 3.88 and 4.87 percent, respectively. The increasing access to electricity of the population and the rising real income per capita[8] over the years which raised the capacities of households to buy basic commodities including electricity, led to the increase in consumption on the residential level.

Despite the country's increased exposure to global risks and uncertainties, electricity consumption grew by 19.14 percent from 69,176 GWh in 2011 to 82,413 GWh in 2015 or an annual average growth rate of 4.49 percent.

Rising income levels in the country were driven by the remittances from OFWs, growth of household-based MSMEs (Micro, Small, and Medium Enterprises) and higher employment rates[9] along with the government's poverty reduction programs and policies among others.

Moreover, the Philippines' Free Trade Agreements (FTAs) and economic partnerships with the ASEAN and other non-ASEAN countries which reduced import taxes and tariff restrictions[10] contributed to the domestic penetration and availability of low-cost and high-powered technology gadgets, appliances and the like that further boosted electricity sales and consumption at the household level.

[8]BSP
[9]BSP
[10]Department of Trade and Industry. Other Trade Agreements include ASEAN-Australia-New Zealand Free Trade Agreement (AANZFTA), ASEAN-China Free Trade Agreement (ACFTA), ASEAN-India Free Trade Agreement (AIFTA) ASEAN-Japan Comprehensive Economic Partnership Agreement (AJCEPA) and ASEAN-Korea Free Trade Agreement (AKFTA)

Table 3. Electricity Sales and Consumption by Sector, 2011-2015 (in GWh)

Sector	2011		2015		2011-2015		
	GWh	% Share	GWh	% Share	Difference	Average Share	AAGR
Residential	18,694	27.02	22,747	27.60	4,053	27.23	5.06
Commercial	16,624	24.03	20,085	24.37	3,461	24.28	4.86
Industrial	19,334	27.95	22,514	27.32	3,180	27.60	3.88
Others	1,446	2.09	2,462	2.99	1,016	2.56	14.26
Total Sales	*56,098*	*81.09*	*67,808*	*82.28*	*11,710*	*81.67*	*4.87*
Utilities Own Use	5,398	7.80	7,124	8.64	1,726	8.06	7.30
Power Losses	7,680	11.10	7,481	9.08	(199)	10.27	(0.43)
Total Consumption	**69,176**	**100.00**	**82,413**	**100.00**	***13,237***	**100.00**	**4.49**

On the other hand, the industry sector's electricity sales growth was elevated by the strong performance of both the domestic and export manufacturing of electronic, automotive, metal, pharmaceutical, paper, plastic, textile and food products.[11] Likewise, the increase in private and public construction and mining activities contributed to the growth of the industrial sector from 2011 to 2015.[12]

The growth of the commercial sector is attributed to the robust performance of the services sector which has evolved to be the major contributor to the country's economic growth. The commercial and services sectors include transport and communication, real estate (condominiums, shopping malls, casinos, hotel, resort and restaurants) and business activities (BPOs, financial intermediary, trading), among others.

Despite having the smallest share to total electricity consumption, the "others" sector posted the highest five-year annual average growth rate at 14.26 percent. This growth was largely propelled by the increase in government spending especially in 2015 for the provision of goods and services to stimulate the country's economic growth. In addition, the increase in farm mechanization and adoption of modern technologies in the agriculture and fisheries sector also contributed to the growth of electricity sales for the "others" sector.

Meanwhile, the annual average growth rate of power generation and utilities' "own use" at 7.30 percent can be attributed to the massive entry of private power generation plants over the years, backed by the intensified efforts and policies of the government towards the improvement of the country's investment climate.

Significantly, power losses recorded a negative annual average growth rate at 0.43 percent from 2011-2015. Annually, power losses posted negative growth rates, due to the improved performance of the generation, transmission and distribution systems, except in 2012 and 2015. This was accomplished due to the continued and collaborative efforts of government and the private sector to enhance the efficiency of the network.

Electricity Sales and Consumption by Grid

On a per grid basis, Luzon, the country's center for commerce, business activities and major economic developments, sustained its major share

[11] Foreign Trade Statistics, PSA
[12] NEDA

to total consumption at 73.99 percent, followed by Visayas and Mindanao at 13.60 and 12.42 percent, respectively. The annual average growth rate of sales and consumption from 2011-2015 for the three Grids moved at the same pace at 4 to 5 percent range.

Despite the catastrophic damage brought by the Bohol earthquake and Super Typhoon Yolanda in 2013, Visayas' electricity consumption managed to grow at 4.19 percent fueled by the growth of electricity sales from the industry sector in the region, particularly manufacturing, mining and quarrying and construction sub-sectors. The offshoot of tourism and wholesale and retail trading brought by the growth of shopping malls, commercial centers, convenience stores and fast food chains also contributed to the growth of electricity sales. Massive increase in public infrastructure such as national highways and airports, among others, along with the strengthening of the agriculture sector, further boosted the economic activities in the Visayas.[13] Aside from rising electricity sales, the spike in own-use consumption growth rate in 2011 at 49.80 percent brought about by the entry of power generation plants in 2010, contributed to the growth of electricity consumption in the Visayas. Own-use consumption levels had normalized on the succeeding years except in 2013 where a negative growth rate of 3.40 percent was recorded as an aftermath of Typhoon Yolanda. However, this growth rate of own-use consumption was the lowest among the three Grids.

Mindanao's electricity consumption was propelled by the growth of the residential and industrial sectors. Increasing level of income, as measured by GRDP per capita, observed in Mindanao from 2011 to 2015[14] uplifted the electricity consumption on the household level. Furthermore, the increasing number of agri-economic and agri-industrial zones also spurred the electricity consumption in the region. The average annual growth rate of own-use consumption at 8.27 percent which resulted from the entry of large power plants in Mindanao was the highest among the three Grids.

Table 4. Electricity Sales and Consumption by Grid, 2011-2015 (in GWh)

Luzon	2011		2015		2011-2015	
	GWh	% Share	GWh	% Share	AAGR	Average Share
Sales	41,706	74.35	50,589	74.61	4.96	74.47
Consumption	50,965	73.67	61,099	74.14	4.65	73.99
Visayas	**2011**		**2015**		**2011-2015**	
	GWh	% Share	GWh	% Share	AAGR	Average Share
Sales	7,224	12.88	8,765	12.93	4.99	12.84
Consumption	9,508	13.75	11,184	13.57	4.19	13.60
Mindanao	**2011**		**2015**		**2011-2015**	
	GWh	% Share	GWh	% Share	AAGR	Average Share
Sales	7,167	12.78	8,453	12.47	4.22	12.69
Consumption	8,703	12.58	10,130	12.29	3.89	12.42
Total Sales	56,098	100.00	67,808	100.00	4.87	100.00
Total Consumption	**69,176**	**100.00**	**82,413**	**100.00**	**4.49**	**100.00**

[13]NEDA, Western Visayas Regional Development Plan 2011-2016
[14]NSCB

Peak Demand

The annual average growth rates of peak demand for Luzon and Visayas are in the 4 percent level while Mindanao moved at the slowest pace at only 3 percent.

Due to its already matured and highly industrialized economy, Luzon's peak demand has been recorded the highest for the whole country from 2011-2014. Peak demand for Luzon occurred during the summer months of April, May and June and is triggered by the increase in the usage of cooling and air-conditioning units due to high temperature.

Visayas peak demand was uplifted by the increase in supply starting in 2010 brought by the entry of new power plants which provided a leeway for the increase in electricity demand in the region.

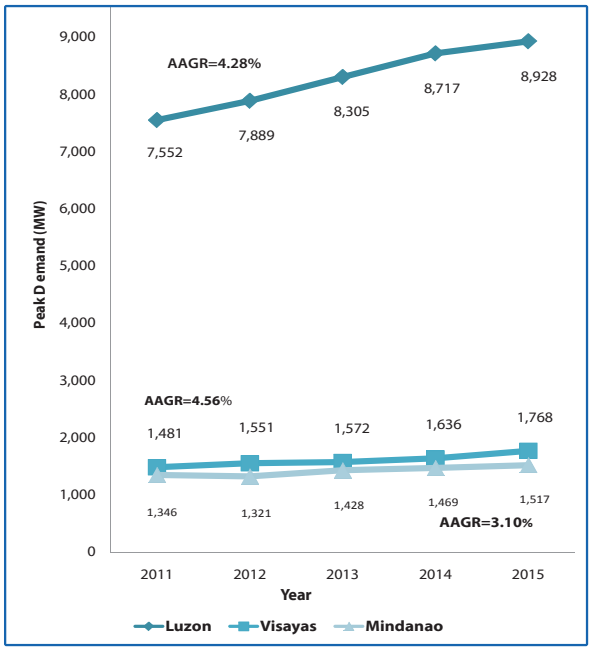


Figure 5. Peak Demand, 2011-2015 (in MW)

Moreover, the increase in industrial and commercial activities and socio-economic developments in the Visayas from 2011-2015 also contributed to its consistently rising peak demand despite the catastrophic damage and economic disruption brought by Typhoon Yolanda in November 2013 that resulted to physical damage to power generation plants as well as the transmission and distribution networks.

Despite having supply shortfalls, Mindanao's annual average peak demand growth rate managed to grow at 3.10 percent. In contrast with Luzon, peak demand in Mindanao occurred during the rainy season from November to December where the hydroelectric power plants were operating at full capacity due to the abundance of water supply.

SUPPLY

Capacity

Increasing installed capacity[15] is a good economic reference that the power sector is improving and adapting to the growing demand of the country. In the past five years, the country's total installed capacity grew by 16.10 percent from 16,162 MW in 2011 to 18,765 MW in 2015 or an annual average growth rate of 3.81 percent. This huge growth is associated to the increased installation of large coal-fired power plants, such as 651 MW GNPower Mariveles, 140 MW Petron Refinery Solid Fuel-Fired Boiler (RSFFB), 200 MW KEPCO-Salcon Power Corporation (KSPC), 246 MW Cebu Energy Development Corporation (CEDC) and 164 MW Panay Energy Development Corporation (PEDC), as baseload capacities are much needed in Luzon and Visayas for stable and reliable power supply. In 2015, coal plants were about 5,963 MW compared to 4,917 MW in 2011.

Moreover, the installed capacity of Renewable Energy (RE), both the conventional type such as geothermal, hydroelectric and biomass, and the variable RE such as solar and wind grew significantly at the end of 2015. This is due to the

[15] **Installed Capacity** – The full-load continuous gross capacity of a unit under the specified conditions, as calculated from the electric generator nameplate based on the rated power factor (source: IEEE Standard 762-2006)

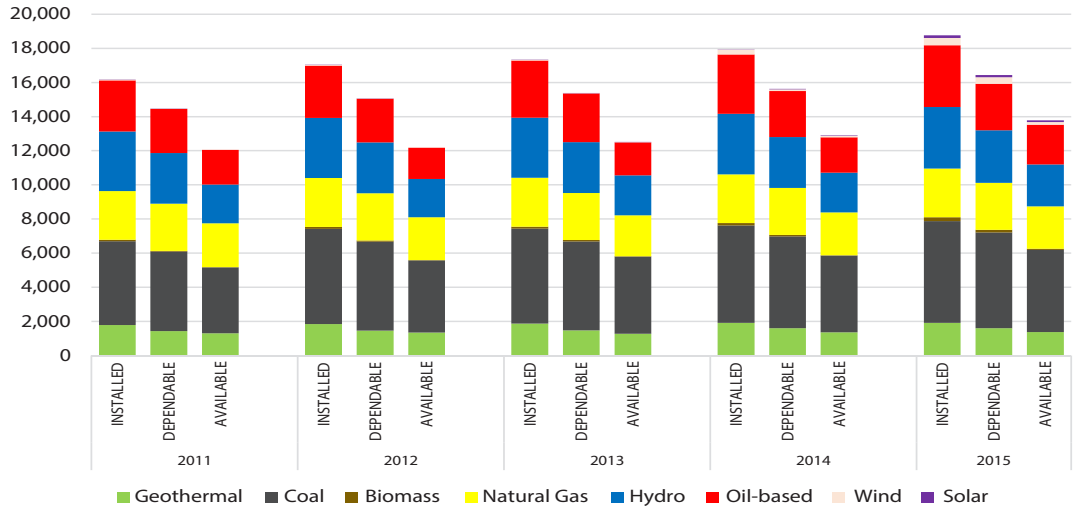


Figure 6. Philippines Installed, Dependable and Available Capacity by Plant Type, 2011-2015 (in MW)

continuous promotion and encouragement of the DOE to RE developers through fiscal and non-fiscal incentives, such as the Feed-In Tariff (FIT) and Must/Priority Dispatch System. From 5,282 MW in 2011, RE installed capacity increased in 2015 at about 6,221 MW.

Following this trend, the total dependable capacity[16] also grew by 13.50 percent from 14,477 MW in 2011 to 15,620 in 2015 or an annual average growth rate of 3.23 percent. However, the average available capacity[17] moved at a faster pace at 14 percent from 12,070 MW in 2011 to 13,778 MW in 2015 or an annual average growth rate at 9 percent. The average available capacity is based on the actual daily operations of power plants. It excluded planned and forced outages as well as major grid disturbances such as typhoon and system-wide blackouts which resulted to zero capacities.

Luzon

In Luzon, total installed capacity rose to 13,668 MW while total dependable capacity grew to 12,179 MW in 2015, associated with 16.4 percent and 12.51 percent growth from 2011-2015. About 25 percent of this increase came from the operation of the new large coal plants. The recommissioning of 242 MW Therma Mobile Power Barges (Former Duracom) in Navotas and the 116 MW Subic Diesel fuel-fired Power Plant were also added to the total capacity of Luzon. Recently, Hopewell Gas Turbine was turned over to Millennium Energy, Inc. (MEI) and the successful recommissioning of the 100 MW Gas turbine in Navotas in May 2015 commenced. The commercial operation of the 20 MW Maibarara geothermal plant in Batangas, recommissioning of 130 MW Bacman geothermal plant in Sorsogon and uprating of 132 MW Binga Hydroelectric plant also increased the capacity of geothermal and hydro plants from 2011-2015.

The growth rate of new RE plants remained stagnant up to 2013 until new wind farms were added to the existing 33 MW Bangui Wind Farm. These included the 18.9 MW Bangui Phase 3 wind farm, 150 MW EDC Burgos Wind,

[16] **Dependable Capacity** – The maximum capacity when modified for ambient limitation for a specified period of time, such as a month or a season. (source: IEEE 762-2006)
[17] **Available Capacity** – The dependable capacity, modified for equipment limitation at anytime. (source: IEEE 762-2006)

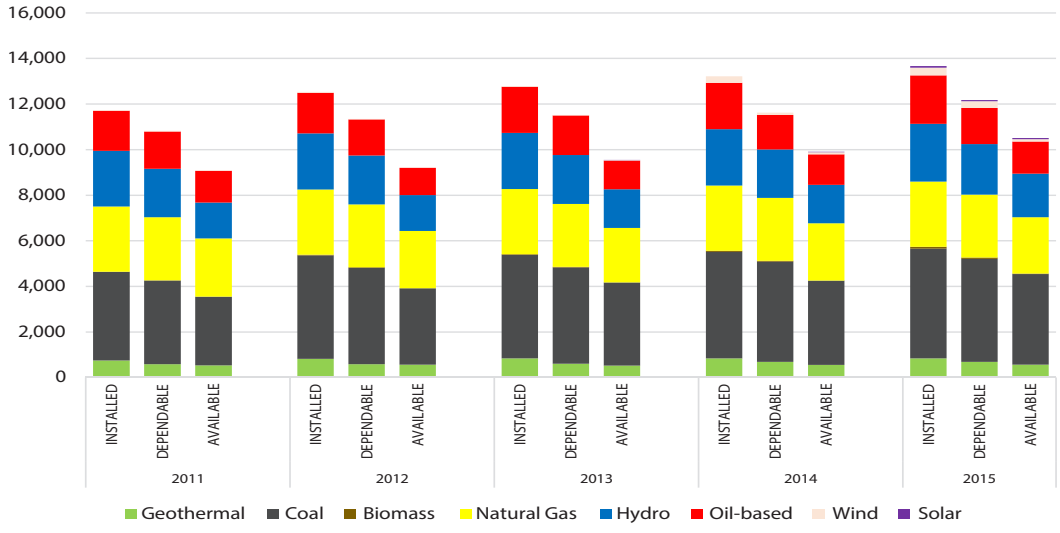


Figure 7. Luzon Installed, Dependable and Available Capacity by Plant Type, 2011-2015 (in MW)

Table 5. Luzon Additional Capacities, 2011-2015 (in MW)

Plant Type	2010 Installed Capacity (MW)	2011	2012	2013	2014	2015
Coal	3,849	0	0	651.6	0	141
Oil Based	1,984	116	0	242	12.7	100
Natural Gas	2,861	0	0	0	0	0
Geothermal	899	0	0	0	20	0
Hydro	2,346	105	0	0	0	13.2
Wind	33	0	0	0	249.9	54
Biomass	9	4.2	10.2	0	12	31
Solar	0	0	0	0	0	70
Total	**11,981**	**225.2**	**10.2**	**893.6**	**294.6**	**409.2**

*Note: There were power generating units that became non-operational over the five-year period.

81 MW NLREC Caparispisan which are located in Ilocos Region, and the 54 MW Pililia Wind in Rizal.

Visayas

In 2015, Visayas has a total installed capacity of 2,683 MW and total dependable capacity of 2,228 MW. In terms of installed capacity, the region's primary energy source is geothermal having 36.0 percent share followed by coal and oil based plants at 29.0 and 25.0 percent share, respectively.

In the past five years, most of the additional capacities are coal power plants that went online on 2011 and 2015. These are the 82 MW CEDC U3, 82 MW PEDC U2, 103 MW KSPC U2, and 83 MW TPC Expansion. In addition, renewable energy plants were also added into the grid such as the 15 MW CASA Bagasse-Fired Cogeneration that started exporting into the grid last March 2011, the 22 MW SACASOL I - A & B solar farm that started its commercial operation on May and August 2014 respectively, the 49.8 MW Nasulo GPP that went online on September 2014, and the 54 MW TAREC wind farm that

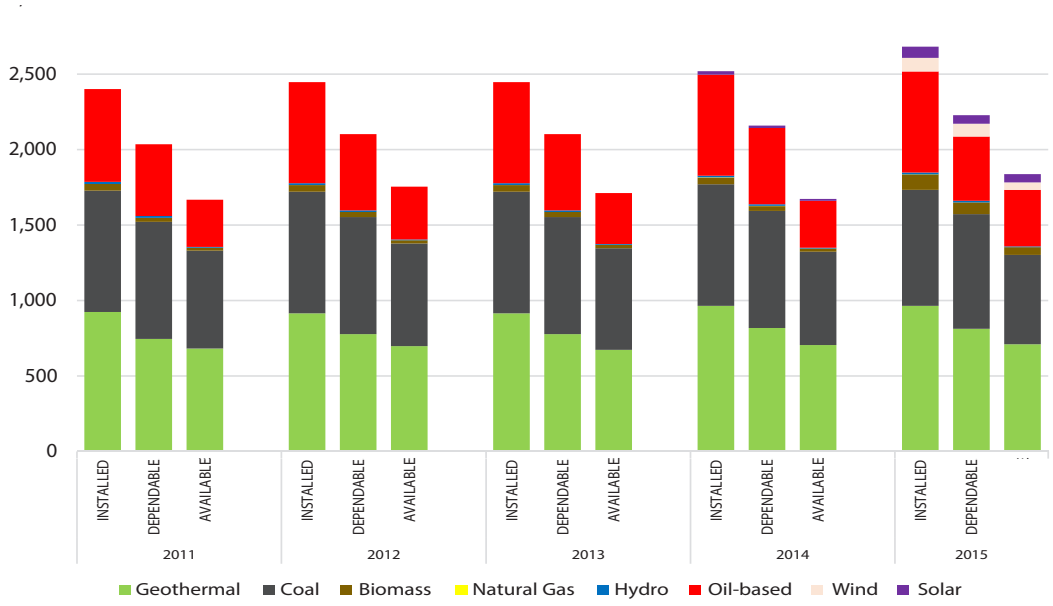


Figure 8. Visayas Installed, Dependable and Available Capacity by Plant Type, 2011-2015 (in MW)

Table 6. Visayas Additional Capacities, 2011-2015 (in MW)

Plant Type	2010 Installed Capacity (MW)	2011	2012	2013	2014	2015
Coal	542	264	0	0	0	0
Oil Based	615	0	0	0	0	82
Natural Gas	0	0	1	0	0	0
Geothermal	964	0	0	0	50	0
Hydro	13	0	0	0	0	0
Wind	0	0	0	0	0	36
Solar	0	0	0	0	22	46
Biomass	30	0	0	0	0	52
Total	**2,164**	**264**	**1**	**0**	**72**	**216**

*Note: There were power generating units that became non-operational over the five-year period.

started its operation last December 2014. Adding to the list of renewable energy plants are the 30 MW SOLEQ and 23 MW SACASOL I – C & D solar farms, the 36 MW Nabas wind farm, the 46 MW URC, the 8 MW HPCo, and the 3 MW VMC Biomass Cogeneration plants.

It can also be noted that there are power plants in the Visayas grid that have been decommissioned. These are the 106.8 MW Cebu TPP 1 and 2, the 1.08 MW Ton-ok and the 0.81 NW Hinabian HEPPs, and the 49 MW Northern Negros GPP. The Power Barge 103 is still on shutdown and was recently privatized by PSALM. The Cebu Land-Based GT owned by SPC Island Power Corporation and located within the Naga complex is also on economic shutdown and under preservation since 2011.

Mindanao

For Mindanao, the total installed capacity in 2015 is at 2,414 MW while the total dependable capacity is at 2,025 MW with corresponding growth rates from 2011 to 2015 at 4.57% percent and 5.87% percent, respectively. Power supply in

Mindanao is still highly dependent on the hydro resources of the Agus and Pulangi Hydro Power Plants. The recommissioning of the former Iligan Diesel Power Plant with an installed capacity at 103 MW by the Mapalad Power Corporation formed a significant role in securing the supply of Mindanao for 2013. For the last quarter of 2015, the power supply in Mindanao also improved due to the commissioning of the Therma South Coal Unit 1.

In addition, the increase in capacity for the Mindanao Grid is attributed to the influx of embedded diesel power plants with a total of 30.7 MW for 2012, 37.6 MW for 2013, 92.9 MW for 2014 and 34.6 MW for 2015. There are also run-off river type hydropower plants which are embedded to the DUs such as 9.2 MW Cabulig HEP and 2 units from Tudaya HEP which have a total of 13.6 MW of installed capacity. These embedded power plants are important to the DUs especially during peak hours as these generators fill the deficiency in supply.

Lastly, there are two (2) solar power plants that have been commissioned in Mindanao for the year 2015. These are the 6.2 MW Centralla Solar and 12.5 MW Kirahon Solar.

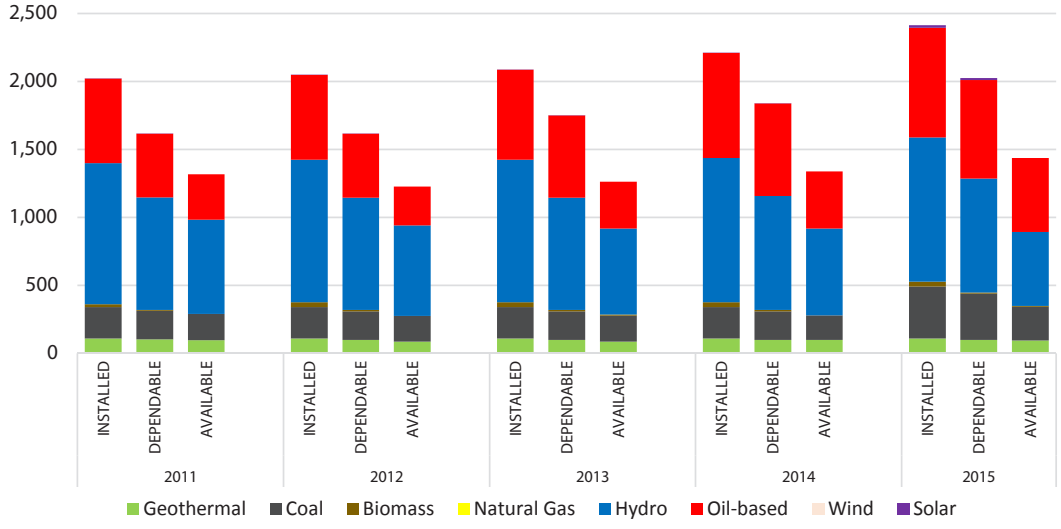


Figure 9. Mindanao Installed, Dependable and Available Capacity by Plant Type, 2011-2015 (in MW)

Table 7. Mindanao Additional Capacities, 2011-2015 (in MW)

Plant Type	2010 Installed Capacity (MW)	2011	2012	2013	2014	2015
Coal	232	0	0	0	0	150
Oil Based	594	0	30.7	140.6	92.9	34.6
Natural Gas	0	0	0	0	0	0
Geothermal	103	0	0	0	0	0
Hydro	1,041	0	9.2	0	13.6	0
Wind	0	0	0	0	0	0
Biomass	0	0	35.9	0	0	0
Solar	1	0	0	0	0	18.7
Total	**1,971**	**0**	**75.8**	**140.6**	**106.5**	**203.3**

*Note: There were power generating units that became non-operational over the five-year period.

Generation

As new generating capacities were added to the existing supply, generation or production of electricity also grew in the past five years which manifested the improvements in the generation sector of the Philippine Power Industry. Generation in 2011 at 69,176 GWh rose up to 82,413 GWh after five years with substantial 19.14 percent growth, as shown in Figure 10.

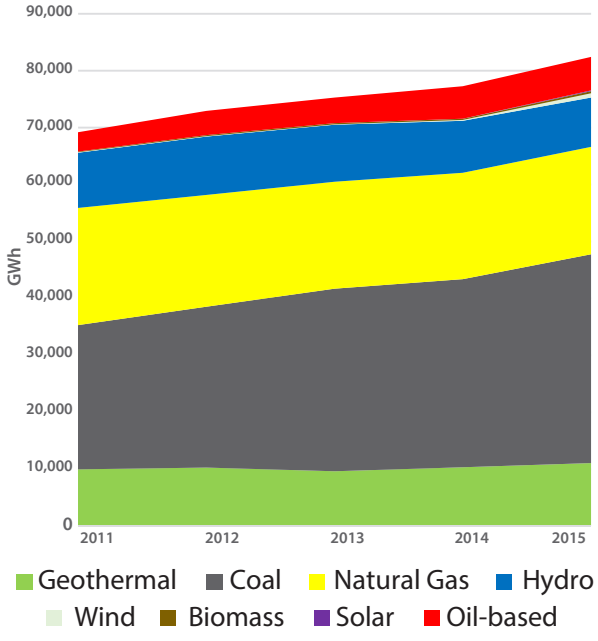


Figure 10. Philippine Power Generation Mix, 2011-2015 (in GWh)

Coal generation also increased in the past five years and became the most dominant and most utilized source in the generation mix. This is because coal plants provide low-cost generation and a stable operation. From 25,342 GWh in 2011 coal generation escalated to 36,686 GWh or boasting 44.76 percent growth in just five years.

