Republic of the Philippines
Department of Energy

ASIA EDGE
Enhancing Development and Growth through Energy
The U.S. Government's Indo-Pacific Energy Initiative

UPSCRFI *University of the Philippines Statistical Center Research Foundation, Inc.*

Natural Gas Development Plan

Prepared with the assistance of GAS POLICY DEVELOPMENT PROJECT

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Table of Contents

List of Tables

List of Figures

List of Boxes

Acronyms

AAGR	Annual average growth rate
AG&P	Atlantic Gulf & Pacific Company of Manila, Inc.
AHTN	Association of Southeast Asian Nations Harmonized Tariff Nomenclature
ASEAN	Association of Southeast Asian Nations
Asia EDGE	Asia Enhancing Development and Growth through Energy
AST-NG	Acknowledgement to Supply and Transport Natural Gas
ATI-LNG	Acknowledgement to Import Liquefied Natural Gas
ATIGA	Association of Southeast Asian Nations Trade in Goods Agreement
BFP	Bureau of Fire Protection
BIR	Bureau of Internal Revenue
BOC	Bureau of Customs
BOG	Boil-off gas
BOI	Bureau of Investments
BOQ	Bureau of Quarantine
BSI	British Standards Institution
BWC	Bureau of Working Conditions
CAAP	Civil Aviation Authority of the Philippines
CALABARZON	Cavite, Laguna, Batangas, Rizal, and Quezon
CCGT	Combined-cycle gas turbine
CEO	City Engineer's Office
CES	Clean Energy Scenario
CFR	Code of Federal Regulations
CHO	City Health Office
CLDP	Commercial Law Development Program
CNG	Compressed Natural Gas
COVID-19	Coronavirus disease 2019
CO2	Carbon dioxide
CREATE	Corporate Recovery and Tax Incentives for Enterprises
DC	Department Circular
DENR	Department of Environment and Natural Resources
DILG	Department of Interior and Local Government
DNG-REC	Downstream Natural Gas Review and Evaluation Committee
DOE-OIMB-NGMD	Department of Energy - Oil Industry Management Bureau - Natural Gas Management Division

Acronyms

DOH	Department of Health
DOLE	Department of Labor and Employment
DOTr	Department of Transportation
DTI-BPS	Department of Trade and Industry - Bureau of Philippine Standards
EICC	Energy Investment Coordinating Council
EMB	Environmental Management Bureau
EMSA	European Maritime Safety Agency
ENR	Bureau of Energy Resources
EPIRA	Electric Power Industry Reforms Act
EPNS	Energy Projects of National Significance
ERC	Energy Regulatory Commission
EVOSS	Energy Virtual One-Stop Shop
EWC	Energy World Corporation
FGD	Focus group discussion
FSRU	Floating storage and regasification unit
FSU	Floating storage unit
GFC	Global Financial Crisis
GHG	Greenhouse gas
GPDP	Gas Policy Development Project
GSPA	Gas Sales Purchase Agreement
IACS	International Association of Classification Societies
IL	Inclusion List
IPP	Investment Priorities Plan
ISO	International Organization for Standardization
ITH	Income tax holiday
KII	Key informant interview
LGU	Local government unit
LLDA	Laguna Lake Development Authority
LNG	Liquefied natural gas
LNG-IAC	Liquefied Natural Gas Importer Accreditation Certificate
LPG	Liquefied petroleum gas
LTO	Land Transportation Office
MARINA	Maritime Industry Authority
MARSECOM	Maritime Security Command
MEPCOM	Marine Environmental Protection Command
MFN	Most Favored Nation

MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MSSC	Maritime Safety Services Command
NDC	Nationally Determined Contribution
NFPA	National Fire Protection Association
NGDP	Natural Gas Development Plan
NIRC	National Internal Revenue Code
NPC	National Power Corporation
NTP	Notice to Proceed
NTRC	National Tax Research Center
OIAB	Oil Industry Administration Bureau
OIC	Omnibus Investments Code
OIT	Onshore import terminal
OSHC	Occupational Safety and Health Center
PCECP	Philippine Conventional Energy Contracting Program
PCERM	Permit to Construct/Expand/Rehabilitate/Modify
PCG	Philippine Coast Guard
PDNGI	Philippine Downstream Natural Gas Industry
PDNGR	Philippine Downstream Natural Gas Regulation
PDOE	Philippine Department of Energy
PEZA	Philippine Economic Zone Authority
PIA-HSSE-IMT	Philippine Inter-Agency Health, Safety, Security, Environment Inspection and Monitoring Team
PNOC-EC	Philippine National Oil Company -Exploration Corporation
PNS	Philippine National Standards
POM	Permit to Operate and Maintain
PPA	Philippine Ports Authority
PPP	Public-Private Partnership
PRP	Proposed Regulatory Process
PSC	Port State Control
PSPC	Pilipinas Shell Petroleum Corporation
QS	Quality Standards
RA	Republic Act
REF	Reference Scenario
SC	Service Contract
SCIT	Special Corporate Income Tax

Acronyms

SEZ	Special Economic Zone
SIGTTO	Society of International Gas Tanker and Terminal Operators
TC	Technical Committee
TCCP	Tariff and Customs Code of the Philippines
TPA	Third-party access
TPES	Total primary energy supply
TRAIN	Tax Reform for Acceleration and Inclusion
UPSCRFI	UP Statistical Center Research Foundation, Inc.
USDS	United States Department of State
VAT	Value-added tax
VRE	Variable renewable energy

Units of Measurement

°C	degree Celcius
bcm	billion cubic meter
MMB	million barrel
MMSCF	million standard cubic feet
MTOE	million tons of oil equivalent
MTPA	metric ton per annum
MW	megawatt
TCF	trillion cubic feet
TWh	terawatt-hour

Photo taken in Energy World Corp, Pagbilao Quezon (March 2019)

Message from the Philippine Energy Secretary

The Philippines is facing a significant challenge with respect to the natural gas supply. The Malampaya gas field is experiencing a reduction in its production, and the reservoir is expected to be depleted by 2027. All our gas-fired power plants with a combined 3,200 MW capacity will eventually face the inevitable loss of gas supply. Additionally, as highlighted by the President in his State of the Nation's Address (SONA) last July 22, 2022, our current energy situation is vulnerable to sudden price shocks and disruptions in supply chains due to geopolitical tensions. Hence, the need to recalibrate our strategies to counteract these posing energy threat.

Part of our efforts to address this challenge is to look for alternative sources of natural gas. It also aligns with our goal of transitioning to cleaner energy and a low-carbon future. We acknowledge, however, that looking for alternative sources of natural gas and transitioning to cleaner energy sources, such as liquified natural gas (LNG), would require corresponding infrastructures in place. And this would also require an investor's substantial capital investment.

The formulation of the Natural Gas Development Plan (NGDP) with the assistance of the Gas Policy Development Project is therefore very timely in providing prospective investors guidance and policy framework, legal requirements, and incentives in putting up LNG facilities and other infrastructure projects, including our future development plans and programs.

It is hoped that this undertaking will help us advance the development of the downstream natural gas industry, including the role of LNG in our energy system.

Secretary Raphael P. M. Lotilla
Department of Energy

Acknowledgment

The Natural Gas Development Plan (NGDP) was developed by the Gas Policy Development Project 2 (GPDP 2) with the Department of Energy - Oil Industry Management Bureau - Natural Gas Management Division (DOE-OIMB-NGMD). Throughout the implementation of GPDP, from Phase 1 to 2, various government agencies have been valuable partners, enabling the Project to deliver the outputs included in this report.

The GPDP team is grateful for the significant inputs of the following government agencies:

- Batangas City Local Government Unit (LGU)
  - City Engineer's Office (CEO)
  - City Health Office (CHO)
- Department of Environment and Natural Resources (DENR): Environmental Management Bureau (EMB)
- Department of Health (DOH): Bureau of Quarantine (BOQ)
- Department of Interior and Local Government (DILG): Bureau of Fire Protection (BFP)
- Department of Labor and Employment (DOLE): Occupational Safety and Health Center (OSHC) and Bureau of Working Conditions (BWC)
- Department of Transportation (DOTr):
  - Philippine Coast Guard (PCG) – Marine Environmental Protection Command (MEPCOM), Maritime Safety Services Command (MSSC), Port State Control (PSC), Maritime Security Command (MARSECOM)
  - Maritime Industry Authority (MARINA)
  - Philippine Ports Authority (PPA)
- Laguna Lake Development Authority (LLDA)
- Pagbilao LGU
- Philippine Economic Zone Authority (PEZA)
- Tokyo Gas Co., Ltd.
- U.S. Department of Commerce - Commercial Law Development Program (CLDP)

Finally, the GPDP team expresses its tremendous gratitude to the Bureau of Energy Resources (ENR), United States Department of State (USDS) under the Asia Enhancing Development and Growth through Energy (Asia EDGE) initiative, for its financial support that made this initiative and all other GPDP outputs and activities possible.

Photo courtesy of First Gen Corporation

Overview

As the Philippines prepares for a clean energy future that is both sustainable and competitive, natural gas usage and application will play a bigger and more crucial role in the country's energy mix. To this end, the Department of Energy-Oil Industry Management Bureau-Natural Gas Management Division (DOE-OIMB-NGMD), in partnership with the Gas Policy Development Project 2 (GPDP 2) of the UP Statistical Center Research Foundation, Inc. (UPSCRFI) developed the Natural Gas Development Plan (NGDP) to serve as a guide to all stakeholders in the natural gas sector.

The NGDP is a comprehensive report on the Philippine natural gas sector that aims to shed light on the role of natural gas, legal and regulatory framework of the sector, ongoing projects, potential areas for development, and way forward plans for the sector. It is intended to be a useful reference for agency regulators, policymakers, and investors as the country sees the imminent need to move beyond relying on indigenous natural gas and to look for other sources through importation of liquefied natural gas (LNG).

