



**Asia-Pacific
Economic Cooperation**

APEC Oil and Gas Security Exercise The Philippines Exercise

Department of Energy, Philippines

07-09 December 2015

Final Report

Energy Working Group

June 2016

APEC Oil and Gas Security Initiative: 2014-2015 EWG 06 2014S

PRODUCED BY:

Asia Pacific Energy Research Centre (APEREC)
Institute of Energy Economics, Japan
Inui Building, Kachidoki 11F, 1-13-1 Kachidoki
Chuo-ku, Tokyo 104-0054 Japan
Tel: (813) 5144-8551
Fax: (813) 5144-8555
E-mail: master@aperc.iecej.jp (administration)
Website: <http://aperc.iecej.or.jp/>

FOR:

Asia-Pacific Economic Cooperation Secretariat
35 Heng Mui Keng Terrace
Singapore 119616
Tel: (65) 68919 600
Fax: (65) 68919 690
Email: info@apec.org
Website: www.apec.org

© 2016 APEC Secretariat

APEC#216-RE-01.16

TABLE OF CONTENTS

***PREFACE*..... i**

***EXECUTIVE SUMMARY*..... iii**

PART 1: BACKGROUND INFORMATION

1. INTRODUCTION..... 2

2. ENERGY SITUATION (OIL and GAS)..... 3

2.1. Total Primary Energy Supply and Final Energy Consumption _____ 3

2.2. Oil Demand and Supply _____ 5

2.2.1. Oil Demand 5

2.2.2. Oil Supply 6

2.2.3. Oil Downstream Facilities..... 9

2.3. Gas Demand and Supply _____ 10

3. INSTITUTIONAL STRUCTURE AND EMERGENCY MEASURES..... 12

3.1. Disaster Risk Reduction and Management _____ 12

3.2. Inter-Agency Energy Contingency Committee (IECC) _____ 14

3.3. Oil Contingency Plan _____ 15

3.4. Natural Gas Contingency Plan _____ 16

PART 2: OIL AND GAS SECURITY EXERCISE

1. THE FIRST STAGE OF OIL AND GAS SUPPLY EMERGENCY 19

1.1. The Scenario _____ 19

1.2. The Response _____ 21

1.3. Experts' Recommendations _____ 23

2. THE SECOND STAGE OF OIL AND GAS SUPPLY EMERGENCY 24

2.1. The Scenario _____ 24

2.2. The Response _____ 26

2.3. Experts' Recommendations	30
3. THE THIRD STAGE OF OIL AND GAS SUPPLY	32
3.1. The Scenario	32
3.2. The Response	33
3.3. Experts' Recommendations	36
4. GENERAL COMMENTS FROM THE EXPERTS	37
<i>Appendix A: Expert Review Team Members and APERC Secretariat</i>	<i>39</i>
<i>Appendix B: Philippines' stakeholders participants</i>	<i>41</i>
<i>References</i>	<i>44</i>

LIST OF FIGURES

Figure 1: Total Primary Energy Supply, 2004-13	4
Figure 2: Total Final Energy Consumption, 2004-13	4
Figure 3: Sectoral Oil Demand, 2013	5
Figure 4: Oil Demand by Product, 2004-13.....	6
Figure 5: Crude Oil Supply, 2004-13.....	7
Figure 6: Crude Oil Import Sources, 2013	7
Figure 7: Refinery Production and Oil Demand, 2004-13	8
Figure 8: Refinery Production by Petroleum Product, 2013.....	8
Figure 9: Petroleum Product Imports by Source and Product, 2013.....	9
Figure 10: Oil Downstream Facilities, 2013.....	10
Figure 11: Gas Demand by Sector, 2005-13.....	11
Figure 12: Overview of Natural Gas Industry.....	12
Figure 13: Organizational Structure of Office of Civil Defense and NDRRMC	13
Figure 14: National Disaster Risk Reduction and Management Plan Diagram	14
Figure 15: Overview of Malampaya Gas Field.....	20
Figure 16: Natural Disaster and Incident near Malampaya.....	20
Figure 17: Natural Disaster and Incident near Petron Refinery Facility	25
Figure 18: Refinery Facilities in Chinese Taipei.....	32

PREFACE

At St. Petersburg APEC Energy Ministerial Meeting in June 2012, the Energy Ministers' directed the Energy Working Group (EWG) and APERC to pursue regional cooperation on supply emergency response and to conduct workshops and exercises to assist economies strengthen emergency response measures and policies based on their respective domestic circumstances. With such directive, APERC held two (2) oil and gas security exercises (OGSE) in 2013, the first was the Joint Southeast Asian Exercise in Bangkok, Thailand and the second was the Indonesian Exercise, which was solely focus on the economy's oil security situations.

Further to the OGSE efforts, APERC implements the Oil and Gas Security Initiative (OGSI), which was officially launched in November 2015 where OGSE is one of its pillars. The OGSI is a response to the Energy Ministerial Mandate adopted during the Beijing APEC Energy Ministerial Meeting in September 2014. The Philippines was the second to host OGSE focused on one economy and the first economy to undertake the exercise under OGSI.

The OGSE in the Philippines also served as a venue to present the Oil and Gas Security-Exercise Model Procedure (OGS-EMP), which APERC drafted in collaboration with experts from relevant organizations, such as the International Energy Agency (IEA), Economic Research Institute for ASEAN and East Asia (ERIA) and the Institute of Energy Economics, Japan (IEEJ). The OGS-EMP provides a step-by-step approach for developing and implementing supply emergency exercises with some inputs taken from the previous OGSE exercises. The OGS-EMP is still work in progress and will be improved from the lessons learned in the Philippines exercise, and from future exercises to be conducted.

The Exercise was held on 7-9 December 2015 and fully supported by Experts Review Team from different international organizations and other APEC member economies. The Experts Review Team is composed of representatives from IEA, ERIA, ASEAN Centre for Energy (ACE), ASEAN Council on Petroleum (ASCOPE), Head of ASEAN Power Utilities/Authorities (HAPUA), the U.S. Department of Energy, the Ministry of Economy, Trade and Industry (METI) of Japan, and the Ministry of Trade, Industry and Energy (MOTIE) of Korea.

This report provides the outcome of the exercise, which details the Philippines responses to the three (3) hypothetical emergency scenarios formulated for the said exercise. The report likewise presents the comments and recommendations from the team of experts on the responses generated from each scenario. These recommendations from experts are aimed to improve the response measures, including institutional framework, of the economy during supply emergency situations.

Through the OGSE, APERC envisions that those APEC economies who have not yet conducted regular emergency exercises to consider doing such to strengthen their emergency preparedness system, such as policies, plans, procedures and communication strategy, to address and mitigate the impacts of supply disruptions. The response measures must be continuously improved through the conduct of exercise to make the system more resilient to any supply crisis.

The Expert Review Team and APERC Secretariat wish to thank all the participants and delegates who engaged with the team for discussions. Special thanks go to the Philippine Department of Energy who organized the event.

EXECUTIVE SUMMARY

Oil remains an import fuel for the Philippines with 30% and 44% shares to total primary energy mix and final energy consumption (excluding non-energy use), respectively, in 2013. The economy has limited oil resources with crude oil import dependency of almost 100% to meet its refinery demand. Crude oil imports in 2013 stood at 154 thousand barrels per day (mb/d), around 75% was sourced from the Middle East. Almost half of domestic oil demand – 322 mb/d in 2013 – was provided by refinery output, while the rest was met through petroleum product importation. In the same year, petroleum products imports reached 170 mb/d, 30% of which came from Chinese Taipei. The economy has total refining capacity of 285 mb/d being operated by 2 oil companies – Petron and Pilipinas Shell. Petron owns 63% (180 mb/d) of total refining capacity of the economy.

On the other hand, the primary source of natural gas in the Philippines is the Malampaya field, which provides the gas supply requirement for the 3 natural gas power plants. These power plants contribute significantly (25%) to the total power generation of the economy. Natural gas produced from Malampaya field is transported via 504 kilometer (km) pipeline to the gas processing plant in Batangas province. The gas pipeline and gas processing plant have no backup facilities, which could be used once an accident/incident happens in these facilities. If these facilities are struck by any accident/incident that would affect their operations, Malampaya gas field will be in total shutdown.

Given the significant contributions of oil and gas to fuel the Philippine economy, any type or magnitude of supply disruptions or emergencies will have large impact to the economy. With this backdrop, the exercise covered a three-stage emergency scenarios involving oil and gas supply crises. The first stage was gas emergency scenario caused by gas pipeline leaks resulting from sank cargo ship hitting the pipeline. This scenario led to total shutdown of Malampaya field, and thus loss of natural gas supply to fuel the 3 power plants. To address the gas supply emergency situation, the Philippine government will have to secure supply for alternate fuels such as condensate and diesel. Two of the natural gas power plants can run using condensate and the other one (Ilijan natural gas power plant) can use diesel, but at reduced capacity of 600 MW (instead of 1,200 MW). Rescheduling of maintenance of other power plants will be also strictly enforced, and to utilize all standby oil-based power plants. On the demand side, the Interruptible Load Program (ILP) will be implemented to reduce electricity demand during peak hours, as well as other demand side management will also be considered such as shift of operating hours of manufacturing plants to off-peak hours.

From the responses, the team of experts recommended to establish a well-organized structure to improve the reporting process during supply emergency to ensure right information is given to high officials (decision makers) for the formulation and implementation of emergency

policy and measures. As the Malampaya shutdown affects electricity generation of the economy, a functional reserve market must be considered to provide immediate source of additional power supply. Redundancy in the Malampaya facility is important to avoid total shutdown. As an option, LNG infrastructure must also be put in place to receive imports.

The second stage was oil emergency scenario, which involved the largest refinery facility (Petron) being damaged by a very strong typhoon. This scenario worsen the situation as the alternate fuel for the other natural gas power plant is diesel and that standby oil-based power plants will be tapped under the first scenario. The shutdown of Petron resulted in loss of 98 mb/d of oil supply for the economy. In addressing the second emergency situation, the Philippine government will request and instruct oil companies to increase oil importation from existing and other potential sources. Post compliance of import documents will be sought from concerned government agencies to reduce the processing time to securing import permit. Lifting of mandatory 15-day inventory will be imposed to utilize all available oil stocks. To restraint demand, energy conservation measures like reduce operating hours of gas stations, shopping malls and other entertainment establishment will be undertaken. As last recourse, fuel rationing may be done in accordance to sectoral requirement and priority.

As a reaction to the Philippines responses to second scenario, the team of experts suggested that the government should prioritize securing additional supply as demand restraint has economic and social implications. Estimate the impact of oil supply shortfall to the different economic sectors and to the public to have better information for the government to institute a mechanism to avoid panic and calm down the public. In this kind of situation, the government must have plan A and B on how to address the emergency situation to include mapping out of potential import sources. A legal framework must be formulated mandating oil companies to support Petron.

The third stage of oil emergency scenario further aggravated the oil supply situation. The major source of petroleum products imports, Chinese Taipei, was also hit by the same typhoon that damaged the Petron refinery plant. Said typhoon caused damage to the 2 refinery facilities of Chinese Taipei. With this, the Chinese Taipei government decided to reduce its export by 30%. The decision resulted in 9% reduction in total petroleum products imports bringing the oil supply shortage to 39%. As a response to the third scenario, the government will intensify all measures identified in the second scenario. However, for this scenario, the government will invoke the ASEAN Petroleum Security Agreement (APSA), an emergency supply sharing scheme under the ASEAN energy cooperation. Assistance from APSA will lower the supply shortfall to 30%.

The team of experts' recommendations for this scenario include: formulation of a nationwide communication campaign calling to save fuel and energy; establish a cooperation framework with other economies having huge emergency stocks; and, instead of post compliance

on import documents, the government should create a special lane or specific institution to streamline the process and procedure for securing import permit.

The team of experts likewise suggested to the Philippine government to maintain an updated database on fuel supply, production, inventory, storage or unloading capacity, other sources of imports, among others, to aid in the formulation of appropriate measures and responses. The experts also implied to institutionalize the conduct of exercise, which should be jointly undertaken by government and industry. The exercise should focus on policy barriers to be addressed for the economy to be better prepared during real emergency situation.

PHILIPPINES EXERCISE
APEC OIL AND GAS SECURITY EXERCISES

PART 1: Background Information

1. INTRODUCTION

The Philippines is an archipelago located in the south-eastern part of Asia, bordered by the Philippines Sea on the east and west, the Luzon Strait on the north, and Celebes Sea on the south. The economy consists of 7,107 and covers a total land area of 300,000 square kilometres. It has 3 major geographical divisions – Luzon, Visayas and Mindanao islands. Manila, the capital of the Philippines and situated in Luzon island, is one of the 120 largest cities in the world (based on World Bank report). In 2013, the economy's population reached 96.7 million, an increase of 1.6% from last year's level.