Luzon

The Luzon Grid has the largest generation among the three grids since almost three-fourths of the total generating facilities are from this grid. Starting 2011, Luzon has generated 50,017 GWh of energy and it grew with an average annual growth rate of 4.71 percent. Majority of the increase is attributed to the increase of new coal-fired power plants in the grid. In 2011, there were only 19,681 GWh coming from coal plants and eventually, coal generation increased by about 50 percent due to the operation of new plants such as the 651 MW GNPower Mariveles and the 140 MW Petron RSFFB.

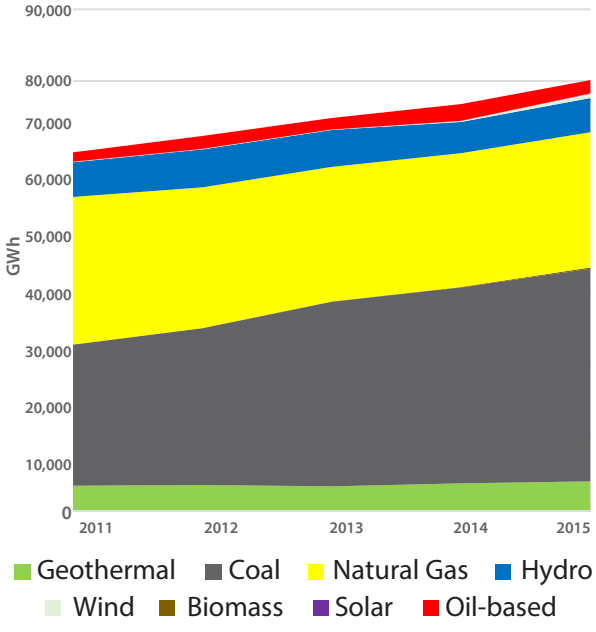


Figure 11. Luzon Power Generation Mix, 2011-2015 (in GWh)

Generation from Natural Gas Power Plants remained almost at 20,000 MWh except in 2013 due to the 2013 and 2015 Malampaya Scheduled Maintenance Shutdown (SMS). In those years, the off-shore gas facility cut off its supply for 30 days to the three large natural gas-fired power plants such as 1,200 MW Ilijan, 1,000 MW Sta. Rita and 500 MW San Lorenzo plants. These plants used alternate fuels to continue their operation during the maintenance of Malampaya.

Visayas

The Visayas Grid remains primarily dependent on the energy generated by geothermal and coal power plants. Coal generation in the region grew by 16.5 percent from 2011 to 2012 due to the various coal power projects that went online. On the other hand, it can be observed that the generation from diesel-fired power plants for the past five years (2011-2015) have been stable and were relatively lower compared to the years before significant number of baseload capacities were introduced in the area.

As seen in Figure 12, total generation in Visayas for 2013 and 2014 were lower compared to 2012. This can be attributed to the recent calamities that struck the region, such as the October 2013 magnitude 7.2 earthquake in Bohol and the November 2013 Super Typhoon Yolanda that caused heavy damage to the Visayas that included various generating facilities and the transmission and distribution lines and equipment.

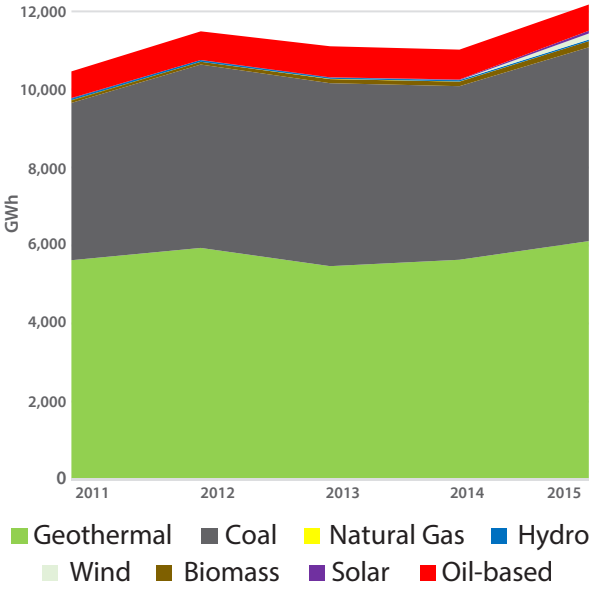


Figure 12. Visayas Power Generation Mix, 2011-2015 (in GWh)

With the current push for renewable energy, the contribution of renewable energy resources such as solar, wind, and biomass to the generation mix of the region is becoming more significant. The power generated from these resources grew by 194 percent from 2014 to 2015. This growth is still expected to increase in the coming years since most of the capacities that are expected to be in operation are renewable energy plants.

Mindanao

The Mindanao Grid generated 10,129,866 MWH of energy for 2015 and it grew with an average annual growth rate of 3.89% percent from 2011. This growth is attributed to the addition of embedded generators (diesel and run-off river hydro plants) and the commercial operation of the Therma South Coal Unit 1.

Hydro power plants retained its largest share in the generation mix of Mindanao for the past years despite the frequent maintenance and outages of the Agus and Pulangi hydroelectric power plants. There are also a number of run-off river types of hydroelectric power plants that were commissioned from 2011 to 2015 which are embedded to distribution utilities. These power plants have contributed to the share of hydro sources to the power generation mix of Mindanao.

On the other hand, coal-fired generation in Mindanao from 2011-2013 has been stable except in 2014, where coal generation declined due to the Mindanao Wide Blackout that occurred on February 2014. This damaged the units of the STEAG Mindanao Coal Fired Power Plant and caused the power plant to undergo maintenance for at least two months. For 2015, the generation from coal increased due to the commercial operation of Therma South Coal Unit 1.

The generation of diesel power plants dropped from 2010 to 2011 due to the rehabilitation and upgrading of the former Iligan Diesel Power Plant. After the rehabilitation, the power plant was recommissioned under the Mapalad Power Corporation (MPC) in 2013 which contributed to the increase in generation for diesel. The other power plants that are operating using diesel fuel are the Southern Philippines Power Corp. in General Santos City, Western Mindanao Power Corp. in Zamboanga City and the two power barges operated by the Therma Marine Inc. The increase in generation for 2014 is mainly attributed to the embedded diesel generators that started operating during the year.

For biomass, the bagasse-fired cogeneration Plant of Crystal Sugar started exporting to FIBECO in the year 2012. Generation from geothermal power plants has been stable in the past five (5) years with the normal operation of the Mt. Apo Geothermal Power Plant.

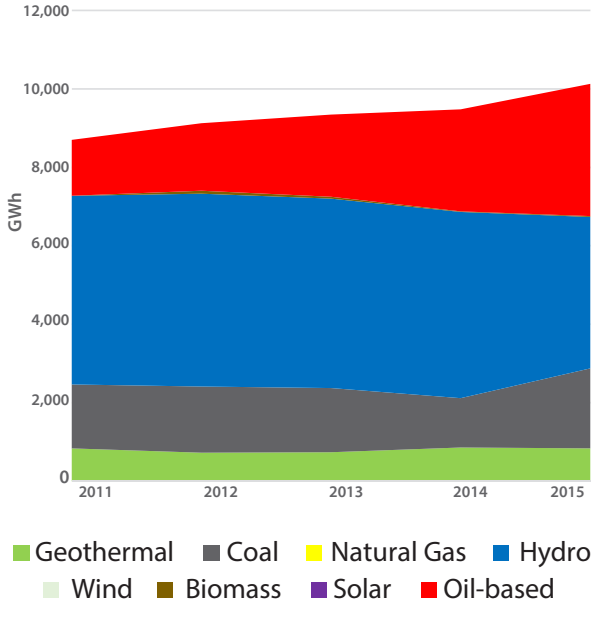


Figure 13. Mindanao Power Generation Mix, 2011-2015 (in GWh)

AGE AND ECONOMIC LIFE OF POWER GENERATING PLANTS

The DOE is looking at assessing the power sector performance based on the age of existing power generating plants relative to its economic life. This shall be part of the DOE's plant performance assessment and benchmarking activities to improve power generation, operational efficiency and system reliability.

For coal-fired power plants, some subcritical plants in Luzon and Visayas were already beyond 30 and 20 years in operation, respectively. In general, Coal-fired power plants are prescribed to be operational for a period of 60 years provided that periodic maintenance will be implemented by operators.

Natural gas power plants in Luzon are almost two-decade-old in operation since the commissioning of the Malampaya Gas facility in Palawan in 2000. It is projected that by 2024, the supply of natural gas from Malampaya will be depleted.

Hydro power plants in the Philippines are the oldest among the types of technology mentioned. Some of these plants, such as Botocan and Caliraya, have been operational since World War II. Geothermal power plants in the Philippines have exceeded their typical economic life which is at 20 years. For example, Makban and Tiwi, two of the larger geothermal power plants have already been operating for more than 30 years.

On the other hand, other RE technologies such as solar, wind and biomass are new with ages ranging from one to twelve years. Biomass technologies are expected to last up to 45 years while solar and wind are up to 20 to 30 years.

Table 8. Age of Power Generating Plants per Technology

Plant Type	Economic Life*	Luzon			Visayas			Mindanao		
		Max	Min	Ave	Max	Min	Ave	Max	Min	Ave
Coal										
Subcritical Pulvurized	60	33	4	18.5	24	24	24	11	11	11
Circulating Fluidized Bed (CFB)	60	2	1	1.5	7	1	4	2	1	1.5
Oil-based	30	24	3	13.5	39	1	20	23	4	13.5
Natural Gas	30	17	1	9.0						
Renewable Energy (RE)										
Geothermal	20	38	3	20.5	34	3	18.5	21	21	21
Hydro	100	75	2	38.5	56	1	28.5	64	3	33.5
Wind	20	12	3	7.5	3	2	2.5			
Biomass	45	8	1	4.5	10	2	6			
Solar	30	2	1	1.5	3	1	2	1	1	1

* Source: National Renewable Energy Laboratory (NREL), 2008

SIGNIFICANT INCIDENTS

Over the five-year period, the electric power industry encountered several forced outages and significant incidents which led to major system disturbances and power interruptions. In 2011, 2013 and 2015, the Malampaya preventive maintenance activities resulted to supply deficiency in Luzon due to limited capacity from Ilijan power plant and the occurrence of forced outages. Furthermore, this also resulted to higher power cost by running these combined-cycle power plants using alternative fuels. Major blackouts also occurred due to technical issues such as system faults, transmission line trippings and cascading forced outages of power plants. Moreover, the power system was adversely affected by natural disasters such as the El Niño, typhoons and a major earthquake causing damage to energy infrastructure. In Mindanao, transmission tower bombings caused disruptions in power delivery of generating plants.

2011

- **Plant Outages**

  In 2011, Luzon and Mindanao posted negative growth in power generation due to the planned maintenance outages of major coal power plants in Luzon such as Calaca Unit 1 (300 MW) since September 2011, Pagbilao Unit 1 (382 MW) during the whole 4th quarter of 2011 and Sual Unit 1 since 20 August to 16 October 2011. In Mindanao, Mindanao Coal Unit 1 (116 MW) was on planned outage since 15 to 24 October 2011 while Mindanao Coal Unit 2 since 16 to 31 July 2011.

- **20 to 26 October 2011 - Malampaya Scheduled Shutdown**

  Generation from natural gas slightly increased to about 4 percent in 2011 due to the supply constraint brought about by the maintenance

shutdown of the Malampaya natural gas pipeline from 20 to 26 October. The effect of the gas restriction caused the whole plant of Ilijan (1,200 MW) to be unavailable for the whole period in parallel with the Malampaya Natural Gas shutdown.

- **27 September 2011 - Typhoon Pedring**

  In 2011, Typhoon Pedring (international name: Nesat) hit Luzon grid on 27 September 2011 and caused damages to the power lines in many areas in the NCR and the nearby provinces of Cavite, Batangas, Bulacan suffered blackouts as strong winds damaged power lines. It was estimated to 1.9 million or "almost close to half" of Meralco's customers were left without power as the storm swept through Metro Manila and surrounding provinces.[19] Pedring caused power outage in Luzon which dropped the grid demand to a low 3,732 MW.

- **16 to 18 December 2011 - Tropical Storm Sendong**

  On the latter part of 2011, Tropical Storm Sendong (international name: Washi) was named the world's deadliest typhoon that hit Philippines in 2011 and killed at least 957 people with hundreds missing according the National Disaster Risk Reduction and Management Council (NDRRMC).[20] It made its first landfall at the vicinity of Hinatuan, Surigao del Sur in the afternoon of 16 December 2011 and traversed the provinces of Agusan del Sur, Bukidnon and Misamis Oriental, and the cities of Cagayan de Oro and El Salvador before midnight. This caused torrential rains that led to widespread and catastrophic flooding, including power outages in major cities in Northern Mindanao such as Cagayan de Oro and Iligan City.

2012

- **04 December 2012 – Typhoon Pablo/ Bopha**

  On 04 November 2012, Typhoon Pablo (International Name: Bopha) slammed Mindanao provinces such as Misamis Oriental, Surigao del Sur, Agusan del Sur, Compostela Valley, and Davao Oriental as well as Siquijor province, hitting some of the same cities and towns still recovering from the havoc suffered during Typhoon Sendong in 2011. Pablo was 375 miles in diameter and packed gusts up to 130 mph with torrential rains on average over one inch per hour. According to the NDRRMC, as of December 18, the death toll from Pablo reached 1,046 people with 841 still missing, and damages to agriculture reaching $398 million, infrastructure $190.4 million, and private property $1.2 million. [21]

  Several transmission lines servicing Mindanao distribution utilities were cut during the passage of Typhoon Pablo which brought down the total grid demand to 791 MW.

2013

- **15 October 2013 – Bohol Earthquake**

  An earthquake of tectonic origin with a magnitude of 7.2 occurred in Region VII at about 8:12 a.m, 15 October 2013 with an epicenter at Carmen, Bohol Province. This caused region-wide outages in Bohol, Cebu and Negros. Power plants such as Central Azucarera de San Antonio (CASA) and Panay Energy Development Corporation (PEDC) in Iloilo as well as the Cebu Thermal Power Plant 2 (CTPP2) and Cebu Energy Development

[19] http://www.gmanetwork.com/news/story/233585/news/nation/typhoon-pedring-exits-luzon-leaves-18-people-dead
[20] http://news.abs-cbn.com/nation/12/19/11/sendong-worlds-deadliest-storm-2011
[21] http://asiafoundation.org/2012/12/19/typhoon-pablo-batters-typhoon-free-mindanao/

Corporation (CEDC) in Cebu, went on outage due to destruction caused by the earthquake but went back on normal operation on the same day.

Unfortunately, majority of the supply which was coming from the Leyte grid (mainly from Unified Leyte Geothermal Power Plant) thru the submarine cable connecting Bohol and Leyte was cut off due to the earthquake.

- **08 November 2013 – Super Typhoon Yolanda/Haiyan**

  On November 8, 2013, Super Typhoon Yolanda (International Name: Haiyan) cut a devastating path across the central Philippines. It made a landfall at Guiuan, Eastern Samar. It had a storm strength of category 5 - highest and the strongest tropical cyclone to ever make a landfall. It had sustained wind speed at 195 miles per hour and wind gusts up to 235 miles per hour. This natural calamity caused severe damage to the power system in Visayas. In the transmission sector, NGCP accounted 566 transmission structures (248 towers and 318 poles) that were damaged by the typhoon. Also there were 7 substations that were damaged in the area.

  Majority of distribution utilities in Visayas, as well as in Bicol and MIMAROPA regions, suffered immensely during the devastation of the typhoon. There were also power plants that incurred damages from the strong winds of the typhoon, as follows:

  - Tongonan Geothermal and Unified Leyte (Cooling towers of the Malitbog, Tongonan and Mahanagdong Power Plants have sustained damages including Admin building and control rooms; and
  - PB 103 in Estancia, Iloilo (detached mooring causing damage to hull and oil spill to the area)

- **11 November to 10 December 2013 – 30-day Malampaya Off-shore Gas field Turnaround**

  The Malampaya scheduled maintenance shutdown was intended for the replacement of the obsolete Safety Instrumented System (SIS) and Fire and Gas System on SWP. It also included additional works such as implementation of changes to enable production of new wells for Malampaya Project 2 and, completion of critical electrical tie-ins for the depletion compressors. Original schedule was 01 November to 01 December 2013 but was moved to a new schedule of 09 November to 08 December 2013. This was further moved to a later date, 11 November to 10 December 2013. The two-day deferment was caused by the delay in the shipment of equipment and personnel to the off-shore gas field during the Super Typhoon "Yolanda" (Haiyan) that hit Central Visayas on 08 November 2013.

  This activity on Malampaya off-shore gas field caused the tight supply condition in the Luzon Grid. Ilijan Block A operated at a limited capacity of 420 MW due to biodiesel operation then went on planned outage from 05 to 10 December 2013 due to 5-day nozzle cleaning in preparation for the gas operation. On the other hand, Block B was out for Maintenance from 12 November to 12 December 2013. Available units of Sta. Rita and San Lorenzo power plants operated using alternate fuel during the maintenance shutdown. Aside from these outages of natural gas power plants, there were other

outages that occurred within the turnaround period that aggravated the tightness of supply in Luzon:

- GNPower Unit 2 (Forced outage from 12 to 19 November 2013 due to turbine vibration correction)
- Calaca Unit 1 (Forced outage from 26 October to 15 November 2013 due to low condenser vacuum)
- Pagbilao Unit 2 (Planned outage from 31 August to 26 November 2013)

Several coal-fired generating units also suffered boiler tube leak during the latter part of the turnaround causing severe supply shortage in the Luzon grid and high offer price of peaking power plants in the Wholesale Electricity Spot Market (WESM). The coal-fired power plants that went on forced outage due to boiler tube leak are as follows:

- GNPower Unit 2 (Forced outage from 27 November to 08 December 2013);
- Pagbilao Unit 1 (Forced outage from 28 November to 12 December 2013);
- Pagbilao Unit 2 (Forced outage from 28 November to 13 December 2013); and
- Masinloc Unit 1 (Forced outage from 06 to 08 December 2013)

With these outages, the electricity price for November and December of MERALCO was greatly affected. The rate of Meralco, which comprises almost 70 percent demand in Luzon, in December spiked on account of higher generation charge for power purchased from WESM. Meralco had to buy more power from the spot market due to tight supply brought about by the Malampaya maintenance and the simultaneous outages of some power plants.

The average WESM price ballooned to P33.216 per kilowatt hour (kWh) in November and P36.08 per kWh in December, against only P13.74 per kWh in October. The Supreme Court (SC) issued a Temporary Restraining Order (TRO) on Meralco's record high price increase in its December generation charge of P3.44 per kilowatt-hour to P9.10 per kWh.

In effect, the SC ordered Meralco to revert to its old generation charge of P5.67 per kWh. With the rate hike of over P4 per kWh on hold, Meralco faces roughly P10 billion in payables to energy suppliers, through the Philippine Electricity Market Corp., the operator of the WESM.

2014

- **27 February 2014 – Mindanao Blackout**

On 27 February 2014, Mindanao experienced a grid-wide blackout due to a demand and supply imbalance causing under-frequency (UFR). This was caused by a combination of events like the unwanted loss of generation of 2 x 105 MW STEAG Mindanao Coal-fired Power Plant caused by unprecedented plant control system trouble, defective equipment of Agus 1 Hydroelectric power plant and insufficient Automatic Load Drop (ALD) at Off-Peak scenario.

Repair of Unit 1 (105 MW) was completed on 08 May 2014 and Unit 2 (105 MW) went online on 01 June 2014.

- **12 July 2014 – PIGging activity for Ilijan Pipeline**

Due to the compromised integrity of the Ilijan pipeline supplying natural gas, the National Power Corporation, in coordination with the

other stakeholders such as Shell Philippines Exploration B.V, KEILCO, DOE, NGCP, PSALM conducted a "PIGging" activity to check if there were abnormalities such as leaks, malformation or dents within the pipeline. An instrument called PIG, which stands for Pipeline Intelligence Gauge, was inserted in the pipeline and traveled from Tabangao on-shore gas facility to the Ilijan power plant. This activity was the first PIGging of the said pipeline after it was constructed 12 years ago.

The PIGging activity for Ilijan pipeline was finalized on scheduled on 11 July 2014 (2200H) to 13 July 2014 (2200H) for the purpose of inspecting its integrity, and to clean the debris in the pipeline. Due to this activity, the Luzon grid experienced Red alert on 12 July 2014, Saturday, due to generation deficiency caused by limited capacity of Ilijan, and the outages of Masinloc Unit 1, Calaca Unit 2, Pagbilao Unit 1 and GN Power Unit 2.

- **15 to 16 July 2014 – Typhoon Glenda/ Rammasun**

  Typhoon Glenda (International Name: Rammasun) hit the Luzon particularly Bicol region, Southern and Central Luzon as well as Metro Manila. It had 250 kph wind and caused Php 38 billion damages to agriculture and infrastructure .[22]

  Power supply from power plants such as the coal plants of Pagbilao and QPPL as well as the natural gas plants like Ilijan, Sta Rita and San Lorenzo were affected by the typhoon. Around 90% of Meralco's franchise area experienced power outage brought about by downed poles, lines and outages of transmission lines according to NGCP.

2015

- **19 February 2015 – Visayas Partial Blackout**

  There was a widespread system disturbance in Visayas grid which occurred last 19 February 2016 at around 1:45 AM due to a fault caused by the explosion of Potential Transformer (PT) at the 138 kV side of Cebu Diesel Power Plant 1 (CDPP1) Generator Transformer No. 2 connected to the NGCP Old Naga substation. Power restoration was completed at 9:09 AM of the same date.

- **15 March to 13 April 2015 – 2015 Malampaya Turnaround**

  In the advent of a projected power shortage in the Luzon grid in Summer 2015, Shell Philippines Exploration B.V. conducted their 30-day maintenance of the Malamapaya to give way for the coupling of the newly built Malampaya Phase 3 platform to the existing platform. The purpose was to increase the capability to retrieve the indigenous gas supply in SC-38. With this maintenance, gas supply for natural gas has been cut out. Contingency plan during this event is the operation of 1,500 MW Sta. Rita and San Lorenzo Natural gas-fired power plant in Batangas using condensate as alternative fuel. This is more expensive compared to the natural gas from Malampaya. For the 1,200 MW Ilijan plant, also in Batangas, Block A (600 MW) was operated using biodiesel at a limited capacity of 420 MW while Block B was scheduled for maintenance.

- **5 April 2015 – Mindanao Blackout**

  At 1:01 AM of 5 April 2015, Mindanao grid experienced a system blackout. A fault occurred on Line 2 of Agus 7 138 KV which

[22]Data gathered from the last update by National Disaster Risk Reduction and Management Council (NDRRMC) as of September 16, 2014

was caused by the failure of the insulator of Agus 7 138 kV double circuit line 2 Phase A due to severe corrosion of the suspension insulator shank. The sequence of events led to the tripping of the transmission lines and power plants followed by the splitting of the Mindanao grid into two sub-grids - the Northern and Southern part, then resulted in total system collapse. The system collapse was due to the lack of supply during that time to support the demand.

All Area Control Centers (ACC) sub-grids were interconnected and all NGCP substations were fully energized at 7:52 AM of 5 April 2015.

- **June 2015 – Fire incident that affected the operations of KSPC**

A fire incident happened last 31 May 2015 within the compound of the coal plant of KSPC which affected the coal conveyors of the generating facilities. Both units were out from 31 May to 03 June 2015 that put the Visayas grid on Red Alert status. KSPC Unit 1 (103 MW) went online on 4 June 2015 while KSPC Unit 2 (103 MW) was on unplanned maintenance from 31 May to 14 June 2015.

- **October 2015 – Typhoon Lando**

On 12 October 2015, a typhoon was detected in the Pacific Ocean named "Lando" with an international name "Koppu". It entered the Philippine Area of Responsibility (PAR) on 14 October 2016 and made its landfall on 18 October 2016 over Casiguran, Aurora with a maximum speed of 185 kph and gustiness of 220 kph. There were four (4) 500 kV lines, twelve (12) 230 kV lines, and forty-two (42) 69 kV lines that were affected during the passage of the said typhoon. Typhoon Lando dissipated on 21 October 2015 as it entered from Aurora, crossed Nueva Ecija, Nueva Viscaya, Benguet, Ilocos Sur, and exited Ilocos Norte leaving 13 provinces with full or partially province-wide power outages due to the affected transmission lines.

- **2015 El Niño Phenomenon[23]**

Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) declared the state of El Niño in 2015 characterized by unusually warm ocean surface temperatures in the central and eastern equatorial Pacific. This resulted to a period of long dry spell to drought characterized by below to way below normal rainfall conditions. From weak to moderate conditions in the early months of 2015, strong El Niño evolved starting fourth quarter of 2015 affecting most parts of the country. This phenomenon persisted until June 2016 which resulted to high system demand and low water level of reservoirs and weirs, especially in Mindanao.