The NGDP is divided into four (4) main sections. Section 1 provides an overview of the role of natural gas in the Philippine energy sector, while Section 2 provides details on natural gas demand and outlook. Section 3 focuses on the existing legal framework on natural gas, highlighting the DOE's Department Circular (DC) No. 2017-11-0012 or the Philippine Downstream Natural Gas Regulation (PDNGR). Section 4 is divided into seven (7) subsections to zero in on specific aspects of the sector. The subsections include:

1. Ongoing Natural Gas Projects – provides details on the LNG infrastructure and facilities currently being constructed
2. Investors' Guide – features a section of GPDP 1's output that provides details on the policies put in place to facilitate investments and incentives that are made available to potential LNG proponents
3. Proposed Regulatory Process – highlights GPDP 2's recommendations on the regulatory process per stage of operation, including the five (5) identified business types for each concerned agency as well as the list of current and proposed documentary requirements and checklist of codes and standards recommended for adoption
4. Development of Products, Facility, and Codes of Safety Practice Standards - provides an overview of the composition of the committee that will be tasked to develop the standards as well as the process of developing such standards for the downstream natural gas facilities
5. Market Profiling on Natural Gas Potential Users in Economic Zones – consolidates the findings of GPDP 1 and 2's research on the potential use of natural gas in special economic zones, specifically looking into the likelihood of fuel switching by locator firms and their considerations for switching to natural gas
6. Power and Non-Power Applications on Natural Gas – provides details on GPDP 2's research on the existing and emerging technologies for power applications of natural gas and the technical feasibility of using natural gas for non-power applications, such as in the industrial and transport sectors
7. Way Forward – lays out recommendations on policies, regulations, and research to be explored that will aid further development in the sector

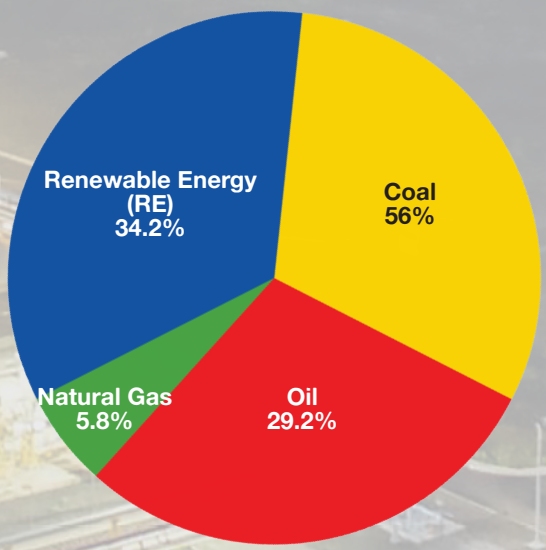
Photo courtesy of First Gen Corporation

I. Philippine Energy Sector and the Role of Natural Gas[1]

Since 2001, the Philippines' primary source of natural gas has been the Malampaya offshore gas field. Discovered in 1990, under Service Contract No. 38, Malampaya allowed the country to be self-sufficient in natural gas and has fueled the power and industrial sectors for two decades. At its peak, it was able to supply around 40 percent of the country's energy needs.

In 2020, the country's total primary energy supply (TPES) was at 56.4 million tons of oil equivalent (MTOE) where natural gas took a 5.8 percent share (see Figure 1). Natural gas production was at 141,732 million standard cubic feet (MMSCF) and total consumption of 133,606 MMSCF or 94.2 percent utilization.

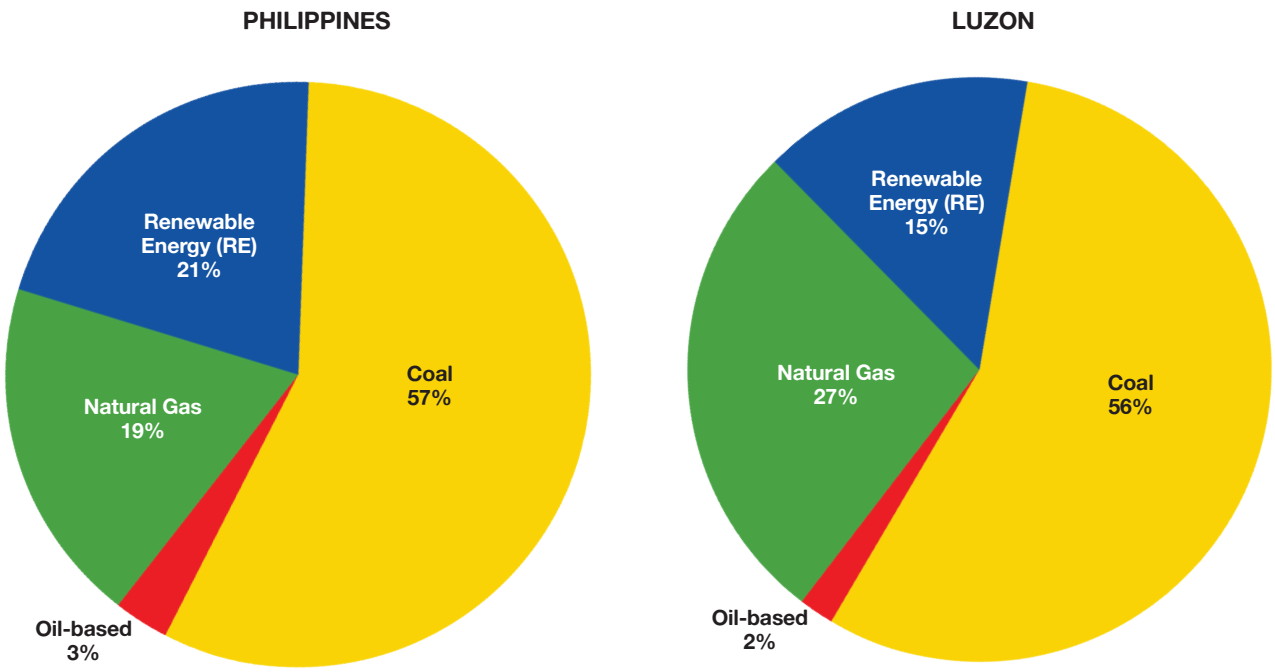
Figure 1. Energy Mix by Fuel, 2020



[1] All data and figures in this section are based on the data in the Department of Energy. (2021). Philippine Energy Plan 2020-2040. Department of Energy. https://www.doe.gov.ph/pep

Power generation continued to be the main application for natural gas at 98.8 percent. The share of natural gas in the power generation mix, however, recorded a slight drop from 22.4 terawatt-hours (TWh) in 2019 to 19.5 TWh in 2020 due to the economy-wide reduction in electricity demand owing to the Coronavirus disease 2019 (COVID-19) pandemic quarantine protocols. Nonetheless, the natural gas-fired power plants—Ilijan, Sta. Rita, San Gabriel, Avion, and San Lorenzo, with a combined installed capacity of 3,453MW—remained significant fuel sources for power, providing about 19.0 percent of the country's total power requirements and 27.0 percent of the Luzon grid (Figure 2).

Figure 2. Share of Natural Gas in Gross Power Generation, 2020

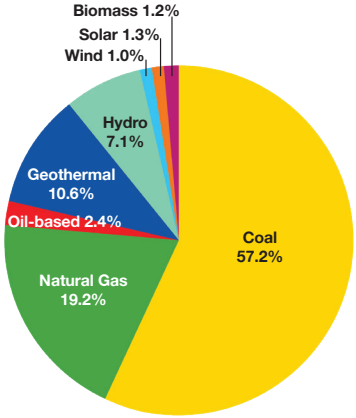


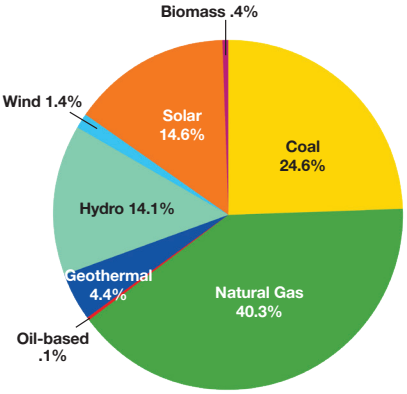
The remaining 1.2 percent in gas usage was used by Pilipinas Shell Petroleum Corporation (PSPC) for their own-use power plant and in the refinery process prior to its closure in response to the drastic decline in local product demand and the significant deterioration of regional refining margins brought about by the pandemic. The refinery ceased operation and the facility was converted into a petroleum import receiving terminal in 2020.

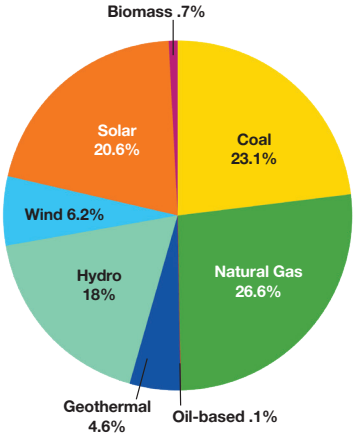
In the coming decades, natural gas will continue to play a crucial role as the country's peak demand is projected to increase by almost four-folds, growing 6.6 percent annually over a 20-year period—from 15,282 megawatts (MW) in 2020 to 54,655 MW in 2040. In the Department of Energy's (DOE) Reference Scenario (REF), which assumes the continuation of present development trends and strategies, natural gas is poised to take over coal as the major fuel for power generation in 2040, with its share increasing significantly to 40.0 percent from nearly 20.0 percent in 2020. Whereas in the Clean Energy Scenario (CES), generation from natural gas will take one-fourth of the share at 26.6 percent (Figure 3). The CES accounts for greater decarbonization efforts to achieve the Philippine Nationally Determined Contribution (NDC) of 75 percent reduction in greenhouse gas (GHG) emissions by 2030 relative to the business-as-usual scenario.