The Philippine economy grew by 7.2%, from USD 569.0 billion in 2012 to USD 609.9 billion in 2013 (USD 2010 Price and 2010 PPP). Such growth was primarily driven by the service sector, accounting for nearly 60% of GDP, due to robust domestic trade and boom in the real estate business. The industry sector provided 33% to GDP from improvement in manufacturing output, and expansion of public construction owing to government stimulus infrastructure spending. On the other hand, the Agricultural, Fishery and Forestry (AFF) sector had the least contribution to GDP, about 10%, expanded by 1.1%, which could be attributed to increased rice production despite several typhoons that hit the economy (Navarro and Llanto, 2014).

The economy's GDP per capita income also displayed a huge growth, rose by 5.5% from 2012 level of USD 5,926/person (EDMC, 2015). The resurgence in investments and the robust external trade contributed to having a strong growth for the economy during the period (PSA-NSCB, 2014).

As the Philippines exhibited positive economic outlook, the Standard and Poors, Fitch and Moody's rating agencies upgraded the credit ratings of the economy to "stable outlook" (high quality with very low/minimal credit risks) (Official Gazette, 2014). Further, the economy's ranking also improved in the World Economic Forum from 65th out of 144 countries in 2012 to 59th out of 148 countries in 2013 (Navarro and Llanto, 2014).

The economy has modest fossil fuel resources with proven reserves of around 75.5 million barrels of oil (Mmbo) (includes condensate), 23.6 billion cubic metres (Bcm) (834 billion cubic feet) of natural gas, and 440.4 million metric tonnes (Mmt) of coal (Source: DOE-Energy Resources Development Bureau). It has been a priority of the Philippine government to harness domestic energy resources to reduce reliance on imported fuels and increase the economy's self-sufficiency level. As such, the Philippine Energy Contracting Round (PECR) has been implemented to promote and attract investments in the exploration and development of oil, gas and coal resources in the economy.

Table 1: Economic Profile and Energy Reserves, 2013

Key data		Energy Reserves	
Area (thousand sq. km)	300	Oil (billion barrels)c	75.5
Population (million)a	97.6	Gas (billion cubic metres)c	23.6
GDP (USD (2010) billion at PPP)b	609.9	Coal (million metric tonnes)c	440.4
GDP (USD (2010) per capita at PPP)b	6,250		

Sources: a. (WB, 2014); b. (ESTO, 2015); c. (DOE-Energy Resource Development Bureau).

2. ENERGY SITUATION (OIL AND GAS)

2.1. Total Primary Energy Supply and Final Energy Consumption

The Philippines total primary energy supply (TPES) in 2013 went up by 2.7% from last year's level reaching 45.0 million tonnes of oil equivalent (mtoe). About 57% of energy supply requirement was produced domestically and largely contributed by renewable energy and coal. Although oil displayed a decreasing average annual growth rate of 0.3% in the last 10 years (2004-2013), oil remains as a major source of fuel for the Philippines accounting for about one-third of TPES (2013).

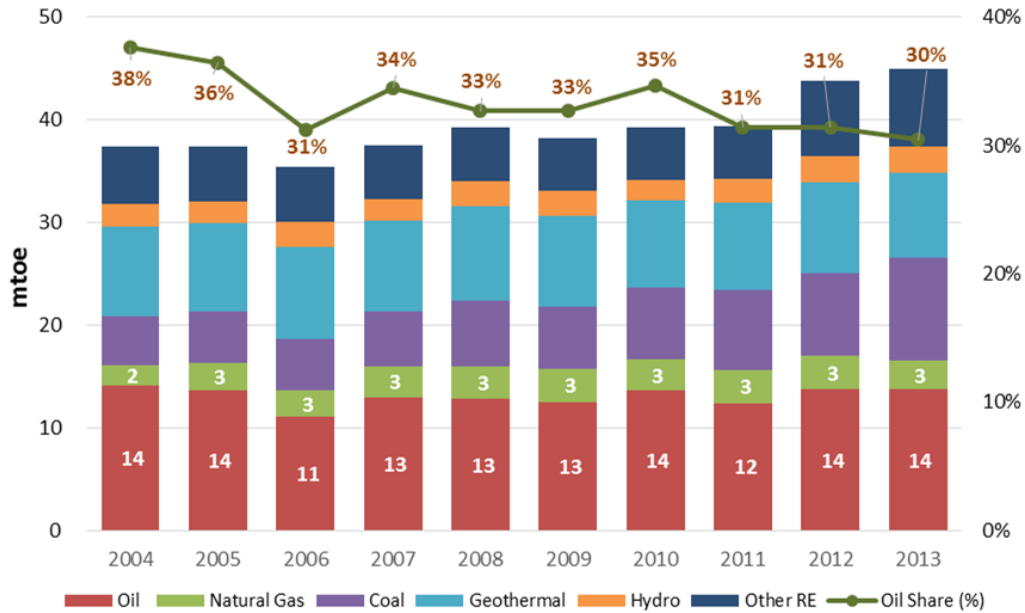
The increasing oil demand for transport constitutes the bulk of the economy's oil supply requirement. The slight decline in oil supply requirement of 0.4% in 2013 was attributed to oil demand reduction of the household sector, the most vulnerable sector from oil price escalation (DOE, 2014a). Meanwhile, natural gas share to TPES stood at 6.4%, majority of which (98%) is used for power generation.

The remarkable growth of the Philippine economy of 7.2% in 2013 was translated to 6.0% increase in total final energy consumption (TFEC), from 25.8 mtoe in 2012 to 27.4 mtoe. Transport and industry sectors remained as the largest energy consuming sectors. Energy demand of the transport sector rose by 5.0%, and accounted for 33% of the TFEC. Such growth was due to increased utilization of gasoline, diesel and bioethanol for public transport, and jet fuel for domestic aviation.

On the other hand, the aggregate requirement of the industry sector escalated by 8.7% primarily triggered by increased production output from cement and basic metal industries (DOE, 2014a). Petroleum products continued to be the major fuel for the economy contributing 44.7% to the total energy demand. Despite exhibiting negative growth rate in the last 10-year period, oil demand started to pick up in 2009 reaching 12.2 Mtoe in 2013 (11.9 Mtoe if non-energy use is excluded). On the other hand, the small share of gas in TFEC is for industry and transport uses. Pilipinas Shell utilises natural gas for its refinery operation, while the government's program on

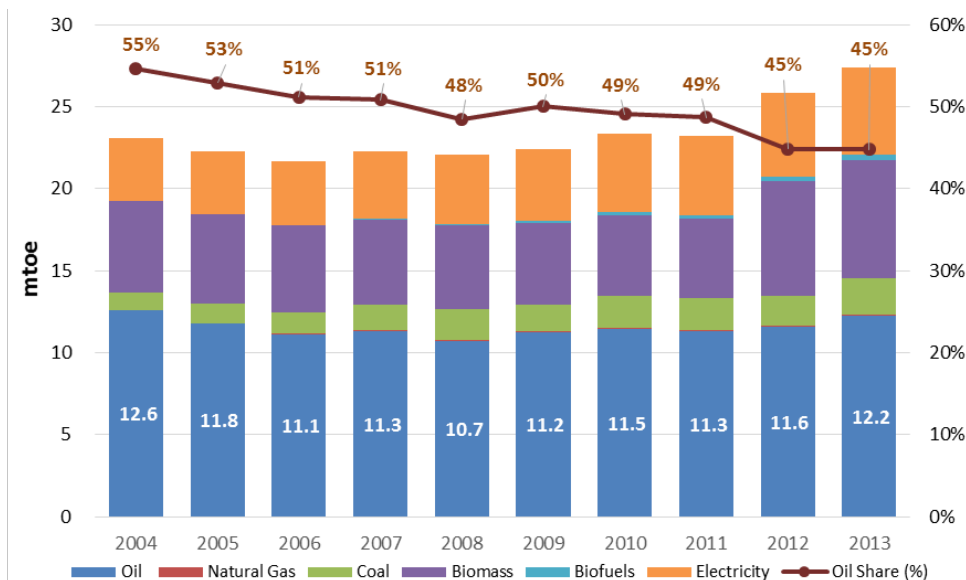
Natural Gas Vehicle Program for Public Transport (NGVPPT) takes a 1.0% portion of natural gas demand.

Figure 1: Total Primary Energy Supply, 2004-13



Source: DOE, 2014c

Figure 2: Total Final Energy Consumption, 2004-13



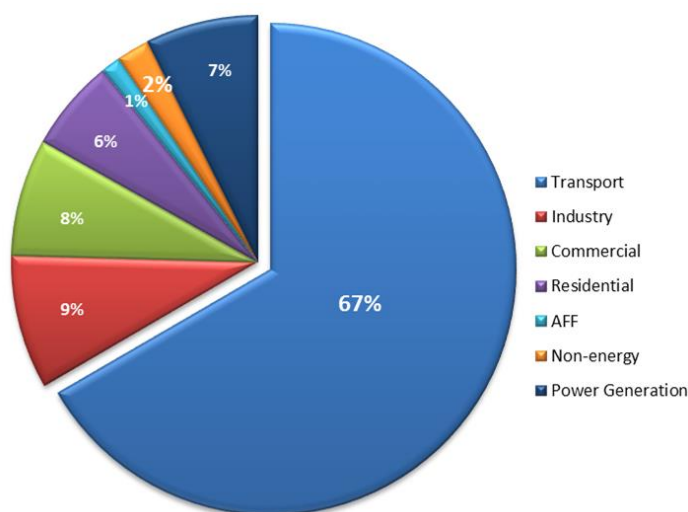
Source: DOE, 2014c

2.2. Oil Demand and Supply

2.2.1. Oil Demand

In 2013, total demand for petroleum products (including international aviation and marine) rose to 117,489 thousand barrels (mb), up by 5.9 % from 2012 level of 100,991 mb. This can be translated to an average of 322 mb/d of oil consumption for the economy (DOE, 2014b). Transport sector was the largest user of oil in the Philippines taking 67% of total oil demand in 2013. Around 76% of oil demand of the sector was for road transport, 8.2% for water transport, and 15.8% for domestic air transport. Followed next was industry sector with 9.0% of the total oil consumption. Food and tobacco consumed about one-fourth of total oil industry demand, while mining used up 22%, non-metallic minerals 14%, and chemical and petrochemical 9.2%. Commercial sector got 8.0% of total oil demand, while residential sector 6.0%. Large portion of residential sector's oil consumption is LPG for cooking (DOE, 2014c). Oil demand intensity (final energy demand) in 2013 was registered at 20.1 tonne of oil equivalent (toe) per USD million gross domestic product (GDP), slightly lower by 1.1% from 2012 level (ESTO, 2015).

Figure 3: Oil Demand, 2013



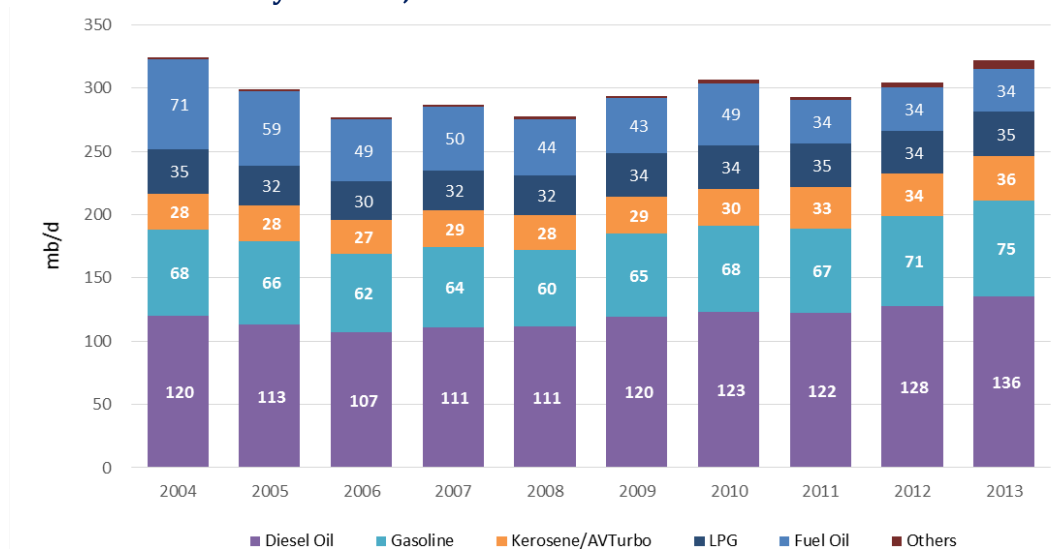
Source: DOE, 2014c

Note: Oil demand includes international aviation and marine

The Philippines' petroleum product mix comprised mostly of diesel fuel with an average share of 40% in the last 10 years. Demand for diesel fuel grew at 1.1% annually, from 120 mb/d in 2004 to 136 mb/d in 2013. Compared to 2012 level, diesel posted a significant increase of 6.3%. Gasoline was the second most consumed petroleum product, 20% average share to product mix, and grew at 6.1% in 2013 from previous year's level. In the same year, LPG, kerosene/avturbo and fuel oil each exhibited about 11% share to product mix, and other products

at 2.0% (DOE, 2014b). LPG also demonstrated an increase of 5.0%, which was attributed to expanded use of LPG in taxis. On the other hand, the increased demand for avturbo of 2.3% was driven by growth in domestic tourism (DOE, 2014a).