- **Bombed and Toppled Transmission Towers in Mindanao for 2015**

In 2015, there were occurrences of transmission tower bombings in Mindanao which caused the interruption in the power delivery of power plants. A series of investigations and coordination meetings in Congress, under the House Committee on Energy, were held to seek resolutions on the issue as well as to resolve any peace and security concerns to prevent future bombings of the power industry assets such as transmission towers, substations, and others. Following were the towers bombed in 2015:

[23]PAGASA El Niño Advisories

Table 9. Bombed and Toppled Transmission Towers in Mindanao for 2015

Affected Transmission line	Tower No.	Date of Bombing	Date of Temporary Restoration	Date of Permanent Restoration
Kabacan-Sultan Kudarat 138kV Line	26	13 January 2015		13 October 2015
Kabacan-Sultan Kudarat 138kV Line	41	18 January 2015		03 October 2015
Kibawe - Tacurong 138kV Line	155	26 January 2015		21 December 2015
Kabacan-Sultan Kudarat 138kV Line	25 (IED unexploded)	27 January 2015		
Kibawe – Sultan Kudarat 138kV Line	44, 45	09 October 2015	17 October 2015	
Kabacan-Sultan Kudarat 138 kV Line	110 (IED unexploded)	18 October 2015		
Agus 2 – Kibawe 138 kV Line	20	29 October 2015		16 December 2015
Agus 2 – Kibawe 138 kV Line	19	29 October 2015		09 November 2015
Agus 2 – Kibawe 138 kV Line	21 (not toppled)	29 October 2015		01 November 2015
Agus 2 – Kibawe 138 kV Line	13 (not toppled)	06 November 2015		09 November 2015
Kibawe-Tacurong 138 kV Line	69 (IED unexploded)	13 November 2015		
Kibawe – Sultan Kudarat 138kV	68	10 December 2015	16 December 2015	
Kibawe – Sultan Kudarat 138kV	168 (not toppled)	18 December 2015		20 December 2015
Kibawe – Tacurong 138kV Line	153 (not toppled)	23 December 2015		28 December 2015
Agus 2-Kibawe 138 kV Lines 1 and 2	25	24 December 2015		Restoration works were suspended since 29 December 2015
Kibawe-Sultan Kudarat 138 kV Line	95 (not toppled)	24 December 2015		27 December 2015
Balo-i-Agus 2 138 kV Lines 1 and 2	4 (not toppled)	28 December 2015		29 December 2015

CHALLENGES AND KEY POLICIES AND PROGRAMS

Ensuring power supply security in the three Grids, especially in Mindanao, has been the forefront concern over the recent years. These challenges encompass not only the supply and/or technical constraints in the whole system but also involve institutional and regulatory concerns. Among others, below are the major challenges which have been encountered over the five-year period:

Luzon, Visayas and Mindanao

1. Bureaucratic processes involved in the issuance of various permits, clearances and certificates
2. Higher occurrence of Forced Outages
3. Apparent Poor Maintenance of Power Facilities
4. Unresponsive Protective Relays
5. Line Congestions
6. Delays in the completion of generation and transmission projects
7. Impacts of Climate Change/Natural Calamities (Typhoons, Earthquake and El Niño)
8. Malampaya Gas Turnaround and Restrictions

9. Right of Way Issues
10. Need for a well-defined treatment of embedded generation in the market system

Specific for Mindanao

1. Insufficient capacities and over dependence on hydro power
2. Decreasing capability of the aging power plants of Agus and Pulangui Hydro Complex
3. Timely commissioning of needed capacities have not materialized due to various technical, commercial, institutional and regulatory issues and environmental concerns raised by Local Government Units (LGU) and communities
4. Insufficient power supply contracts of some distribution utilities
5. Peace and order (Bombing of Transmission Facilities)
6. Intentional planting of vegetation and construction of structures under transmission facilities

To address these, the DOE, in coordination with its attached agencies, the Energy Regulatory Commission (ERC) and electric power industry participants, has undertaken the following initiatives, policy issuances and programs to ensure supply security, foster competition, and increase energy access.

Interruptible Load Program (ILP)

In 2015, the country experienced "yellow" and "red" alert statuses due to thin reserves and forced outages of power plants. As part of the counter measures, the DOE and the Energy Regulatory Commission (ERC) implemented the Interruptible Load Program (ILP).[24] Under this program, Distribution Utilities (DU) and its Participating Customers (PCs) enter into an agreement for a voluntary full or partial de-loading of the PC during a mutually agreed period of time. PCs with stand-by generation capacities that are requested by the DU to participate in the ILP during instances of power supply deficits will be compensated should they use their own generating facilities.

To date, there are about 3,612 MW of Self-Generating capacities that can be tapped to participate in the ILP excluding those SGFs owned by firms that are directly connected to the grid. There are about 979 MW SGF capacities committed to participate in the ILP in Luzon, Visayas, and Mindanao with 792.65 MW in Luzon for its Captive Customers and contestable customers within DUs' franchise areas. The Visayan Electric Company is the lone implementer in the Visayas with 63.70 MW while seven (7) DUs in Mindanao have implemented the ILP involving 48 SGFs with combined capacity of 58.40 MW.

Mindanao Modular Generator Set Program[25]

This program was implemented to provide the needed additional power supply to electricity end-users in Mindanao. Through Executive Order 137, the Department of Budget and Management (DBM) was directed to release the amount of Four Billion Five Hundred Million Pesos (PhP 4.5 Billion) sourced from the Malampaya Fund for the implementation of the said modular generator sets program. Under the Program, a loan facility is extended to participating electric cooperatives (ECs) in Mindanao for the acquisition of the modular gensets as an immediate relief to supply the needed power in the franchise areas of ECs. The ECs have the option to eventually retain the generator sets or return the generator sets to the Government when the power supply in Mindanao has already stabilized after the entry of new power generation projects. Following are the ECs that availed the Program as of December 2016:

[24] ERC Resolution No. 8, Series of 2010 and amended by Resolution No. 8, Series of 2013
[25] Executive Order No. 137 Series of 2013

Table 10. Status Report of Mindanao Modular Generator Set Program
As of 15 December 2016

Mindanao ECs	Capacity (MW)	Status
ZAMCELCO	16	Tested and Commissioned. On-going COC application.
MORESCO I	2	In Commercial Operation.
MORESCO II	10	On-going Civil and Electric Works.
DANECO	3	Tested and Commissioned. On-going COC application.
ANECO	10	On-going Site Preparation.
SURNECO	10	Tested and Commissioned. On-going COC Application.
Total	51	

Interim Mindanao Electricity Market (IMEM)

The IMEM was intended to augment supply by serving as a venue for transparent and efficient utilization of all the available capacities in the Mindanao Grid. The program started commercial operations on 3 December 2013; however, due to system wide blackout, the Mindanao System Operator declared an IMEM intervention starting 27 February 2014. On 07 May 2014, the DOE issued Department Circular No. DC 2014-05-0010 entitled, "Amending the Interim Mindanao Electricity Market Rules and Providing for Transitory Arrangements." Currently, the market intervention issued by the Mindanao System Operator has not yet been lifted. The DOE is reviewing the appropriate market mechanisms for Mindanao and the issues on the outstanding IMEM settlement are being resolved.

Competitive Selection Process (CSP)

To institutionalize a transparent system of power supply contracting that ensure provision of adequate and reliable supply of electricity to all end-users, the DOE issued on 11 June 2015, Department Circular No. DC2015-06-0008, "Mandating All Distribution Utilities to Undergo Competitive Selection Process in Securing Power Supply Agreements (PSAs)." To implement the policy, the DOE and ERC jointly issued Resolution No. 1, "A Resolution Enjoining All Distribution Utilities to Conduct CSP in the Procurement of Supply for Their Captive Market" in October 2015. Further, ERC issued Resolution No. 13 Series of 2015, "A Resolution Directing All Distribution Utilities (DUs) to Conduct a Competitive Selection Process (CSP) in the Procurement of Their Supply to the Captive Market" and ERC Resolution No. 1 Series of 2016, "A Resolution Clarifying the Effectivity of ERC Resolution No. 13, Series of 2015." To date, the Technical Working Group (TWG) was created to work on drafting the implementing guidelines on the CSP Policy.

To institutionalize a transparent system of power supply contracting that ensure provision of adequate and reliable supply of electricity to all end-users, the DOE issued on 11 June 2015, Department Circular No. DC2015-06-0008, "Mandating All Distribution Utilities to Undergo Competitive Selection Process in Securing Power Supply Agreements (PSAs)."

Privatization of Government's Power Sector Assets

The privatization of the government's power facilities is one of the key features of EPIRA and a prerequisite to the establishment of a level playing field in the power industry. The period 2010 to 2016 saw the turn-over of majority of the National Power Corporation's major generation assets, IPP contracts and transmission assets.

As of September 2016, the privatization level of NPC generating assets in Luzon and Visayas reached 93.5 percent while for total Philippines, it stood at 71.8 percent having privatized a total of 4,473 MW out 6,234 MW. With respect to IPP contracts, privatized capacities include the contracted capacities for Sual and Pagbilao coal-fired thermal power plants, San Roque, Bakun, and Benguet mini hydroelectric power plants and the Ilijan Natural Gas Combined Cycle Power Plant, and Unified Leyte GPP-Strips of Energy. This is equivalent to 77.46 percent of the total NPC contracted energy output in Luzon and Visayas thereby marking the completion of the five preconditions for the implementation of RCOA.

Wholesale Electricity Spot Market (WESM)

The establishment of WESM is part of the package of electric power industry reforms mandated by EPIRA where trading of electricity through a transparent and competitive process can be made. Following several months of trial operations, the WESM commenced commercial operations in the Luzon grid in 2016 while WESM officially commenced operations in the Visayas grid in 2010.

The need of further augmenting the power supply in the Visayas region necessitated the integration of the Visayas in the WESM. Further, Luzon and Visayas provide market signals to potential investors in the region making it more efficient and a competitive power trading system, and would allow for the optimization of the energy flow between the two regions. As of 25 September 2016, the integrated WESM (Luzon and Visayas) has a total of two hundred seventy-six (276) registered participants comprised of one hundred five (105) generation companies and one hundred seventy-one (171) customers comprised of sixteen (16) Private DUs, seventy-one (71) ECs, seventy-nine (79) Bulk users, and five (5) Wholesale Aggregators.

On the other hand, to ensure the competitiveness of the WESM, the DOE promulgated policies and continue on closely supervising its operations and governance. As of November 2016, the DOE has provided the policies for the implementation of new WESM Design primarily the change from the one (1) – hour trading interval to five (5) minutes trading interval, the removal of minimum stable loading constraints, preparation for the reserve market and automation of several features of the Market Management System (MMS) to improve transparency and competition in the WESM. The Philippine Electricity Market Corporation (PEMC) is already in the process of determining appropriateness and compliance of the New Market Management Systems (NMMS) to the rules of the new WESM design. The DOE on the other hand has promulgated amendments to the WESM Rules for this purpose.

The establishment of WESM is part of the package of electric power industry reforms mandated by EPIRA where trading of electricity through a transparent and competitive process can be made.

Retail Competition and Open Access (RCOA)

The implementation of RCOA is pursuant to Section 31 of Republic Act No. 9136 or the EPIRA where Contestable Customers (CC) will be allowed to source their supply of electricity from a Retail Electricity Supplier (RES) by allowing the use of transmission and distribution systems and

associated facilities, subject to the payment of transmission and distribution wheeling charges duly approved by the ERC.

The initial phase of implementation started with electricity end-users with an average peak demand of at least 1 MW and provided an interim option for CCs to remain with their franchised DUs as Captive Market.

With roughly more than two years of implementation, challenges with respect to implementation were encountered such as difficulty of contestable customer to secure supply contracts, ensuring a level playing field for suppliers, and limited capacity for non-generator suppliers. As a counter-measure, the DOE issued Department Circular No. DC2016-04-0004 providing for the new timelines for the mandatory contestability of the CCs as follows:

- Starting 26 June 2016, those Contestable Customers (CCs) with an average demand of 750 and above for the last 12 months may voluntarily secure its power supply from a Retail Electricity Supplier (RES);
- By 26 February 2017, all CCs with an average demand of 1 MW and above shall be required to source their supply from a licensed RES;
- By 26 June 2017, all CCs with an average demand of below 1 MW to 750 kW for the last 12 months shall secure their power supply from a licensed RES.
- By 26 June 2018, aggregators will also be allowed to serve electricity end-users with an aggregated demand of at least 750 kW.

Missionary Electrification

As defined in the EPIRA-IRR, Missionary Electrification is the provision of basic electricity service in Unviable Areas with the ultimate aim of bringing the operation of these areas to viability levels. These missionary areas are basically off-grid areas or Small Island and Isolated Grids (SIIG) which are not connected to the main grids of Luzon, Visayas, and Mindanao. Section 70 of EPIRA mandates the National Power Corporation (NPC) to perform missionary electrification function through its Small Power Utilities Group (SPUG) and shall be responsible for providing power generation and associated power delivery systems. The missionary electrification function is being funded from the revenues from sales in missionary areas from the universal charge (UCME) which is being collected from electricity end-users.

By virtue of DOE Department Circular 2004-01-001, missionary areas have been declared open for private sector participation (PSP) consistent to the direction set forth by the EPIRA Law to privatize NPC-SPUG's generating assets. This circular delineates the general guidelines for the selection of a New Power Provider (NPP) that will take-over the function of NPC-SPUG at the onset of the privatization of generation services in a missionary area.

Table 11. Installed and Dependable Capacity and Peak Demand in SIIGs, as of December 2015

Grid	Number of Plants	Installed	Dependable	Peak Demand
Luzon	245	314.46	243.08	163.29
NPC	220	106.90	76.59	
NPP / IPP / DU / QTP	25	207.55	166.49	
Visayas	50	33.71	23.84	15.82
NPC	46	17.36	9.79	
NPP/DU/ QTP	4	16.35	14.04	
Mindanao	25	57.94	40.02	30.75
NPC	24	57.27	39.38	
NPP/DU/ QTP	1	0.07	0.64	
Total	320	406.11	306.95	209.86
NPC	290	181.53	125.77	
NPP/IPP/ DU/QTP	30	224.58	181.17	

Notes: 1. Including 153 PRES Mini-Grid GenSet in Masbate
2. Excluding BASELCO's Balagtasan MHPP which is non-operating ORMECO's Bulangan MHPP which was destroyed by Typhoon Nona
Source: NPC Plant Parameters Report, GenCo MORs, DU DDPs

As of December 2015, there are 286 SIIGs across the country with total rated capacity of 406.107 MW being supplied by 30 NPP/IPP/DU/Qualified Third Party (QTP) plants and 290 NPC-SPUG power plants. To meet the increasing demand in missionary areas which currently do not have private power providers, NPC undertakes necessary augmentation of capacity. In 2015, a total of 900kW capacity in Luzon has been added to the current rated capacity to augment the supply being delivered to over 800,000 households in SPUG areas.

Since some areas currently served by NPC-SPUG do not receive 24-hour electricity service, NPC-SPUG accordingly schedules increase in operating hours.

Table 12. NPC-SPUG Increase in Operating Hours

Operating Hours	Number of Areas	
	2014	2015
24 hours	23	36
16 to 23 hours	10	8
8 to 15 hours	31	78
4 to 8 hours	218	166
Total	**282**	**288**

As of December 2015, there are seven areas with a total of 126.28 MW capacity which have successfully privatized their generation services and concurrently receive 24 hours of electricity service:

Table 13. Missionary Areas with New Power Providers, as of December 2015

Area	New Power Provider	Date of Take-over	Contracted Capacity / Energy (MW)
Bantayan Island	Bantayan Island Power Corporation	2006	4.89
Masbate Main Grid	DMCI	2010	15.00
Palawan Main Grid	DMCI	2013	49.70
Oriental Mindoro	DMCI	July 2014	40.40
Busuanga Island	Calamian Island Power Corporation	August 2014	7.72
Roxas, Palawan	DMCI	2014	4.00
Siquijor	S. I. Power Corporation	February 2015	4.56
Total			**126.67**

As delegated to perform the function of Missionary Electrification, NPC continuously identifies new areas to be electrified. From 2012-2015, these are the areas that were electrified by NPC:

Table 14. NPC Electrified Areas, 2012-2015

Name of Plant	Location	Distribution Utility/Electric Cooperative	Capacity (kW)	Commissioning Date
Malaking Ilog	Masbate	LGU-San Pascual	60	April 9, 2012
Mababang Baybay	Masbate	LGU-Claveria	60	April 24, 2012
Kiri-kiti	Western Samar	NPC	60	May 2, 2012
Bagongon	Western Samar	NPC	60	May 7, 2012
Cinco Rama	Western Samar	NPC	100	May 8, 2012
Buluan	Western Samar	NPC	40	May 9, 2012
Dancalan	Masbate	LGU-San Pascual	80	May 27, 2012
Quezon	Masbate	LGU-Claveria	60	June 7, 2012
Penafrancia	Masbate	LGU-Claveria	80	June 10, 2012
Osmena	Masbate	LGU-Claveria	80	July 10, 2012
Batag	Northern Samar	NORSAMELCO	50	March 19, 2013
Cabul-an	Bohol	BOHECO I	64	November 14, 2013
Atulayan	Camarines Sur	CASURECO IV	22	June 1, 2014
Palumbanes	Catanduanes	FICELCO	22	February 1, 2015
Total			**838**	

Electrification

The government in partnership with various stakeholders is committed to bring electricity access to energy-poverty stricken areas in the country. As a conduit to progress, electricity access is interlinked with advancing the quality of life, delivering the basic and essential services, improving productivity and fostering economic prosperity. It also directly impacts education as children and youth in unelectrified areas are able to reap the benefits of electricity access by having longer study hours in their homes. This has been the Government's guiding framework in its electrification efforts and initiatives that covers barangays, households and sitios.

The barangay was the starting point for the program but focus shifted on energizing households in 2010. Electrification at the household level increased from 79.7 percent in 2010 to 89.6 percent in July 2016.

For the 2017-2040 planning horizon, the electrification goals that will serve as guideposts for the sector are: (i) 90 percent household electrification by 2017; (ii) 100 percent electrification of targeted and identified household accessible to grid (based on 2015 Census) and accomplishment of off-grid targets by 2022; (iii) Electrification of all targeted and identified households (household beyond 2015 Census) and 100 percent electrification of target household in off-grid areas within the period 2023-2040 and (iv) total electricity access by 2040.

Consistent with the electrification goals of the PEP, the energy sector is also guided with the nine (9)-point program of the Administration to pursue 100 percent electrification of targeted and identified households in all three major islands.

Status of Electrification

The barangay was the starting point for the program but focus shifted on energizing households in 2010.[26] Electrification at the household level increased from 79.7 percent in 2010 to 89.6 percent in July 2016.[27] This shows that 20,360,334 out of the potential 22,721,430 households are already enjoying electricity access.

Electrification on a grid level shows the Luzon has the highest household electrification level at 94.8 percent followed by Visayas at 92.4 percent and Mindanao with 72.4 percent. On a per region basis, National Capital Region (NCR) has the highest household electrification level at 98.3 percent (3,451,303 out of the 3,512,439 potential households already with electricity access). In Visayas and Mindanao, Region 7 (Central Visayas) and Region XIII (CARAGA) registered the highest electrification levels at 95.9 percent and 93.8 percent respectively. ARMM remains as the least electrified region in the country in terms of households having only 38.7 percent electrification level or 199,373 energized households out of the potential 514,592 as shown in the Table 15.

[26]The shift to electrification at the household level from the barangay was one of the objectives stated under DC No. 2003-04-004 signed by then DOE Secretary Vincent S. Perez.

[27]DOE adopted NEA's total potential households from 2011 – 2015 thus adjustments were made for the said period particularly the potential and served households covered by electric cooperatives (EC). The adjustment resulted to having 22,310,084 total potential households in 2015 which is higher than the 22,247,154 total potential households specified in the HEDP Accelerated Scenario. The harmonization with NEA's is also in line with Sen. Osmeña's inquiry to both DOE and NEA on the budgetary requirements for achieving 100 percent household electrification. The data sourced for the computation of Household Electrification Level are the NEA Status of Energization Reports for the case of Electric Cooperatives and the Distribution Development Plan (DDP) 2016-2025 submitted to DOE for the case of Private Investor Owned Utilities (PIOUs) and Local Goverment Unit Owned Utilities (LGUOUs).

Table 15. Household Electrification Level by Region, as of July 2016

Region	Total HH	Served HH	Unserved HH	Electrification Level (%)
CAR	392,000	348,471	43,529	88.9%
I	1,184,431	1,100,259	84,172	92.9%
II	785,900	721,354	64,546	91.8%
III	2,687,073	2,593,462	93,611	96.5%
IV-A	3,506,353	3,376,855	129,498	96.3%
IV-B	648,149	533,017	115,132	82.2%
NCR	3,512,439	3,451,303	61,136	98.3%
V	1,087,469	964,270	123,199	88.7%
Luzon Total	**13,803,814**	**13,088,991**	**714,823**	**94.8%**
VI	924,701	863,878	60,823	93.4%
VII	1,430,541	1,371,853	58,688	95.9%
VIII	889,968	776,180	113,788	87.2%
NIR	831,100	755,480	75,620	90.9%
Visayas Total	**4,076,309**	**3,767,391**	**308,918**	**92.4%**
ARMM	514,592	199,373	315,219	38.7%
CARAGA	607,700	570,025	37,675	93.8%
IX	655,300	476,510	178,790	72.7%
X	1,039,243	837,560	201,683	80.6%
XI	1,076,655	771,250	305,405	71.6%
XII	947,816	649,234	298,582	68.5%
Mindanao Total	**4,841,306**	**3,503,952**	**1,337,354**	**72.4%**
Philippines	**22,721,430**	**20,360,334**	**2,361,096**	**89.6%**

Coordinating the Government's overall electrification efforts is being undertaken by the Household Unified Strategic Electrification (HOUSE) Team. It was created by virtue of Department Circular (DC) 2014-09-0018 issued in 29 September 2014. DOE chairs the team with NEA and NPC sitting as co-chairs. Members that comprise the HOUSE team include representatives coming from DOE, NEA, NPC-SPUG, Department of Budget and Management and Department of Interior and Local Government. Ensuring that the Government attains its 90 percent household electrification by 2017 is one of the Team's key functions.

The HOUSE team will assist in the implementation of all policy measures and strategies as well as the management and monitoring of all the programs and activities as embodied under the Household Electrification Development Plan (HEDP) with the overall purpose of achieving the policy goal of attaining 90% HH electification by 2017 and full electricity access in the country by 2040. The HOUSE Team will further develop specific guidelines and/or review and recommend revision on existing policies related to household electrification in order to improve their effectiveness in achieving specific goals such as 100% electrification of identified household in areas accessible to grid of

the country as well as on how to fully achieve the 100% electrification of households situated in off-grid areas.

Under the HEDP, there are several sub-program components aiding the Government's umbrella program of household electrification. These programs are delineated in terms of target or focus areas i.e. grid or off-grid and are all contributing and in support to the overall goal of attaining 90% household electrification by 2017.

- **Grid Electrification**

1. Sitio Electrification Program (SEP)

In 2011, NEA established the Sitio Electrification Program (SEP) wherein the commitment was to energize 32,441 sitios. From the onset of SEP in 2011 to March 2016, NEA was able to surpass its target by energizing 32,688 sitios translating to 100.8 percent accomplishment in the SEP Roadmap (Table 16).

After accomplishing the targeted 32, 441 Sitios, NEA still have sitios to electrify for the years 2016 and 2017. For 2016, NEA have target total of additional 3,150 sitios where 1,151 were in Luzon, 959 sitios in Visayas and 1,040 sitios in Mindanao. As of October 12, 2016, 91 percent or 2,863 of the target sitios area already energized.

2. Barangay Line Enhancement Program (BLEP)

One of NEA's programs that aim to rehabilitate barangays which have been energized previously by off-grid solutions (diesel generator sets and solar photovoltaic) but were deemed unsustainable. The program focuses only on those off-grid barangays that are already economically feasible for distribution line extension.

From 2011 to 2015, 619 barangays benefitted from the program with a total program cost of PhP 1,814.53 million. For 2016, 254 are targeted with an estimated cost of PhP 1,204.80 million.

Based on the latest memorandum issued by NEA, the following are the interventions used to extend the distribution line to the targeted BLEP barangays (i) Submarine cables, and (ii) Improvement of Tapping points (Upgrading the distribution lines to be able to further extend the distribution line).

3. Energy Regulations (ER) 1-94

The Department serves as administrator of ER 1-94 which has three (3) fund components – electrification fund (EF), development and livelihood fund (DLF), and reforestation, watershed management, health and/or

Table 16. Sitio Electrification Program (SEP) Roadmap

	2011	2012	2013	2014	2015	2016 (as of March)
% Accomplishment	4.7	23.7	39.9	63.2	95.2	100.8
Target Sitios	1,410	6,007	5,831	7,073	7,092	1,567
Energized Sitios	1,520	6,163	5,263	7,567	10,361	1,814
Total Sitios Energized (cumulative)		**7,683**	**12,946**	**20,513**	**30,874**	**32,688**

environment enhancement fund (RWMHEEF) – utilized for host communities to promote growth and advancement in their respective areas.

For the electrification program, DOE shall effectively administer Electrification Fund of ER 1-94 in bringing electricity to all households, prioritizing the host cities/municipalities by implementing both grid and off-grid electrification projects.

The DOE is currently undertaking the "ER 1-94 Rationalization of Electrification Fund Leading towards 100% Electrification of Host Community Targets (ER 1-94 REFLECT Program)." The objective of the program is to conduct technical and financial viability assessment of potential electricity service solutions that will result to provision of electrification projects funded under ER 1-94 EF for the rural development of Host Communities of the country. At total of 259 Host Communities (144 in Luzon, 53 in Visayas and 62 in Mindanao) were already identified based on the current list of installed generation facilities in the country.

As for the completed projects funded under ER 1-94 EF, around 1,258 (1,218 are grid and 40 are off-grid) sitios/barangays with an equivalent household connection of 30,332 were energized from 2011 – July 2015. The total approved project cost for these sitios/barangays was at PhP1,408.5 million. The Department targets to complete the electrification projects and benefits annually at least 3,000HH within the host communities.

4. Nationwide Intensification of Household Electrification (NIHE)

The NIHE is one of DOE's locally-funded projects (LFP). Approved in 2014, the project will run for three (3) years (2015-2017). It has the objective of developing and implementing specific measures and financial incentives (i.e. grant assistance) to mobilize DU's in fast-tracking connections of their remaining unelectrified households.

The NIHE is one of DOE's locally-funded projects (LFP). It has the objective of developing and implementing specific measures and financial incentives (i.e. grant assistance) to mobilize DU's in fasttracking connections of their remaining unelectrified households.

For the grant assistance, the program shall provide house-wiring subsidy amounting to Php 3,750 to poor and qualified household situated to areas/ sitios where the distribution lines of the DU is physically available. For 2015, the DOE approved a total of 30,512 Household beneficiaries with a total amout of PhP 114.42 million and will be implemented by 22 participating distribution utilities. For 2016, the DOE approved a total of 116,592 Household beneficiaries with a total amout of PhP 437.9 million and will be implemented by 20 participating distribution utilities. For 2017 another 183,000 household beneficiaries is target by the program.

Also, the DOE have successfully conducted a 9-Leg series of NIHE Project Development Workshop with Luzon, Visayas and Mindanao DUs. The said workshop provided the interested DUs the information to effectively implement the program in their franchise areas.

Aside from the grant assistance provided to qualified household beneficiaries, the NIHE programs also aims to provide the following

Technical assistance (i) Streamlining of connection process; (ii) LGU-DU partnership for assistance in connection permits; and (iii) Policy support to address the issue of slum electrification and flying connections, among others.

- **Off-Grid Electrification**

1. Household Electrification Program (HEP) using renewable energy (RE) systems

The HEP involves the energization of off-grid households using mature RE technologies which include photovoltaic solar home system (PV-SHS), PV streetlights and micro-hydro systems. From 2011 to 2015, a total of 22,904 off-grid households gained electricity access thru the program.