Accordingly, the overall share of natural gas in the TPES is also projected to increase taking a 17 percent share in REF while 11.6 percent in CES (Figure 4).

Figure 3. Power Generation by Fuel Source: 2020; 2040 Reference Scenario; 2040 Clean Energy Scenario







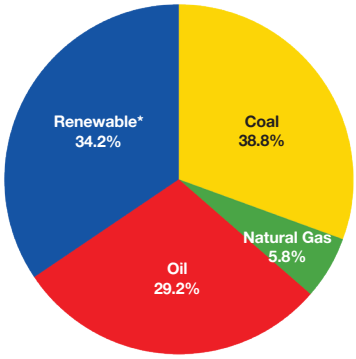
2020: 101.8 TWh
RE Share: 21.2%

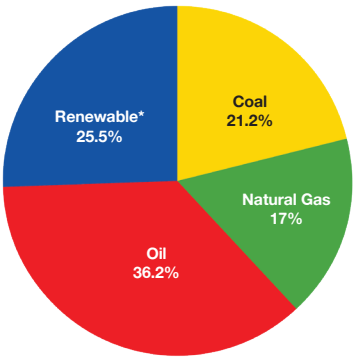
2040 REF: 364.4 TWh
RE Share: 35.0%

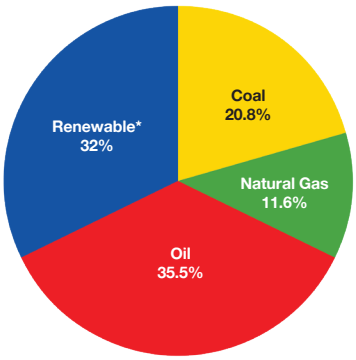
2040 CES: 356.9 TWh
RE Share: 50.0%

Fuel Type (TWh)	2020		2040				AAGR 2020-2040	
	Actual	% Shares	REF	% Shares	CES	% Shares	REF	CES
Coal	58.2	57.2	89.7	24.6	82.6	23.1	2.2%	1.8%
Natural Gas	19.5	19.2	146.9	40.3	95.3	26.6	10.6%	8.3%
Oil-based	2.5	2.4	0.3	0.1	0.5	0.1	-10.4%	-7.4%
Renewable	21.6	21.2	127.5	35.0	178.5	50.0	9.3%	11.1%
Total	**101.8**	**100.0**	**364.4**	**100.0**	**356.9**	**100.0**	**6.6%**	**6.5%**

Figure 4. Total Primary Energy Supply by Fuel: 2020; 2040 Reference Scenario; 2040 Clean Energy Scenario







2020 Actual: 56.4 MTOE
Self-Sufficiency: 52.6%

2040 REF: 155.6 MTOE
Self-Sufficiency: 51.1%

2040 CES: 144.8 MTOE
Self-Sufficiency: 59.9%

Fuel Type (TWh)	2020		2040				AAGR 2020-2040	
	Actual	% Shares	REF	% Shares	CES	% Shares	REF	CES
Coal	17.3	30.8	33.1	21.2	30.1	20.8	3.3%	2.8%
Natural Gas	3.3	5.8	26.5	17.0	16.8	11.6	11.0%	8.5%
Oil-based	16.5	29.2	56.4	36.2	51.5	35.5	6.4%	5.9%
Renewable	19.3	34.2	39.7	25.5	46.4	32.0	3.7%	4.5%
Total	**56.4**	**100.0**	**155.6**	**100.0**	**144.8**	**100.0**	**5.2%**	**4.8%**

This projection underscores the role of natural gas in a transitional energy system working towards a low-carbon economy. The lower AAGR for coal and oil implies that natural gas will be used to substitute for these other fossil fuels to satisfy future power generation demand.

Deemed as a transition or "bridge" fuel (see Box 1), natural gas is envisioned to adequately support renewable energy sources as the latter takes a significant share in the country's energy mix by 2040. This transition may prove to be challenging, however, as the Malampaya concession is set to expire in 2024 and a reduction in the production level is anticipated starting 2022. Several Gas Sales Purchase Agreements (GSPAs) are likewise expiring starting 2022. Although the current supply can go as far as 2027, the volume may not be enough to supply the requirements of the existing natural gas-fired power plants as well as to support future expansion of natural gas application in the industrial, commercial, residential, transport, and agriculture sectors.

To address this impending dilemma, the government, with the support of the private sector, has taken measures to transition the country into importing of liquefied natural gas (LNG) through the development of LNG facilities. To date, six (6) LNG terminal projects are in the pipeline, estimated at PhP 69.227 billion. The operation of these projects is expected between 2022 and 2025. These developments are expected to bring about energy security, ensuring the continued operation of the existing power plants being supplied by Malampaya.

Box 1

Natural Gas – A transitionary or "bridge" fuel

Lifetime GHG emission from natural gas for power generation is almost 50 percent less compared to coal, which is a convenient energy source due to its large reserves and low costs. Composed primarily of methane and higher alkanes, natural gas combustion and its derivative products also produce negligible particulate emissions and sulfur dioxides, as well as lower amounts of nitrogen oxides (Gouw, et al., 2014), leading to lower contributions to local air pollution relative to coal and oil-based fuels.

Given this, natural gas is regarded as a transitionary fuel towards variable renewable energy (VRE) sources. Gas-fired power plants have relatively quick start-up times and ramp rates, allowing them to adjust power output more quickly and ensure adequate balance of electricity supply and demand. These power plants are dispatchable and can be used by grid operators to supply reserve and balancing power, thus providing both operational and strategic flexibility (The Lantau Group, 2013). As such, adequate utilization of natural gas power plants can form part of a suite of solutions for ensuring power grid flexibility and permit higher shares of VRE sources, such as solar and wind, in the national energy mix (Speirs et al., 2020).

References:

Gouw, J. A. de, Parrish, D. D., Frost, G. J., & Trainer, M. (2014). Reduced emissions of CO2, NOx, and SO2 from U.S. power plants owing to switch from coal to natural gas with combined cycle technology. *Earth's Future, 2*(2). https://doi.org/10.1002/2013EF000196

Speirs, J., Vega, F. J., Machado, P. G., Giarola, S., Brandon, N., & Hawkes, A. (2020). *The flexibility of gas: What is it worth?* (Issue July, pp. 86–86). http://www.sustainablegasinstitute.org/flexibility-of-gas-worth/

The Lantau Group. (2013). *Philippines Natural Gas Master Plan Phase One Report: Assessment of the role of LNG within the Philippines energy market* (p. 139). https://www.doe.gov.ph/sites/default/files/pdf/downstream_natgas/first_report_naturalgasmasterplan.pdf

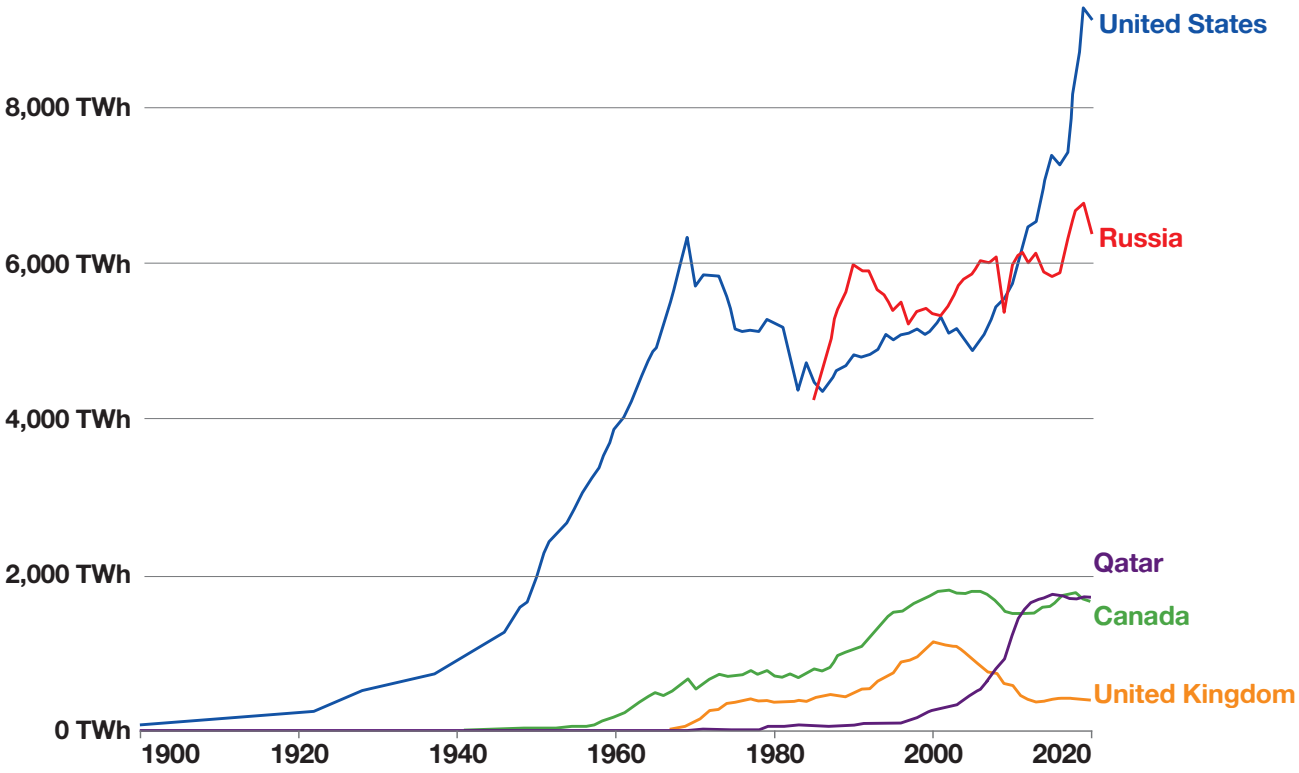
II. Natural Gas Demand and Outlook

A. GLOBAL NATURAL GAS MARKET

There is currently much uncertainty in the global gas market. Supply and demand during the COVID-19 pandemic were affected as economic activity across the world contracted. In addition, global oil and gas prices soared with the ongoing conflict between Russia and Ukraine. For the past few years, Russia is next to the United States when it comes to natural gas production; behind these countries are Qatar, Canada, and the United Kingdom (see Figure 5). The European region is heavily dependent on Russian export of natural gas, with 40 percent of their energy demand being supplied by the latter.