Figure 4: Oil Demand by Product, 2004-13



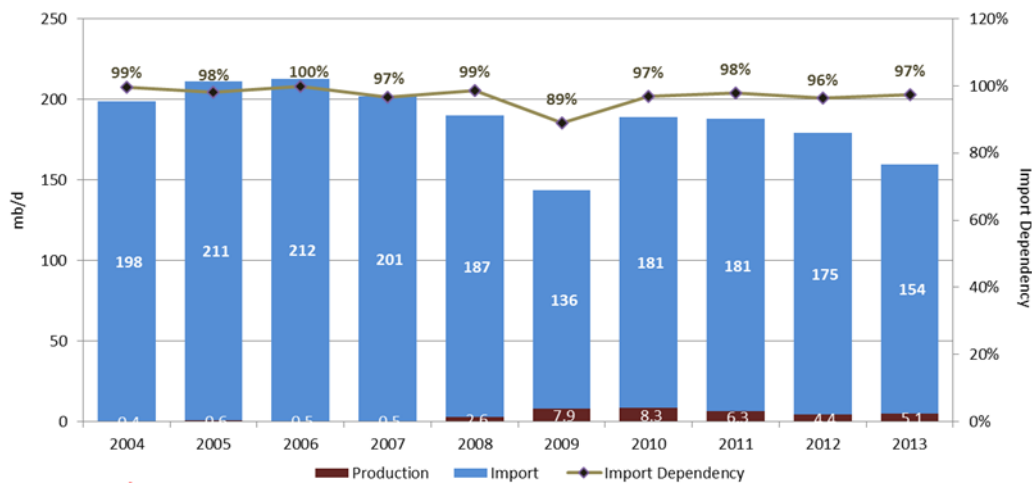
Source: DOE-Oil Industry Management Bureau

Based on the draft 6th APEC Energy Demand and Supply Outlook (2013-2040), the economy's oil demand is on increasing trend demonstrating an average growth rate of 3.1% annually. At the end of the outlook period, oil supply requirement of the economy rises to 31 mtoe or 658 mb/d, more than twofold increase from 2013 level. Over the outlook period, oil demonstrates an average share of 47% to total final energy consumption (APEREC, 2016).

2.2.2. Oil Supply

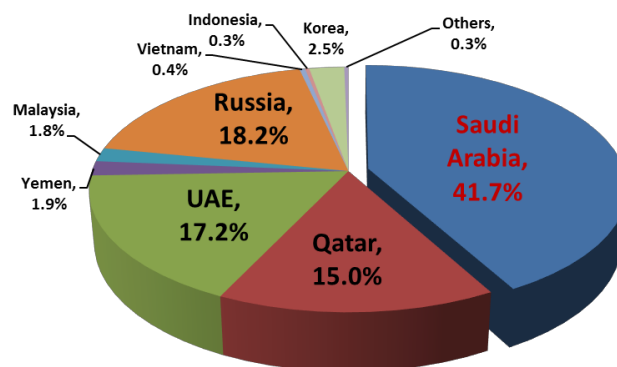
The Philippines relies heavy on oil imports to meet its domestic demand. Given the economy's limited oil resources, dependency on crude import is high, almost 100%, to meet its refinery demand. However, crude oil imports dropped by 22% during the 10-year period, from 198 mb/d in 2004 to 154 mb/d in 2013, which was compensated by increasing product imports. Compared with 2012 level, crude oil imports declined by 12%. Bulk of crude imports was sourced from the Middle East, 76.0% of total, and about 40% of which came from Saudi Arabia. The remaining crude oil requirement was imported within the APEC region, such as Russia which provided 18% of total imports (DOE, 2014b).

Figure 5: Crude Oil Supply, 2004-13



Source: DOE-Energy Policy and Planning Bureau & Oil Industry Management Bureau

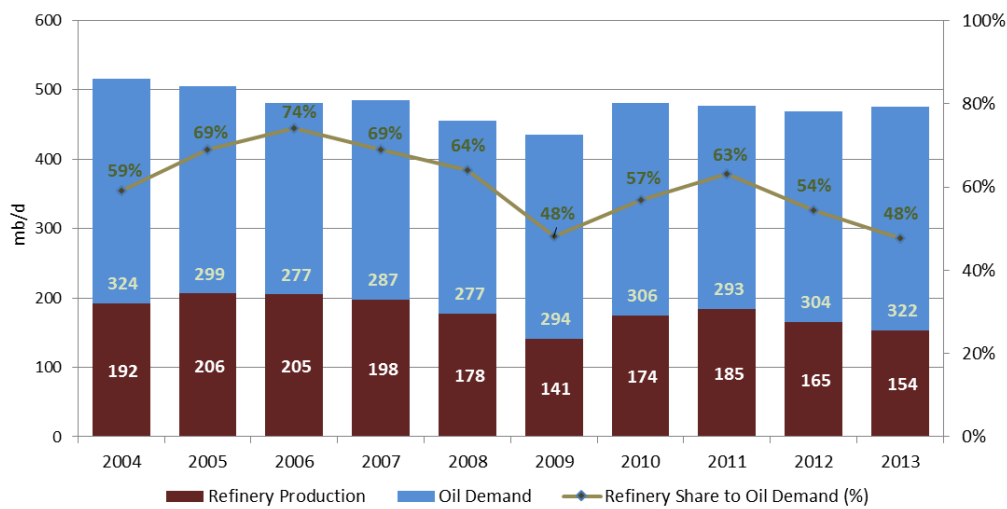
Figure 6: Crude Oil Import Sources, 2013



Source: DOE, 2014b

The Philippines' working crude distillation capacity is 285 mb/d being operated by 2 oil companies – Petron and Pilipinas Shell. Petron owns the largest refinery facility in the economy, about 63% of total distillation capacity. Petron's refinery facility located in Bataan province (north of Manila) consists of three distillation units with total capacity of 180 mb/d. Meanwhile, the Pilipinas Shell refinery facility situated in Batangas province (south of Manila) has a distillation capacity of 105 mb/d. Petron and Pilipinas Shell captured 37% and 24%, respectively, of total market demand, while the remaining was shared by direct importers/distributors (DOE, 2014b).

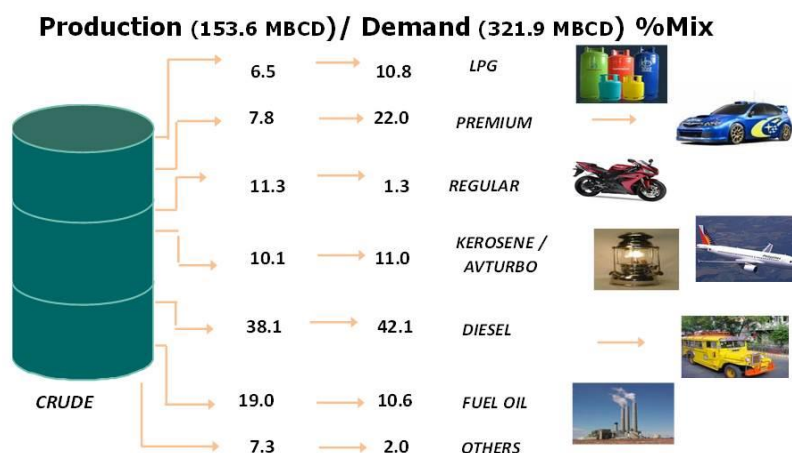
Figure 7: Refinery Production and Oil Demand, 2004-13



Source: DOE-Oil Industry Management Bureau

Over the 10-year period, refinery output declined at annual average rate of 2.5%. Refinery production in 2013 went down significantly by 7.5%, from 165 mb/d in 2012 to 154 mb/d, as a result of extended emergency maintenance shutdown of the refineries during the said period. This brought the refinery utilization rate from 62% in 2012 to 55% in 2013. Historical share of refinery output to total oil demand likewise decelerated to 48% in 2013 from 59% and 74% in 2004 and 2006, respectively.

Figure 8: Refinery Production by Petroleum Product, 2013

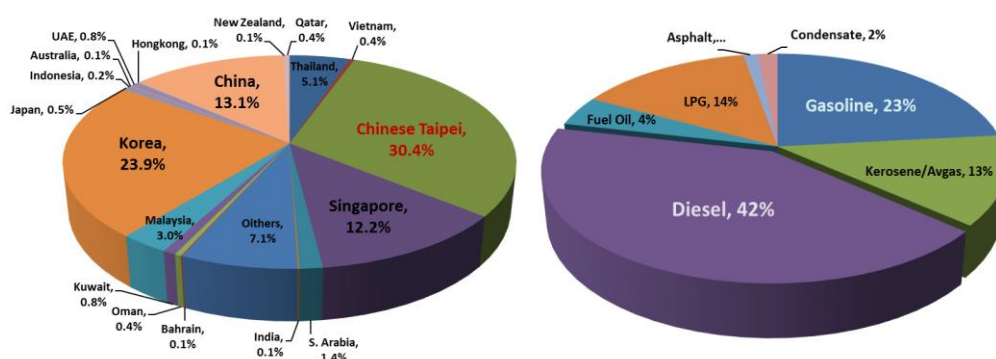


Source: Source: DOE, 2014b

In 2013, nearly 40% of refinery output was diesel oil, followed by gasoline and fuel oil with 19% share each to total production. Kerosene/avturbo and LPG got shares of 10% and 6.5%, respectively. To fill the shortfall in refinery production, petroleum product imports were up by 13% in 2013 compared with 2012 level, which stood at 170 mb/d. In the same year,

about 40% of petroleum product import mix was diesel oil, 23% gasoline, 14% LPG, 13%, kerosene/avburbo, 4% fuel oil, and the remaining for other products. Almost 90% of imports was sourced within the APEC region, around one-third of which coming from Chinese Taipei or about 19 million barrels (mmb). Imports from Chinese Taipei was mostly diesel (72%) and gasoline (19%) (DOE, 2014b).

Figure 9: Petroleum Product Imports by Source and Product, 2013



Source: DOE, 2014b

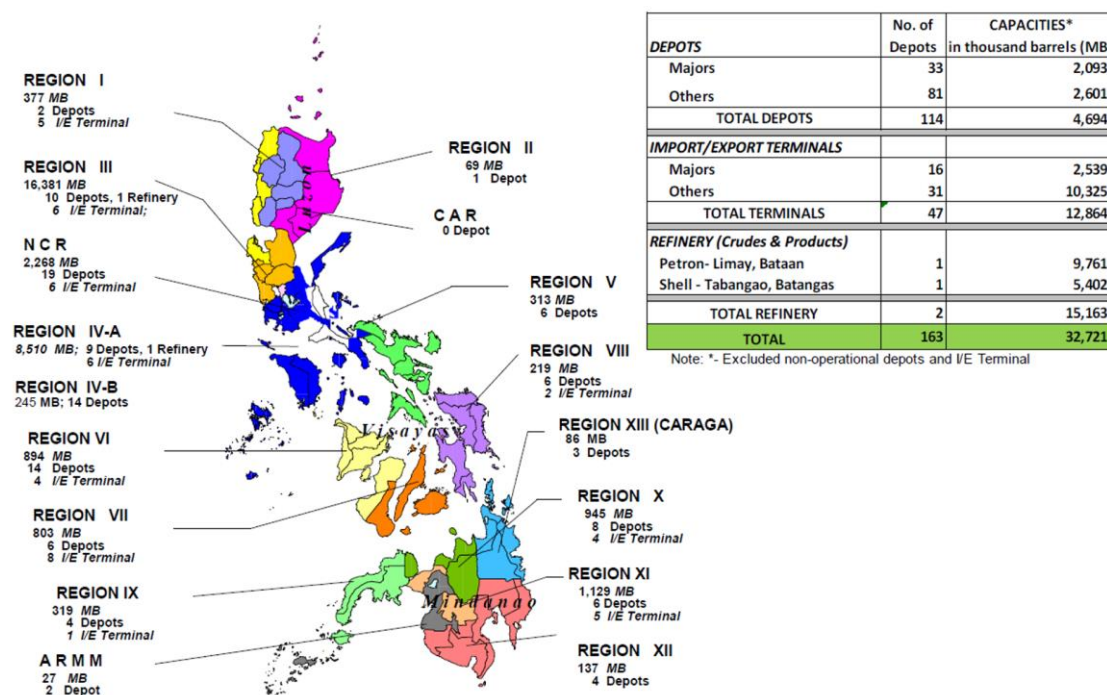
The economy also exports crude oil and condensate with total export volume in 2013 reaching 1.4 mmb and 3.8 mmb, respectively. The economy exports domestic crude oil and condensate from producing fields to Korea, Singapore and Thailand, or refines them domestically at the Shell refinery (DOE, 2015a). The economy likewise exports a total of 4.8 mmb of petroleum products in 2013, mostly naphtha (49%) and fuel oil (33%). Other products exported were mixed xylene, reformat, toluene, benzene and reformat.