2. Solar PV Mainstreaming (under Access to Sustainable Energy Program or ASEP)

This PVM project is co-financed by the EU-Philippines "Access to Sustainable Energy Programme" (ASEP), DOE, participating Electric Cooperatives and the recipient households. It targets 40,500 households for the next three (3) years to be provided with solar PV electrification as a utility service offering by the Electric Cooperatives. To date, eight (8) ECs have committed to participate in the Project. Activities undertaken over the past months include (a) market segmentation through remote sensing and geo-tagging of potential households beneficiaries, (b) firming up the service packages and technical specifications of the products to be offered to the households; (c) establishing the PV supply chain; and (d) creation of the Solar Business Unit (SBUs) within the ECs organizational structure.

Of recent events, ASEP through the World Bank and Global Partnership on Output-based Aid (GPOBA), organized the first Philippines Offgrid Electrification Expo held at SMX MOA, Pasay City from September 21-23, 2016 and participated in by international and local PV suppliers. The participants of this Expo had the opportunities to learn more about the incentive program demonstrate their off-grid products, network with international off-grid industry leaders (e.g., distributors of Lighting Global certified products and 2015-16 Global LEAP Awards Winners and Finalists), meet with local electricity cooperatives to explore ways to conduct business in the growing off-grid market.

Meanwhile, the Energy Regulatory Commission (ERC) approved in 25 October 2016, the benchmark tariff for SHS to be adopted by the ECs as follows:

Table 17. Benchmark Tariff for Solar Home System (SHS)

SHS Capacity	Zone A	Zone B	Zone C
50 Wp	207	215	222
30 Wp	180	187	195

The Benchmark SHS Tariff is the best approximation of the operating costs an EC incurs in providing electricity service to all SHS Customers, including the cost of maintaining and replacing the SHS components as necessary, and both direct and indirect overhead costs (ie., salaries, transportation cost, etc).

The costs of servicing SHS for more remote and difficult to reach areas shall be considered through an incremental cost adjustment that will apply to SHS Customers in such areas. This adjustment will be common across

all ECs serving SHS Customers in the same defined zones, referring to the distance of SHS customers from the EC's main office, the farthest (Zone C) as the highly mountainous areas and islands/islets.

3. Qualified Third Party (QTP) Program

Under Sec. 59 of EPIRA, areas deemed unviable and waived by the DUs may be offered to QTPs as part of the missionary electrification program. There is now a growing interest among private sector to enter into QTP operations with the entry of the renewables in offgrid electrification. Said interest was generated by the various incentives offered to private sector among which is the cash generation based incentive per kWh generated, equivalent to 50% of the Universal Charge (UC) in the area where it operates. Hence, the program anticipates the future development of mini-grid and micro-grid electrification projects using solar, biomass, wind and other renewable energy sources by other proponents that may also adopt QTP approach.

Following are the updates on the QTP Program being spearheaded by the DOE:

a. Rio Tuba QTP Project in Bataraza, Palawan

PowerSource Philippines, Inc. (PSPI) continues to operate as QTP in Barangay Rio Tuba. For the reporting period, the average monthly electricity generation reached 295,599 kWh and the average monthly electricity sales is 264,647 kWh, indicating an increase of about 7.69% & 7.0% respectively as compared with the last year's report (for 6 months period from March 2015 to September 2015) electricity generation and sales. To date, overall installed capacity is 1.10MW covering the highest recorded peak demand of 660kW. The average system loss is 10%.

To date, there were 680 remaining unelectrified households which can be classified as informal settlers as they do not have permanent residencies. PSPI is coordinating with the LGU and DOE on how to provide electricity to these households.

In regard to the Biomass Plant, testing and commissioning was completed last February 2016 and now operating with a dependable capacity of 10 kW. There are modifications still to be made on the gasifier to meet the target output of 50 kW due to the very low output. Gasifier is undergoing upgrading including the purchase of blower with a higher capacity to supply enough gas required by the gas engine to operate at 100% load.

In order to provide efficient and reliable service and serve more customers, PSPI completed the following activities, namely: a) Extension of line in Kinurong; b) Commissioning of 350 kW in April 2016; c) Macadam Road pole relocation in September 2016; and d) replacement of overloaded distribution transformer and splitting of transformer load to achieve a balanced system for system improvement.

b. Malapascua QTP Project in Malapascua Island, Logon, DaanBantayan, Cebu

PSPI continues to operate its existing generating facility in the island. For the reporting period, the average net electricity generation was 170,501 kWh per month and the average electricity sales was 159,872

kWh. There was a significant increase of about 18.12% in generation and 22.82% in sales showing the continuous growth of demand in the area. In June 2016, a new genset was installed with a capacity 500 kW in replacement of genset no.3. The installed capacity now is 1.2 MW. Highest recorded peak demand is 440kW and the average system loss is 6.26%.

For the reporting period, 40 additional households were electrified, a 3.26% increase in the past six (6) months. Based on the barangay records, out of 1,227 households in the island, 1,007 are connected to the mini grid system, achieving 82.07% electrification level. The remaining 220 households are targeted to the connected to the grid within the next 2-3 years.

In June 2016, the final decision with regard to PSPI's application for Malapascua was issued by ERC. On the Su bsidized Approved Retail Rate (SARR), the ERC granted a 2-tier tariff as follows:

- For consumers with monthly consumption of 40kWh or lower, the SARR is PhP12/kWh.
- For consumers with monthly consumption higher than 40kWh, the SARR is Php15kWh.

On August 2016, PSPI has complied with NPC's Subsidy Protocol Payment with the installation of NPC Billing Meter on project site.

c. Liminangcong, Taytay, Palawan

The mini-grid systems in these barangays were funded by the Provincial Government of Palawan (PGP) and operated by a Barangay Power Association from 1995-2012. In February 2013, a Master Agreement was signed between PGP and PSPI to take-over the management and operations in nine (9) areas including. Consequently, an Alliance with Palawan Electric Cooperative, Inc. (PALECO) was signed in November 2013 for the electrification of remote and unviable areas through the QTP Program of which these areas were also included.

On August 2016, PSPI received the ERC's order for the Provisional Authority (PA). In the Order, the ERC granted the SARR equivalent to PhP9.12/kWh.

Currently, the total number of customers is 705 which results to 78% electrification level and expected to increase due to upcoming line extensions. The installed capacity is 310 kW and has a recorded peak demand of 80 kW with an average loss is 13.63%. PSPI has an on-going replacement of defective household kilowatt-hour meters and upgrading of distribution system to reduce the losses.

From March to September 2016, the average monthly net electricity generation is 21,953 kWh and the average monthly electricity sale is 18,960 kWh.

The operating hours was gradually increased from 8-12-14 hours and now reaching the 20 hour operation (6AM to 2AM). PSPI is expecting a 24/7 operation on the fourth quarter of 2016 as soon as the new gensets are installed and commissioned.

d. Brgy. Cabayugan , Puerto Princesa City

On 05 October 2016, ERC approved the: (i) application of Sabang Renewable Energy Corporation (SREC) for Authority to Operate

(ATO) as a Qualified Third Party (QTP) in Barangay Cabayugan, Puerto Princesa City, Palawan and (ii) correspondingly, its QTP Service and Subsidy Agreement (QSSA) with the National Power Corporation (NPC).

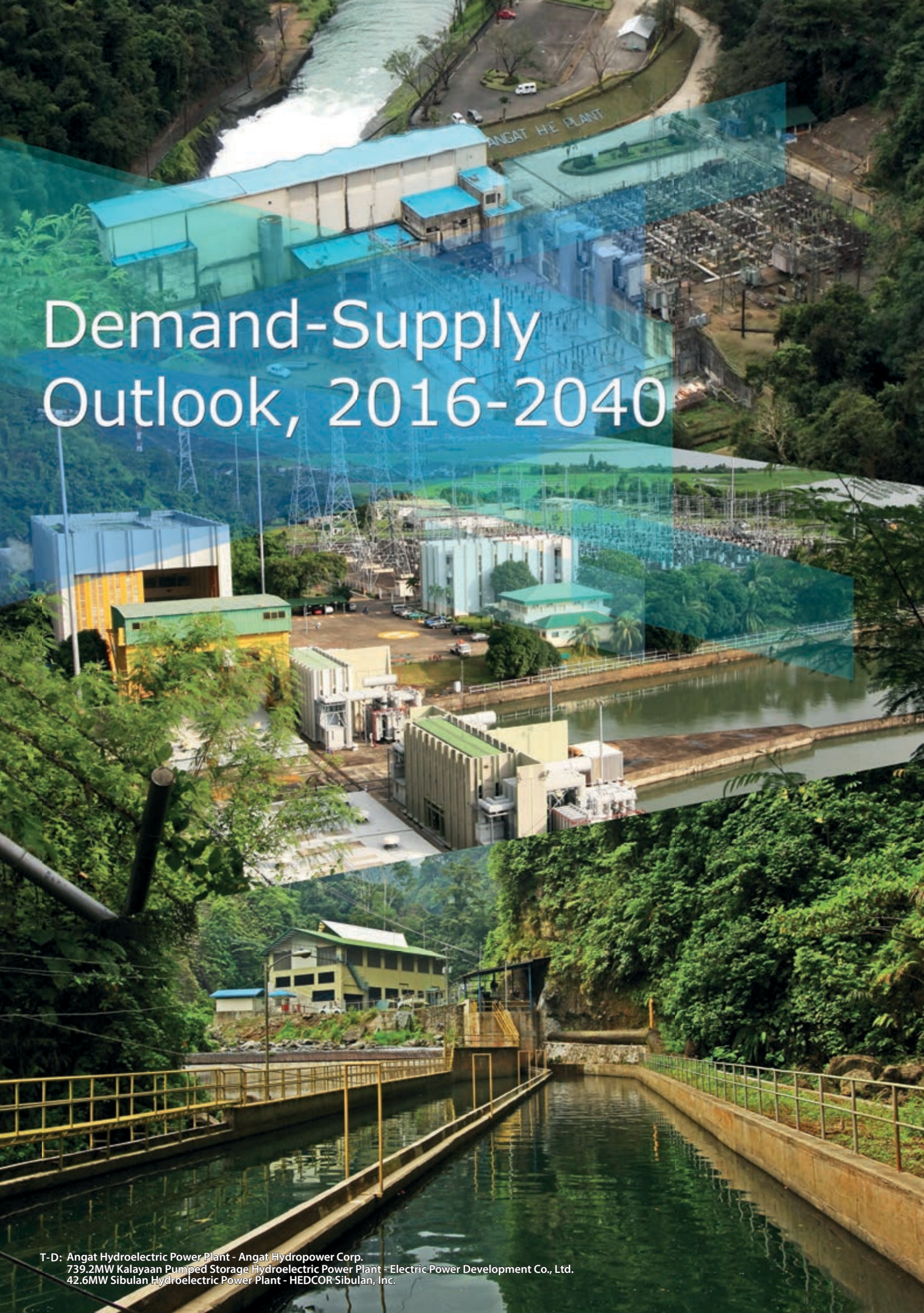
The Project comprises a 1.404 (Solar PV), 2.363 (battery), and 1.280 (four (4) gensets@320kW diesel) to be installed in year 1 and additional capacities to be installed in succeeding years as the energy demand increases in the area.

e. Other QTP Projects:

ERC still has to issue its approval on the application of PowerSource Philippines, Inc. (PSPI) for the following QTP Projects: (a) Balut Island comprising seven (7) barangays in Sarangani, Davao Occidental; and, (b) Brgy. Candawaga and Culasian, Municipality of Rizal, Palawan.

On the other hand, the DOE expects to receive the technical and financial proposals for the potential QTPs for the following areas:

- Sixty-six (66) Sitios in the Province of Apayao;
- Lahuy Island, Municipality of Caramoan, Camarines Sur (with 4 barangays, namely Gata, Oring, Daraga, and Gogon);
- Haponan Island in the same Municipality;
- Quinasalag Island in the Municipality of Garchitorena, Camarines Sur (with 8 barangays, as follows: Dangla, Binagasbasan, Burabod, Cagamutan, Mansangat, Tamiawon, Cagnipa, and Sumaoy); and,
- Semirara Island in the Municipality of Caluya, Antique (with 3 barangays)



Demand-Supply Outlook, 2016-2040

T-D: Angat Hydroelectric Power Plant - Angat Hydropower Corp.
739.2MW Kalayaan Pumped Storage Hydroelectric Power Plant - Electric Power Development Co., Ltd.
42.6MW Sibulan Hydroelectric Power Plant - HEDCOR Sibulan, Inc.

ELECTRICITY DEMAND FORECASTING METHODOLOGY AND ASSUMPTIONS

The preparation of an accurate and acceptable electricity demand forecast is crucial in power system planning and development as this load forecast will determine the country's future power requirements as well as the necessary generation investments and distribution and transmission reinforcements to meet future demand. High demand projection could lead to over investments especially on the generation sector thereby entailing wastes and inefficiency, while under projection could result to capacity shortfalls when demand would exceed supply.

To address these shortcomings requires the use of accurate input data, appropriate methodology and valid assumptions. Figure 14 shows the steps in coming up with the electricity sales and peak demand forecasts for the three main grids.

1. Data Collection

Actual 2015 data on the following were collected to serve as the reference forecast scenario for 2016-2040:

A. Power Generation submitted by Generation Companies (GenCos) through their Monthly Operations Report (MOR);

B. Power Delivered by the National Grid Corporation of the Philippines (NGCP) to Distribution Utilities (DUs), Non-Utility Customers or directly-connected industries, Economic Zones, Government Owned Utility (GOU) and Generation Customers;

C. Electricity Sales and Consumption sourced from the MOR submitted by private DUs and Monthly Financial and Statistical Report (MFSR) submitted by Electric Cooperatives (ECs) thru the National Electrification Administration (NEA); and

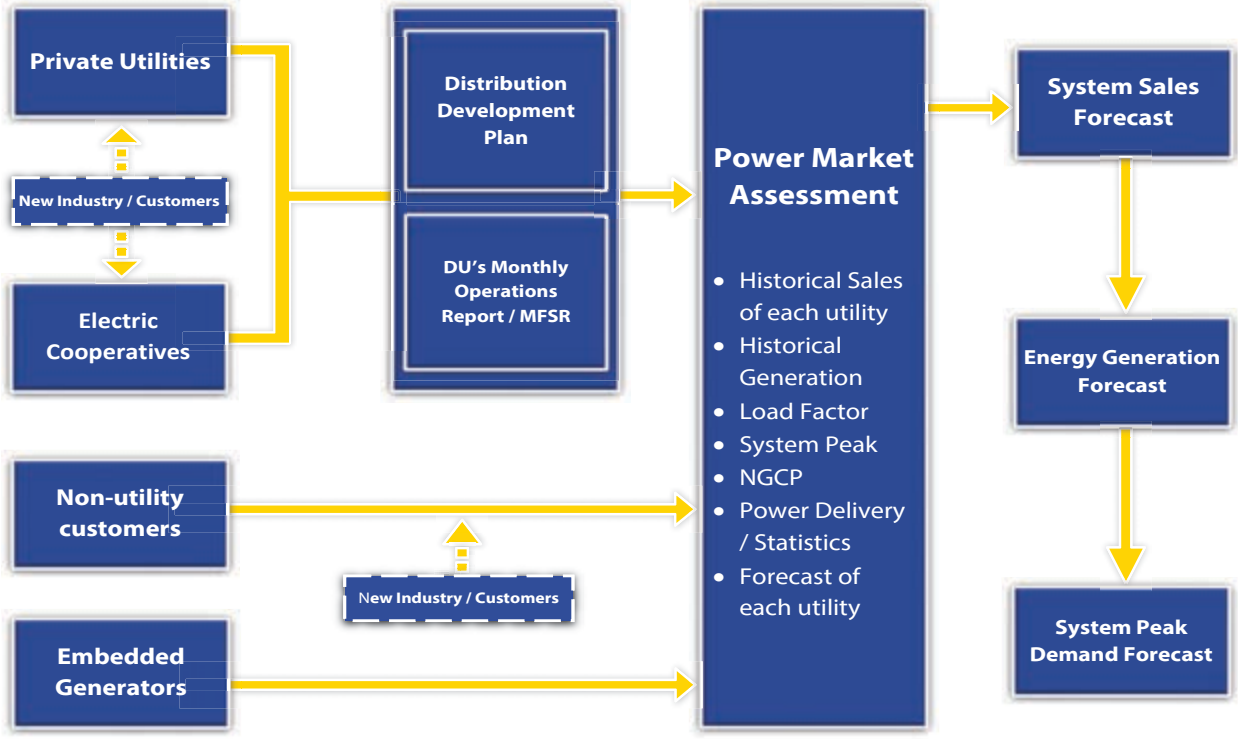


Figure 14. Electricity Sales and Peak Demand Forecast

D. Other relevant data such as station use, transmission losses, peak demand and load factor gathered by the DOE.

2. Electricity Sales and Peak Demand Forecasts

The high GDP growth projection of the Development Budget Coordination Committee (DBCC)[28] at 7 to 8 percent and the electricity consumption to gross regional domestic product (GRDP)[29] of Luzon, Visayas and Mindanao based on historical trend were used and applied to the actual 2015 electricity sales to come up with the baseline electricity sales forecasts. This high GDP growth forecast is aligned with the long-term goal towards industrialization and increase in income per capita which lead to higher electricity demand.

The historical average of 2004 to 2015 actual electricity-to-GRDP elasticity was used for Luzon and Visayas[30] while the elasticity adopted for Mindanao is pegged at 1.0 to account for the suppressed electricity demand and insufficient supply during the previous years. This elasticity level is also fixed at 1.0 in anticipation of demand side expansion in the region for the coming years brought by the commercial operation of large power generation plants starting 2015.

By 2040, peak demand is expected to increase by about four times from 12,213 MW in 2015 to 49,287 MW in 2040 under the high GDP growth scenario.

Table 18. Energy and Economic Growth Assumptions by Grid, 2016-2030

Grid	Year	High GDP Growth Rate (%)	Electricity-to-GRDP Elasticity
Luzon	2017	7.00	0.7
	2018 - 2020	8.00	0.7
	2021 - 2040	7.50	0.7
Visayas	2017	7.00	1.0
	2018 - 2020	8.00	1.0
	2021 - 2040	7.50	1.0
Mindanao	2017	7.00	1.0
	2018 - 2020	8.00	1.0
	2021 - 2040	7.50	1.0

3. Peak Demand Forecasting

From the energy sales forecasts, the actual 2015 Station Use (SU) and transmission Losses (TL) are added to come up with the gross generation. From this gross generation, the peak demand forecasts are derived using the load factor approach which is also based on the actual load factor for 2015.

Table 19. SU/TL and Load Factor Assumptions

Grid	SU/TL (%)	Load Factor (%)
Luzon	7.15	74.6
Visayas	5.88	71.6
Mindanao	3.84	72.6

By 2040, peak demand is expected to increase by about four times from 12,213 MW in 2015 to 49,287 MW in 2040 under the high GDP growth scenario. This increase is translated to a 6 percent annual average growth rate from 2016 to 2040. On a per grid basis, Mindanao is projected to have the highest annual average growth at 8 percent, followed by Visayas at 7 percent and Luzon at 5 percent.

[28] DBCC is composed of the Department of Budget and Management (DBM), Department of Finance (DOF), National Economic and Development Authority (NEDA) and Office of the President (OP)
[29] Ratio of electricity consumption and GRDP growth rate
[30] Some annual values were not included in the computation to isolate the effects of extreme weather occurrences such as El Niño and Typhoon Yolanda and Global Financial Crisis

Table 20. Grid Peak Demand Forecast, 2016-2040 (in MW)

Year	Luzon	Visayas	Mindanao	Philippines
		ACTUAL		
2011	7,552	1,481	1,346	10,379
2012	7,889	1,551	1,321	10,761
2013	8,305	1,572	1,428	11,305
2014	8,717	1,636	1,469	11,822
2015	8,928	1,768	1,517	12,213
		FORECAST		
2016	9,726*	1,878*	1,786	13,390
2017	9,870	1,997	1,911	13,778
2018	10,368	2,143	2,064	14,575
2019	10,895	2,298	2,229	15,422
2020	11,451	2,465	2,407	16,323
2021	12,000	2,633	2,588	17,221
2022	12,579	2,812	2,782	18,173
2023	13,187	3,004	2,990	19,181
2024	13,828	3,209	3,215	20,252
2025	14,501	3,427	3,456	21,384
2026	15,210	3,661	3,715	22,586
2027	15,955	3,910	3,993	23,858
2028	16,739	4,176	4,293	25,208
2029	17,564	4,461	4,615	26,640
2030	18,432	4,765	4,961	28,158
2031	19,342	5,089	5,333	29,764
2032	20,298	5,436	5,733	31,467
2033	21,301	5,806	6,163	33,270
2034	22,353	6,202	6,625	35,180
2035	23,457	6,624	7,122	37,203
2036	24,616	7,076	7,656	39,348
2037	25,832	7,558	8,231	41,621
2038	27,108	8,072	8,848	44,028
2039	28,447	8,622	9,512	46,581
2040	29,852	9,210	10,225	49,287

** Actual 2016 Peak Demand as of May 2016*

SUPPLY EXPANSION PLAN

Supply Expansion Plan Methodology and Assumptions

To determine the annual surplus/deficit per type of plant operation (baseload, midrange and peaking), the peak demand forecast plus reserve requirement, which is set at 25 percent of peak demand, was subtracted from the existing average available capacity as of December 2015 and committed capacities as of July 2016.

Baseload power plants that provide continuous, reliable and efficient power at low cost such as coal, existing natural gas, geothermal, biomass, and baseload hydroelectric power plants were accounted. For peaking power plants which provide power during high demand period, oil-based, wind and solar photovoltaic (PV) power plants were considered. For mid-merit power plants which are more flexible in operation than baseload and cheaper than peaking plants, new natural gas-fired power plants were included in the simulation.

To ensure secure, reliable and sufficient supply of electricity, a 70 percent baseload was set as a minimum requirement for capacity addition from 2016-2040.

Power Demand-Supply Outlook, 2016-2040

To meet the projected electricity demand including reserve requirement, the power system capacity addition that the Philippines will need by 2040 is 43,765 MW broken down as follows: 25,265 MW for baseload, 14,500 MW for mid-merit and 4,000 MW for peaking.

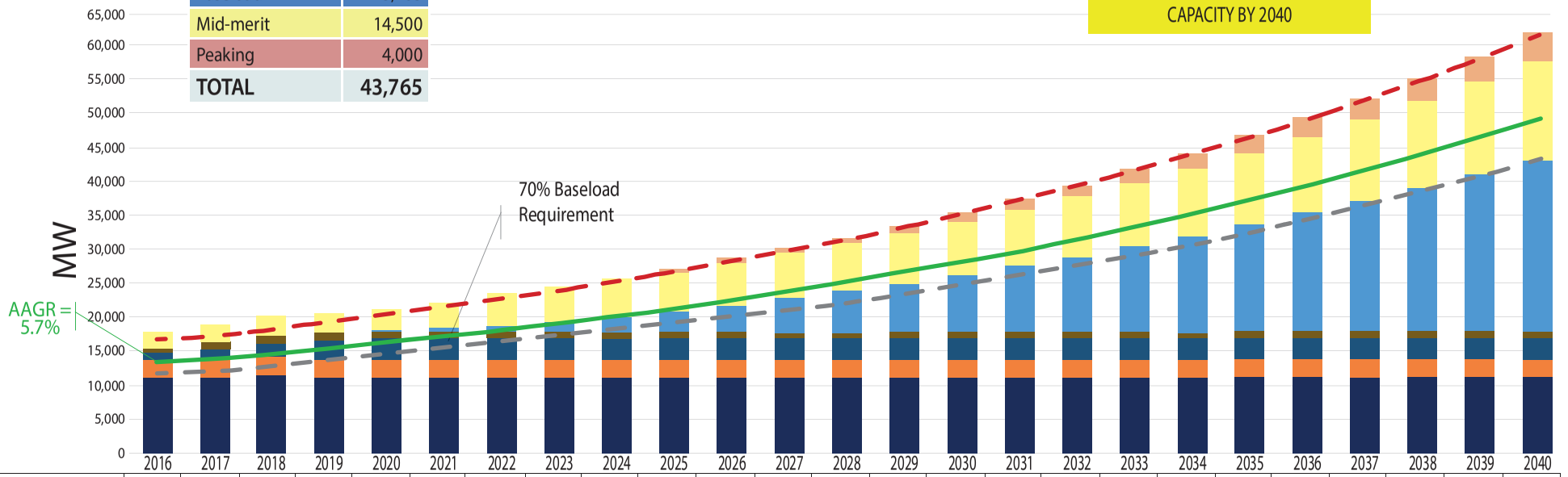
Table 21. Philippines Required Power System Capacity Addition, 2016-2040

Year	Total Existing Available Capacity, MW	Total Committed Capacity, MW	System Peak Demand, MW	Reserve Requirement (25% Peak Demand), MW	Total Capacity Addition, MW
2016	13,877	1,289	13,390	3,347	2,605
2017	13,877	2,325	13,778	3,445	2,705
2018	13,877	3,297	14,575	3,644	2,805
2019	13,877	3,670	15,422	3,855	2,887
2020	13,877	4,078	16,323	4,081	3,169
2021	13,877	4,078	17,221	4,305	4,138
2022	13,877	4,078	18,173	4,543	5,357
2023	13,877	4,078	19,182	4,795	6,484
2024	13,877	4,078	20,251	5,063	7,743
2025	13,877	4,078	21,384	5,346	9,107
2026	13,877	4,078	22,585	5,646	10,603
2027	13,877	4,078	23,859	5,965	12,152
2028	13,877	4,078	25,209	6,302	13,671
2029	13,877	4,078	26,640	6,660	15,402
2030	13,877	4,078	28,158	7,039	17,338
2031	13,877	4,078	29,765	7,441	19,309
2032	13,877	4,078	31,467	7,867	21,480
2033	13,877	4,078	33,270	8,318	23,783
2034	13,877	4,078	35,180	8,795	26,159
2035	13,877	4,078	37,204	9,301	28,652
2036	13,877	4,078	39,348	9,837	31,295
2037	13,877	4,078	41,620	10,405	34,170
2038	13,877	4,078	44,028	11,007	37,185
2039	13,877	4,078	46,581	11,645	40,350
2040	13,877	4,078	49,287	12,322	43,765

High GDP Scenario (8% GDP; 25% Reserve Requirement)

Capacity Addition	MW
Baseload	25,265
Mid-merit	14,500
Peaking	4,000
TOTAL	43,765

THE PHILIPPINES WILL NEED **43,765 MW** ADDITIONAL CAPACITY BY 2040



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Capacity Addition - Peaking	0	0	0	0	0	0	150	250	300	450	450	550	650	950	1,150	1,250	1,550	1,900	2,100	2,400	2,650	2,950	3250	3600	4,000
Capacity Addition - Midmerit	2,500	2,600	2,700	2,700	2,900	3,600	4,400	5,000	5,400	5,700	6,200	6,600	7,000	7,300	7,800	8,300	8,800	9,300	10,000	10,500	11,200	12,000	12,700	13,500	14,500
Capacity Addition - Baseload	105	105	105	187	269	538	807	1,234	2,043	2,957	3,953	5,002	6,021	7,152	8,388	9,759	11,130	12,583	14,059	15,752	17,445	19,220	21,235	23,250	25,265
Committed Peaking	37	66	77	110	111	111	111	111	111	111	111	111	111	111	111	111	111	111	111	111	111	111	111	111	111
Committed Midmerit	402	876	876	876	876	876	876	876	876	876	876	876	876	876	876	876	876	876	876	876	876	876	876	876	876
Committed Baseload	850	1,383	2,343	2,683	3,091	3,091	3,091	3,091	3,091	3,091	3,091	3,091	3,091	3,091	3,091	3,091	3,091	3,091	3,091	3,091	3,091	3,091	3,091	3,091	3,091
Existing Peaking	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600
Existing Midmerit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Baseload	11,277	11,277	11,277	11,277	11,277	11,277	11,277	11,277	11,277	11,277	11,277	11,277	11,277	11,277	11,277	11,277	11,277	11,277	11,277	11,277	11,277	11,277	11,277	11,277	11,277
Reserve Requirement	3,347	3,445	3,644	3,855	4,081	4,305	4,543	4,795	5,063	5,346	5,646	5,965	6,302	6,660	7,039	7,441	7,867	8,318	8,795	9,301	9,837	10,405	11,007	11,645	12,322
System Peak Demand	13,390	13,778	14,575	15,422	16,323	17,221	18,173	19,182	20,251	21,384	22,585	23,859	25,209	26,640	28,158	29,765	31,467	33,270	35,180	37,204	39,348	41,620	44,028	46,581	49,287
70% baseload Reqt	11,716	12,056	12,753	13,494	14,282	15,069	15,901	16,784	17,720	18,711	19,762	20,876	22,057	23,310	24,638	26,044	27,534	29,111	30,783	32,553	34,429	36,418	38,525	40,758	43,126

Figure 15. Philippines Demand-Supply Outlook, 2016-2040

Luzon grid's peak demand by 2040 is expected to triple from 9,726 MW in 2016 to 29,852 MW by 2040. With this expected electricity demand growth, the grid will be needing 13,635 MW of baseload capacity, 8,300 MW of mid-merit capacity and 2,450 MW peaking capacity with a total of 24,385 MW capacity addition in the grid. Considering the existing available capacity including the committed capacity up to 2020, Luzon will start to need additional capacity by 2023.