Photo courtesy of Tokyo Gas Co., Ltd.

Figure 5. Global historical production of natural gas

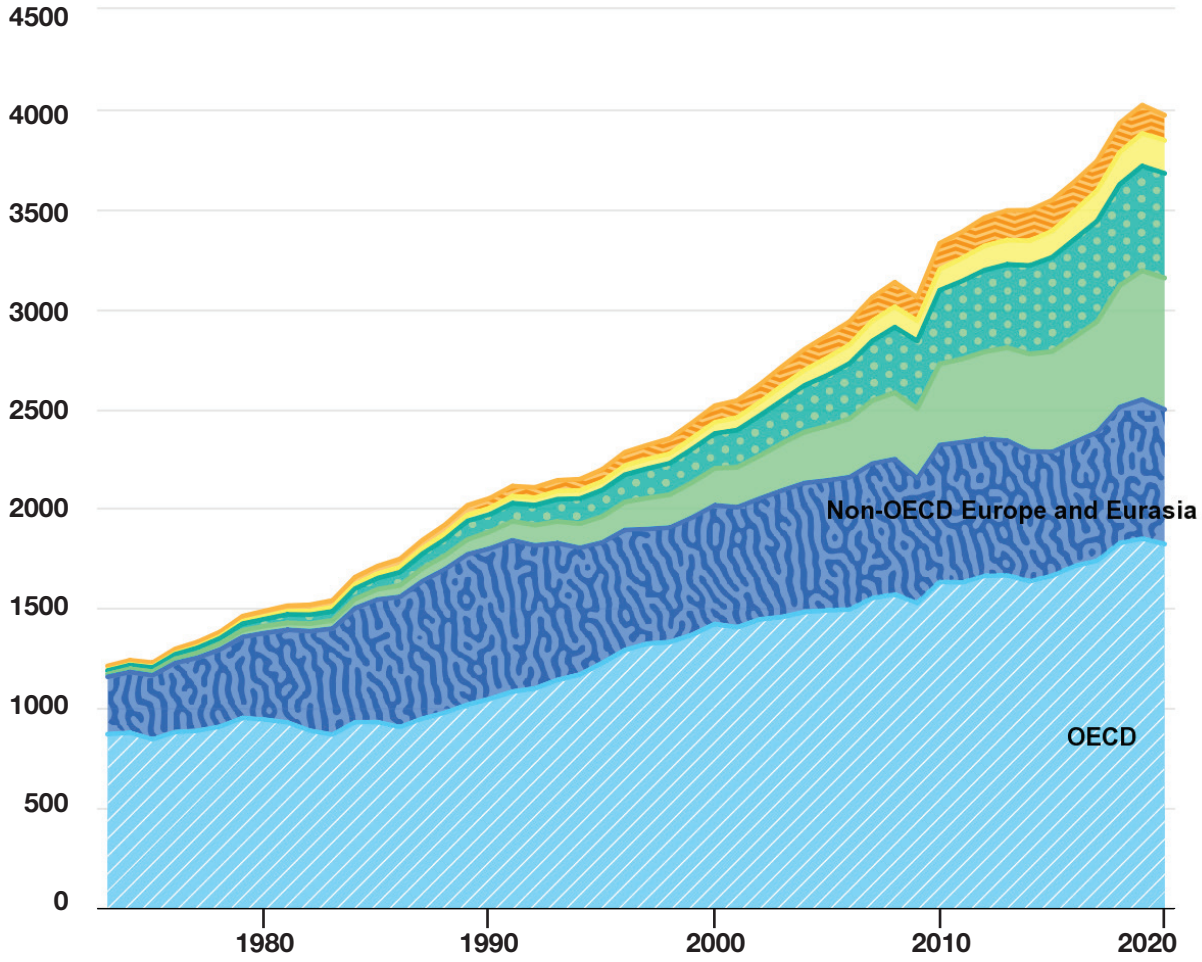


Data Source: BP, 2022; The Shift Project, 2022, as cited by Ritchie & Roser, 2020.

Similar to gas production, there has been an increasing demand over the years for natural gas.[2] The decline in demand in 2008 can be attributed to the economic financial crisis or the Global Financial Crisis (GFC) that year. In 2020, the global demand for natural gas fell by 1.2 percent to 3,970 billion cubic meters due to several months of limited economic activities owing to the pandemic. Figure 6 shows historical global natural gas demand by region.

[2]International Energy Agency. (2021, November 10). *World natural gas demand by region, 1973-2020.* https://www.iea.org/data-and-statistics/charts/world-natural-gas-demand-by-region-1973-2020

Figure 6. Global natural gas demand from 1973 to 2020



Data Source: International Energy Agency, 2021

As economies are slowly recovering, fossil fuel markets are now being strained. Fossil fuel prices have recently shot up as demand increases while supply has yet to return to normal. Global demand was set to rebound strongly by 3.6 percent from 2020 to 2021 due to the general recovery of the global economy from the COVID-19 pandemic. Continued but moderate demand increases are expected up to at least 2024, with global demand by then predicted to be up by 7 percent.[3]

Despite extreme market volatility, natural gas is still seen as the strongest-growing fossil fuel beyond 2030, projected to peak in 2037 but with an anticipated decline of 0.7 percent from 2035 to 2050. LNG, in particular, is expected to grow by 3.4 percent annually until 2035 owing to its transportability, followed by a slowdown to 0.5 percent annual growth from 2035 to 2050.[4]

[3]International Energy Agency. (2021, November 10). *World natural gas demand by region, 1973-2020.* https://www.iea.org/data-and-statistics/charts/world-natural-gas-demand-by-region-1973-2020
[4]McKinsey. (2021, February 26). *Global gas outlook to 2050.*

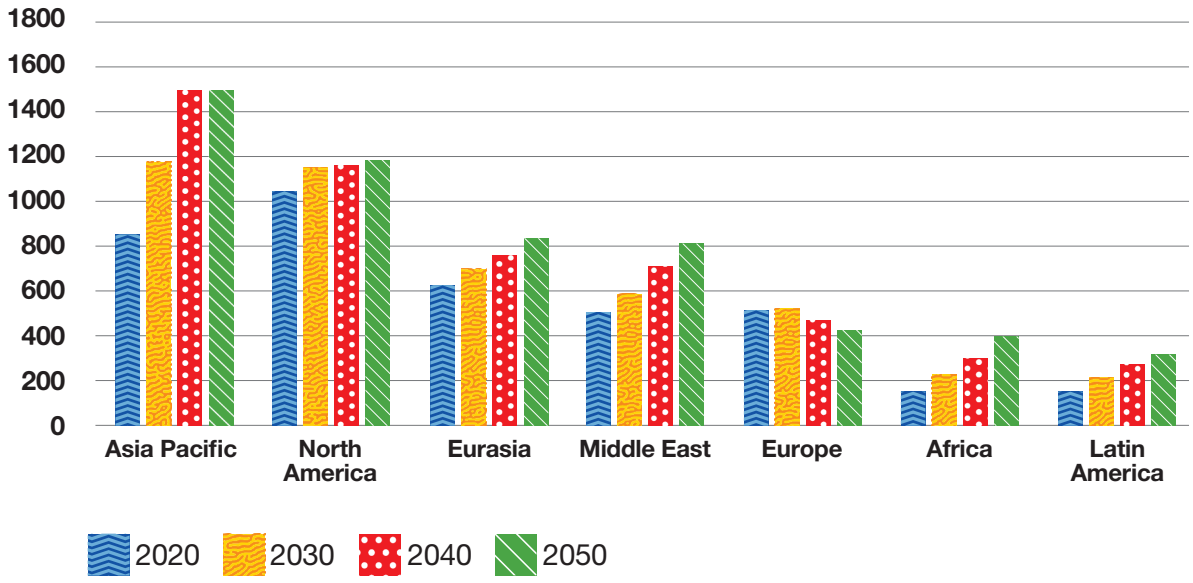
Possible drivers of future increases in demand include the utilization of natural gas to displace more polluting fuels, particularly in power generation for electric grids, transportation, and industry, although this would be more applicable for countries that are currently more reliant on energy sources with higher carbon emission intensities such as coal. However, economies that already heavily utilize natural gas will likely have to decrease their consumption in the coming years with mandates of fossil fuel usage peaking in 2025 in order to give a 50 percent chance to limit global warming to 1.5 degrees Celcius (°C) and a 67 percent chance to limit it to 2°C.[5] Notably, countries with the largest LNG markets such as China, Japan, South Korea and those in the European Union have carbon-neutrality policy thrusts, implying that even if overall natural gas utilization remains resilient, LNG pricing and access will likely change to account for carbon pricing and discouragement of high-emission projects.[6]

B. ASIA PACIFIC NATURAL GAS MARKET

The trend for natural gas demand is generally seen to increase, with the bulk of the increased demand to come from the rapidly-growing economies of the Asia Pacific.[7] Asia Pacific demand for natural gas is forecasted to grow rapidly, surpassing the demand in North America as early as 2030 (see Figure 7). This is critical to natural gas markets as Europe and Asia are competing for the same supply and will inevitably tighten the global gas market. Currently, coal accounts for about 50 percent of the energy mix in Asia Pacific. A policy shift towards emission reduction will contribute to natural gas investments to the detriment of coal and oil.