As a measure to ensure oil supply availability during emergency situation such as geopolitical instability in major oil producers and calamities, the Philippines is still enforcing the Minimum Inventory Requirement (MIR) to oil companies. The MIR imposes 30 days in-country stocks of crude oil and finished products for refiners, 15 days in-country stocks for bulk marketers, and 7 days for LPG. In 2013, closing inventory of crudes and petroleum products stood at 11,589 mb or 38-day supply equivalent (DOE, 2014b).

2.2.3. Oil Downstream Facilities

The Philippines has 161 operating storage facilities with an aggregate capacity of 32.7 mmb. These facilities are comprised of 114 depots, 47 export and import terminals, and 2 refineries. Of the total, 84 storage facilities are found in Luzon island including the 2 refineries, providing about 86% of total storage capacity (source: DOE-Oil Industry Management Bureau).

Figure 10: Oil Downstream Facilities, 2013



Source: DOE, 2014b

2.3. Gas Demand and Supply

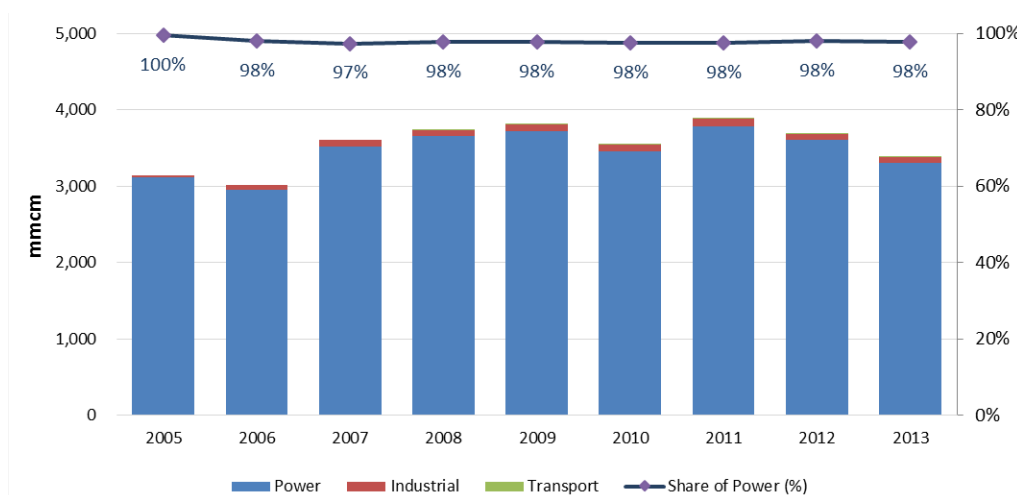
2.3.1. Gas Demand

In 2013, natural gas demand in the Philippines was registered at 3,375 million cubic metre (mmcm), most of which was primarily used for power generation. About 98% of gas demand was allocated for power generation, with total consumption of 3,298 mmcm or 9.0 million cubic metre per day (mmcm/d) (DOE, 2014e). A portion of gas demand is used by Pilipinas Shell for its refinery operation, 2% of total gas consumption, while less than 1% is utilized for NGVPPT. Gas demand in 2013 dropped by 9.0% from a year ago level due to the 30-day shutdown of Malampaya gas production facilities, and the 24-day stoppage of operation of Libertad gas field in Cebu, which resulted in decreased natural gas production. Malampaya is the largest natural gas producing field in the economy. The decline in demand was also contributed by the repair and maintenance of the natural gas power plants (DOE, 2014a).

The economy has four natural gas power plants, namely: Sta. Rita with 1,060 MW, Ilijan with 1,271 MW, and San Lorenzo with 530 MW all located in Luzon, and the 1 MW Desco in the Visayas. These power plants provided around 17% to total installed power generating capacity of the economy. In 2013, natural gas contributed 40% to total power generation mix in Luzon grid, and about 1% in the Visayas grid. The economy has 3 major power grids – the Luzon grid,

Visayas grid, and Mindanao grid. Luzon and Visayas grids are interconnected by submarine cable. Overall, natural gas plants produced about 25% of total power generation of the economy.

Figure 11: Gas Demand by Sector, 2005-13



Source: DOE-Oil Industry Management Bureau

2.3.2. Gas Supply

Currently, the Philippines produces its own natural gas for its domestic supply requirement with total production in 2013 reaching 3,508 mmcm. The Malampaya gas field is the primary source of natural gas in the economy providing 100% of gas supply in Luzon fuelling the 3 natural gas power plants with an aggregate capacity of 2,861 MW. Its production level in 2013 stood at 3,505 mmcm, while demand for its gas was at 3,375 mmcm. The difference in the volume of production and demand was attributed to flaring, gas heating, and usage of gas for own-use power generation at the platform and linepack in the gas pipeline (DOE, 2014e). On the other hand, the marginal Libertad gas field in Cebu province (Visayas) provides fuel for the 1 MW Desco natural gas power plant. The Libertad gas field only started its production in 2012.

The Philippines is also starting to develop its LNG receiving terminal facility to source gas overseas once the Malampaya gas field is already depleted by 2022-2025. The Energy World Corporation (EWC) is developing the first LNG hub in the economy comprising of LNG receiving terminal and regasification plant, and 2 storage tanks with each having a capacity of 130,000 cubic metre (cm) (DOE, 2015a). A 650 MW combined cycle gas turbine (CCGT) consisting of 2 units (325 MW each) serves as an anchor load for the project. The LNG hub is expected to start its operation in June 2016. Other LNG facilities are also being proposed such as the floating storage and regasification unit (FSRU) by Shell Gas and Energy Philippines Corporation with total capacity of 3 to 6 million tonnes per annum (mtpa), and the FSRU by First

Gen Corporation with a capacity of 4.6 to 6.4 mtpa (in two phases) (source: DOE-Natural Gas Management Division).

Figure 12: Overview of Natural Gas Industry



Source: DOE

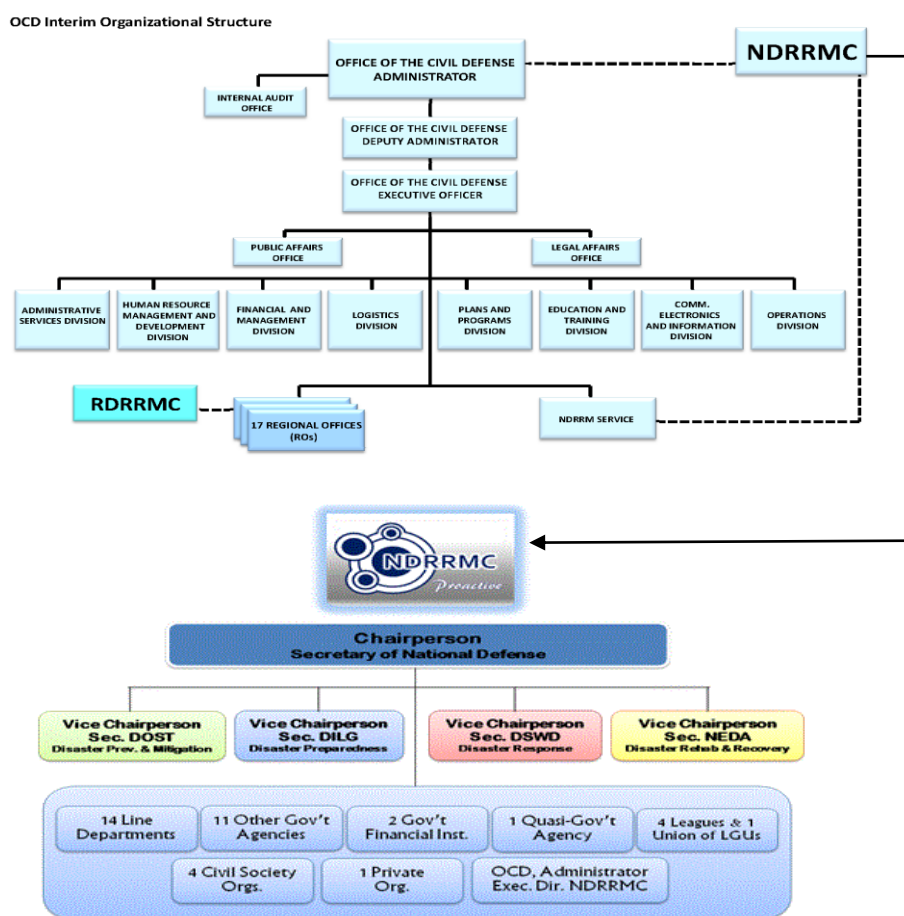
3. INSTITUTIONAL STRUCTURE AND EMERGENCY MEASURES

3.1. Disaster Risk Reduction and Management

The Philippines has established the National Disaster Risk Reduction & Management Council (NDRRMC), formerly known as the National Disaster Coordinating Council (NDCC), in charge of coordinating all efforts and implementing measures to ensure protection and welfare of the public during disasters or calamities. The NDRRMC was created under Republic Act 10121 of 2010 as a working group consisting of various government agencies, non-government organization or civil society, and private organizations, which is being administered by the Office of National Defense under the Department of National Defense. The Council applies the UN approach in disaster management. In February 2010, the NDCC was renamed to NDRRMC, and was reorganized and expanded. The Council is chaired by the Secretary of Department of National Defense and vice-chaired by 4 Departments, namely: Secretary of Interior and Local Government as vice-chairperson for disaster preparedness; Secretary of Department of Social

Welfare and Development as vice-chairperson for disaster response; Secretary of the Department of Science and Technology as vice-chairperson for disaster prevention and mitigation; and the Director-General of the National Economic Development Authority as vice-chairperson for disaster rehabilitation and recovery. The Department of Energy is one of the 14 Line Departments included as members of NDRRMC. Usually, the President of the Philippines convenes the NDRRMC meeting.

Figure 13: Organizational Structure of Office of Civil Defense and NDRRMC

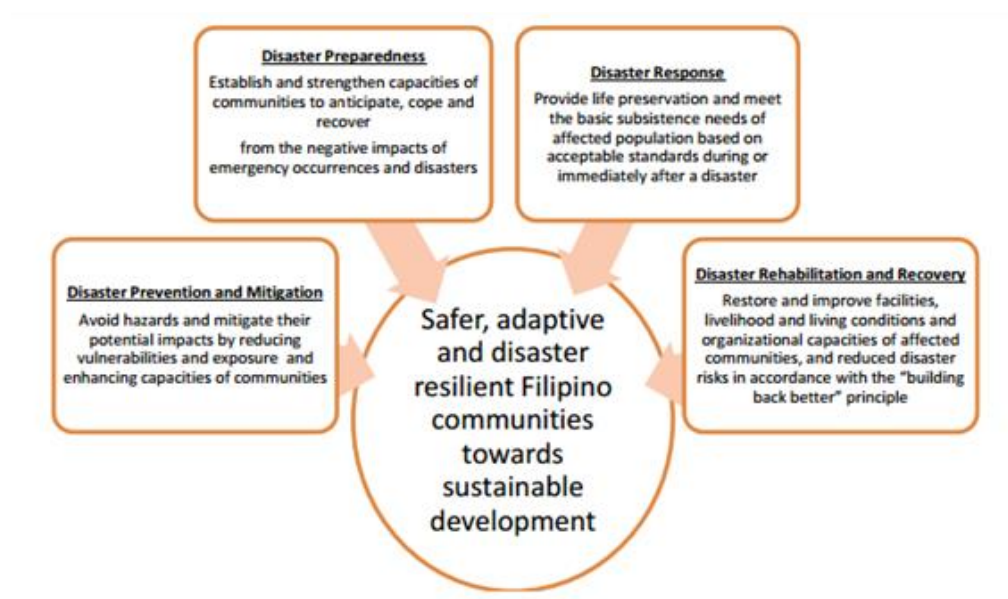


Sources: Office of Civil Defense and www.adrc.asia

The NDRRMC is tasked to advise the President of the Philippines on the status of disaster preparedness, prevention, mitigation, response and rehabilitation operations being undertaken by the government, civil society organizations, private sector, and volunteers. Likewise, the Council recommends to the President the declaration of calamity in areas extremely affected and submit proposal to restore normalcy in the said areas. On the other hand, each member agency shall be assigned specific functions based on their mandates, programs, geographical jurisdictions and special constituency (NDRRMC, 2010).