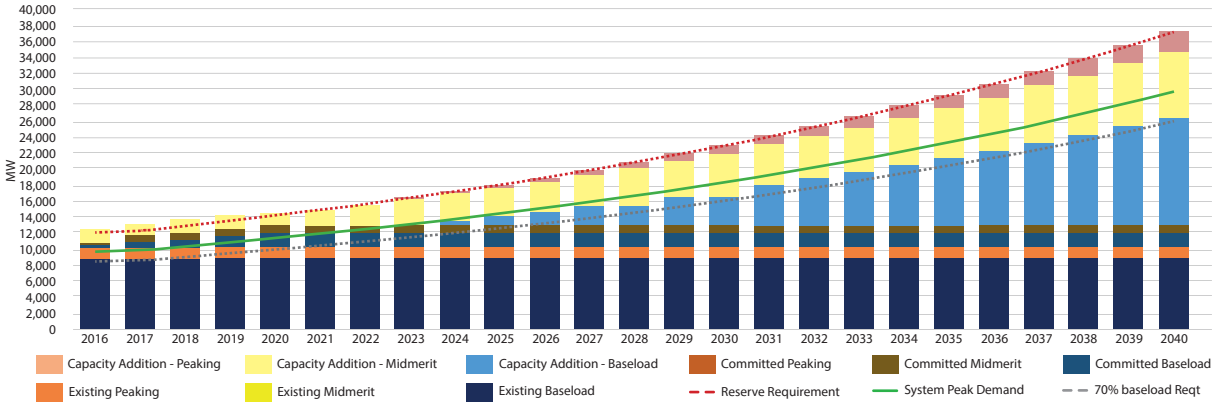


Figure 16. Luzon Demand-Supply Outlook, 2016-2040

Table 22. Luzon Required Annual Capacity Addition, 2016-2040

Year	Total Existing Available Capacity	Total Commited Capacity, MW	System Peak Demand, MW	Reserve Requirements (25% Peak Demand), MW	Total Capacity Addition, MW
2016	10,361	569	9,726	2,432	1,500
2017	10,361	1,442	9,870	2,467	1,500
2018	10,361	1,871	10,368	2,592	1,500
2019	10,361	2,241	10,895	2,724	1,500
2020	10,361	2,650	11,.451	2,863	1,500
2021	10,361	2,650	12,000	3,000	2,000
2022	10,361	2,650	12,579	3,145	2,750
2023	10,361	2,650	13,187	3,297	3,485
2024	10,361	2,650	13,828	3,457	4,275
2025	10,361	2,650	14,501	3,625	5,165
2026	10,361	2,650	15,210	3,802	6,005
2027	10,361	2,650	15,955	3,989	6,980
2028	10,361	2,650	16,739	4,185	7,920
2029	10,361	2,650	17,564	4,391	8,945
2030	10,361	2,650	18,432	4,608	10,070
2031	10,361	2,650	19,342	4,836	11,180
2032	10,361	2,650	20,298	5,074	12,390
2033	10,361	2,650	21,301	5,325	13,700
2034	10,361	2,650	22,353	5,588	15,010
2035	10,361	2,650	23,457	5,864	16,355
2036	10,361	2,650	24,616	6,154	17,800
2037	10,361	2,650	25,832	6,458	19,345
2038	10,361	2,650	27,108	6,777	20,925
2039	10,361	2,650	28,447	7,112	22,605
2040	10,361	2,650	29,852	7,463	24,385

The Visayas grid will be needing a total of 9,180 MW of additional capacity from 2016 to 2040 considering a high GDP Scenario of 8% and reserve requirements of 25% of the peak demand. These additional capacities are broken down into 5,330 MW of baseload, 3,000 MW of mid-merit, and 850 MW of peaking capacity requirements. With an annual average growth rate of 6.9% for the peak demand forecast, Visayas will be needing additional capacity starting 2017 to meet its future demand and reserve requirements.

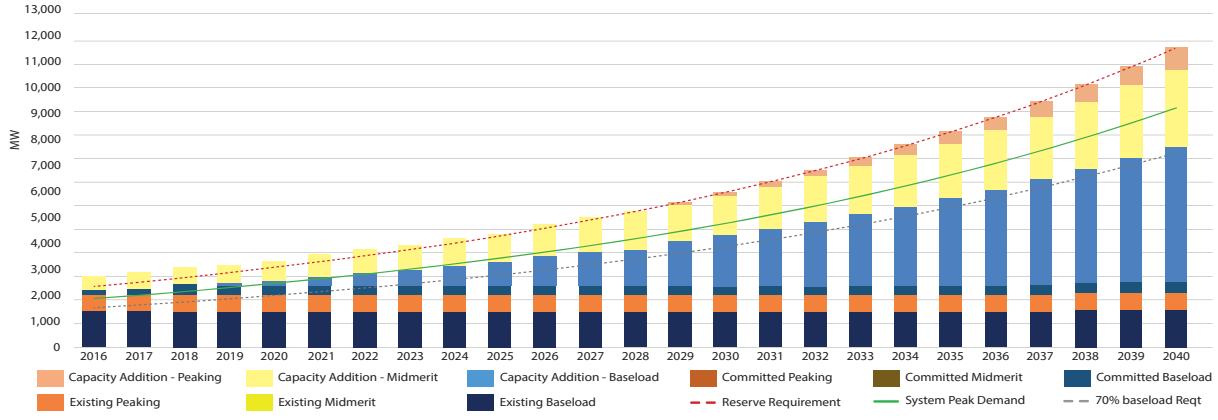


Figure 17. Visayas Demand-Supply Outlook, 2016-2040

Table 23. Visayas Required Annual Capacity Addition, 2016-2040

Year	Total Existing Available Capacity	Total Commited Capacity, MW	System Peak Demand, MW	Reserve Requirements (25% Peak Demand), MW	Total Capacity Addition, MW
2016	2,019	225	1,878	470	500
2017	2,019	248	1,997	499	600
2018	2,019	343	2,143	536	700
2019	2,019	343	2,298	575	782
2020	2,019	343	2,465	616	964
2021	2,019	343	2,633	658	1,228
2022	2,019	343	2,812	703	1,392
2023	2,019	343	3,004	751	1,574
2024	2,019	343	3,209	802	1,838
2025	2,019	343	3,427	857	2,002
2026	2,019	343	3,661	915	2,348
2027	2,019	343	3,910	978	2,612
2028	2,019	343	4,176	1,044	2,876
2029	2,019	343	4,461	1,115	3,222
2030	2,019	343	4,765	1,191	3,618
2031	2,019	343	5,089	1,272	4,014
2032	2,019	343	5,436	1,359	4,460
2033	2,019	343	5,806	1,452	4,938
2034	2,019	343	6,202	1,550	5,434
2035	2,019	343	6,624	1,656	5,962
2036	2,019	343	7,076	1,769	6,490
2037	2,019	343	7,558	1,889	7,100
2038	2,019	343	8,072	2,018	7,760
2039	2,019	343	8,622	2,156	8,420
2040	2,019	343	9,210	2,302	9,180

The capacity used for the simulation is based on the existing available capacity of the Mindanao grid as of June 2016. Mindanao will need a total of 10,200 MW of additional capacity from 2016 to 2040. The additional capacity for Mindanao is divided into 6,300 MW of baseload capacity, 3,200 MW of mid-merit capacity and 700 MW of peaking capacity. With an annual average growth rate of 7.6% for the demand forecast and with the consideration to the 25% peak demand as reserve requirement, Mindanao will need additional capacity starting the year 2016.

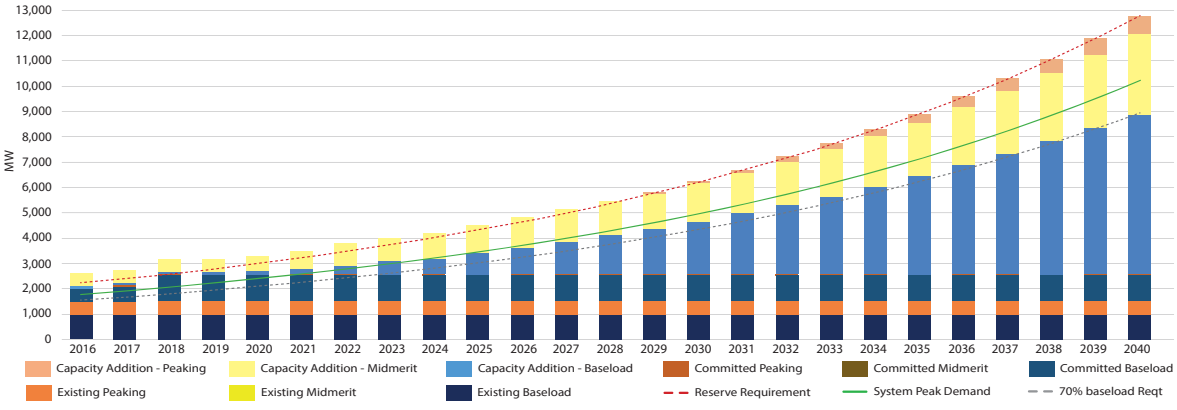


Figure 18. Mindanao Demand-Supply Outlook, 2016-2040

Table 24. Mindanao Required Annual Capacity Addition, 2016-2040

Year	Total Existing Available Capacity	Total Commited Capacity, MW	System Peak Demand, MW	Reserve Requirements (25% Peak Demand), MW	Total Capacity Addition, MW
2016	1,497	495	1,786	446	605
2017	1,497	636	1,911	478	605
2018	1,497	1,082	2,064	516	605
2019	1,497	1,086	2,229	557	605
2020	1,497	1,086	2,407	602	705
2021	1,497	1,086	2,588	647	910
2022	1,497	1,086	2,782	695	1,215
2023	1,497	1,086	2,990	748	1,425
2024	1,497	1,086	3,215	804	1,630
2025	1,497	1,086	3,456	864	1,940
2026	1,497	1,086	3,715	929	2,250
2027	1,497	1,086	3,993	998	2,560
2028	1,497	1,086	293	1,073	2,875
2029	1,497	1,086	4,615	1,154	3,235
2030	1,497	1,086	4,961	1,240	3,650
2031	1,497	1,086	5,333	1,333	4,115
2032	1,497	1,086	5,733	1,433	4,630
2033	1,497	1,086	6,163	1,541	5,145
2034	1,497	1,086	3,325	1,656	5,715
2035	1,497	1,086	7,122	1,781	6,335
2036	1,497	1,086	7,656	1,914	7,005
2037	1,497	1,086	8,231	2,058	7,725
2038	1,497	1,086	8,848	2,212	8,500
2039	1,497	1,086	9,512	2,378	9,325
2040	1,497	1,086	10,225	2,556	10,200

Power Sector Roadmap

T-D: 45MW SACASOL I Solar Farm - San Carlos Solar Energy, Inc.
54MW Pililla Rizal Wind Farm - Alternergy Wind One Corp.
6.2MW Centrala Solar Power Plant - NV Vogt Philippines Solar Energy One, Inc.

The DOE envisions to implement its policy thrusts and strategic directions which are geared towards full restructuring and reform of the electric power industry by 2040. For the four major subsectors of the power industry: generation, transmission, distribution and supply, the DOE identifies its goals and strategies for implementation in the short-, medium-, and long-term planning horizons. Separate roadmaps for off-grid and missionary areas down to household electrification are also included in this plan towards the holistic development of the electric power industry. These roadmaps embody continuing policies and programs and future action plans focusing on ensuring quality, reliable, affordable and secure supply; expanding access to electricity; and ensuring a transparent and level playing field in the power industry.

For the generation subsector, the DOE will remain firm to its mandate of ensuring power supply security, reliability, adequacy and sustainability by inducing more private investments and pursuing new technologies and emerging power supply sources consistent with the appropriate power mix policy. In pursuit of this, the transmission and distribution subsectors shall provide adequate and reliable infrastructures to be able to deliver the supply to end-users. These three sub-sectors are also expected to utilize advanced and efficient technologies and build energy-resilient infrastructure taking-off in the short-term up to the long-term planning horizon. For the supply subsector, the DOE will push for the attainment of full power market independence through the continuous review, issuance and implementation of policy guidelines on WESM and RCOA. This aims to increase participants in the supply sector and clear delineation of the supply between captive and contestable markets. Institutional and support mechanisms will be in place to attain the objectives identified for each subsectors. Consistent to the mandate of DOE to expand and accelerate access to electricity services and craft policies that will redound to a sustainable energy sector, the roadmap for missionary electrification aims to present a strategic direction for the continuous development of missionary areas in terms of energy security and its associated systems, private sector investment, institutional partnerships, and operational efficiency. Lastly, the DOE will continue to work on expanding electricity access to all households by 2040 through various programs and projects embodied under the electrification roadmap.

GENERATION

The DOE will continue to encourage and facilitate the timely completion and commercial operation of power generation projects and increase the number of merchant power plants by formulating relevant policies and regulations that will enable full competition and improved transparency in the sector. DOE will also facilitate the declaration of power projects as projects of national significance under a legislative framework. By doing so, the tedious process for permitting and approval prior to the commercial operation of power generation projects will be streamlined and shortened; hence, the delivery of the much needed capacities to meet the country's growing demand and minimize transaction costs. It also aims to address tax concerns of power companies to make the cost of electricity competitive.

As part of its major policy thrusts, the DOE is also set to prioritize the institutionalization of the appropriate power mix policy for power generation towards an optimal portfolio to meet 24/7 electricity demand and reserve requirement with spatial and sectoral dimensions. The DOE will formulate and implement a fair and transparent rewards-and-penalty system such as the causers pay policy to enforce accountability of power industry players for forced

outages. This ensures more protection to consumers. Along with these initiatives, the DOE will continue to enjoin existing generating companies to undertake rehabilitation and upgrading of their existing power plants to facilitate maximum operation of their facilities. The DOE will encourage compliance to international standards for constructing power plants and provide support for the accreditation of contractors.

The DOE has initiated and will continue to conduct its daily monitoring of power situation along with regular performance assessment of power generation companies to determine and remove bottlenecks and inefficiencies in their operations. This will serve as the basis for benchmarking and identification of appropriate policies for the generation sector.

In the medium to long term, the DOE will encourage and facilitate the entry of new and emerging power generation options such as nuclear technology, energy storage technologies, fuel cells and ocean thermal energy conversion (OTEC), among others. To make this happen, the DOE will establish strong cooperation among government line agencies such as the Department of Science and Technology (DOST) and Philippine Nuclear Research Institute (PNRI) and reinforce partnership with private research institutions which undertakes research, development and demonstration (RD&D) on energy technologies.

From 2017-2040, the DOE will lead in performance assessment and benchmarking of power generation facilities in order to review and develop policies to improve the operation of the

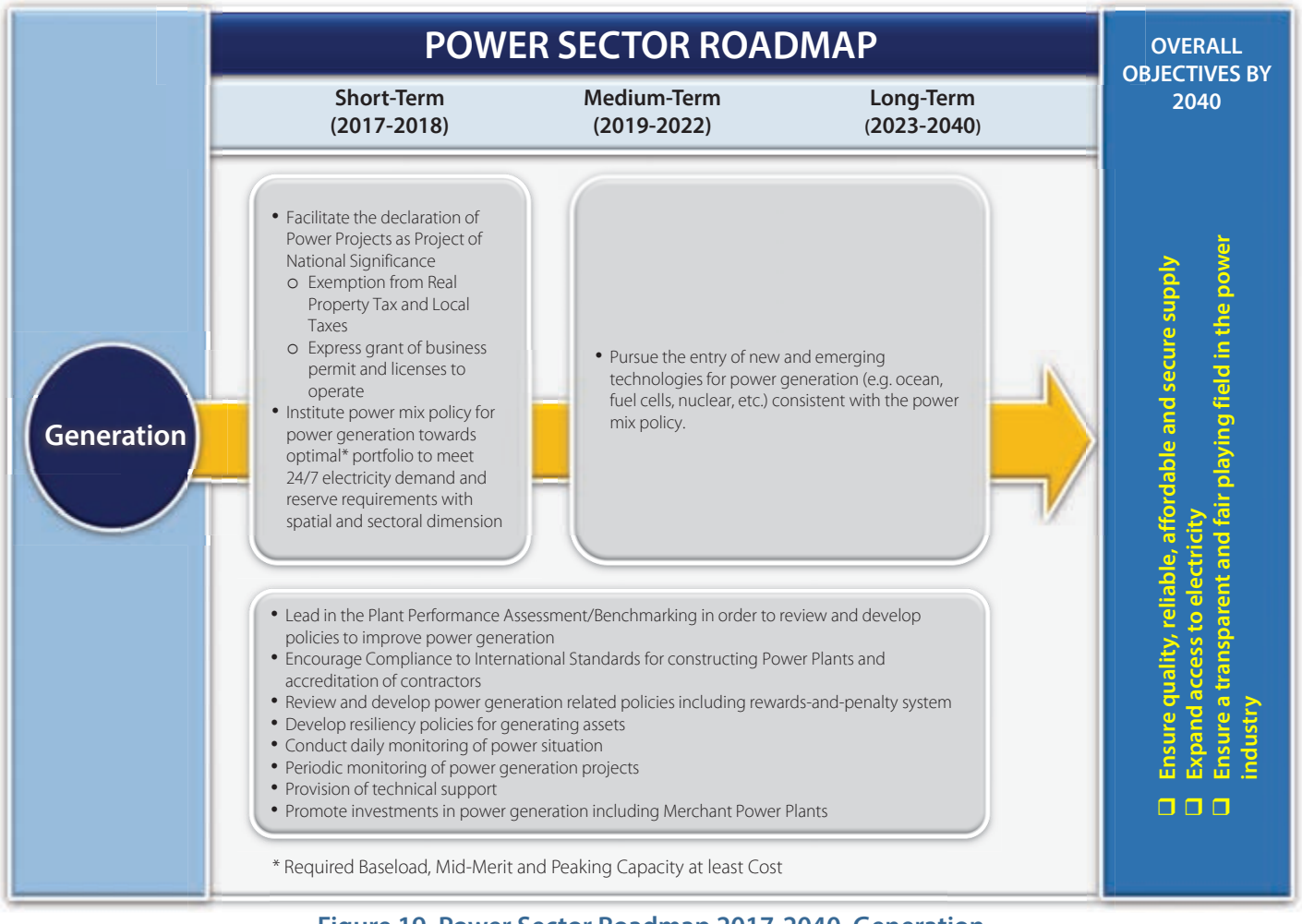


Figure 19. Power Sector Roadmap 2017-2040, Generation

power plants. In line with this, the DOE will also encourage compliance to international standards for constructing power plants and accreditation of contractors. It will also develop resiliency policies for all generating assets. As part of the continuing activities, the DOE will conduct daily and periodic monitoring of power demand-supply situation and provide technical support.

TRANSMISSION

The timely completion and commissioning of transmission infrastructure necessary to deliver electricity to end-users remains a priority of the DOE along with the continuous upgrading, rehabilitation, and expansion of existing transmission lines, substations and other related facilities. Under the supervision of the National Transmission Corporation (TransCo), the NGCP who holds the franchise right to manage and operate the transmission assets is expected to continuously enhance its formulation of the Transmission Development Plan (TDP) and conduct of the System Impact Study (SIS) to provide guide for investors in power generating siting and further improve the operation, reliability, and integrity of the transmission system.

Conclusively, the NGCP must have adequate reserve capacities to ensure uninterrupted power supply. Similar to the generation sector, DOE will likewise lead the conduct of regular performance assessment and benchmarking of transmission facilities and operations to address inefficiencies and system congestions.

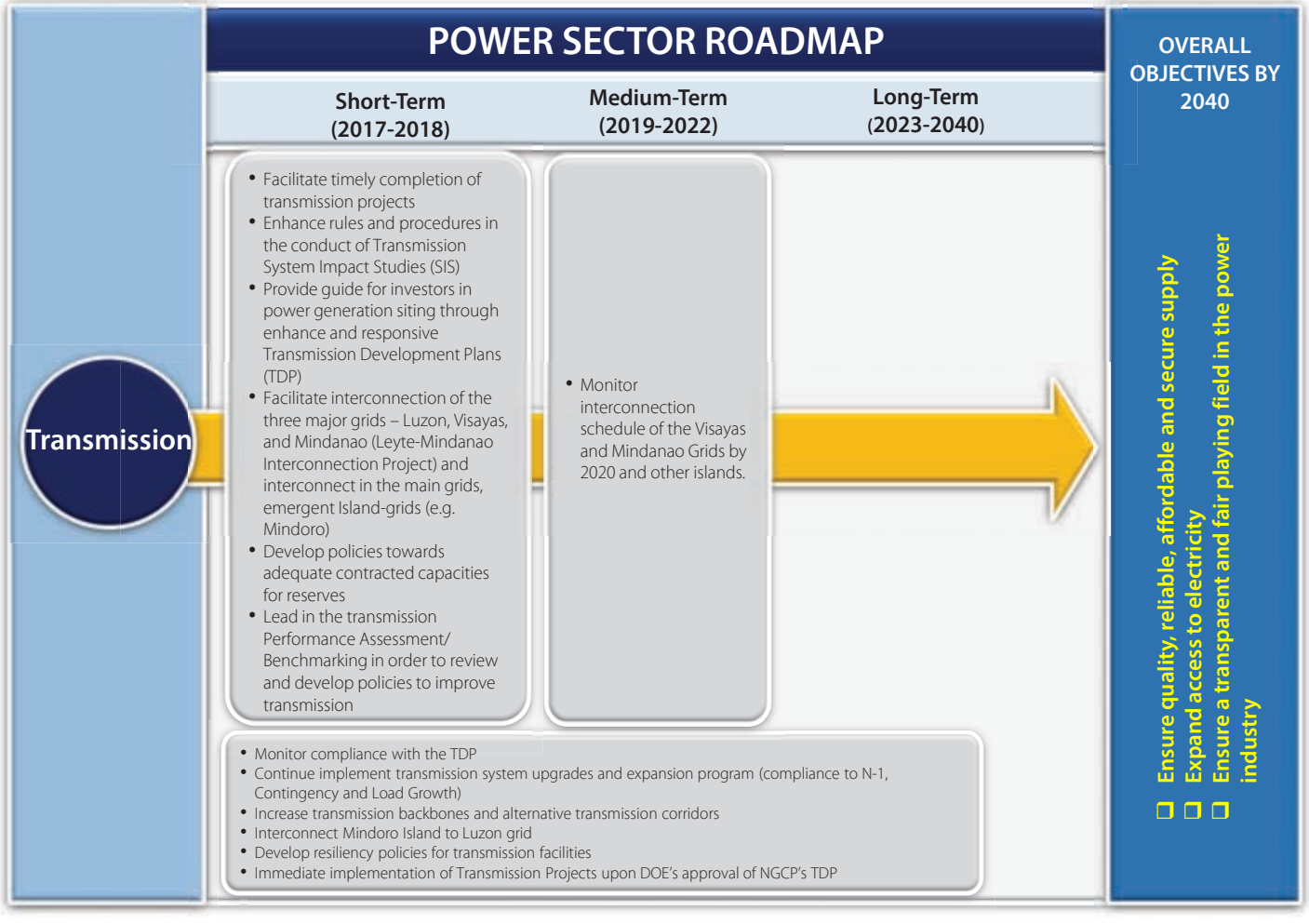


Figure 20. Power Sector Roadmap 2017-2040, Transmission

Apart from the continuing activities underlining transmission system improvement, TransCo and NGCP will jointly undertake the identification and development of new transmission backbones and alternative transmission corridors to lessen if not eliminate line congestions in view of the increasing demand. The DOE will closely monitor the implementation of the TDP as well as the Visayas-Mindanao interconnection which is targeted to be implemented by 2020. Similarly, the interconnection of the main grids and emergent island grids such as Mindoro is also envisioned to be implemented.

In view of the country's vulnerability to climate change, the power sector shall be able to cope up with the increasing incidents of natural calamities through the development and construction of energy and climate-resilient transmission infrastructure and adoption of energy resiliency policies and programs.