In Southeast Asia, the demand for natural gas has been traditionally attributed to the power sector. Around 55 percent in gas consumption since 2000 is due to power applications of natural gas. However, power generation contributions to total gas consumption are foreseen to drop by around 40 percent in 2040 with industrial demand seen as the main driver of future gas demand in the region.

Figure 7. Global natural gas demand trends by region



Data Source: Gas Exporting Countries Forum, 2022

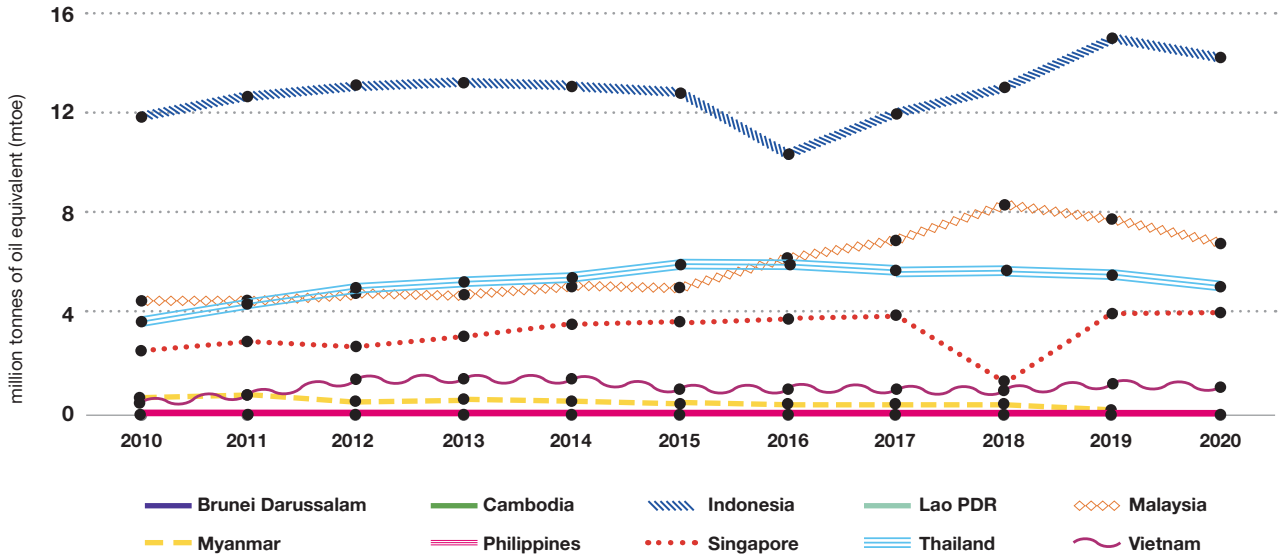
[5]Jim Skea, Priyadarshi R Shukla, Andy Reisinger, Raphael Slade, Minal Pathak, Alaa Al Khourdajie, Renée, van Diemen, Amjad Abdulla, Keigo Akimoto, Mustafa Babiker, Quan Bai, Igor Bashmakov, Christopher Bataille, Göran Berndes, Gabriel Blanco, Kornelis Blok, Mercedes Bustamante, Edward Byers, … Roberto Schaeffer. (2022). *Summary for Policymakers—Climate Change 2022: Mitigation of Climate Changes. Intergovernmental Panel on Climate Change.* https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_SummaryForPolicymakers.pdf

[6]McKinsey. (2021, February 26). *Global gas outlook to 2050.*

[7]Gas Exporting Countries Forum. (2022). GECF Global Gas Outlook 2050. Gas Exporting Countries Forum. https://www.gecf.org/insights/global-gas-outlook

Indonesia and Malaysia are considered as the largest natural gas consumers among the Association of Southeast Asian Nation (ASEAN) countries, accounting for around 66.2 percent of the region's gas consumption in 2020 (see Figure 8). Similar to other regions, the reduction in the ASEAN's gas consumption in 2020 can be attributed to the impacts of COVID-19. Furthermore, coal became increasingly competitive in Malaysia compared to natural gas for power generation which explains the downward trend since 2018.[8]

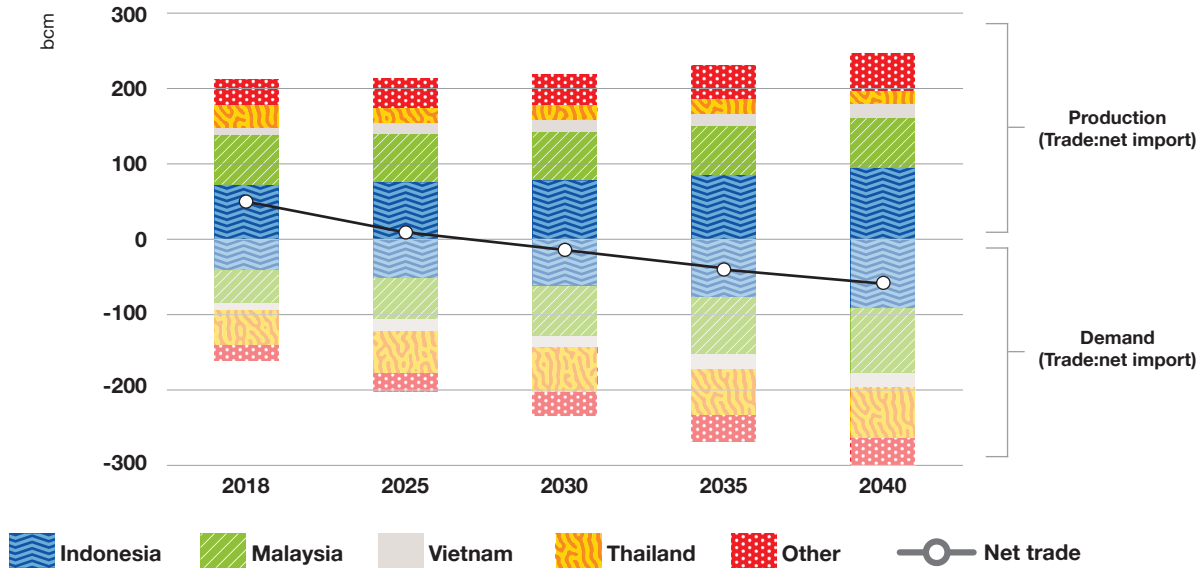
Figure 8. Historical natural gas consumption of ASEAN countries from 2010 to 2020



Data Source: Suwanto, 2021

Natural gas production in Southeast Asia is projected to increase by around 20 percent to 250 billion cubic meters (bcm) by 2040.[9] Demand is expected to reach 300 bcm in the same timeframe, requiring the Southeast Asian region to also rely on imports to adequately meet demand (see Figure 9).

Figure 9. Projected natural gas demand and production in Southeast Asia



Note: bcm = billion cubic metres.

Data Source: International Energy Association, 2019

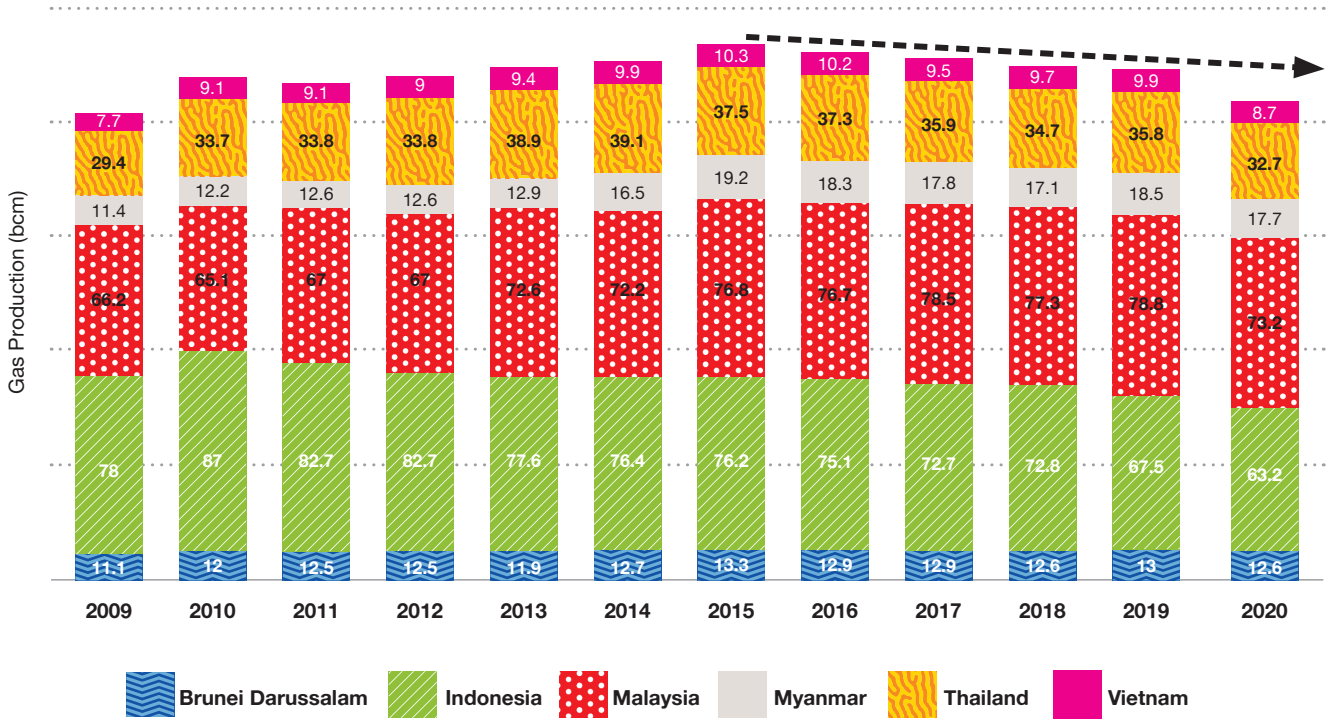
[8]Suwanto, B. S. (2021). *ASEAN Oil and Gas Updates*. ASEAN Centre for Energy. https://aseanenergy.org/asean-oil-and-gas-updates-2021/
[9]International Energy Agency. (2019). *Southeast Asia Energy Outlook 2019*. International Energy Agency. https://iea.blob.core.windows.net/assets/47552310-d697-498c-b112-d987f36abf34/Southeast_Asia_Energy_Outlook_2019.pdf