The NDRMMC has also put in place a National Disaster Response Plan in 2014, which contains the government strategic actions in providing assistance for all natural disasters (NDRRMC, 2014). Further, the National Disaster Risk Reduction and Management Plan (NDRRMP) 2011 -2028 was also formulated as a roadmap covering 4 thematic areas: Disaster Preparedness; Disaster Prevention and Mitigation; Disaster Response; and, Disaster Rehabilitation and Recovery. It also sets out the expected outputs, key activities and indicators, lead agencies, implementing partners and timelines for each thematic area (NDRRMC, 2011).

Figure 14: National Disaster Risk Reduction and Management Plan Diagram



3.2. Inter-Agency Energy Contingency Committee (IECC)

In March 2011, the Office of the President of the Philippines issued an Administrative Order No. 6 organizing the Inter-agency Energy Contingency Committee (IECC) as a precautionary measure to ensure that the necessary preparations are in place in the event of imminent danger of any oil supply disruptions. The Administrative Order also recognizes the need to carefully study and evaluate the existing strategy and contingency plan in addressing energy supply disruptions. Following are the responsibilities of IECC on the evaluation and improvement of contingency plan:

- Undertake a comprehensive audit of the available resources of their respective agencies;
- Validate the viability of the enhancements made to the existing plan;
- Assess the need to operationalize the proposed plan; and,
- Submit reports to the Office of the President on its recommendations.

The Department of Energy serves as the chair of the IECC with 11 Line Departments as members, namely:

- Department of Finance,
- Department of Budget and Management;
- Department of Justice,
- Department of Trade and Industry,
- Department of Agriculture,
- The Department of National Defense,
- Department of Interior and Local Government,
- Department of Transportation and Communication,
- Department of Foreign Affairs,
- National Economic and Development Authority, and
- National Security Council.

Each of the member agencies will have its responsibilities and roles in the Committee such as: ensuring that the proposed contingency plans are consistent with existing fiscal policies, laws, rules and regulations; identifying procedures for utilization and reallocation of funds; monitoring effects on prices and socio-economic impact resulting from supply disruptions; and, assessing impact on national security and energy security (PCOO, 2011).

3.3. Oil Contingency Plan

The Philippines also formulated its Oil Contingency Plan in 2002, which has not yet been updated until now. The Plan contains courses of actions that the government may undertake during oil supply disruptions, specifically for crude oil, with the following guiding principles:

- Priority in the allocation of petroleum products shall be given to vital and strategic activities; and,
- Effects on domestic socio-political stability arising from energy interruptions shall be addressed immediately by agencies concerned with national security and public safety.

The Plan has 3 levels – the Predict Level, Prepare Level and Perform Level. In the Predict Level, the government intensifies intelligence collection efforts through coordination with government agencies, monitoring developments, and issuing up-to-date assessment of the situation. Meanwhile, in the Prepare level the government undertakes supply diversification, building up of inventories, and securing of energy facilities. In the Perform Level, the government implements fuel allocation or rationing, conservation measures, price regulation, among others.

The Energy Contingency Task Force (ECTF), which was established by the government (now replaced by IECC), will be the responsible entity to implement the measures as stipulated in the Oil Contingency Plan. The ECTF is chaired by the Department of Energy with members from other Line Departments. As contained in the Oil Contingency Plan, the ECTF will be responsible for:

- Reviewing the existing policies and guidelines;
- Updating of overall action plan;
- Implementing efficient and equitable distribution of oil; and,
- Implementing allocation and rationing at local levels.

The ECTF can only be activated through the issuance of Executive Order from the Office of the President.

The Oil Contingency Plan has 4 scenarios on crude oil supply disruptions to trigger the implementation of response measures, 5-10% cut in crude oil supply, 11-20% cut, 21-35% cut, and 50% cut. In all scenarios, the fuel allocation shall be instituted with maximum cut and rationing to be introduced in the 50% cut scenario. The fuel allocation and distribution scheme will be based on priority sector categories as follows:

- Food production and transport
- Power generation
- Public and cargo land transportation
- Private land transportation
- Domestic shipping
- Domestic aviation
- Industry
- Government including Armed Forces
- International shipping and aviation
- Residential
- Diplomatic

The 50% cut in crude oil supply necessitates the government to strictly regulate prices, and even the activation of the ASEAN Petroleum Security Agreement (APSA) for supply sharing scheme shall also be taken into consideration. On the other hand, conservation measures include transport volume reduction scheme, limit use of vehicles to essential services, carpooling, limit operating hours of gasoline stations, shopping malls and other entertainment establishments.

3.4. Natural Gas Contingency Plan

The Philippines has not drafted a national contingency plan for natural gas to provide the framework, institutional arrangement, and response measures, among others, to address any

magnitude of gas supply disruptions that could happen in the future. The government only relies on the contingency plan of the Malampaya gas field operator, and the 3 natural gas power plants. On an annual basis, the Malampaya shutdowns for the scheduled maintenance of the platform. Before the scheduled maintenance shutdown, the Department of Energy calls for a meeting with the Malampaya and gas power plants operators, and other concerned stakeholders to thresh out and resolve pending issues, such as the alternate fuels for the operation of the gas power plants. Likewise, re-scheduling of maintenance shutdown of other power plants is also taken into account to ensure that enough power supply during the Malampaya shutdown is available.

PART 2: OIL AND GAS SECURITY EXERCISE

This part presents the three oil and gas emergency scenarios, which were prepared by a number of experts, the Philippines responses to emergency scenarios, and the recommendations from the experts based on the responses. The exercise was conducted with the participation of different government agencies and industry representatives.

1. THE FRST STAGE OF OIL AND GAS SUPPLY EMERGENCY

1.1. The Scenario

Background

The Malampanya gas field is located 850 meters deep in offshore of northwest Palawan island, which is situated in the south sea within the southwestern side of the Philippines. The natural gas field was developed and operated by Shell Philippines Exploration Corporation B.V. (SPEX) with its joint venture partners Chevron Texaco Malampaya LLC and the Philippine National Oil Company-Exploration Corporation (PNOC-EC). The natural gas field was inaugurated in October 2001 and delivered its first commercial production in June 2002 to fuel the 3 natural gas power plants in Luzon. Total gas reserves of the natural gas field was at 2.7 trillion cubic feet and scheduled to produce 146 billion cubic feet (bcf) per year (or 4 billion cubic meter) that will last for 20 years (DOE, 2002a). The gas produced from Malampaya is transported via a 504-kilometer, 24-inch pipeline to the gas processing plant in Batangas. There is no backup pipeline in transporting gas. The gas processing plant has total capacity of 500 million standard cubic feet per day (mmscf/d), of which about 90% of its capacity is utilized (source: SPEX).

A new platform was recently installed adjacent to the existing Malampaya platform combined with 2 new production wells. The Depletion Compression Platform (DCP) is part of the Malampaya Phase 2/3 project, which will maintain the gas production level to fulfil its commitment under the gas purchase agreement and to ensure steady supply for the 3 natural gas power plant in Luzon. The 2nd platform started its operation in October 2015 (SPEX, 2015a).



The Malampaya Gas Platform Offshore of Palawan
Source: Shell Philippines Exploration, B.V.

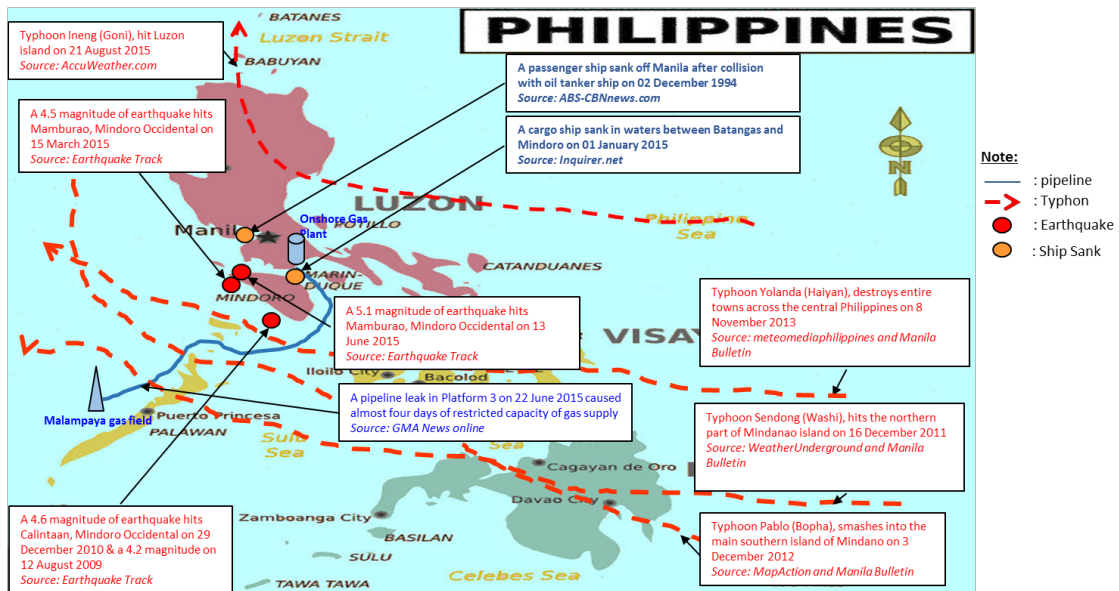
Malampaya gas facility is a critical infrastructure for the Philippines as it is the major source of gas to fuel 3 natural gas power plants providing significantly to the power supply in the Luzon grid. In June 2015, there was an incident of pipeline leak in the platform that caused 4 days of restricted capacity of gas supply. There were natural disasters and incidents that also happened in the past near Malampaya facility such as earthquakes, strong typhoon and even sank ship. An incident of cargo ship that sank happened in June 2015 between waters of Mindoro and Batangas. The Malampaya gas pipeline passes through Mindoro going to Gas Processing Plant in Batangas.

Figure 15: Overview of Malampaya Gas Field



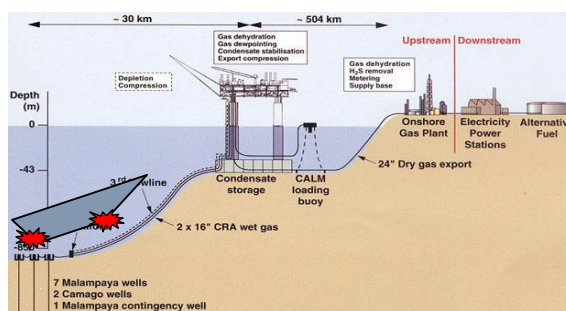
Source: DOE

Figure 16: Natural Disaster and Incident near Malampaya



Emergency Situation

A collision of cargo ship and oil tanker due to mishandling resulted in cargo ship to sink in waters between Mindoro and Palawan where the Malampaya underwater gas pipeline is situated. The sank cargo ship reached the seabed and hit the pipeline causing leaks. The leaks resulted in total shutdown of Malampaya as natural gas cannot be transported to the Gas Processing Plant in Batangas. Shutdown causes a loss of about 8.83 mmcm/d (312 mmcf/d) to fuel the 3 gas power plants, or equivalent to around 60 mb/d of diesel (if diesel will be used as substitute fuel). Based on this emergency scenario, the repair of the pipeline leaks will take about 1 month.



1.2. The Response

Assumptions

The Philippines responses were based on the following assumptions on the socio-economic impact of the gas supply disruptions:

- Loss of 8.83 mmcm/d or equivalent to 265 mmcm for 30 days (or 9,360 mmcf). The 2 natural power plants – the Sta. Rita (1,060 MW) and San Lorenzo (530 MW) – can run using condensate as alternate fuel. Meanwhile, the Ilijan power plant (1,271) can use diesel as alternative fuel but at a reduced capacity of 600 MW and can only run for five (5) days based on diesel fuel reserves kept by the operator. As such, there could be reduced power generation output of about 40% from natural gas power plants due to loss of 1,200 MW capacity.
- Loss of gross revenue of around USD 56 million from production share of government (royalty) as stipulated in Presidential Decree 87.
- As the natural gas power plants will be running using alternate fuels, an increase in electricity rate is expected and estimated to reach from USD 0.16/KWh to USD 0.50/KWh or translated to USD 422 million for 30 days.

Responses

As an immediate emergency response, the Department of Energy will convene a coordination meeting among concerned energy companies for the initial assessment of damage/impact before issuing an official press statement on the current gas supply situation. As the impact of gas supply disruption is on power, the government will conduct inventory of available supply of electricity including schedule of maintenance shutdown of other power plants. The National Grid Corporation of the Philippines (NGCP) will be asked to require all power plants operators to revise their maintenance schedule. Assessment on the impact on power rates will also be undertaken and increasing security in the pipeline leg that has been affected by the accident.