DISTRIBUTION AND SUPPLY

For the short to long-term period, the Department will continually focus on increasing the capacities of Distribution Utilities (DUs), particularly Electric Cooperatives (ECs), in formulating their respective Distribution Development Plans (DDPs). The DOE together with the National Electrification Administration (NEA) will continue to assist and supervise ECs on their institutional strengthening programs. The DOE will also continue to strengthen its coordination with the Energy Regulatory Commission (ERC) and formulate enabling policies and joint resolutions to facilitate the timely approval and implementation of distribution facilities through CAPEX provisions, among others, to further improve the services being provided by DUs to their customers and facilitate economies of scale in their operation. Likewise, the DOE will develop and monitor the accountability of DUs towards an improved operational efficiency and good governance. DUs, both grid and off-grid, will also be subjected to regular performance assessment and benchmarking to address operational and financial inefficiencies and institutional issues.

The full implementation and conduct of the Competitive Selection Process (CSP) and aggregation of DUs shall instill transparency and competition in securing Power Supply Agreements (PSAs) to ensure adequacy of supply at the least cost as well as reserves.

In line with this, enhancement in power supply contracts to include provisions for replacement power and penalty provisions will be facilitated. To raise consumer welfare, improved transparency mechanism in rates and charges along with the development of policies and regulatory support to meet the new and emerging needs of customers. The DOE will continue to process direct connection applications.

Over the planning horizon, DUs are mandated to undertake continuous upgrade and expansion of distribution infrastructure in their respective franchise areas. The sector shall utilize and invest in more efficient technologies such as the smart grid (e.g. prepaid electricity, etc.). Likewise, the distribution sector shall move towards the transformation of its current system and infrastructure to an energy-resilient one by implementing enabling resiliency policies.

Within the short-term horizon, the mandatory contestability of electricity end-users having an average demand of 1 MW and above will be on 26 February 2017 while by end of 2017 for those electricity end-users with average demand of below 750 kW and above effective 2017. Retail aggregation will be implemented as well upon ERC's promulgation of the requisite guidelines that will ensure its proper implementation.

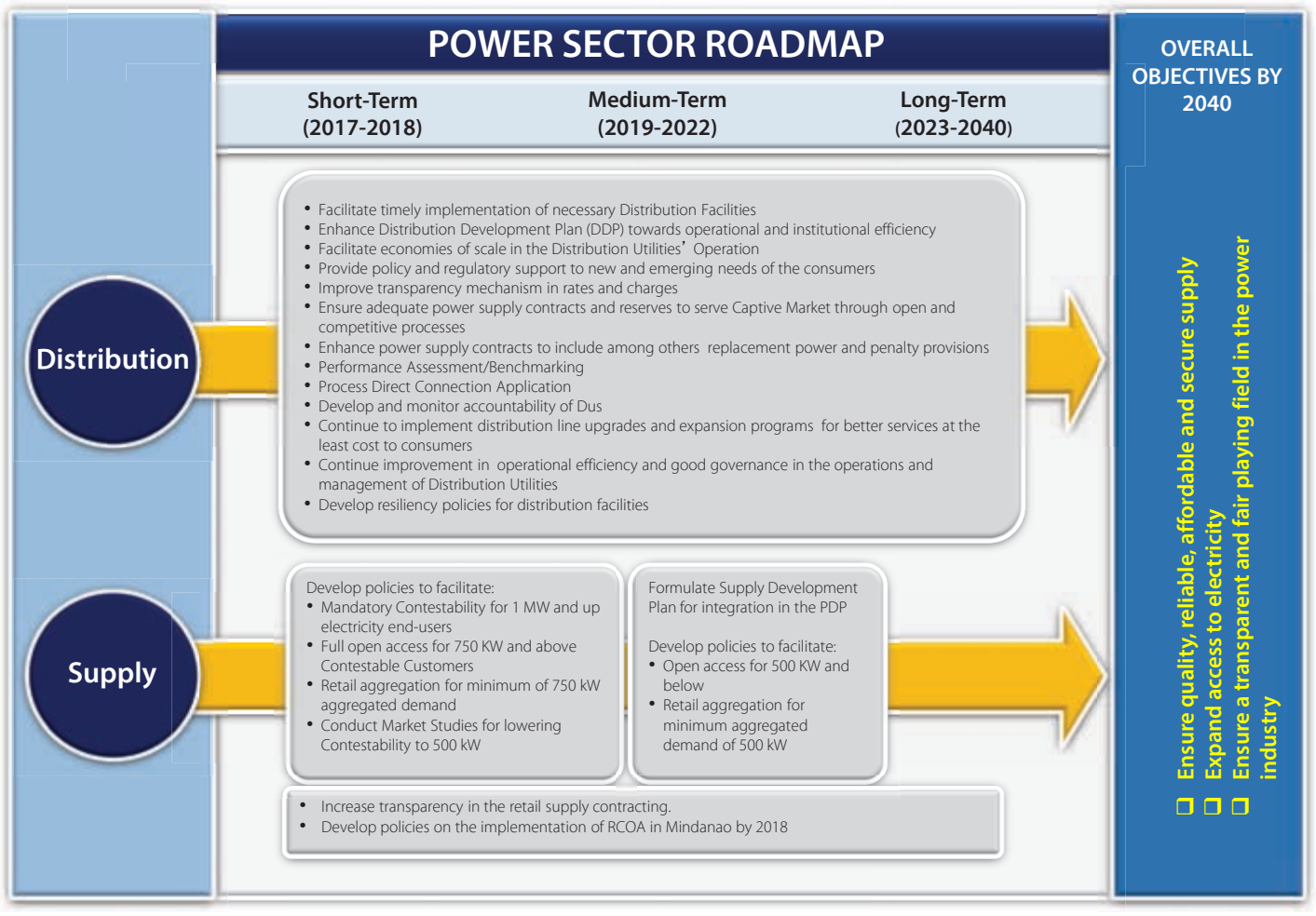


Figure 21. Power Sector Roadmap 2017-2040, Distribution and Supply

For the medium-term, the integration of the supply development plan in the PDP is envisioned considering the transition of the electric power industry into a market-driven and competitive sector wherein customers (contestable) are given the power of choice. The DOE, together with the ERC, will develop policies for lowering the threshold to 500 kW including aggregation for the same threshold.

In the short to long-term, RCOA in Mindanao is targeted to be pursued by 2018 following the implementation of WESM in Mindanao.

MARKET DEVELOPMENT

On the enhancement of the WESM design, while PEMC already completed the systems development, it will continue to conduct trainings and capacity building for the market participants and perform system trials. The NMMS will be fully operationalized by June 2017 including the features for demand side bidding and reserve market.

Preparatory activities for the eventual establishment of a competitive electricity market in Mindanao are also underway given the need to manage and address expected dispatch and pricing issues arising from the full commercial operation of committed capacities in Mindanao resulting to excess supply in the grid. The systems requirements for the Mindanao market will already be part of the NMMS. The groundwork for the appointment of the Independent Market Operator (IMO) has been done, thus, what is needed for the short-term is to be able to endorse the IMO in collaboration with

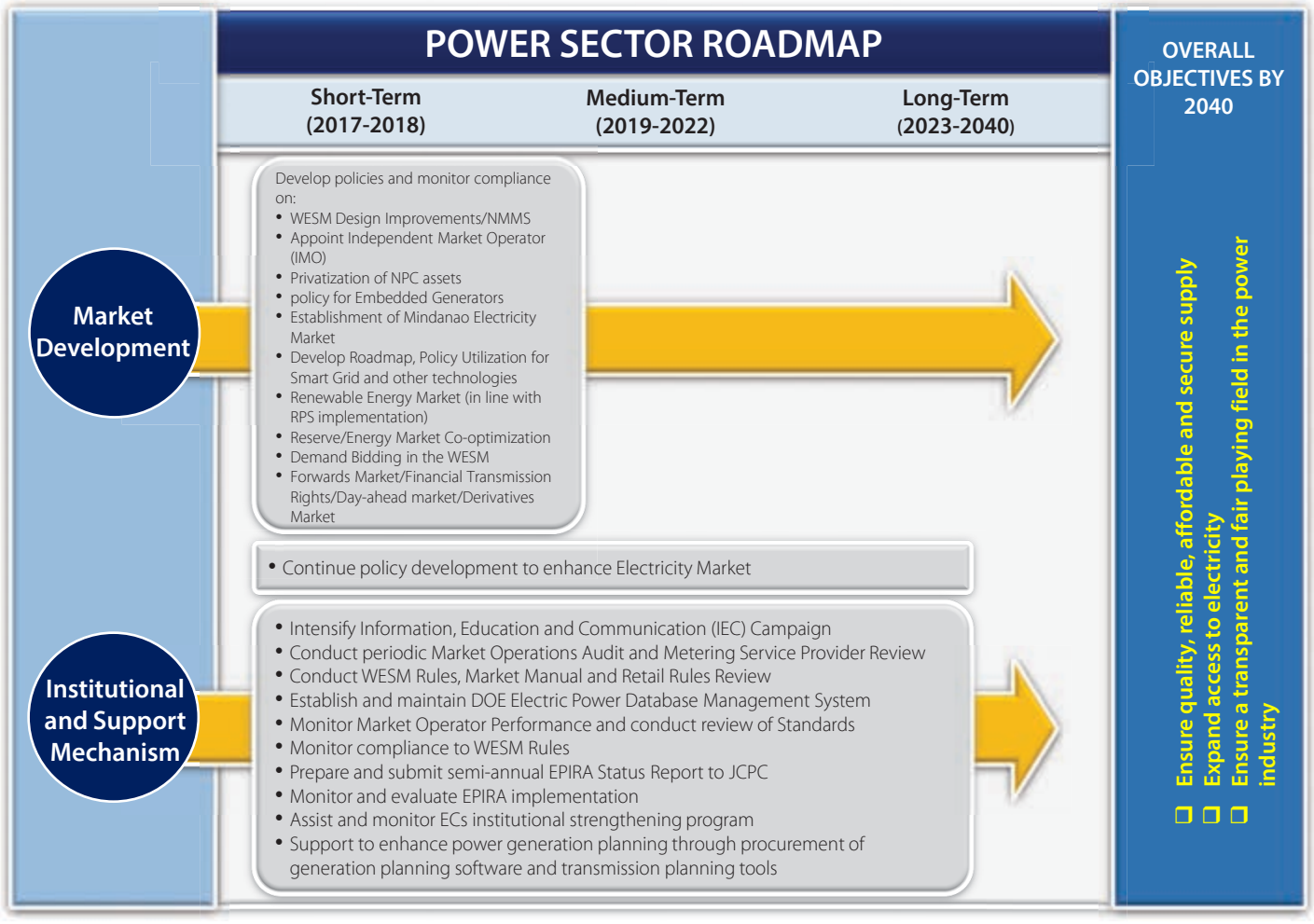


Figure 22. Power Sector Roadmap 2017-2040, Market Development and Institutional Support Mechanism

the electricity power industry participants and in accordance with the legal framework provided by the EPIRA. The IMO will assume the functions and responsibilities of the Autonomous Group Market Operator (AGMO).

The privatization of the remaining NPC generating plants, NPP-IPP contracts and decommissioned assets in will continue to be pursued by PSALM subject to guidance and directives of the DOE considering supply-demand situation specifically in the Mindanao grid. Mindanao Electricity Market will be implemented in 2017 to establish central dispatch system to optimize available capacities. The market will also provide price and other techno-economic signals that will further encourage investments in additional capacities in the region.

To complement this, the DOE will also look into harmonizing policies on embedded generation to ensure optimal use.

Included in the short-term, the DOE is envisioning: 1) co-optimized reserve and energy market that would allow more transparent supply and pricing in the WESM enhancing supply reliability; and 2) Renewable Energy Market to complement the implementation Renewable Portfolio Standards and allow the trading of Green Certificates as a mechanism for compliance to the RPS.

Also included in the short -term, are policy developments on 1) Smart Grid to provide technological support and innovations that would enhance various market developments; and 2)

demand-side bidding in the WESM. Meanwhile, policy developments to enhance the electricity market will be continuously pursued up to the long-term planning horizon.

INSTITUTIONAL AND SUPPORT MECHANISM

The implementation of institutional and other support mechanism will continue to be a main pillar of the DOE's initiatives to ensure the attainment of the EPIRA objectives and realize the short-medium-long term market development goals. Among others, the priorities are: 1) intensification of IEC Campaign at the grass roots level, supported by the different Attached Agencies and the PEMC thru conduct of focus trainings and fora; 2) continuing improvements in WESM operations thru rules review and changes, conduct of WESM audits, monitoring of Market Operator performance and compliance to WESM Rules; 3) establishment and maintenance of the DOE's Electric Power Database Management Systems that would support the various policy initiatives providing analysis and numerical basis; 4) continuing capacity building for DOE personnel to be able to cope up with the dynamic nature of the power industry; 5) enhanced supply expansion planning using advanced modeling tools and optimization software and, 6) ensuring compliance to the various requirements of the EPIRA and related laws.

MISSIONARY ELECTRIFICATION

As of June 2016, there are already seven (7) Small Island and Isolated Grids (SIIGs) that have successfully attained the privatization of its generation services. The turn-over of generation function from NPC-SPUG to a New Power Providers (NPP) will eventually redound to the reduction of Missionary Electrification (ME) subsidy which in turn minimizes the cost incurred by the Government through the NPC-SPUG. It then becomes imperative for DOE to catapult from this progress and ensure the continuous and effective development of this kind of programs that leads to the reduction of UCME. Thus, DOE will commence a policy study and convene a focus group to develop and establish a graduation policy program. DOE will direct NPC-SPUG to assess, in per area-by-area basis, the commercial viability of SPUG areas and determine therein priority areas which may already qualify for the graduation program as soon as the policy becomes implemented. This policy action will also address the intention of DOE to rationalize and improve the UCME subsidy system and cull out important concerns that need to be addressed first before implementing a graduation policy.

The development of resilience policies will also be prioritized by DOE. Learning from previous experiences when typhoons have heavily wreaked havoc on crucial power system facilities, this will serve as our step forward to ensure continuous and reliable power supply before, during and after natural or human-induced calamities. At top of which, power plants of NPC-SPUG and NPPs will also be subject to performance assessment to determine their plant efficiency and further improve their operations.

DOE will also support NPC in its continuous determination of new areas for energization which are being outlined in its Missionary Electrification Plan (MEP). On the other hand, tourism zones or eco-zones in missionary areas will also be determined and included in the Missionary Electrification Development Plan (MEDP) as these areas, if thoroughly studied, can pave the way for an influx of private investment.

An optimal energy mix will also be studied and implemented to ensure that off-grid areas are also synchronized with the direction being taken by our stakeholders from the national grid. The optimal mix will also take into consideration, among

others, required RE generation by ECs while also considering the current infrastructural peculiarity of off-grid areas.

Institutional cooperation among DOE, NEA and NPC will also be strengthened to ensure the expeditious formulation of policies and maximization of their individual and interdependent roles in assisting Electric Cooperatives during power supply contracting especially in the conduct of Competitive Selection Process (CSP), improving SPUG power system facilities and associated delivery systems and bringing the operations in missionary areas to commercial viability levels.

In the short to long run, we envision to bring the operations in missionary areas to viability levels as directed by existing laws and policies. As government agencies make necessary efforts to improve the PSP program through policy formulation and direction, ECs will be capacitated through various trainings to ensure their preparedness in contracting power supply for their franchise areas. This also calls for the improvement of EC's distribution utilities to increase their operational efficiency and eventually reduce system losses. This will also prepare their facilities for the entry of an NPP. One way to work on this intended improvement is the implementation of various compliance measures prescribed in the Philippine Small Grid Guidelines (PSGG) in coordination with the Distribution Management Committee (DMC) as this will direct ECs to comply with minimum operational specifications.

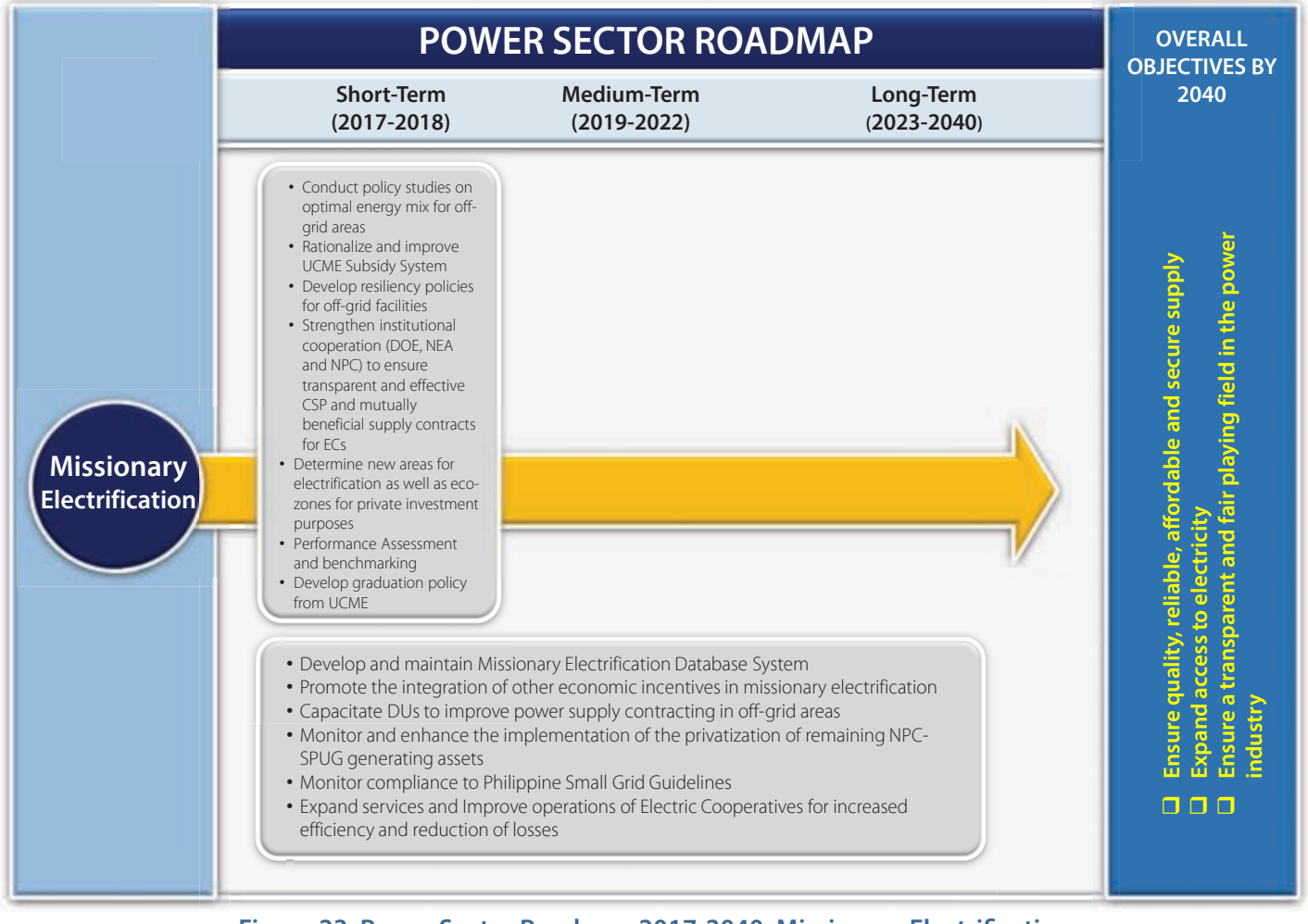


Figure 23. Power Sector Roadmap 2017-2040, Missionary Electrification

In line with improvement of the PSP program, privatization of existing NPC-SPUG generating assets will also be enhanced either through policy clarification, establishment of new policy or amendment of DOE Department Circular 2004-01-001 to make sure the purchase or lease of the said assets becomes a priority item. To further attract private investors, possible economic incentives to stakeholders engaging in power generation in missionary areas will be explored in coordination with the Tourism Infrastructure and Enterprise Zone Authority and other government agencies that are involved in the same operation.

Throughout the succeeding years, a Missionary Electrification Database System will be implemented that will include, among others, information from the reportorial requirements of ECs and Generation Companies as well as relevant data from NPC and NEA. It will also be imperative to enjoin ECs in missionary areas to diligently accomplish their Distribution Development Plan (DDP) to ensure the completeness and accuracy of the needed information in the database.

ELECTRIFICATION

The DOE will continue to work on its programs in order to achieve its goal of attaining the 90 percent household electrification by 2017.

From 90 percent household electrification level by 2017, the DOE is looking on attaining 100 percent electrification of targeted and identified households by 2022. As to how to achieve this goal, the Household Unified Strategic Electrification (HOUSE) Team represented by DOE together with its attached agencies (NEA and NPC) and concerned stakeholders will undertake the following 1) settle issues that arose during the implementation of HEDP in achieving the 90 percent level by 2017; 2) target and identify household consumers that can be connected in the distribution system which will be done by setting a baseline number and target household per franchise area of the DUs based on the recent released 2015 National Census; and 3) for offgrid electrification, separate electrification plan will be developed to achieve its total household electrification. This will be done by establishing an inventory of all the off-grid areas and a well maintained database of its status of electrification will help DOE in achieving its 100 percent household electrification in off grid areas.

The 100 percent electrification of targeted and identified households accessible to the grid is target to be attained by 2022 while the 100 percent electrification of household in off-grid areas are expected in the long term period (2023-2040).

Accordingly, electricity access to all is expected to be experienced by all households in the country by 2040. The DOE will work to maintain to electricity access for the long term and beyond and provide quality and continuous 24-hour service to all household situated on identified off-grid areas.

In the short-term, Table 25 highlights the targets on a per sub-program component of the Household Electrification Development Plan (HEDP) on how to attain 90 percent household electrification level by 2017 as part of the DOE short term goal.

To ensure the success of the long-term electrification goal, the DOE together with the concerned agencies and stakeholders will carry out the following strategies, plans and initiatives:

Establish a coordinated monitoring strategy to ensure the attainment of 90 percent household electrification by 2017. One of the strategies is the provision of a monthly accomplishment report to keep track of program (including sub-program) accomplishments vs. targets.

Issue a policy on the definition of electricity access to clarify issues and concerns on the definition of energized/electrified households in grid area and in off-grid areas. The said policy shall provide guidelines on the minimum requirement on the number of hours of electricity service for household connected to grid and the household energized through interim solutions such as gensets and individual PV Solar Home System.

Establish an efficient monitoring system such as: 1) household electrification information system (HEIS) that will address potential duplication of beneficiaries and 2) nationwide off-grid database that will serve as baseline and target of all off-grid electrification program of the Government.

In the medium term, the DOE through NEA and the concerned DUs in Luzon and Visayas will achieve 100 percent household electrification through implementation of SEP, BLEP, NIHE and ER 1-94 EF Programs.

Periodic review and revisit of the overall electrification goal in order to identify measures for implementation to meet the targets.

Encourage participation and contributions of Civil Society including NGOs, private foundations, Corporate Social Responsibility programs of large corporations and other entities in undertaking the provision of the basic electricity services especially in depressed areas of the country.