The main contributor of growth in the region is Indonesia as its natural gas investments are projected to keep up with the rising demand. Despite growth during the previous decade, gas production in Malaysia is expected to flatline in the coming years. The decreasing production seen in Thailand gas production in the last decade is expected to continue, eventually halving by 2040, even as Thailand remains the third-largest producer in ASEAN. Meanwhile, the Philippines is progressing towards becoming an importer given the impending depletion of the Malampaya gas field that serves as the country's primary indigenous source of natural gas.[10]

Declining gas reserves represents a significant challenge for increasing production, given that proved gas reserves dropped by 35.1 percent from 2010 to 2020 (see Figure 10). Strategic plans to better secure energy supply include the following steps[11]:

- support for gas field discovery
- support for gas infrastructure development, specifically for LNG facilities
- gas resource management such as well service and well workovers
- diversification of energy sources with inclusion of renewables
- business models for high carbon dioxide (CO2) gas fields
- exploration of non-conventional hydrocarbon technologies

Figure 10. Historical natural gas production of ASEAN countries from 2009 to 2020



Data Source: Suwanto, 2021

It is important to note that the gas outlook largely depends on policies set by various governments. Policies made to curtail greenhouse gas emissions will favor renewable energy sources and use of carbon capture technologies, while if maximum power generation is the priority, cheap sources like coal are advantageous. However, the rapid drop in renewable energy generation costs coupled with the need for GHG emissions to peak by 2025 represents downward pressure on future consumption

[10]Suwanto, B. S. (2021). *ASEAN Oil and Gas Updates. ASEAN Centre for Energy*. https://aseanenergy.org/asean-oil-and-gas-updates-2021/
[11]Suwanto, B. S. (2021). *ASEAN Oil and Gas Updates. ASEAN Centre for Energy*. https://aseanenergy.org/asean-oil-and-gas-updates-2021/

of fossil fuels.[12] Based on the ever-increasing urgency to decarbonize, gas will likely comprise a lower share in the regional power mix, dropping from 30 percent currently to 25 percent by 2040. This drop in the energy mix can occur even as natural gas consumption and production are expected to increase in the same time period.

C. PHILIPPINE NATURAL GAS MARKET

The Philippine natural gas consumption is expected to reach at least 16.8 MTOE for power generation and 0.05 MTOE for non-power applications by 2040,[13] with growth mainly driven by the displacement of coal and oil-based fuels in power generation and greater use of gas-fired power plants as sources of balancing power.

Reductions in production levels are anticipated starting in 2022, with the Malampaya concession expiring by 2024. While the gas field will continue to produce significant amounts of natural gas until 2027, the impending depletion of the Malampaya gas fields, ongoing lack of LNG infrastructure, price volatility due to geopolitical and other international issues,[14] and the increasing urgency to reduce coal and oil-based fuel utilization are providing a high level of uncertainty for potential investors and industry stakeholders,[15] given the possibility of stranded assets should projected demand fail to pan out.

The declining output of Malampaya will require the country to source natural gas through international LNG trade as indigenous supply may not be able to keep up with consumption. LNG importation requires infrastructure for receiving, storing, and processing. This underscores the need to further develop the downstream natural gas industry to incorporate LNG operations. This development is guided by DOE Department Circular (DC) 2017-11-0012, which mandates a regulatory framework for market creation and project permits (see Section III for more details).

Apart from LNG importation infrastructure, resource exploration to find additional sources of indigenous natural gas is also necessary. Currently, further evaluation of prospective sedimentary basins under a Joint Study Agreement between the DOE and Philippine National Oil Company -Exploration Corporation (PNOC-EC) is being conducted. With the lifting of the moratorium on West Philippine Sea resource exploration, the DOE expects future drilling operations in six oil prospects and five gas prospects, potentially increasing recoverable reserves of up to 67 million barrels (MMB) of oil and 3.5 trillion cubic feet (TCF) of gas. As of writing, there are 15 applications received under the Philippine Conventional Energy Contracting Program (PCECP), with four (4) new Service Contracts (SCs) already endorsed to the Office of the President and another four (4) under evaluation.

Ultimately, growth in natural gas demand is expected in the next few years, despite the various factors introducing uncertainty. As more projects for securing gas supply become online, reliability of supply is expected to improve. Through sound decision-making initiatives and the careful use of natural gas to replace more polluting fuels, the Philippines' transition to clean energy may be facilitated.

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[12]Jim Skea, Priyadarshi R Shukla, Andy Reisinger, Raphael Slade, Minal Pathak, Alaa Al Khourdajie, Renée, van Diemen, Amjad Abdulla, Keigo Akimoto, Mustafa Babiker, Quan Bai, Igor Bashmakov, Christopher Bataille, Göran Berndes, Gabriel Blanco, Kornelis Blok, Mercedes Bustamante, Edward Byers, … Roberto Schaeffer. (2022). *Summary for Policymakers—Climate Change 2022: Mitigation of Climate Changes.* Intergovernmental Panel on Climate Change.

[13]Department of Energy. (2021). *Philippine Energy Plan 2020-2040.* Department of Energy. https://www.doe.gov.ph/pep

[14]Turaga, U., Thanos, A. D., & Burman, D. X. (2021). LNG Pricing and Market Opportunities in the Philippines. United States Agency for International Development. https://pdf.usaid.gov/pdf_docs/PA00XQNC.pdf

[15]Reynolds, Sam (2021). No Guaranteed Future for Imported Gas in the Philippines. Institute for Energy Economics and Financial Analysis. http://ieefa.org/wp-content/uploads/2021/05/No-Guaranteed-Future-for-Imported-Gas-in-the-Philippines_May-2021.pdf

III. Existing Legal Framework on Natural Gas

The legal framework that provides guidance and incentives for the development of the Philippine Downstream Natural Gas Industry (PDNGI). It is consisted of a number of administrative orders and department circulars. Table 1 provides an overview of these supporting regulations and policies. A detailed discussion on the Philippine Downstream Natural Gas Regulation (PDNGR) follows.

Photo courtesy of Tokyo Gas Co., Ltd.

Table 1. Policies that guide the Philippine Downstream Natural Gas Industry (PDNGI)

Policy/Regulation/Law	Details
Administrative Order No. 38	Provides institutional strengthening to the DOE by redefining the functions and services of its bureaus. This included the creation of the Oil Industry Administration Bureau (OIAB), now known as the Oil Industry Management Bureau (OIMB), mandated to formulate and implement policies, programs, and regulations for the downstream oil industry including the natural gas industry
Executive Order No. 66, Series of 2002	Designates the DOE as the lead agency in developing the Philippine Natural Gas Industry
The Philippine National Standards (PNS)/DOE Quality Standards (QS) 011: 2016 - Petroleum gases – Natural gas – Quality specification	Provides the quality specification for Natural Gas promulgated by the Philippine Bureau of Product Standards
DOE Department Circular 2019-02-0004 - Implementing the Natural Gas Quality Standard for all-Natural Gas Supply in the Philippines	Supports the implementation of the Natural Gas Quality Standard (i.e. PNS/DOE QS 011: 2016), mandating compliance from all entities engaged in the business of importing, trading, supplying, and distributing of natural gas to end-users in the Philippines
Republic Act (RA) No. 11032 - Ease of Doing Business	Promotes the simplification of requirements and procedures to reduce red tape and to expedite business- and non-business-related transactions in the government. Under this law, each government agency, including the DOE, shall classify their processes or services into simple, complex, and highly technical transactions and must submit the same to the DOE based on the criteria provided. Highly technical transactions such as those concerning LNG facilities shall in no case be processed longer than twenty (20) working days, or as determined by the government and instrumentality concerned
RA No. 9136 - Electric Power Industry Reforms Act (EPIRA) of 2001.	Provides a framework for the restructuring of the electric power industry, including the privatization of the assets of National Power Corporation (NPC), the transition to the desired competitive structure, and the definition of the responsibilities of the various government agencies and private entities
Executive Order No. 30 – Establishment of the Energy Investment Coordinating Council (EICC)	Simplifies and harmonizes the approval process that will facilitate the development of energy projects of national significance (EPNS) while upholding transparency and accountability among concerned agencies (see Section IV.B.1. for more details)
RA No. 11234 – Establishment of the Energy Virtual One-Stop Shop (EVOSS)	Streamlines the permitting process of power generation, transmission, and distribution projects through an online platform where government agencies could coordinate and eliminate duplication, redundancy, and overlapping mandates in documentary submissions and processes (see Section IV.B.1. for more details)

Policy/Regulation/Law	Details
Department of Interior and Local Government (DILG)-DOE Joint Memorandum Circular No. 2020-01 (dated April 30, 2020)	Guides the local government units (LGUs) to facilitate the implementation of energy projects. It harmonizes and fast-tracks the implementation of the EVOSS Act, EODB Act, EO 30, and AO 23, with the establishment of unified and streamlined permitting process

Bilateral agreements and cooperation also contribute to the developments in the legal and regulatory framework of PDNGI. These include: 1) Memorandum of Agreement (MOA) between DOE and the Department of Trade and Industry-Bureau of Philippine Standards (DTI-BPS) for the development of PNS on product, facility, and code of practice; 2) Memorandum of Understanding (MOU) to facilitate the operations of the Philippine Inter-Agency Health, Safety, Security, Environment Inspection and Monitoring Team (PIA-HSSE-IMT); 3) MOU between the DOE and the MAN Energy Solutions; and 4) MOA between the DOE and the U.P. Statistical Center Research Foundation Inc. (UPSCRFI).