To address the gas supply shortfall, the government will take certain measures as follows:

▪ Supply Side

- The government will find ways on how to optimize use of line pack, which is the gas that remains in the pipeline. Such could provide certain amount of gas supply to be used by the power plants and buy little time to securing alternate fuels.
- Secure supply of alternative fuels (condensate and diesel) through additional importation from existing and other sources. Although the Philippines produces small amount of condensate, which in 2013 stood at 4.1 mmb, it is not being used for domestic use but rather exported. Domestic production of condensate could also be a source of alternate fuel for the 2 natural gas power plants.
- The government will strictly implement the re-scheduling of maintenance shutdown of other power plants to ensure that all available power generating facilities are operating within the period when the Malampaya gas facility is on forced shutdown. Available capacities from Independent Power Producers will also be utilized including the standby oil-based power plants, if required.

▪ Demand Side

- The government will implement Interruptible Load Program (ILP) to reduce demand during peak hours. The ILP was initially implemented by the government in the Visayas and Mindanao islands (southern part of the Philippines) to address power shortage in those areas. In 2015, the ILP was also carried out in Luzon during the summer months due to El Niño (drought) which reduced the

output from hydro power plants. Under the ILP, the customers of the distribution utilities will be encouraged to voluntarily de-load themselves from the grid by operating their own generation facilities during peak demand hours. The distribution utilities will then compensate the ILP customers from the charges to be collected from customers within the franchise area on the corresponding electricity freed up (kilowatt-hours) (DOE, 2015b).

- Energy conservation measures will be implemented such as demand side management like shifting of operating hours of manufacturing plants to off-peak hours. Other measure is to mandate all government agencies, shopping malls and commercial establishments to set their air conditioner units to 25 degrees celsius.
- Schedule of rotating black out with priority to sectoral requirement will also be considered, if required.

Challenges

Among the challenges identified to improve the economy's response for this scenario were:

- Restriction in importation of natural gas and establishment of gas reserves due to absence of required infrastructure such LNG import terminals and storage;
- Investment intensive in upstream exploration and the development of downstream infrastructure;
- Geopolitical issues, specifically territorial disputes, in natural gas prospect areas; and,
- Absence of National Gas Contingency Plan.

1.3. Experts' Recommendations

- The Philippines should consider the importance of governance and a well-organized structure for reporting process during energy supply emergency to ensure that right information is brought to the high levels in time for the formulation and implementation of emergency policy and measures. There must be a clear process flow to follow including the system and procedure to be addressed properly for the smooth and effective implementation of emergency measures. Good planning and budgeting are critical in implementing the measures. It may also be useful for the Philippines to compile its emergency response processes and related information into a comprehensive Emergency Response Handbook for use by relevant government and industry personnel during an energy supply disruption.

- There is a need to quantify the damage in terms of socio-economic and the impacts to non-energy sectors that may cause social turmoil. With information on the extent of the socio-economic impacts of the gas supply disruption to the public, appropriate measures may be undertaken to prevent public chaos.
- A special communication team must be created to be in charge of preparing the process for communicating to the public during emergency supply situation.
- As the Philippines has no enough reserve capacity for power, additional functional reserve market must be considered to have an immediate source for securing power supply to fill the shortfall in electricity in the event of incident. Attracting more investors to engage in power generation is important in establishing a reserve market.
- The Philippines should also consider redundancy in the Malamapaya facility to avoid total shutdown. As an option, LNG infrastructure must be put in place as part of the solution. LNG import terminals can be built in less than a year, and thus can immediately receive imports within that period.

2. THE SECOND STAGE OF OIL AND GAS SUPPLY EMERGENCY

2.1. The Scenario

Background

The Petron Refinery Facility is the largest refinery operating in the Philippines with 180 mb/d refining capacity. The other refinery facility is owned by Shell. Based on 63% share to total refinery capacity, Petron's refinery output contributed about 30% of total oil requirement (demand) of 322 mb/d in 2013. Much of the refinery output, around 40% is diesel followed by fuel oil and gasoline (19%). Nearly 40% of oil market is captured by Petron, and a portion of which is met by petroleum product importation (by Petron).

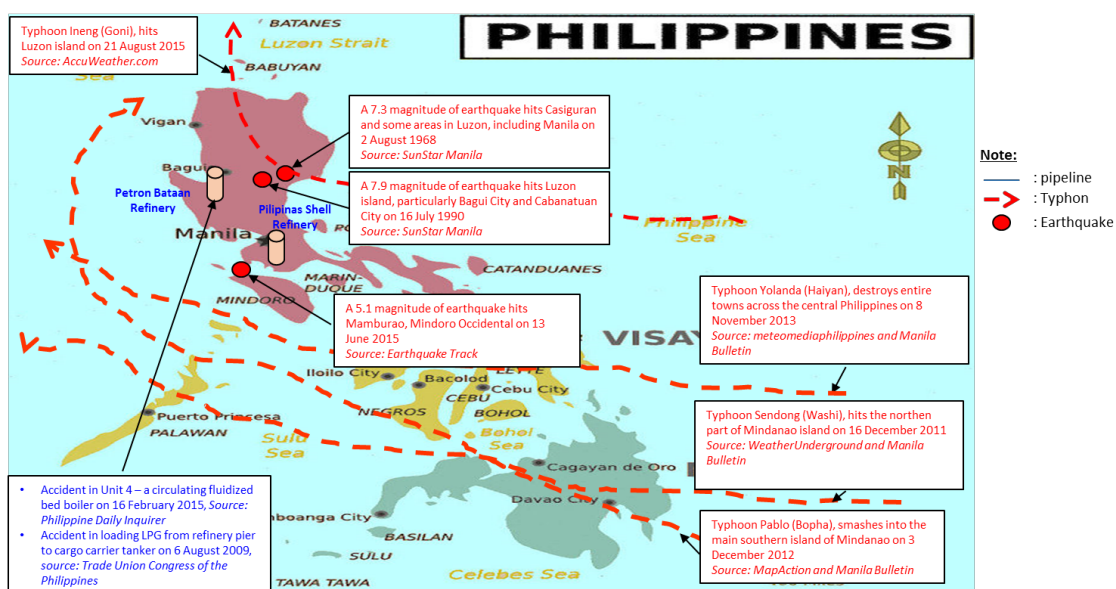


From its refinery facility in Limay, Bataan province, refinery products are transported through barges and marine vessels to 32 International Organization of Standardization (ISO)-certified depots and terminals located in the different parts of the Philippines. Petron also supplies jet fuel for international and domestic carriers in key airports in the economy. It also exports various petroleum products to the APEC region

such as Japan, Korea, Malaysia, Singapore and Thailand, and outside the region like India and Pakistan (Petron).

Petron traces its history way back in 1933 as the Standard Vacuum Oil Company (Stanvac). The refinery plant in Limay, Bataan was constructed in 1957 and started its initial operation in 1961 with refining capacity of 25 mb/d. In 1962, it was named Esso Philippines, and the Philippine National Oil Company (PNOC) acquired the company in 1973 and renamed it Petrophil Corporation, and later (1988) as Petron Corporation (Petron).

Figure 17: Natural Disaster and Incident near Petron Refinery Facility



Given the significant contribution of refinery output from Petron to meet the economy's oil supply requirement, the refinery facility comprising of 3 distillation units is also a critical infrastructure. Thus, any incident or accident that affects refinery facility and its production output poses a threat of oil supply disruption for the economy. The refinery facility is also threatened by natural disasters and incidents like earthquakes and strong typhoons. On the average, about 20 typhoons hit the Philippines in a year. In 2015, an accident happened in the circulating fluidized bed boiler in the refinery facility.

Emergency Situation

Three weeks after the Malampaya incident, a very strong typhoon, similar to typhoon Haiyan in 2013, hit Bataan province with one (1) minute sustained winds of 315 km/hr. (from Joint Typhoon Warning Center) and caused damage to the Petron Refinery. Distillation Units 1 and 2 installation process were damaged after the typhoon that resulted in total loss of production of fuel products. On the other hand, distillation unit 3 is also somewhat damaged.



Source: NASA on typhoon Haiyan

Based on assessment of damage on the refinery facility, distillation units 1 and 2 (with combined refining capacity of 155 mb/d) will take about 3 months to repair and restore their normal operation. On the other hand, distillation unit 3 (with 25 mb/d capacity) will require 3 weeks to repair the damage.

2.2. The Response

Assumptions

Following were the assumptions on the impacts of oil supply disruption as the bases for Philippines responses to this scenario:

- Loss of 98 mb/d of oil supply due to shutdown of Petron, which is about 30% reduction in total oil supply. Based on the refinery production output per petroleum product, the 98 mb/d shortfall could comprise of about 37 mb/d of diesel, 18 mb/d of gasoline, and 18 mb/d of fuel oil, 6 mb/d of LPG, 9 mb/d of Jet A-1, and the remaining for other fuels.
- The loss of 37 mb/d of diesel production from refinery output leads to a decrease of 27% in total diesel supply. About 42% of oil supply is diesel. On the other hand, the loss of 18 mb/d in gasoline refinery production results in 24% decline in total gasoline supply, loss of 18 mb/d of fuel oil causes 58% reduction in total fuel oil supply, and 9 mb/d reduction in Jet A-1 cuts total Jet A-1 supply by 29%. The decrease of 6 mb/d of LPG results in 18% deficit in total LPG supply.
- Transport will be greatly affected as 67% of oil supply is consumed by the sector. The sector consumes 75% of total diesel supply, about 97% of gasoline supply, and 28% of fuel oil supply.

- Industry sector will also be affected as 10% of oil supply is demanded by the sector. The sector consumes diesel, LPG, fuel oil, and kerosene. Meanwhile, commercial sector gets 9% of total oil supply for its fuel requirements – diesel, LPG and fuel oil. Residential sector is likewise affected as it consumes nearly 70% of LPG supply.
- Power sector, specifically in missionary areas, will also be affected (about 8% of total oil supply, specifically diesel and fuel oil, is devoted for power generation). However, with the shutdown of Malampaya field, the additional diesel supply will be required to run the Ilijan natural gas power plant using alternate fuel (diesel). Ilijan needs an estimated diesel consumption of 13 mb/d to run the power plant at 600 MW. This means that total shortfall of diesel supply will be 50 mb/d.

Responses

As the emergency situation is brought by natural disaster, the initial response of the Philippines is to immediately convene the National Disaster Risk Reduction & Management Council for pre-assessment of the impact of the typhoon before it hits the economy, and implement appropriate measures before, during and post typhoon scenario. Rapid damage and needs assessment and post disaster risk assessment will be carried out by NDRRMC. The Department of Energy will likewise convene the Inter-agency Energy Contingency Committee to thresh out possible measures to be implemented in preparation for the foreseen impact on energy supply the typhoon could bring to the economy. Oil companies will be requested to update their action plans before the typhoon. Daily reporting and monitoring of inventory and replenishment will be strictly undertaken. The government will release press statement to inform the public of the current situation and to prevent panic.

Under extreme circumstances, the government may involve the granting of emergency powers to the President of the Philippines to ensure that the government is in control of the situation, thus minimizing the possibility of public chaos and avoid potential collapse of the economy. Likewise, during the existence of state-of-emergency, the government is empowered to tap the available resources of the private sector and enjoin their support in the delivery of basic goods and services.

In the event of oil supply disruptions, the government will implement the following measures:

▪ **Supply Side**

- The government will request and instruct oil companies to increase oil importation from existing and other potential suppliers to secure additional oil supply to make up for the loss in refinery production brought by total shutdown of the Petron refinery facility.
- As additional oil supply is an immediate concern and utmost priority, cooperation of other government agencies will be sought to allow post compliance of import documents by oil companies. Granting of post compliance reduces the processing time to get import permit by oil companies. This would speed up importation of petroleum products from different sources.
- The government will also lift the mandatory 15-day inventory for petroleum products until the situation is back to normal. Temporary lifting of inventory is meant to utilize all available oil stocks to fill the supply gap.
- The government will enforce Mutual Product Sharing Accommodation (MPSA) among the Big 3 oil companies (Petron, Shell and Chevron) in areas where Petron has no existing depot. The MPSA was implemented by the government through a Memorandum issued by the Department of Energy to oil companies as a response to emergency situation after super typhoon Haiyan hit the economy in 2013. Under the MPSA, oil companies are permitted to supply petroleum products to facilities of other oil companies to ensure steady supply of petroleum production in affected areas (DOE, 2014d).
- To reduce domestic oil supply requirement, the government will propose to increase biofuel blend rate. The Philippines has excess production of biodiesel, which could accommodate higher blend rate for biodiesel. The economy has mandated a 2% biodiesel blend rate in all diesel fuel sold in the economy, and with available supply the blend rate could be increased up to 5%.
- As increasing importation requires foreign currency, the government will also ensure that there is enough forex for oil imports.