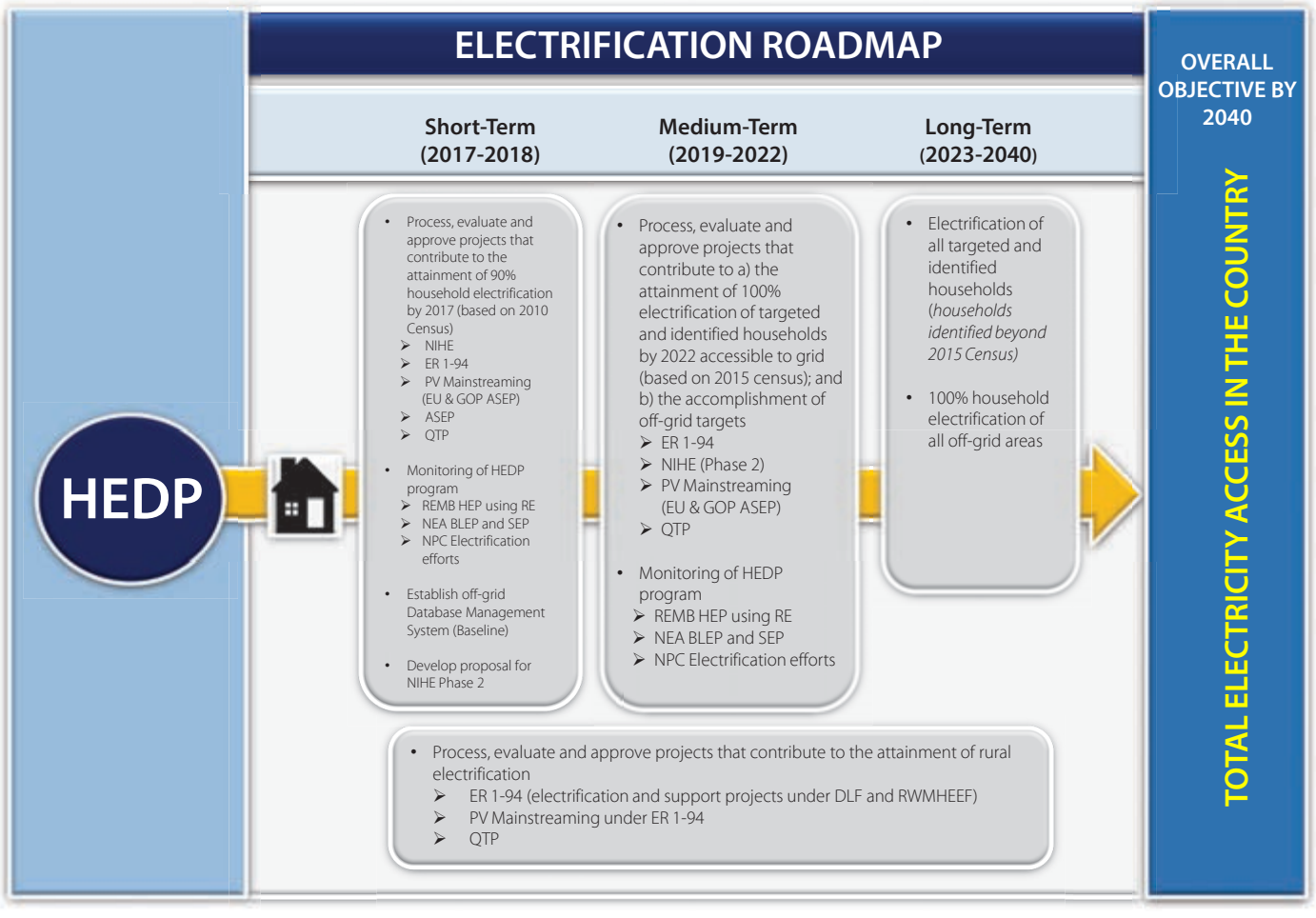


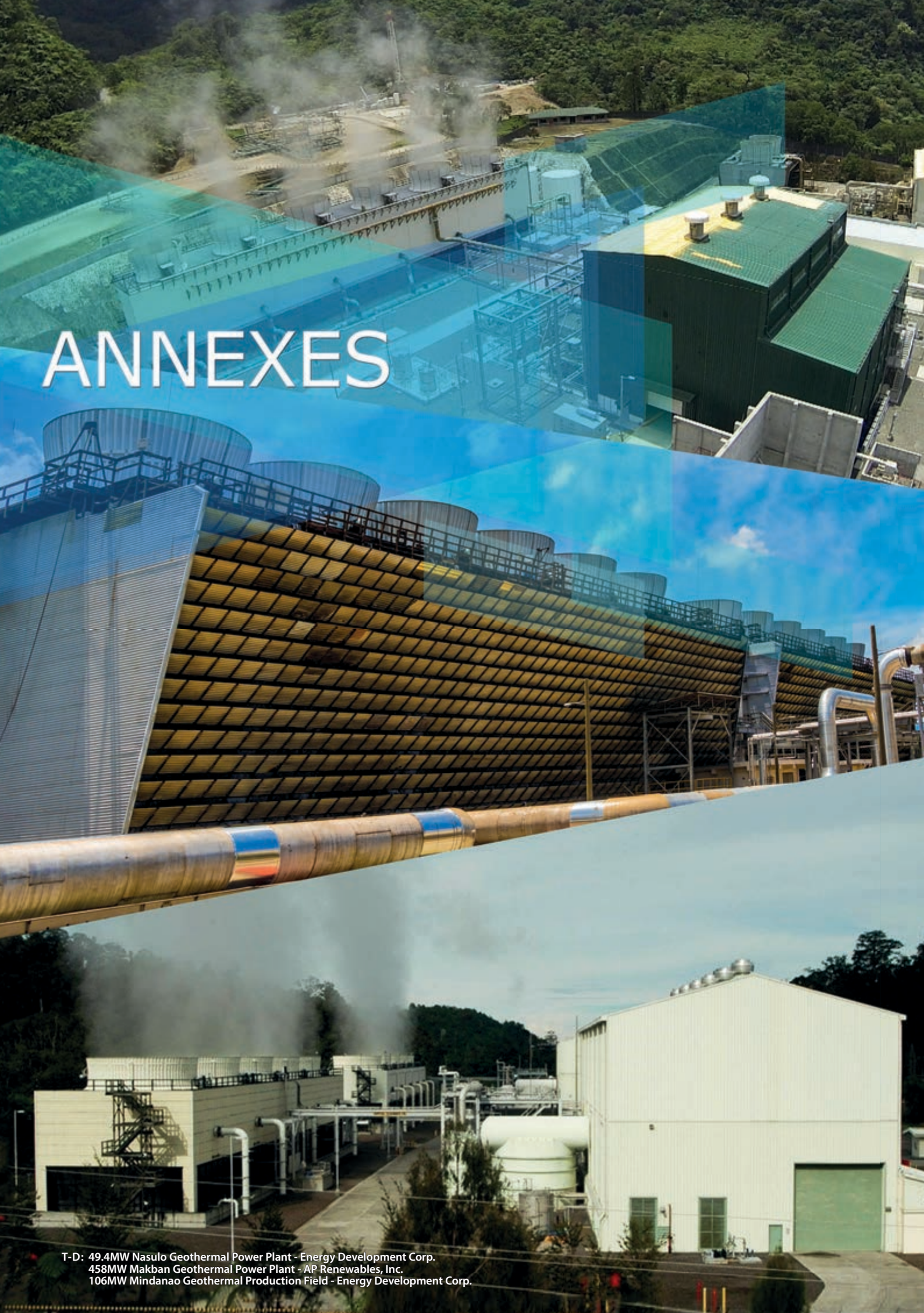
Figure 24. Power Sector Roadmap 2017-2040, Electrification Roadmap

Table 25. Household Electrification Sub-Programs and Targets for 2016-2017

HEDP Programs	Program Period	Implementer	Target Households		
			2016	2017	Cumulative 2016-2017
GRID					
Sitio Electrification Program (SEP)	2011-2016	NEA	23,622		23,622
NEA Subsidy fo Sitio Electrification (2016-2017)	2016-2017	NEA	94,500	189,630	284,130
Barangay Line Enhancement Program (BLEP)	2011-2016	NEA	10,160		10,160
Nationwide Intensification of Household Electrification (NIHE)	2015-2017	DOE	177,000	177,000	354,000
E.R. 1-94 EF	Annual	DOE	3,000	3,000	6,000
DU Regular Connections		DOE	57,976	34,626	84,759
Sub-Total			**366,258**	**404,256**	**762,671**
OFF-GRID					
PV Mainstreaming Program (PVM)	Annual	DOE		10,000	19,607
PV Mainstreaming Program - ASEP	2016-2019	DOE	9,735	17,252	26,987
Household Electrification Program (HEP) using RE	2011-2017	DOE	5,600	5,600	11,200
Missionary Electrification Projects in NPC-SPUG Areas	Annual	NPC-SPUG	5,100	2,500	7,600
Sub-Total			20,435	35,352	65,394
Total			**386,693**	**441,372**	**828,065**

Note: Targets are referenced on the December 2015 HH Electrification Level

ANNEXES



T-D: 49.4MW Nasulo Geothermal Power Plant - Energy Development Corp.
458MW Makban Geothermal Power Plant - AP Renewables, Inc.
106MW Mindanao Geothermal Production Field - Energy Development Corp.

Annex 1.
Philippine Historical Electricity Consumption and Peak Demand to GDP Elasticity, 2004-2015

Year	Electricity Consumption (GWh)	Electricity Consumption Growth Rate (%)	Peak Demand (MW)	Peak Demand Growth Rate (%)	GDP (2000=100) Million Pesos	GDP Growth Rate (%)	Electricity Consumption to GDP Elasticity	Peak Demand to GDP Elasticity
2004	55,957		8,525		4,276,941		0.9	0.5
2005	56,568	1.1	8,629	1.2	4,481,279	4.8	0.2	0.3
2006	56,784	0.4	8,760	1.5	4,716,231	5.2	0.1	0.3
2007	59,612	5.0	8,987	2.6	5,028,288	6.6	0.8	0.4
2008	60,821	2.0	9,054	0.7	5,237,099	4.2	0.5	0.2
2009	61,934	1.8	9,472	4.6	5,297,240	1.1	1.6	4.0
2010	67,743	9.4	10,375	9.5	5,701,539	7.6	1.2	1.2
2011	69,176	2.1	10,379	0.0	5,910,201	3.7	0.6	0.0
2012	72,922	5.4	10,761	3.7	6,305,229	6.7	0.8	0.6
2013	75,266	3.2	11,305	5.1	6,750,631	7.1	0.5	0.7
2014	77,261	2.7	11,822	4.6	7,170,414	6.2	0.4	0.7
2015	82,413	6.7	12,213	3.3	7,593,769	5.9	1.1	0.6

Annex 2.
Luzon Historical Electricity Consumption and Peak Demand to GRDP Elasticity, 2004-2015

Year	Electricity Consumption (GWh)	Electricity Consumption Growth Rate (%)	Peak Demand (MW)	Peak Demand Growth Rate (%)	GRDP (2000=100) Million Pesos	GRDP Growth Rate (%)	Electricity Consumption to GRDP Elasticity	Peak Demand to GRDP Elasticity
2004	42,390		6,323		3,110,292		0.7	0.4
2005	42,563	0.4	6,443	1.9	3,265,801	5.0	0.1	0.4
2006	42,424	(0.3)	6,466	0.4	3,435,661	5.2	(0.1)	0.1
2007	44,340	4.5	6,643	2.7	3,663,711	6.6	0.7	0.4
2008	45,317	2.2	6,674	0.5	3,814,637	4.1	0.5	0.1
2009	45,635	0.7	6,928	3.8	3,861,247	1.2	0.6	3.1
2010	50,322	10.3	7,656	10.5	4,174,036	8.1	1.3	1.3
2011	50,965	1.3	7,552	(1.4)	4,308,393	3.2	0.4	(0.4)
2012	53,723	5.4	7,889	4.5	4,598,670	6.7	0.8	0.7
2013	55,736	3.7	8,305	5.3	4,942,077	7.5	0.5	0.7
2014	57,489	3.1	8,717	5.0	5,246,187	6.2	0.5	0.8
2015	61,099	6.3	8,928	2.4	5,560,531	6.0	1.0	0.4

Annex 3.
Visayas Historical Electricity Consumption and Peak Demand to GRDP Elasticity, 2004-2015

Year	Electricity Consumption (GWh)	Electricity Consumption Growth Rate (%)	Peak Demand (MW)	Peak Demand Growth Rate (%)	GRDP (2000=100) Million Pesos	GRDP Growth Rate (%)	Electricity Consumption to GRDP Elasticity	Peak Demand to GRDP Elasticity
2004	6,481		1,025		549,003		1.3	0.4
2005	6,762	4.3	1,037	1.2	574,164	4.6	0.9	0.3
2006	6,946	2.7	1,066	2.8	602,538	4.9	0.5	0.6
2007	7,382	6.3	1,102	3.4	639,203	6.1	1.0	0.6
2008	7,532	2.0	1,176	6.7	666,315	4.2	0.5	1.6
2009	8,064	7.1	1,241	5.5	665,784	(0.1)	(88.6)	(69.3)
2010	9,018	11.8	1,431	15.3	718,742	8.0	1.5	1.9
2011	9,508	5.4	1,481	3.5	759,128	5.6	1.0	0.6
2012	10,072	5.9	1,551	4.7	799,533	5.3	1.1	0.9
2013	10,183	1.1	1,572	1.4	844,313	5.6	0.2	0.2
2014	10,292	1.1	1,636	4.0	888,023	5.2	0.2	0.8
2015	11,184	8.7	1,768	8.1	939,393	5.8	1.5	1.4

Annex 4.
Mindanao Historical Electricity Consumption and Peak Demand to GRDP Elasticity, 2004-2015

Year	Electricity Consumption (GWh)	Electricity Consumption Growth Rate (%)	Peak Demand (MW)	Peak Demand Growth Rate (%)	GRDP (2000=100) Million Pesos	GRDP Growth Rate (%)	Electricity Consumption to GRDP Elasticity	Peak Demand to GRDP Elasticity
2004	7,087		1,177		617,646		1.4	0.7
2005	7,243	2.2	1,149	(2.4)	641,314	3.8	0.6	(0.6)
2006	7,414	2.4	1,228	6.9	678,031	5.7	0.4	1.2
2007	7,890	6.4	1,241	1.1	725,374	7.0	0.9	0.2
2008	7,972	1.0	1,204	(3.0)	756,147	4.2	0.2	(0.7)
2009	8,235	3.3	1,303	8.3	770,209	1.9	1.8	4.4
2010	8,403	2.0	1,288	(1.2)	808,762	5.0	0.4	(0.2)
2011	8,703	3.6	1,346	4.5	842,680	4.2	0.9	1.1
2012	9,127	4.9	1,321	(1.9)	907,026	7.6	0.6	(0.2)
2013	9,347	2.4	1,428	8.1	964,241	6.3	0.4	1.3
2014	9,481	1.4	1,469	2.9	1,036,204	7.5	0.2	0.4
2015	10,130	6.8	1,517	3.3	1,093,845	5.6	1.2	0.6

Annex 5.
Electricity Sales and Consumption by Sector, 2003-2015 (in GWh)

Philippines	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Residential	*15,357*	*15,920*	*16,031*	*15,830*	*16,376*	*16,644*	*17,504*	*18,833*	*18,694*	*19,695*	*20,614*	*20,969*	*22,747*
Commercial	*11,106*	*11,785*	*12,245*	*12,679*	*13,470*	*14,136*	*14,756*	*16,261*	*16,624*	*17,777*	*18,304*	*18,761*	*20,085*
Industrial	*15,188*	*15,012*	*15,705*	*15,888*	*16,522*	*17,031*	*17,084*	*18,576*	*19,334*	*20,071*	*20,677*	*21,429*	*22,514*
Others	*1,069*	*1,359*	*1,177*	*1,275*	*1,641*	*1,395*	*1,523*	*1,596*	*1,446*	*1,668*	*1,971*	*2,186*	*2,462*
Total Sales	42,720	44,076	45,159	45,672	48,009	49,206	50,868	55,266	56,098	59,211	61,566	63,345	67,808
Own-Use	3,410	4,654	4,591	4,227	3,994	3,935	3,524	4,677	5,398	5,351	5,959	6,461	7,124
System Loss	6,810	7,228	6,817	6,885	7,608	7,680	7,542	7,800	7,680	8,360	7,741	7,455	7,481
Total Consumption	**52,941**	**55,957**	**56,568**	**56,784**	**59,612**	**60,821**	**61,934**	**67,743**	**69,176**	**72,922**	**75,266**	**77,261**	**82,413**

Annex 6.
Electricity Sales and Consumption by Sector, per Grid, 2003-2015 (in GWh)

Luzon	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Residential	*11,796*	*12,115*	*12,038*	*11,802*	*12,129*	*12,236*	*12,801*	*13,865*	*13,558*	*14,262*	*15,056*	*15,304*	*16,528*
Commercial	*9,649*	*10,138*	*10,495*	*10,865*	*11,503*	*12,066*	*12,519*	*13,684*	*13,975*	*14,905*	*15,510*	*16,103*	*17,272*
Industrial	*10,476*	*10,149*	*10,670*	*10,563*	*11,034*	*11,522*	*11,745*	*13,030*	*13,394*	*14,086*	*14,379*	*14,939*	*15,876*
Others	*547*	*623*	*589*	*712*	*768*	*792*	*794*	*809*	*779*	*810*	*859*	*895*	*913*
Total Sales	32,468	33,025	33,791	33,941	35,435	36,615	37,859	41,389	41,706	44,064	45,803	47,241	50,589
Own-Use	2,826	3,856	3,738	3,444	3,141	3,069	2,666	3,729	4,114	3,952	4,550	5,040	5,598
System Loss	5,191	5,509	5,033	5,039	5,764	5,632	5,110	5,204	5,145	5,707	5,383	5,208	4,912
Total Consumption	**40,485**	**42,390**	**42,563**	**42,424**	**44,340**	**45,317**	**45,635**	**50,322**	**50,965**	**53,723**	**55,736**	**57,489**	**61,099**
Visayas	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Residential	*1,785*	*1,873*	*1,999*	*2,036*	*2,157*	*2,208*	*2,341*	*2,523*	*2,527*	*2,668*	*2,735*	*2,770*	*3,068*
Commercial	*666*	*783*	*861*	*910*	*1,003*	*1,044*	*1,094*	*1,312*	*1,324*	*1,426*	*1,446*	*1,302*	*1,418*
Industrial	*2,022*	*1,999*	*2,104*	*2,340*	*2,402*	*2,416*	*2,562*	*2,770*	*3,038*	*3,032*	*3,137*	*3,214*	*3,268*
Others	*245*	*377*	*320*	*265*	*455*	*293*	*313*	*431*	*336*	*521*	*550*	*753*	*1,011*
Total Sales	4,718	5,032	5,284	5,551	6,017	5,961	6,309	7,036	7,224	7,647	7,868	8,039	8,765
Own-Use	484	661	679	606	574	589	565	665	996	1,092	1,055	1,049	1,131
System Loss	742	788	799	788	790	982	1,190	1,317	1,288	1,333	1,260	1,204	1,288
Total Consumption	**5,945**	**6,481**	**6,762**	**6,946**	**7,382**	**7,532**	**8,064**	**9,018**	**9,508**	**10,072**	**10,183**	**10,292**	**11,184**
Mindanao	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Residential	*1,776*	*1,933*	*1,995*	*1,992*	*2,089*	*2,200*	*2,362*	*2,445*	*2,609*	*2,765*	*2,823*	*2,895*	*3,151*
Commercial	*791*	*864*	*889*	*904*	*964*	*1,026*	*1,143*	*1,265*	*1,324*	*1,446*	*1,348*	*1,357*	*1,394*
Industrial	*2,690*	*2,864*	*2,931*	*2,985*	*3,086*	*3,092*	*2,778*	*2,776*	*2,902*	*2,954*	*3,161*	*3,275*	*3,370*
Others	*277*	*359*	*269*	*298*	*418*	*311*	*417*	*356*	*332*	*336*	*563*	*538*	*538*
Total Sales	5,534	6,020	6,084	6,179	6,557	6,630	6,699	6,841	7,167	7,500	7,895	8,065	8,453
Own-Use	100	137	173	178	279	277	293	282	289	306	355	372	395
System Loss	877	931	985	1,057	1,054	1,065	1,243	1,280	1,247	1,320	1,097	1,044	1,281
Total Consumption	**6,511**	**7,087**	**7,243**	**7,414**	**7,890**	**7,972**	**8,235**	**8,403**	**8,703**	**9,127**	**9,347**	**9,481**	**10,130**

Annex 7.
Annual System Peak Demand per Grid, 1985-2015 (in MW)

Year	Luzon	% AAGR	Visayas*	% AAGR	Mindanao	% AAGR	Total Non-Coincident Peak (Max)	% AAGR
1985	2,311		256		470		3,037	
1986	2,435	5.4	284	10.9	484	3.0	3,203	5.5
1987	2,592	6.4	307	8.1	533	10.1	3,432	7.1
1988	2,780	7.3	333	8.5	571	7.1	3,684	7.3
1989	2,938	5.7	354	6.3	617	8.1	3,909	6.1
1990	2,973	1.2	380	7.3	621	0.6	3,974	1.7
1991	3,045	2.4	410	7.9	626	0.8	4,081	2.7
1992	3,250	6.7	472	15.1	573	(8.5)	4,295	5.2
1993	3,473	6.9	512	8.5	691	20.6	4,676	8.9
1994	3,561	2.5	557	8.8	696	0.7	4,814	3.0
1995	3,920	10.1	628	12.7	780	12.1	5,328	10.7
1996	4,306	9.8	647	3.0	828	6.2	5,781	8.5
1997	4,773	10.8	725	12.1	852	2.9	6,350	9.8
1998	4,863	1.9	707	(2.5)	868	1.9	6,438	1.4
1999	4,986	2.5	729	3.1	892	2.8	6,607	2.6
2000	5,450	9.3	749	2.7	939	5.3	7,138	8.0
2001	5,646	3.6	898	19.9	953	1.5	7,497	5.0
2002	5,823	3.1	903	0.6	995	4.4	7,721	3.0
2003	6,149	5.6	995	10.2	1,131	13.7	8,275	7.2
2004	6,323	2.8	1,025	3.0	1,177	4.1	8,525	3.0
2005	6,443	1.9	1,037	1.2	1,149	(2.4)	8,629	1.2
2006	6,466	0.4	1,066	2.8	1,228	6.9	8,760	1.5
2007	6,643	2.7	1,102	3.4	1,241	1.1	8,987	2.6
2008	6,674	0.5	1,176	6.7	1,204	(3.0)	9,054	0.7
2009	6,928	3.8	1,241	5.5	1,303	8.3	9,472	4.6
2010	7,656	10.5	1,431	15.3	1,288	(1.2)	10,375	9.5
2011	7,552	(1.4)	1,481	3.5	1,346	4.5	10,379	0.0
2012	7,889	4.5	1,551	4.7	1,321	(1.9)	10,761	3.7
2013	8,305	5.3	1,572	1.4	1,428	8.1	11,305	5.1
2014	8,717	5.0	1,636	4.1	1,469	2.9	11,822	4.6
2015	8,928	2.4	1,768	8.1	1,517	3.3	12,213	3.3

Annex 8.
Visayas Annual System Peak Demand per Sub-Grid, 1995-2015 (in MW)

Year	Cebu	% AAGR	Negros	% AAGR	Panay	% AAGR	Leyte-Samar	% AAGR	Bohol	% AAGR	Total Visayas	% AAGR
1995	248		113		88		116		21		586	
1996	272	9.73	127	12.61	95	7.03	116	0.30	22	5.69	632	7.87
1997	291	7.10	141	10.66	114	20.76	152	30.41	24	7.17	722	14.15
1998	297	2.06	136	(3.70)	114	(0.47)	127	(15.96)	28	15.90	702	(2.79)
1999	333	12.16	152	12.03	81	(28.65)	126	(1.10)	30	8.66	722	2.97
2000	353	6.04	156	2.45	84	3.45	122	(3.25)	32	4.98	746	3.33
2001	377	6.65	151	(2.78)	146	73.92	156	28.09	31	(3.39)	861	15.33
2002	349	(7.40)	178	17.45	113	(22.39)	162	3.91	40	30.88	842	(2.16)
2003	422	20.97	179	0.94	105	(7.61)	175	7.93	41	3.28	923	9.54
2004	417	(1.14)	199	10.86	122	16.68	167	(4.52)	49	18.73	955	3.46
2005	438	4.94	195	(2.03)	120	(1.91)	168	0.65	46	(6.33)	967	1.28
2006	458	4.68	199	1.87	123	2.64	171	1.43	46	0.44	997	3.09
2007	477	4.12	209	5.11	182	48.20	186	8.76	49	5.42	1,102	10.61
2008	522	9.39	218	4.30	203	11.49	182	(2.21)	52	6.17	1,176	6.68
2009	559	7.07	215	(1.13)	223	9.91	188	3.49	56	7.77	1,241	5.52
2010	674	20.56	263	22.29	243	8.68	204	8.33	48	(14.21)	1,431	15.31
2011	704	4.44	245	(6.75)	260	7.25	209	2.81	62	30.83	1,481	3.50
2012	747	6.20	256	4.45	262	0.48	221	5.65	65	3.42	1,551	4.71
2013	780	4.41	253	(1.40)	272	3.82	199	(10.08)	63	(2.25)	1,567	1.01
2014	862	10.45	266	5.38	264	(2.72)	181	(8.74)	62	(2.23)	1,636	4.40
2015	850	(1.34)	309	15.92	309	16.84	230	26.54	70	14.18	1,768	8.09

Annex 9.
Luzon Monthly System Peak Demand, 2001-2015 (in MW)

Month	Luzon														
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Jan	5,119	5,212	5,282	5,511	5,471	5,619	5,819	5,972	6,118	6,407	6,594	7,027	7,079	7,121	7,315
Feb	5,157	5,056	5,345	5,701	5,853	5,776	6,115	6,094	6,452	6,878	6,877	7,162	7,214	7,545	7,610
Mar	5,384	5,424	5,705	6,065	6,210	6,186	6,157	6,211	6,642	7,057	7,006	7,503	7,720	7,655	7,878
Apr	5,523	5,589	6,149	6,218	6,266	6,222	6,581	6,663	6,845	7,305	7,056	7,885	8,178	8,267	8,727
May	5,646	5,823	6,109	6,323	6,443	6,466	6,643	6,485	6,829	7,656	7,538	7,889	8,305	8,717	8,928
Jun	5,447	5,750	5,831	5,978	6,348	6,339	6,619	6,674	6,928	7,646	7,552	7,709	8,208	8,607	8,881
Jul	5,281	5,652	5,856	6,061	6,039	6,221	6,464	6,559	6,848	7,240	7,438	7,574	8,030	8,265	8,826
Aug	5,313	5,604	5,813	5,906	6,107	6,094	6,369	6,403	6,863	7,009	7,200	7,242	7,755	8,230	8,889
Sep	5,364	5,559	5,885	6,097	5,998	6,195	6,416	6,496	6,873	7,057	7,107	7,293	7,966	8,005	8,738
Oct	5,460	5,687	5,878	5,916	5,843	5,845	6,155	6,627	6,530	7,074	7,255	7,421	7,564	7,993	8,624
Nov	5,319	5,712	5,957	5,987	5,889	5,974	6,137	6,492	6,662	6,851	7,223	7,425	7,488	8,033	8,498
Dec	5,305	5,707	5,904	5,900	5,910	5,813	6,195	6,376	6,575	6,946	7,178	7,395	7,670	7,996	8,487
Max	**5,646**	**5,823**	**6,149**	**6,323**	**6,443**	**6,466**	**6,643**	**6,674**	**6,928**	**7,656**	**7,552**	**7,889**	**8,305**	**8,717**	**8,928**

Annex 10.
Visayas Monthly System Peak Demand, 2001-2015 (in MW)

Month	Visayas														
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Jan	761	781	797	866	890	906	946	1,067	1,122	1,219	1,324	1,391	1,463	1,331	1,476
Feb	747	760	792	839	892	929	969	1,069	1,159	1,199	1,356	1,386	1,446	1,362	1,479
Mar	755	765	822	878	899	949	972	1,092	1,166	1,254	1,370	1,370	1,528	1,411	1,528
Apr	794	826	828	889	916	964	1,007	1,112	1,193	1,308	1,431	1,447	1,548	1,499	1,630
May	777	842	837	896	928	968	1,015	1,090	1,204	1,364	1,405	1,464	1,572	1,606	1,618
Jun	773	818	858	857	926	961	1,078	1,089	1,204	1,344	1,399	1,449	1,555	1,636	1,562
Jul	780	803	817	880	931	977	1,090	1,105	1,201	1,323	1,398	1,440	1,543	1,511	1,584
Aug	778	793	832	889	919	951	1,100	1,127	1,214	1,310	1,415	1,480	1,207	1,579	1,596
Sep	826	790	834	894	911	976	1,094	1,128	1,206	1,341	1,414	1,456	1,547	1,528	1,625
Oct	798	780	857	904	917	967	1,088	1,174	1,215	1,333	1,435	1,489	1,520	1,517	1,705
Nov	799	790	897	952	943	984	1,101	1,176	1,241	1,402	1,462	1,502	1,518	1,610	1,768
Dec	813	842	924	955	967	997	1,102	1,165	1,231	1,431	1,481	1,551	1,350	1,526	1,727
Max	**826**	**842**	**924**	**955**	**967**	**997**	**1,102**	**1,176**	**1,241**	**1,431**	**1,481**	**1,551**	**1,572**	**1,636**	**1,768**

Annex 11.
Mindanao Monthly System Peak Demand, 2001-2015 (in MW)