The Philippine Downstream Natural Gas Regulation

The DOE, in consultation with relevant government agencies and private stakeholders, issued, adopted, and promulgated **Department Circular No. DC-2017-11-0012**, also known as the **Philippine Downstream Natural Gas Regulation (PDNGR)** to ensure long-term energy security beyond Malampaya's ability to fuel the existing gas power plants. The circular establishes regulations appertaining to: siting, design, construction, expansion, rehabilitation, modification, operation, and maintenance of the PDNGI value chain with a view to enabling its development into a mature market.

Declaration of Policy. Designed to promote and develop the PDNGI Value Chain by putting in place a system of competition, transparency and fair trade. The PDNGR likewise aims to ensure compliance with global and Philippine health, safety, security and environmental standards and best practices in all the activities of the said industry value chain.

DOE Responsibilities. Under the PDNGR, the DOE is given the overall responsibility of promoting and supervising the development and operation of downstream natural gas projects and facilities in the Philippines. This includes, but not limited to, the evaluation of downstream natural gas project applications, the issuance of Notice to Proceed (NTP), Permit to Construct/Expand/Rehabilitate/Modify (PCERM), Permit to Operate and Maintain (POM), Importer's or Supplier's Accreditation Certification, Acknowledgement to Import Liquefied Natural Gas (ATI-LNG), and Acknowledgement to Supply and Transport Natural Gas (AST-NG). The DOE is likewise mandated to issue directives to qualified government agencies as investing arms that will spearhead the development of the said value chain.

The circular allowed for the creation of committees to help in its implementation (see Table 2). If necessary or if recommended by the Downstream Natural Gas Review and Evaluation Committee (DNG-REC), the DOE may enter into an MOA or Joint Circulars with concerned heads of the PIA-HSSE-IMT member agencies to carry out their respective responsibilities.

Table 2. Committees and councils created by the PDNGR and other laws that play a role in the PDNGI.

Name of councils/ Committee/Team	Role in PDNGI	Composition
DNG-REC	Evaluates applications and recommend the issuance of NTP, among other permits, for the committee secretary's approval; work in coordination with the PIA-HSSE-IMT	Chair: DOE-OIMB Supervising Undersecretary Vice Chair: DOE-OIMB Supervising Assistant Secretary Members: OIMB Director, Legal Service Director, Financial Services Director
PIA-HSSE IMT	Conducts inspection and monitoring of downstream natural gas facilities	Chaired by DOE

Downstream Natural Gas Facility. The circular covers the regulation of LNG terminal facilities, natural gas pipelines, and transmission- and/or distribution-related facilities (e.g. processing plants, interconnections, and natural gas refilling stations--including indigenous natural gas facilities). The units or elements included in these facilities are shown in Table 3.

Table 3. Units or elements in facilities covered by the PDNGR

LNG Terminal	Pipelines	Transmission and/or Distribution-Related Facilities	Indigenous Natural Gas Facility
• Jetty and Unloading/ Loading arms; • Cryogenic pipelines; • Storage Tanks; • Send-out System; • Low- and High-Pressure pumps; • Boil-off Gas (BOG) compressors and re-condensers; • Vaporizers; • Metering; • Other relevant components	• Transmission pipelines • Distribution (including Spur lines) • Other relevant components	• Processing plants; • Facilities for pipeline interconnections and metering; • Natural Gas Refilling stations; • Other relevant components	• Pipelines and related facilities used to transport indigenous natural gas

Permits and Acknowledgments. Any entity intending to implement a downstream natural gas project shall obtain a permit depending on the activity or the level of development of the project. There are eight (8) permits required under the PDNGR: the Notice to Proceed (NTP) if the entity is intending to start a project, the Permit to Construct/Expand/Rehabilitate/Modify (PCERM), Permit to Operate and Maintain (POM), LNG Importer Accreditation Certificate (LNG-IAC), and Natural Gas Supplier Accreditation Certificate. There are likewise two (2) notification requirements which require acknowledgement from the DOE: (1) Acknowledgement to Import LNG (ATI-LNG) and (2) Acknowledgment to Supply and Transport Natural Gas (AST-NG). These permits have to be approved by the DOE Secretary upon the recommendation of the DNG-REC, based on their compliance with documentary requirements and technical, legal, and financial considerations, including consistency with the PDNGR declaration of policies and compliance with the Philippine Competition Law (RA 10667).

Natural gas may be sourced locally or imported as LNG. LNG terminal operators are to ensure the accommodation of both indigenous and imported LNG. Furthermore, plans to upgrade the terminals into international trading and transshipment hubs will be supported by the DOE.

Gas sale and purchase agreements involving the government's share in indigenous natural gas production will be negotiated and subsequently approved by the DOE Secretary or a representative. Thereafter evaluation and recommendation from the Upstream Conventional Resource Review and Evaluation Committee and the DNG-REC may be considered in the decision process.

The periods, fees, and application procedures for the issuance of permits as well as mechanisms for the modification of any condition in the permits are likewise specified in the circular. DC2002-07-004, also known as the Rules of Practice and Procedure, governs any legal proceeding relative to the application, interpretation, and implementation of the PDNGR.

Table 4 shows a list of permits that PDNGI players need to secure before embarking on a project or before starting an activity. Meanwhile, Table 5 describes the guidelines provided in the PDNGR for the information and guidance of applicants. Many of these permits require clearances and certifications from several other government agencies and local government units.

Table 4. List of permits, certificates, and acknowledgments

Permits/Certificates/ Acknowledgement	Description
NTP	Issued to an applicant who is deemed to have the technical, legal, and financial means to proceed with its proposed downstream natural gas project
PCERM	Issued to an applicant upon compliance with the requirements for the permit to construct/expand/rehabilitate/modify a downstream natural gas facility
POM	Issued to an applicant upon verification of completion of the construction, expansion, rehabilitation, or modification of the downstream natural gas facility and upon compliance to testing and commissioning and other requirements
LNG Importer Accreditation Certificate (LNG-IAC)/Natural Gas Supplier Accreditation Certificate	Issued to an LNG importer and supplier compliant with the Importer and Supplier Accreditation Guideline
ATI-LNG	Issued to qualified importers of LNG
AST-NG	Issued to qualified suppliers and transporters of natural gas

Table 5. List of guidelines

Guidelines/Registry	Description or Reference
Permit Application Guideline	Guide to documentary and other requirements for those applying for notice to proceed (NTP), permits to construct/expand/ rehabilitate/modify (PCERM), and permit to operate and maintain (POM) downstream natural gas facilities. (PDNGR Annex A)
Importer and Supplier Accreditation Guideline	Guide to documentary and other requirements for anyone who intends to import, supply, and/or transport natural gas. (PDNGR Annex C)
Operator and Facility Registry	Register of natural gas facility operators, their buildings, facilities, equipment and activities, including their management profile. (PDNGR Annex B)
Reportorial Requirements Guideline	Guide on the required reports submitted by natural gas facility operators to be submitted to the OIMB for supervision and monitoring. (PDNGR Annex B)
Third Party Access Guidelines	For subsequent issuance based on the Third-Party Access Guiding Principles (Rule 8 Section 1)

Franchise. Rules on franchise requirements, particularly for the transmission and/or distribution pipelines that function as public utilities, require a congressional franchise and certificate of public necessitate or similar legislative authorization. Additionally, the DOE, in coordination with the Energy Regulatory Commission (ERC), is responsible for fixing and regulating the rates or schedule of prices for the usage of these pipelines.

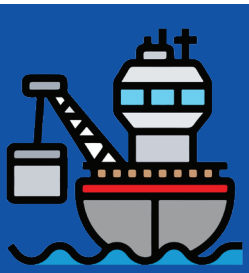
Third Party Access. To guide the formulation of Third-Party Access (TPA) Guidelines, a set of guiding principles was laid down in the PDNGR in order to encourage competition; support foreign and local investments in energy supply and infrastructure; promote diverse and sustainable energy sources; ensure transparency, among others. An infrastructure development period during which operators are exempted from TPA is provided to encourage initial capital investment.

Competition and Natural Gas Retail Pricing. Guiding principles are likewise provided in the PDNGR to promote competition. Specifically, the PDNGR prohibits concerted practices and agreements to fix prices and/ or production output; and practices that undermine competition. Also provided are rules on cross-ownership and natural gas retail pricing.

Facility, Product & Safety Practice Standards. To ensure safety in the LNG workplace and the public, the PDNGR stipulates regulations that focus on compliance with applicable Philippine and global standards in the natural gas industry, including critical safety conditions of the LNG ships, LNG facilities, pipelines, and other transmission and related distribution facilities.

The circular likewise stipulates the operators' responsibility in maintaining gas quality in accordance with Philippine and global standards and relevant standards for gas measurement. Operators are required to submit environmental, occupational health & safety, and facility risk assessment and management plans, together with disaster/emergency preparedness and response plans.

To ensure compliance with the abovementioned requirements, the PDNGR lists the responsibilities of the operator and those of the DNG-REC.



Overview of the Philippine Downstream Natural Gas Regulation (PDNGR)

General Provisions

Establishes regulations relevant to siting, design, construction, expansion, rehabilitation, modification, operation, and maintenance of the PDNGI Value Chain with a view to enabling its development into a mature market.