▪ **Demand Side**

- Enforcement of energy conservation measures will be considered by the government to restraint oil demand amidst supply shortages. Among the measures to be implemented, which are also contained in the oil contingency plan are:

- Limit operating hours of gas station, shopping mall, stores and other entertainment places;
 - Car pooling;
 - Four-day work and school in urban areas;
 - Limit use of government vehicles (prioritization);
 - Expand the “transport volume reduction scheme,” which limits vehicles to be on the road on certain days;
 - Ban of vehicles except in line of public service from 12mn to 4am; and,
 - Implement carless days.
- If demand still needs to be further reduced as supply is not enough, the government will implement fuel allocation as a last resort. The fuel allocation is intended to optimize the available oil supply based on sectoral requirements and priority. This measure is already included in the oil contingency plan of the economy. The fuel rationing will be carried out in order of priority as follows:
 - 1) Food production and transport;
 - 2) Hospitals and health care facilities;
 - 3) Power generation;
 - 4) Transport (Public and cargo land transportation; Private land transportation; Domestic shipping; Domestic aviation);
 - 5) Industry;
 - 6) Government, Armed Forces and Police;
 - 7) International shipping and aviation;
 - 8) Residential; and
 - 9) Diplomatic.

Among the sectors, the hospitals and health care facilities were not identified in the oil contingency plan, but now considered as second in priority.

As oil supply shortages may also trigger increases in prices of basic commodities, the government will strictly and closely monitor prices of these commodities on a daily basis. If necessary, price regulation may be imposed by government on basic commodities to include LPG and Kerosene, which are socially-sensitive petroleum products for households.

Challenges

Challenges identified to improve the economy's response for this scenario were:

- Reviewing and updating of the oil contingency plan to make the emergency framework more responsive in dealing with any type and magnitude of oil supply disruption. The government may enjoin owners of critical energy infrastructure and facilities such as depots/terminals, oil refinery and power plants to have or strengthen their emergency response plans.
- Ensuring business continuity plans are crafted by all oil stakeholders. The Department of Energy does not require oil stakeholders to submit contingency plan or action plan to address any accident or incident that disrupts their normal operation;
- Conducting of simulation and drills of emergency preparedness plan. The Department of Energy has no experience in conducting simulation and drills during oil/gas emergency situation.
- Implementing effective and timely dissemination of information to the public to prevent public panic and chaos.
- Timely delivery of foods/goods is critical in any oil supply emergency.

2.3. Experts' Recommendations

- Priority must be first given on how to secure additional oil supply to meet domestic requirement rather than implementing demand measures. Executing demand restraint has economic and social implications which should be taken into account. Due to the often significant economic and social costs of implementing demand restraint measures, many economies explicitly prioritise the release of emergency stocks over the use of demand restraint measures in an emergency (with the latter often considered a last resort). It is therefore important that when economies are formulating or reviewing their emergency response policies, the emergency stocks (or readily accessible alternative sources of supply) are treated as a higher priority than demand restraint measures.
- Determine the immediate impacts of oil supply disruption to society, such as the consequences to transport, industry and household sector. Estimation of the impacts provides information for the government to institute a mechanism to avoid social panic and calm down the public, as well as to solicit public cooperation.

- Government must have a full grasp of the economic impact with proper assessment and information. This is necessary to formulate appropriate policies and mobilize the right measures to address the problem. Accurate assessment drives government policies.
- It is important to know and have full knowledge of the market system to determine the availability of additional petroleum products to be delivered including shipping time. Possibly, shipping time for petroleum products will only take 5 days, while for crude oil about a month.
- There must be plan A and B in securing additional supply. Mapping out of import sources of petroleum products, such as the location of spot markets and other potential sources in the region should be part of the plan. The plan must also identify the fastest route to bring the petroleum product imports to the economy.
- The government should encourage or instruct oil companies to put important provisions in their import agreements/contracts with suppliers where pricing is agreed upon beforehand and a special assistance package during emergency is included. These provisions are essential in import agreements such that during emergency situation prices will not shoot up.
- Evaluate the unloading capacity of Petron for imports in other depot, not necessarily in Bataan. If there is still spare or excess capacity, larger inventory or emergency stockpiling must be considered. The stockpiling should be mainly for petroleum products rather than crude oil – crude oil still needs to be refined. Having larger inventory could give the economy enough time to secure additional imports.
- As the scenario involves disaster, the government should give more priority for available fuel supply to first responders. Hospital should be the top priority rather than food production and transport. Fuel allocation for government vehicles to be used on rescue and emergency responses must also be a priority. Likewise, utility people doing repair or restoration must be provided with available fuel supply.
- There must be a legal framework where the government can mandate the oil companies to support Petron. Mutual agreement must be facilitated by the government for and among the oil companies during supply emergency, and not only for the Big 3.
- On demand side management, the government must quantify how much oil will be saved from the different measures to be implemented to determine the additional supply that needs to be secured. It is also recommended that the government

conducts a volumetric study on oil savings potential and estimated timeframe for implementation of the available demand restraint measures.

3. THE THIRD STAGE OF OIL AND GAS SUPPLY

3.1. The Scenario

Background

The Philippines sources more than 50% of its petroleum products supply requirement overseas. In 2013, the largest supplier of petroleum products imports was Chinese Taipei providing around 30% of total imports. About 70% of imports from Chinese Taipei in 2013 was diesel, equivalent to 37 mb/d. Meanwhile, gasoline imports was almost 20% of total imports from Chinese Taipei, or 10 mb/d. Remaining imports were LPG, Jet A-1 and kerosene.

Figure 18: Refinery Facilities in Chinese Taipei



Chinese Taipei has 4 refinery facilities with total aggregate refining capacity of 1,260 mb/d. Three of the refineries are owned by CPC Corporation and the other is operated by Formosa Petrochemical Corporation. Kaohsiung refinery will be closed by end of December 2015 and its oil-refining operation will be gradually transferred to Dalin refinery. Both refineries are operated by CPC Corporation and located in Kaohsiung province, southern part of Chinese Taipei. The economy is also threatened by natural disasters or calamities like typhoon and earthquake. In May 2015, a 4.7 magnitude earthquake occurred where the epicenter was 71 km. from Kaohsiung. A strong typhoon named Soudelor hit Chinese Taipei in August 2015 with sustained winds of more than 230 km/hour. Typhoon Matmo (which also hit the Philippines) also slammed Chinese Taipei in July 2014 with strong winds and heavy rainfalls. Super typhoon Usagi made landfalls in the Philippines and Chinese Taipei in September 2013.

Emergency Situation

The strong typhoon that hit the Philippines also made a landfall in Chinese Taipei 3 days after, specifically in the southern part, and caused damage to 2 Oil Refinery Facilities (Kaohsiung and Dalin). As a result, these refinery facilities will be out of operation. Since Kaohsiung distillation unit will be retired in December 2015, then repair of damaged installation process is applied for Dalin distillation unit, which is expected to take at least 1 month.



Considering this situation, the Chinese Taipei government decided, 1 week after the incident, to reduce its oil products export by 30%. As a result, Chinese Taipei's oil product export to the Philippines also reduces by 30%, or about 9% reduction in total imports. Import from Chinese Taipei in 2013 was about 51 MB/D.

3.2. The Response

Assumptions

For this scenario, the following assumptions were drawn for the Philippines responses:

- Deficit of around 39% in total oil supply (compounded supply shortfall) from:

- 9% reduction in total petroleum products imports due to Chinese Taipei's decision;
 - 30% reduction in oil supply from Petron refinery shutdown; and,
 - 4% additional supply in diesel requirement for Ilijan power plant.
- Around 39% reduction in oil supply for all sector leads to reduced mobility of goods and people (all modes of transport).
 - The reduction of imports from Chinese Taipei causes 11 mb/d loss in total diesel supply bringing total shortfall of diesel to 35%. This could result in reduced available capacity for peak load (from oil-based power plants) with 5 mb/d of diesel requirement.

Responses

The Philippines will continue to convene the Inter-agency Energy Contingency Committee to assess the extent of impact of Chinese Taipei's decision to decrease its export quantity. Given the current oil supply shortfall faced by the economy from Petron refinery shutdown, the reduction of imports from Chinese Taipei would further aggravate the situation. With this assumption, the government will further advice and instruct oil companies to beef up their importation and look for other supply sources other than ASEAN. Public information on the oil supply situation will be continued by the government to avoid panic that could lead to social unrest.

Among the responses to be implemented by the Philippine government to address the third scenario were:

- **Supply Side**
 - The government will now invoke the regional energy cooperation under the Association of Southeast Asian Nations (ASEAN), specifically the ASEAN Petroleum Security Agreement or APSA. APSA is a form of an emergency supply sharing scheme under the ASEAN energy cooperation. Based on APSA, ASEAN member states are endeavoured to supply petroleum to the ASEAN member state at an aggregate amount equal to 10% of the normal domestic requirement for a continuous period of 30 days of the said member state. However, the member state seeking assistance must have implemented short-term measures to reduce demand as a condition under APSA. With assistance from APSA, oil shortfall could be decreased to 30%.
 - Continue to seek cooperation with other government agencies for post compliance of import documents, and streamline oil import processing and documentation.
 - Intensify securing import sources from existing and potential suppliers (spot markets).

- Ensure availability of foreign exchange for additional increase in oil imports.

- **Demand Side**

As in the 2nd scenario, the government will continue and intensify enforcement of energy conservation measures:

- Shorten further operating hours of gas station, shopping mall, stores and other entertainment places;
- Intensify implementation of car pooling;
- Longer implementation of four-day work and school in urban areas;
- Limit use of government vehicles (prioritization);
- Strict enforcement of transport “volume reduction scheme;”
- Longer implementation of ban of vehicles except public service from 12mn to 4am; and,
- Strict implement carless days.

Similarly, the fuel rationing based on sectoral prioritization as defined in the second scenario will be continuously implemented.

Challenges

With the aggravated oil supply disruptions, the Philippines further identified additional challenges as follows:

- Establishing strategic stockpiling (crude oil and refined products) is seen as a challenge by the government as it means additional investment to put up the necessary infrastructure such as storage facilities. However, strategic stockpiling should be considered as a long-term response measure or policy even in a deregulated oil industry set-up. Such strategic stockpiling must be studied carefully in consultation with the industry, including put up of government-owned storage facilities.
- Establishing joint emergency stocks with other countries through bilateral or regional framework. The government must enter into bilateral agreement within ASEAN and APEC for possible joint emergency stocks. Likewise, the government should also propose and seek support from member economies of APEC or ASEAN to have a regional framework on joint emergency stocks; and,
- Securing emergency stocks of other countries with large strategic oil stockholding. In the same manner, the government must survey and look for those economies and

establish cooperation and partnership agreement to secure a portion of their strategic stocks during emergency situation.

- Creation of a National Energy Sector Disaster Risk Reduction Management Committee, which could be a sub-committee under the IECC. The said committee is tasked to formulate a unified plan of action to respond to any emergency situation.

3.3. Experts' Recommendations

- Before the typhoon is detected (involving 2nd and 3rd scenarios), the government must conduct market pre-assessment, which is necessary to establish sources of petroleum products or where to purchase in spot markets.
- The government must now formulate a communication campaign nationwide calling to save fuel and energy as the situation has worsened.
- The government must establish a cooperation framework agreement (bilateral or multilateral approach) on emergency supply sharing for oil products with those economies having huge emergency oil stocks. For instance, Japan and Korea both have established large strategic oil stockpiling, and having emergency supply sharing framework agreement with these economies would allow the Philippines to access such stocks during emergency. The contract agreement of importation will be done between oil companies, while the government can facilitate the shipment of oil.
- Instead of post compliance on import documents, the government may consider creating a special lane or specific institution to streamline the process and procedure. Post compliance could open up to some kind of fraud, smuggling or certain goods may not be accounted properly.
- A review of the current legal framework should be carried out whether it allows the government to take possession of private oil companies' oil stocks in the event of supply emergency. The government must have such authority during supply crisis to ensure that all available oil stocks held by oil companies will be utilized to reduce the supply shortfall. However, the government is obliged to pay the oil companies equivalent to the amount of withdrawn oil stocks.

4. GENERAL COMMENTS FROM THE EXPERTS

From the 3 scenarios presented in the emergency exercise, the following were the general comments and/or additional inputs from the experts:

- The Department of Energy and other stakeholders might want to analyze further the scenarios and get more information/data on the impacts (from each scenario), because if the real situation happens, the immediate availability of data will be helpful in crafting policies and measures;
- Maintaining an updated database on fuel supply, production, inventory, storage or unloading capacity, other sources of imports, among others, would aid the government in formulating appropriate measures and responses;
- The exercise is about the action plan that needs to be implemented and the responses should be explored on a greater extent for the economy to be ready when accident/incident happens. It is important to put in place a workable emergency response and action plan in dealing with supply disruptions.
- Examine the different aspects of the emergency scenarios and communicate among the concerned government agencies and stakeholders and set the goals. Focus on the policy barriers to be addressed to make the economy better prepared when face with real emergency situation;
- Institutionalise the conduct of exercise to be jointly undertaken by government and industry together with other concerned stakeholders to include the local government units (LGUs) as emergency situation may affect a specific geographical location, which needs support from local government to ensure continuous distribution of basic goods and services. The exercise is a test to see how people work together and respond on a given emergency situation, as well as identify in what areas the stakeholders can coordinate better. The exercise will also generate a lot of ideas and innovativeness on responses in dealing with different types of emergency situation; and,
- Get historical actual cases on how the economy or government responded or addressed the supply emergency as these will serve as learning exercises. The historical cases provide additional information, which could be essential in the exercise in terms of what responses were effective and where are the areas that need more improvement.