Month	Mindanao														
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Jan	887	911	946	1,058	1,082	1,062	1,108	1,158	1,143	1,240	1,250	1,270	1,284	1,354	1,387
Feb	900	913	918	1,044	1,082	1,077	1,141	1,146	1,163	1,180	1,231	1,191	1,244	1,351	1,380
Mar	903	900	978	1,027	1,082	1,088	1,177	1,162	1,158	1,026	1,219	1,244	1,245	1,344	1,370
Apr	887	927	985	1,051	1,087	1,090	1,167	1,190	1,186	1,009	1,253	1,232	1,226	1,310	1,406
May	901	920	1,001	1,099	1,055	1,118	1,109	1,159	1,194	1,211	1,253	1,301	1,366	1,339	1,438
Jun	897	931	1,021	1,035	1,072	1,100	1,145	1,188	1,220	1,238	1,264	1,309	1,364	1,416	1,435
Jul	894	924	976	1,025	1,045	1,093	1,141	1,163	1,198	1,214	1,298	1,289	1,384	1,390	1,397
Aug	926	941	980	1,086	1,061	1,119	1,141	1,147	1,208	1,221	1,290	1,306	1,326	1,386	1,446
Sep	947	927	995	1,102	1,078	1,090	1,203	1,163	1,217	1,235	1,288	1,268	1,256	1,391	1,453
Oct	954	950	1,019	1,134	1,122	1,130	1,193	1,156	1,292	1,263	1,290	1,319	1,219	1,441	1,507
Nov	938	965	1,051	1,155	1,149	1,147	1,158	1,204	1,303	1,286	1,326	1,321	1,397	1,469	1,517
Dec	933	995	1,131	1,177	1,105	1,228	1,241	1,175	1,282	1,288	1,346	1,318	1,428	1,453	1,510
Max	**954**	**995**	**1,131**	**1,177**	**1,149**	**1,228**	**1,241**	**1,204**	**1,303**	**1,288**	**1,346**	**1,321**	**1,428**	**1,469**	**1,517**

Annex 12.
Philippine Installed and Dependable Capacity by Plant Type, 2003-2015 (in MW)

Philippines														
Philippine Installed Capacity	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Coal	3,958	3,967	3,967	4,177	4,213	4,213	4,277	4,867	4,917	5,568	5,568	5,708	5,963	7,419
Oil Based	3,604	3,669	3,663	3,602	3,616	3,353	3,193	3,193	2,994	3,074	3,353	3,476	3,610	3,616
Natural Gas	2,763	2,763	2,763	2,763	2,834	2,831	2,831	2,861	2,861	2,862	2,862	2,862	2,862	3,431
Renewable Energy (RE)	4,799	5,149	5,226	5,261	5,277	5,284	5,309	5,438	5,391	5,521	5,541	5,898	6,330	6,958
Geothermal	*1,932*	*1,932*	*1,978*	*1,978*	*1,958*	*1,958*	*1,953*	*1,966*	*1,783*	*1,848*	*1,868*	*1,918*	*1,917*	*1,916*
Hydro	*2,867*	*3,217*	*3,222*	*3,257*	*3,293*	*3,291*	*3,291*	*3,400*	*3,491*	*3,521*	*3,521*	*3,543*	*3,600*	*3,618*
Biomass, Solar, Wind	*0*	*0*	*26*	*26*	*26*	*34*	*64*	*73*	*117*	*153*	*153*	*437*	*812*	*1,424*
Total	**15,124**	**15,548**	**15,619**	**15,803**	**15,941**	**15,681**	**15,610**	**16,359**	**16,162**	**17,025**	**17,325**	**17,944**	**18,765**	**21,423**
Philippine Dependable Capacity	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Coal	3,691	3,696	3,432	3,638	3,467	3,412	3,813	4,245	4,651	5,206	5,206	5,378	5,613	6,979
Oil Based	3,175	3,216	3,043	2,879	2,670	2,702	2,528	2,488	2,579	2,561	2,846	2,705	2,734	2,821
Natural Gas	2,703	2,703	2,703	2,703	2,703	2,562	2,700	2,756	2,770	2,760	2,760	2,760	2,759	3,291
Renewable Energy (RE)	3,828	4,251	4,419	4,407	4,650	4,370	4,285	4,413	4,478	4,539	4,559	4,789	5,325	6,005
Geothermal	*1,568*	*1,560*	*1,685*	*1,682*	*1,667*	*1,387*	*1,322*	*1,350*	*1,434*	*1,462*	*1,482*	*1,607*	*1,601*	*1,689*
Hydro	*2,260*	*2,690*	*2,725*	*2,715*	*2,973*	*2,950*	*2,919*	*3,021*	*2,963*	*2,983*	*2,983*	*2,982*	*3,073*	*3,181*
Biomass, Solar, Wind	*0*	*1*	*10*	*10*	*10*	*34*	*44*	*41*	*80*	*94*	*94*	*201*	*651*	*1,135*
Total	**13,397**	**13,865**	**13,598**	**13,627**	**13,490**	**13,047**	**13,326**	**13,902**	**14,477**	**15,066**	**15,371**	**15,633**	**16,432**	**19,097**

Annex 13.
Luzon Installed and Dependable Capacity by Plant Type, 2003-2015 (in MW)

Luzon														
Luzon Installed Capacity	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Coal	3,769	3,769	3,769	3,769	3,783	3,783	3,849	3,849	3,879	4,531	4,531	4,671	4,812	5,294
Oil Based	2,514	2,514	2,404	2,333	2,363	2,100	1,984	1,984	1,757	1,778	2,020	2,033	2,133	2,133
Natural Gas	2,763	2,763	2,763	2,763	2,834	2,831	2,831	2,861	2,861	2,861	2,861	2,861	2,861	3,430
Renewable Energy (RE)	2,765	3,115	3,192	3,226	3,194	3,199	3,199	3,287	3,242	3,358	3,378	3,649	3,863	4,120
Geothermal	*907*	*907*	*954*	*954*	*886*	*886*	*886*	*899*	*751*	*824*	*844*	*844*	*844*	*843*
Hydro	*1,858*	*2,208*	*2,213*	*2,247*	*2,284*	*2,281*	*2,280*	*2,346*	*2,440*	*2,462*	*2,462*	*2,471*	*2,528*	*2,537*
Biomass, Solar, Wind	*0*	*0*	*25*	*25*	*25*	*33*	*34*	*42*	*50*	*72*	*71*	*333*	*490*	*740*
Total	**11,812**	**12,162**	**12,128**	**12,092**	**12,174**	**11,913**	**11,863**	**11,981**	**11,739**	**12,528**	**12,790**	**13,213**	**13,668**	**14,977**
Luzon Dependable Capacity	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Coal	3,551	3,551	3,287	3,287	3,112	3,056	3,450	3,531	3,664	4,219	4,219	4,391	4,512	4,970
Oil Based	2,236	2,236	2,059	1,928	1,713	1,742	1,617	1,586	1,633	1,586	1,736	1,507	1,585	1,655
Natural Gas	2,703	2,703	2,703	2,703	2,703	2,562	2,700	2,756	2,770	2,759	2,759	2,759	2,759	3,291
Renewable Energy (RE)	2,031	2,381	2,547	2,547	2,782	2,507	2,464	2,626	2,757	2,785	2,805	2,965	3,322	3,684
Geothermal	*604*	*604*	*727*	*726*	*714*	*439*	*431*	*500*	*587*	*587*	*607*	*692*	*691*	*777*
Hydro	*1,428*	*1,778*	*1,811*	*1,813*	*2,059*	*2,035*	*1,999*	*2,101*	*2,124*	*2,147*	*2,147*	*2,131*	*2,224*	*2,323*
Biomass, Solar, Wind	*0*	*0*	*9*	*9*	*9*	*33*	*34*	*25*	*46*	*52*	*52*	*142*	*407*	*584*
Total	**10,521**	**10,871**	**10,596**	**10,466**	**10,311**	**9,868**	**10,230**	**10,498**	**10,824**	**11,349**	**11,519**	**11,622**	**12,179**	**13,600**

Annex 14.
Visayas Installed and Dependable Capacity by Plant Type, 2003-2015 (in MW)

Visayas														
Visayas Installed Capacity	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Coal	189	198	198	198	198	198	196	786	806	806	806	806	769	1,054
Oil Based	530	596	668	678	659	659	615	615	615	670	670	670	670	655
Natural Gas	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Renewable Energy (RE)	927	927	927	927	976	977	1,007	1,006	981	971	971	1,043	1,242	1,574
Geothermal	*916*	*916*	*916*	*916*	*964*	*964*	*964*	*964*	*923*	*915*	*915*	*965*	*965*	*965*
Hydro	*12*	*12*	*12*	*12*	*12*	*13*	*13*	*13*	*13*	*11*	*11*	*11*	*11*	*20*
Biomass, Solar, Wind	*0*	*0*	*0*	*0*	*0*	*0*	*29*	*29*	*44*	*44*	*44*	*66*	*266*	*590*
Total	**1,647**	**1,721**	**1,793**	**1,803**	**1,833**	**1,835**	**1,818**	**2,407**	**2,402**	**2,448**	**2,448**	**2,520**	**2,683**	**3,284**
Visayas Dependable Capacity	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Coal	140	145	145	140	155	155	153	501	777	777	777	777	761	1,050
Oil Based	416	507	493	459	479	482	426	464	476	505	505	505	425	434
Natural Gas	0	0	0	0	0	0	0	0	0	1	1	1	0	0
Renewable Energy (RE)	868	868	868	868	865	862	813	779	784	820	820	877	1,042	1,329
Geothermal	*856*	*856*	*856*	*856*	*853*	*849*	*792*	*751*	*745*	*777*	*777*	*817*	*813*	*813*
Hydro	*12*	*12*	*12*	*12*	*12*	*13*	*13*	*13*	*13*	*11*	*11*	*11*	*11*	*18*
Biomass, Solar, Wind	*0*	*0*	*0*	*0*	*0*	*0*	*9*	*15*	*26*	*32*	*32*	*49*	*219*	*498*
Total	**1,424**	**1,520**	**1,506**	**1,467**	**1,498**	**1,499**	**1,392**	**1,745**	**2,037**	**2,103**	**2,103**	**2,160**	**2,228**	**2,813**

Annex 15.
Mindanao Installed and Dependable Capacity by Plant Type, 2003-2015 (in MW)

Mindanao														
Mindanao Installed Capacity	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Coal	0	0	0	210	232	232	232	232	232	232	232	232	382	1,070
Oil Based	559	559	591	591	594	594	594	594	622	625	663	773	807	828
Natural Gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Renewable Energy (RE)	1,106	1,106	1,107	1,107	1,107	1,107	1,103	1,145	1,168	1,192	1,192	1,206	1,225	1,264
Geothermal	*108*	*108*	*108*	*108*	*108*	*108*	*103*	*103*	*108*	*108*	*108*	*108*	*108*	*108*
Hydro	*998*	*998*	*998*	*998*	*998*	*998*	*998*	*1,040*	*1,038*	*1,047*	*1,047*	*1,061*	*1,061*	*1,061*
Biomass, Solar, Wind	*0*	*0*	*1*	*1*	*1*	*1*	*1*	*1*	*22*	*37*	*37*	*37*	*56*	*95*
Total	**1,665**	**1,665**	**1,698**	**1,908**	**1,933**	**1,933**	**1,929**	**1,971**	**2,022**	**2,049**	**2,087**	**2,211**	**2,414**	**3,162**
Mindanao Dependable Capacity	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Coal	0	0	0	210	200	201	210	212	210	210	210	210	340	959
Oil Based	524	473	491	491	478	478	485	438	469	470	605	693	724	733
Natural Gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Renewable Energy (RE)	929	1,002	1,005	992	1,003	1,001	1,008	1,008	937	934	934	948	961	993
Geothermal	*108*	*100*	*101*	*100*	*100*	*98*	*100*	*100*	*102*	*98*	*98*	*98*	*98*	*100*
Hydro	*821*	*901*	*902*	*891*	*902*	*902*	*907*	*907*	*827*	*826*	*826*	*840*	*837*	*840*
Biomass, Solar, Wind	*0*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*8*	*10*	*10*	*10*	*25*	*53*
Total	**1,453**	**1,475**	**1,496**	**1,694**	**1,681**	**1,680**	**1,703**	**1,658**	**1,616**	**1,614**	**1,749**	**1,851**	**2,025**	**2,684**

Annex 16.
Philippine Gross Generation by Plant Type, 2003-2015 (in GWh)

Plant Type	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Coal	14,939	16,194	15,257	15,294	16,837	15,749	16,476	23,301	25,342	28,265	32,081	33,054	36,686
Oil-based	7,170	8,504	6,141	4,665	5,148	4,868	5,381	7,101	3,398	4,254	4,491	5,708	5,886
Combined Cycle	*439*	*738*	*91*	*239*	*653*	*513*	*639*	*1,202*	*124*	*227*	*247*	*515*	*276*
Diesel	*5,509*	*6,253*	*5,717*	*4,152*	*4,162*	*3,660*	*3,771*	*4,532*	*2,762*	*3,332*	*3,805*	*4,730*	*5,521*
Gas Turbine	*42*	*82*	*25*	*0*	*9*	*36*	*62*	*3*	*0*	*0*	*0*	*0*	*10*
Oil Thermal	*1,180*	*1,431*	*309*	*274*	*324*	*658*	*909*	*1,364*	*512*	*695*	*438*	*463*	*80*
Natural Gas	13,139	12,384	16,861	16,366	18,789	19,576	19,887	19,518	20,591	19,642	18,791	18,690	18,878
Renewable Energy (RE)	17,692	18,874	18,308	20,459	18,837	20,628	20,191	17,823	19,845	20,762	19,903	19,810	20,963
Geothermal	*9,822*	*10,282*	*9,902*	*10,465*	*10,215*	*10,723*	*10,324*	*9,929*	*9,942*	*10,250*	*9,605*	*10,308*	*11,044*
Hydro	*7,870*	*8,593*	*8,387*	*9,939*	*8,563*	*9,843*	*9,788*	*7,803*	*9,698*	*10,252*	*10,019*	*9,137*	*8,665*
Biomass	*0*	*0*	*0*	*0*	*0*	*0*	*14*	*27*	*115*	*183*	*212*	*196*	*367*
Solar	*0*	*0*	*2*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*17*	*139*
Wind	*0*	*0*	*17*	*53*	*58*	*61*	*64*	*62*	*88*	*75*	*66*	*152*	*748*
Total Generation	**52,941**	**55,957**	**56,568**	**56,784**	**59,612**	**60,821**	**61,934**	**67,743**	**69,176**	**72,922**	**75,266**	**77,261**	**82,413**

Annex 17.
Luzon, Visayas and Mindanao Gross Generation by Plant Type, 2003-2015 (in GWh)

Luzon	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Coal	14,351	15,548	14,653	14,099	14,418	13,504	14,091	20,047	19,681	21,878	25,756	27,346	29,680
Oil-based	3,596	4,591	2,022	1,711	2,192	1,928	1,864	3,287	1,291	1,800	1,601	2,342	1,845
Natural Gas	13,139	12,384	16,861	16,366	18,789	19,576	19,887	19,518	20,591	19,642	18,783	18,686	18,878
Renewable Energy (RE)	6,448	7,330	7,091	9,065	8,221	9,192	9,132	7,413	8,454	8,993	8,679	8,392	9,711
Geothermal	*2,600*	*3,033*	*2,742*	*3,519*	*3,601*	*3,730*	*3,516*	*3,323*	*3,486*	*3,588*	*3,399*	*3,817*	*4,096*
Hydro	*3,848*	*4,297*	*4,331*	*5,492*	*4,562*	*5,400*	*5,549*	*4,014*	*4,836*	*5,292*	*5,156*	*4,357*	*4,769*
Biomass	*0*	*0*	*0*	*0*	*0*	*0*	*3*	*14*	*44*	*37*	*60*	*65*	*187*
Solar	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*66*
Wind	*0*	*0*	*17*	*53*	*58*	*61*	*64*	*62*	*88*	*75*	*66*	*152*	*592*
Total Generation	**37,535**	**39,854**	**40,627**	**41,241**	**43,620**	**44,200**	**44,975**	**50,265**	**50,017**	**52,312**	**54,820**	**56,766**	**60,113**
Visayas	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Coal	588	646	604	719	848	746	822	1,529	4,032	4,701	4,690	4,449	4,968
Oil-based	1,861	1,998	1,800	1,282	1,477	1,665	1,864	1,727	683	734	796	766	672
Natural Gas	0	0	0	0	0	0	0	0	0	0	8	4	0
Renewable Energy (RE)	6,394	6,373	6,295	6,128	5,776	6,239	6,038	5,820	5,740	6,047	5,606	5,794	6,530
Geothermal	*6,361*	*6,338*	*6,267*	*6,100*	*5,747*	*6,199*	*5,985*	*5,771*	*5,616*	*5,930*	*5,463*	*5,627*	*6,105*
Hydro	*33*	*34*	*27*	*28*	*29*	*40*	*42*	*36*	*53*	*46*	*37*	*35*	*38*
Biomass	*0*	*0*	*0*	*0*	*0*	*0*	*11*	*13*	*72*	*71*	*106*	*117*	*159*
Solar	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*15*	*71*
Wind	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*157*
Total Generation	**8,842**	**9,016**	**8,698**	**8,129**	**8,102**	**8,650**	**8,724**	**9,075**	**10,456**	**11,483**	**11,100**	**11,014**	**12,170**
Mindanao	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Coal	0	0	0	476	1,571	1,499	1,563	1,726	1,629	1,686	1,635	1,258	2,038
Oil-based	1,714	1,916	2,320	1,672	1,479	1,275	1,652	2,087	1,424	1,720	2,094	2,599	3,369
Natural Gas	0	0	0	0	0	0	0	0	0	0	0	0	0
Renewable Energy (RE)	4,850	5,171	4,923	5,266	4,841	5,197	5,020	4,590	5,650	5,721	5,618	5,624	4,723
Geothermal	*861*	*910*	*893*	*846*	*867*	*794*	*823*	*834*	*841*	*731*	*743*	*864*	*842*
Hydro	*3,989*	*4,262*	*4,028*	*4,419*	*3,972*	*4,402*	*4,196*	*3,754*	*4,808*	*4,913*	*4,827*	*4,745*	*3,858*
Biomass	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*75*	*47*	*14*	*21*
Solar	*0*	*0*	*2*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*2*
Wind	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Total Generation	**6,564**	**7,087**	**7,243**	**7,414**	**7,890**	**7,972**	**8,235**	**8,403**	**8,703**	**9,127**	**9,347**	**9,481**	**10,130**

Annex 18.
Visayas Subgrid Gross Generation by Plant Type, 2003-2015 (in GWh)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Cebu	**1,716**	**1,366**	**1,567**	**1,647**	**1,902**	**2,434**	**3,651**	**4,158**	**4,197**	**3,811**	**4,154**
Coal	604	719	848	746	822	1,499	3,249	3,674	3,652	3,354	3,868
Oil-based	1,108	642	714	895	1,074	930	395	477	532	448	282
Natural Gas	0	0	0	0	0	0	0	0	8	4	0
Renewable Energy (RE)	5	5	5	6	6	5	6	7	5	4	4
Geothermal	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Hydro	*5*	*5*	*5*	*6*	*6*	*5*	*6*	*7*	*5*	*4*	*4*
Biomass	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Solar	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Wind	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Negros	**1,423**	**1,379**	**1,460**	**1,344**	**1,356**	**1,425**	**1,452**	**1,600**	**1,552**	**1,743**	**1,940**
Coal	0	0	0	0	0	0	0	0	0	0	0
Oil-based	0	0	0	0	0	0	0	0	0	0	0
Natural Gas	0	0	0	0	0	0	0	0	0	0	0
Renewable Energy (RE)	1,423	1,379	1,460	1,344	1,356	1,425	1,452	1,600	1,552	1,743	1,940
Geothermal	*1,421*	*1,377*	*1,458*	*1,343*	*1,344*	*1,411*	*1,404*	*1,572*	*1,491*	*1,657*	*1,767*
Hydro	*2*	*3*	*2*	*2*	*1*	*2*	*2*	*0*	*0*	*0*	*0*
Biomass	*0*	*0*	*0*	*0*	*11*	*13*	*47*	*28*	*62*	*70*	*131*
Solar	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*15*	*42*
Wind	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Panay	**652**	**608**	**728**	**725**	**744**	**787**	**1,043**	**1,266**	**1,284**	**1,393**	**1,597**
Coal	0	0	0	0	0	30	783	1,027	1,037	1,095	1,101
Oil-based	652	608	728	725	744	757	235	197	202	251	312
Natural Gas	0	0	0	0	0	0	0	0	0	0	0
Renewable Energy (RE)	0	0	0	0	0	0	25	43	44	46	185
Geothermal	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Hydro	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Biomass	*0*	*0*	*0*	*0*	*0*	*0*	*25*	*43*	*44*	*46*	*28*
Solar	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Wind	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*157*

Annex 18.
Visayas Subgrid Gross Generation by Plant Type, 2003-2015 (in GWh) (continued)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Leyte-Samar	**4,848**	**4,725**	**4,290**	**4,858**	**4,643**	**4,362**	**4,212**	**4,358**	**3,972**	**3,970**	**4,367**
Coal	0	0	0	0	0	0	0	0	0	0	0
Oil-based	0	0	0	0	0	0	0	0	0	0	0
Natural Gas	0	0	0	0	0	0	0	0	0	0	0
Renewable Energy (RE)	4,848	4,725	4,290	4,858	4,643	4,362	4,212	4,358	3,972	3,970	4,367
Geothermal	*4,847*	*4,723*	*4,289*	*4,857*	*4,641*	*4,361*	*4,212*	*4,358*	*3,972*	*3,970*	*4,339*
Hydro	*2*	*2*	*1*	*2*	*2*	*1*	*0*	*0*	*0*	*0*	*0*
Biomass	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Solar	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*28*
Wind	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Bohol	**24**	**23**	**33**	**50**	**54**	**38**	**49**	**45**	**38**	**43**	**45**
Coal	0	0	0	0	0	0	0	0	0	0	0
Oil-based	5	5	11	20	20	10	4	6	6	12	11
Natural Gas	0	0	0	0	0	0	0	0	0	0	0
Renewable Energy (RE)	19	18	21	30	33	28	45	39	32	31	34
Geothermal	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Hydro	*19*	*18*	*21*	*30*	*33*	*28*	*45*	*39*	*32*	*31*	*34*
Biomass	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Solar	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Wind	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Summary per Visayas Subgrid	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Cebu	1,716	1,366	1,567	1,647	1,902	2,434	3,651	4,158	4,197	3,811	4,154
Negros	1,423	1,379	1,460	1,344	1,356	1,425	1,452	1,600	1,552	1,743	1,940
Panay	652	608	728	725	744	787	1,043	1,266	1,284	1,393	1,597
Leyte-Samar	4,848	4,725	4,290	4,858	4,643	4,362	4,212	4,358	3,972	3,970	4,367
Bohol	24	23	33	50	54	38	49	45	38	43	45
Total Visayas w/o SPUG	**8,663**	**8,101**	**8,077**	**8,625**	**8,698**	**9,046**	**10,407**	**11,428**	**11,043**	**10,959**	**12,103**
SPUG	**35**	**28**	**24**	**25**	**26**	**30**	**49**	**55**	**56**	**55**	**67**
Total Visayas w/ SPUG	**8,698**	**8,129**	**8,102**	**8,650**	**8,724**	**9,075**	**10,456**	**11,483**	**11,100**	**11,014**	**12,170**

Annex 19.
Gross Power Generation by Ownership, 2003-2015 (in GWh)

Total Philippines	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
NPC	14,868	16,431	15,318	16,792	15,151	12,743	9,745	4,053	5,142	5,241	5,035	4,692	3,759
NPC-SPUG	459	395	462	507	437	448	474	522	543	466	423	416	405
NPC-IPP	24,058	25,133	24,717	23,173	26,156	27,972	27,400	14,725	9,536	9,875	8,912	8,382	8,747
Non-NPC	13,556	13,999	16,071	16,312	17,867	19,658	24,315	48,442	53,955	57,340	60,895	63,770	69,501
Total Generation	**52,941**	**55,957**	**56,568**	**56,784**	**59,612**	**60,821**	**61,934**	**67,743**	**69,176**	**72,922**	**75,266**	**77,261**	**82,413**
Luzon	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
NPC	8,658	9,816	8,941	10,151	8,754	6,018	3,834	225	527	514	474	212	243
NPC-SPUG	362	308	348	396	323	330	347	380	381	314	263	250	236
NPC-IPP	16,551	17,388	16,802	15,698	18,187	19,591	18,598	6,691	2,160	2,285	2,069	1,973	1,575
Non-NPC	11,963	12,342	14,535	14,997	16,357	18,260	22,195	42,969	46,949	49,200	52,014	54,332	58,059
Total Generation	**37,535**	**39,854**	**40,627**	**41,241**	**43,620**	**44,200**	**44,975**	**50,265**	**50,017**	**52,312**	**54,820**	**56,766**	**60,113**
Visayas	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
NPC	2,248	2,384	2,406	2,285	2,380	2,332	1,690	176	43	35	30	21	0
NPC-SPUG	28	26	35	28	24	25	26	30	49	32	33	34	22
NPC-IPP	5,014	4,987	4,783	4,568	4,255	4,983	4,967	4,482	4,174	4,274	3,581	3,364	3,576
Non-NPC	1,552	1,619	1,474	1,248	1,443	1,310	2,042	4,387	6,191	7,142	7,455	7,595	8,572
Total Generation	**8,842**	**9,016**	**8,698**	**8,129**	**8,102**	**8,650**	**8,724**	**9,075**	**10,456**	**11,483**	**11,100**	**11,014**	**12,170**
Mindanao	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
NPC	3,962	4,231	3,971	4,356	4,017	4,393	4,221	3,652	4,572	4,692	4,531	4,458	3,516
NPC-SPUG	68	61	80	83	90	93	101	113	113	121	128	132	147
NPC-IPP	2,493	2,757	3,131	2,907	3,715	3,398	3,834	3,551	3,202	3,316	3,262	3,046	3,596
Non-NPC	41	38	61	67	68	88	79	1,086	815	998	1,426	1,844	2,870
Total Generation	**6,564**	**7,087**	**7,243**	**7,414**	**7,890**	**7,972**	**8,235**	**8,403**	**8,703**	**9,127**	**9,347**	**9,481**	**10,130**

NPC – National Power Corporation; SPUG-Small Power Utilities Group; IPP-Independent Power Producer

For inquiries, please contact:

Felix William B. Fuentebella
Undersecretary

Redentor E. Delola
Assistant Secretary

Mylene C. Capongcol
Director, Electric Power Industry Management Bureau

Irma C. Exconde
Assistant Director, Electric Power Industry Management Bureau

Electric Power Industry Management Bureau

Thelma B. Ejercito
OIC-Chief, Power Planning and Development Division

Luningning G. Baltazar
Chief, Power Market Development Division

Josue B. Balacuit
OIC-Chief, Rural Electrification Administration and Management Division

Mark Christian P. Marollano
Jhoana R. Bautista-Limbaga
Mary Grace V. Gabis
Noriel Christopher R. Reyes
Beejee B. Dequiña
Genevieve Dawn Tolentino
Kenneth Jack P. Muñoz
Jordan M. Ballaran
Arthur Kent M. Holt
Marc Louie I. Olap

Department of Energy
Energy Center, Rizal Drive, Bonifacio Global City (BGC)
Taguig City, Philippines 1632
Tel. Nos.: 840-2173; 479-2900 local 386, 202
Website: http://www.doe.gov.ph
Facebook: http://www.facebook.com/doe.gov.ph
Instagram: @DOE_PH
Twitter: @DOE_PH