On the conduct of exercise itself, the experts also recommended the following:

- Although the exercise was conducted with government, industry and other stakeholders' representatives, the exercise should consider having smaller breakout groups to have detailed discussions on the impacts of emergency scenarios, and the corresponding measures and responses to be implemented;
- The emergency scenarios should also be given in advance to the participants before the exercise. This would allow the participants (government and private sectors) to think comprehensively on the impacts on the emergency scenarios to the economy, and the appropriate measures that would be implemented. Further, the government agencies and the concerned private sector to be invited would be given the opportunity to identify appropriate persons from their agencies/companies to join the exercise. The exercise should not put more emphasis on how quick the participants can think of the responses to emergency scenarios. Rather, the exercise should be more concerned on the full assessment of the emergency scenarios and the available options and resources for the government or economy to respond to supply crisis;
- The panel of experts should be involved in the deliberation in each scenario to have a more detailed discussions and insights with the participants; and,
- It might also be useful, as an alternative to exercise, to prepare case studies of actual emergency cases in the past, either in host economy itself (such as the case of typhoon Haiyan) or other economies that experienced oil and gas supply crisis. Reviewing the past experiences would give an opportunity to identify which among the responses were very useful to address the supply emergency, and the other responses that need to be crafted to have complete and effective solutions to the crisis.

APPENDIX A: EXPERT REVIEW TEAM MEMBERS AND APERC SECRETARIAT

The Philippines Oil and Gas Security Exercise was participated in by an Expert Review Team composed of the following experts from energy-concerned regional and international organizations, the APEC Economies, and the APERC Secretariat:

Expert Review Team Members:

1. Mr. Andrew Maxwell ROBERTSON, Energy Analyst, Emergency Policy Division, International Energy Agency (IEA)
2. Mr. Christopher ZAMORA, Manager, ASEAN Plan of Action for Energy Cooperation, ASEAN Centre for Energy (ACE)
3. Mr. Surachit SONGCHAROEN, Analyst, ASEAN Council on Petroleum (ASCOPE)
4. Ms. Chairani RACHMATULLAH, Senior Manager of Primary Energy Planning, PLN, Heads of ASEAN Power Utilities/Authorities (HAPUA), Working Group 1 HAPUA
5. Dr. Phoumin Han, Energy Economist, Economic Research Institute for ASEAN and East Asia (ERIA)
6. Mr. Jun OKUNISHI, Deputy Director of Petroleum Refining and Reserve Division, Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry (METI)
7. Mr. Chang Hwan RYU, Deputy Director of Energy Safety Division, Ministry of Trade, Industry & Energy (MOTIE)
8. Mr. Christopher ROARK, Crude Oil Marketing Analyst, Crude Oil, Drawdown Readiness, and Cavern Integrity Division, U.S. Department of Energy
9. Ms. Carissa VANDERMEY, Infrastructure System Analyst, Infrastructure Security and Energy Restoration, U.S. Department of Energy
10. Dr. Peter Lee U, Dean, School of Economics, and Chair for Operations Committee, School of Economics, University of Asia and the Pacific

APERC Secretariat:

1. Takato OJIMI, Expert Review Team Leader, President, Asia Pacific Energy Research Centre
2. Dr. Kazutomo IRIE, General Manager, Asia Pacific Energy Research Centre
3. Elvira Torres GELINDON, Senior Researcher, Asia Pacific Energy Research Centre

4. Michael Ochoada SINOCRUZ, Senior Researcher, Asia Pacific Energy Research Centre
5. Fang-Chia LEE, Researcher, Asia Pacific Energy Research Centre
6. Mr. Hiroshi HASHIMOTO, Senior Analyst, Gas Group, Institute of Energy Economics, Japan (IEEJ)
7. Ms. Tomoko MATSUMOTO, Senior Researcher, Oil Group, Institute of Energy Economics, Japan (IEEJ)

APPENDIX B: PHILIPPINES' STAKEHOLDERS PARTICIPANTS

Philippines Government Officials

Department of Energy

1. Ms. Loreta G. AYSON, Undersecretary
2. Mr. Jesus T. TAMANG, Director of Energy Policy and Planning Bureau
3. Ms. Carmencita A. BARISO, Assistant Director of Energy Policy and Planning Bureau
4. Ms. Melita V. OBILLO, Director of Oil Industry Management Bureau
5. Atty. Rino E. ABAD, Director of Energy Resource Development Bureau
6. Ms. Ma. Victoria B. CAPITO, OIC-Division Chief, Policy Formulation and Research Division, Energy Policy and Planning Bureau
7. Ms. Laura L. SAGUIN, Division Chief, Natural Gas Management Division, Oil Industry Management Bureau
8. Mr. Renante M. SEVILLA, Division Chief, Retail Market Monitoring Special Concern Division, Oil Industry Management Bureau
9. Ms. Lana Rose A. MANALIGOD, OIC-Division Chief, Planning Division, Energy Policy and Planning Bureau
10. Mr. Danilo V. VIVAR, Supervising Science Research Specialist, Policy Formulation and Research Division, Energy Policy and Planning Bureau
11. Ms. Desiree Joy C. SOLIS, Senior Science Research Specialist, Planning Division, Energy Policy and Planning Bureau
12. Ms. Cynthia P. MANALAC, Senior Science Research Specialist, Planning Division, Energy Policy and Planning Bureau
13. Mr. Arnel C. ANTONIO, Senior Science Research Specialist, Policy Formulation and Research Division, Energy Policy and Planning Bureau
14. Ms. Lilibeth T. MORALES, Senior Science Research Specialist, Policy Formulation and Research Division, Energy Policy and Planning Bureau
15. Ms. Rosanna Y. TEJUCO, Senior Science Research Specialist, Policy Formulation and Research Division, Energy Policy and Planning Bureau
16. Ms. Gloria A. FERRANCO, Senior Science Research Specialist, Oil Industry Competition and Monitoring Division, Oil Industry Management Bureau
17. Ms. Castle Faery Ishelry I. SANTOS, Science Research Specialist II, Oil Industry Competition and Monitoring Division, Oil Industry Management Bureau
18. Ms. Geraldine M. SACAYAN, Science Research Specialist II, Oil Industry Competition and Monitoring Division, Oil Industry Management Bureau

19. Ms. Jessol M. SALVO, Science Research Specialist II, Natural Gas Management Division, OIL Industry Management Bureau

Department of Public Works and Highways

20. Mr. Mariel S. VERGARA, National Capital Region Office

Department of Foreign Affairs

21. Atty. Roy B. ECRAELA

Office of Civil Defense

22. Ms. Susana Cruz, Regional Director, National Capital Region

23. Ms. Susana E. QUIAMBAO, Office-in-Charge, Operations Division

Philippine Coast Guard

24. Mr. Jeff R. CAUNGACION, Head of Operations

25. Lt. Victorino ACOSTA, Chief, GIG

26. Lt. Patrick BABAG

National Security Council

27. Mr. Ray D. RODEROS, Assistant Director General

Philippine National Police

28. Ms. Lerma TIRANIA, Chief Inspector

Government-owned and Controlled Corporation

Philippine National Oil Company

29. Mr. Dionisio R.E. REYES, Division Chief, Strategic Planning

National Power Corporation

30. Mr. Jonas Q. EVANGELISTA, Division Manager

National Transmission Company

31. Mr. Christopher O. SERRANO

Energy Companies/Associations

Philippine Institute of Petroleum

32. Mr. Teddy REYES, Executive Director

33. Ms. Nimfa T. VILLAMAYOR, Assistant Executive Director

Pilipinas Shell Petroleum Corporation

34. Mr. Conrad PARIZAL, Country Community Liaison Office

Liquigaz Philippines Corporation

35. Mr. Laurence R. UCHI, Deputy Manager, Technical Services

36. Mr. Leomhar M. PADAOAN, Sr. Technical and Safety engineer

REFERENCES

- APERC (Asia Pacific Energy Research Centre) (2016). Draft APEC Energy and Supply Outlook.
- DOE (Department of Energy) (2002a). History of Malampaya Deep Water Gas to Power Project .
http://www.doe.gov.ph/microsites/ngmd%20website/malampaya_history.pdf
- _____(2002b). Oil Contingency Plan
- _____(2014a). Philippine Energy Sector Situationer 2013. DOE-Energy Policy and Planning Bureau
- _____(2014b). Oil Supply/Demand Report 2013.
<http://www.doe.gov.ph/downstream-oil-industry/484-oil-supply-demand-report-2013/2399-oil-supply-demand-report-2013>
- _____(2014c). 2013 Energy Balance Table.
- _____(2014d). Energy Sector Accomplishment Report 2013.
http://www.doe.gov.ph/doe_files/pdf/Transparency_Seal/Annual%20Report%20-%20Energy%20Sector%20Accomplishment%20Report%202013.pdf
- _____(2015a). Energy Sector Accomplishment Report 2014.
https://www.doe.gov.ph/doe_files/pdf/Transparency_Seal/Annual%20Report%20-%20Energy%20Sector%20Accomplishment%20Report%202014.pdf
- _____(2015b). Mindanao Energy Plan 2014-2030
- ESTO (Energy Statistics and Training Office) (2015). APEC Energy Database, APEC Energy Research Centre (APERC)
- IEA (International Energy Agency) (2015). World Energy Statistics and Balances 2015.
- LNG World News (2015). EWC's Philippines LNG Projects Nearing Start-up
<http://www.lngworldnews.com/ewcs-philippines-lng-projects-nearing-start-up/>
- Navarro, Adoracion and Llanto, Gilbert (2014). The Philippine Economy in 2013 and Prospects for 2014. Philippine Institute for Development Studies (PIDS). March 2014.
<http://dirp3.pids.gov.ph/webportal/CDN/PUBLICATIONS/pidsdrn14-1.pdf>
- NDRRMC (National Disaster Risk Reduction and Management Council) (2010). Implementing Rules and Regulations of Republic Act No. 10121.
http://www.ndrrmc.gov.ph/attachments/article/95/Implementing_Rules_and_Regulation_RA_10121.pdf
- _____(2011). National Disaster Risk Reduction and Management Plan (NDRRMP) 2011 - 2028.
http://www.ndrrmc.gov.ph/attachments/article/41/NDRRM_Plan_2011-2028.pdf

- _____(2014). National Disaster Response Plan. June 2014.
http://www.ndrrmc.gov.ph/attachments/article/1334/NDRP_Hydro_Meteorologica_l_Hazards_as_of_2014.pdf
- Official Gazette (2014). Philippines Credit Rating. <http://www.gov.ph/report/credit-ratings/>
- Petron Profile. <http://www.petron.com/about-profile.html>
- PCOO (Presidential Communications Operations Office) (2011). Organizing the Inter-agency Energy Contingency Committee (IECC).
<http://www.pcoo.gov.ph/issuances/issuances-ao/AO-06.pdf>
- PSA-NSCB (Philippine Statistics Authority-National Statistical Coordination Board) (2014). The Philippine Economy Grew by 7.2 in 2013.
<http://www.nscb.gov.ph/sna/2013/4th2013/2013qpr4.asp>
- SPEX (Shell Philippines Exploration B.V.) (2015a). Malampaya begins Gas Production from New Offshore Platform.
<http://malampaya.com/2015/10/malampaya-begins-gas-production-from-new-offshore-platform/>
- WB (World Bank) IBRO-IDA. World Population Ranking. September 2014.
<http://data.worldbank.org/data-catalog/Population-ranking-table>

Useful Links

Department of Energy (DOE)	-	doe.gov.ph
Department of Public Works & Highways	-	dpwh.gov.ph
Department of Foreign Affairs (DFA)	-	dfa.gov.ph
Liquigaz Philippines Corporation	-	liquigaz.com
Malampaya Natural Gas Field	-	malampaya.com
National Power Corporation (NPC)	-	napocor.gov.ph
National Security Council (NSC)	-	nsc.gov.ph
National Transmission Company (TransCo)	-	Transco.ph
Office of Civil Defense	-	ocd.gov.ph
Petron Oil Company	-	petron.com
Philippine Coast Guard	-	coastguard.gov.ph
Philippine Institute of Petroleum	-	piponlinesite.com
Philippine National Oil Company (PNOC)	-	pnoc.com.ph
Pilipinas Shell Petroleum Corporation	-	shell.com.ph
Shell Philippines Exploration B.V	-	shell.com.ph