Declaration of Policy

- Promote and develop the PDNGI Value Chain
- Put in place a system of competition, transparency and fair trade
- Ensure compliance with global and Philippine health, safety, security and environmental standards and best practices in all PDNGI-related activities

DOE Responsibilities

Promote and supervise the development and operation of downstream natural gas projects and facilities in the Philippines, including the evaluation of downstream natural gas project applications:

- Notice to Proceed (NTP)
- Permit to Construct/Expand/Rehabilitate/ Modify (PCERM)
- Permit to Operate and Maintain (POM)
- Importer's or Supplier's Accreditation Certification, Acknowledgement to Import Liquefied Natural Gas (ATI-LNG)
- Acknowledgement to Supply and Transport Natural Gas (AST-NG)

Facilities Covered

- LNG Terminal facilities
- Natural gas pipelines
- Transmission and/or distribution-related facilities

Scope

The PDNGR applies to the overall monitoring and supervision of PDNGI-related activities and industry compliance to policies, rules, standards, and best practices on:

- Areas of siting, design, construction, expansion, modification, operation and maintenance of any natural gas project
- The importation of LNG and the supply and transport of imported LNG or liquefied indigenous natural gas
- Third-party access
- The development of the Philippines as an LNG trading and transshipment hub for the Asia-Pacific region

Permits, Certificates, and Acknowledgments

Eight (8) main permits and two (2) notification requirements required under the PDNGR:

1. Notice to Proceed
2. Permit to Construct
3. Permit to Expand
4. Permit to Rehabilitate
5. Permit to Modify
6. Permit to Operate and Maintain
7. LNG-Importers Accreditation Certificate
8. Natural Gas Supplier Accreditation Certificate
9. ATI-LNG
10. AST-NG

IV. Development Plans and Programs

A. ONGOING NATURAL GAS PROJECTS

The private sector is a crucial partner in the development of the country's natural gas sector, especially with regard to the construction of the required infrastructure such as the LNG import receiving terminals. With the imminent depletion of the Malampaya gas field and without an immediate indigenous gas replacement, putting up such terminals has become a chief priority in order to continuously supply the demand of the existing natural gas power plants. Moreover, the successful operations of these LNG terminals will be a pivotal step towards establishing the country as an LNG trading and trans-shipment hub, addressing not only the country's energy needs but also that of the Asia-Pacific Region.

As of December 2021, the DOE has already approved the application of six (6) LNG terminal projects (see Annex A). The proposed projects are envisioned to start operations between 2022-2025.

Photo courtesy of First Gen Corporation

The full version of the GPDP's Investors' Guide is available in Annex B

Note: Requirements and processes indicated in this guide are subject to change based on the PDNGR updates and the adoption of concerned government agencies of the GPDP's Proposed Regulatory Process

Status of LNG Projects[16]. Among the LNG import terminal projects, one (1) is expected to be completed and operational by 2022— the Linseed Field Corporation. The Energy World Corporation (EWC) and FGen LNG Corporation have proposed commercial operation target of March 2023.

Overall Investment and Potential Capacity. These LNG terminal projects have a total estimated investment of PhP69.227 billion (USD 1.357 billion)[17]. Based on the Philippine Energy Plan's (2022-2040) Energy Demand and Supply Outlook, the country's LNG terminal capacity requirement is projected to reach 24.6 MTPA by 2040 under REF and 15.6 MTPA under CES. As such, the 21.766 MTPA total potential capacity of these projects could provide the natural gas requirements in both scenarios.

Location of the LNG Projects. Most of the LNG terminal projects are found in Batangas, with close proximity to the existing anchor markets of the Malampaya. The proposed project in Quezon, on the other hand, will be able to supply potential markets in the area and nearby provinces. The ongoing projects are all concentrated in Luzon, the island with the highest demand for natural gas. Nonetheless, some investors have likewise been signifying their interests to develop LNG facilities in Visayas and Mindanao regions.

B. INVESTORS' GUIDE

The development of critical LNG infrastructures requires sizeable capital investments; thus, the government has been determined in creating a conducive business environment to encourage keen involvement from the private sector. This section of the Natural Gas Development Plan (NGDP) aims to provide guidance to investors with regard to the policies put in place to facilitate investments and incentives that are made available to them. The full primer on LNG project applications, including the documentary requirements and forms needed for the various permit applications in setting up and operating liquified natural gas facilities, may be found in Gas Policy Development Project's (GPDP) Investors Guide.

- **RA No. 11032 - Ease of Doing Business and Efficient Government Service Delivery Act of 2018**

RA 11032 promotes the simplification of requirements and procedures to reduce red tape and to expedite business- and non-business-related transactions in the government. Under this law, each government agency, including the DOE, shall classify their processes or services into simple, complex, and highly technical transactions and must submit the same to the DOE based on the criteria provided. Highly technical transactions such as those concerning LNG facilities shall in no case be processed longer than twenty (20) working days, or as determined by the government and instrumentality concerned.

[16]Based on May 2022 status
[17]Based on USD 1 = Php 51.00

• RA No. 11234 - An Act Establishing the EVOSS for the Purpose of Streamlining the Permitting Process of Power Generation, Transmission and Distribution Projects

The EVOSS Act aims to ensure timely completion of power generation, transmission, or distribution projects by eliminating duplication, redundancy, and overlapping mandates in documentary submissions and processes by supplying an online platform for government agencies to coordinate and share information. It also hopes to provide a paperless and electronic application and processing system which serves as a single gateway through which proponents can access all information necessary in the application for new generation, transmission or distribution project, submit all requirements related to the application, and monitor the approval of such application.

• Executive Order No. 30 - Creating the EICC

EO 30 specifies the creation of an EICC that will spearhead and coordinate national government efforts to harmonize, integrate, and streamline regulatory processes, requirements, and forms relevant to the development of energy investments in the country, primarily with regard to EPNS. EPNS possess any of the following attributes:

1. Significant capital investment of at least Php 3.5 billion;
2. Significant contribution to the country's economic development;
3. Significant consequential economic impact;
4. Significant potential contribution to the country's balance of payments;
5. Significant impact on the environment;
6. Complex technical processes and engineering designs; and/or
7. Significant infrastructure requirements

Presumption of Prior Approvals. The EICC and all government agencies in charge of issuing permit applications for EPNS shall act on the presumption that relevant permits from other agencies had already been complied with by the project. Government agencies shall process the permit applications without awaiting the action of any other agency.

Processing of Applications. The EICC and all government agencies shall inform the applicants in writing whether applications are approved or rejected within thirty (30) days after receiving the complete documentary requirements. In case no decision was made within 30 days, the approving authority may no longer deny the application and shall issue the relevant permit within five (5) working days after the thirty-day timeframe. In addition, the EICC may call for assistance from any agency and local government in performing its functions with respect to the processing of permits for EPNS.

• Omnibus Investments Code (OIC) and the CREATE Law

The OIC of 1987 provides fiscal and non-fiscal incentives to domestic and foreign investors on preferred activities of investment as listed in the 2017 Investment Priorities Plan (IPP) of the Bureau of Investments (BOI). Under infrastructure and logistics, LNG storage and regasification facilities and pipeline projects for oil and gas are included in the list of preferred activities. In addition, power generation projects using natural gas are also included under the area of energy.[18]

In 2020, the Specific Guidelines of IPP on LNG Storage and Regasification Facility under the Infrastructure and Logistics Including LGU-Public-Private Partnerships (PPPs) have been amended through the BOI Memorandum Circular 2020-014[19]. As stated in the Circular, LNG Storage and Regasification Facility shall cover:

[18]See Board of Investments Memorandum Circular No. 2017-004.
[19]See BOI Memorandum Circular 2020-014. https://boi.gov.ph/wp-content/uploads/2020/12/MC-2020-014-LNG-PhilStar-2.pdf

- Establishment and operation of natural gas storage and regasification facilities in accordance with relevant Philippine National Standards
- LNG regasification plants located on land and/or floating barges

It also stated the qualifications for registration, including:

- Must cater to power plants, industrial plants, commercial establishments, etc.
- Must cater to at least one (1) clientele, other than the proponent's own business

The passage of RA No. 11534, otherwise known as the Corporate Recovery and Tax Incentives for Enterprises (CREATE) Act updated the incentives for sectors and industries included in the IPP. Noting its critical role in industrial development, LNG storage and regasification facility remained on the list of preferred activities.

Once registered with the BOI, the CREATE law provides the following incentives[20]:

1. Income Tax Holiday (ITH) – 4 to 7 years
2. 5 percent Special Corporate Income Tax (SCIT) based on Gross Income Earned, in lieu of all national and local taxes – 5 to 10 years
3. Enhanced deductions
   - Depreciation allowance of assets additional 10 percent for buildings; and additional 20 percent for machineries and equipment
   - 50% additional deduction on labor expense
   - 100% additional deduction on research and development
   - 100% additional deduction on training expense
   - 50% additional deduction on domestic input expense
   - 50% additional deduction on power expense
   - Deduction for reinvestment allowance to manufacturing industry – the amount reinvested to a maximum of 50 percent
   - Enhanced Net Operating Loss Carry-Over
4. Duty exemption on importation of capital equipment, raw materials, spare parts, or accessories
5. Value-added tax (VAT) exemption on importation and VAT zero-rating on local purchases

The CREATE law was passed in response to the COVID-19 pandemic as a fiscal relief to domestic and foreign corporations doing business in the Philippines.

• Import Duty Exemption

Republic Act No. 1937 also known as the Tariff and Customs Code of the Philippines (TCCP) 20 governs the tariff implementation of the country. The TCCP (Section 104 in particular) also provides the tariff schedule and duties imposed on goods and articles entering the country.

Tariff rates are generally levied in ad valorem form and depend on existing regional and bilateral trade agreements. Currently, duty rates are classified in either one of the two (2) most widely implemented tariff schedules as per the TCCP – the (1) Most Favored Nation (MFN) and (2) ASEAN Trade in Goods Agreement (ATIGA). Under the MFN, rate ranges from zero to thirty percent (0-30%). On the other hand, under the ATIGA, ASEAN member states including the Philippines, agreed to impose an import duty

[20]Echague, Raquel. 2021. Registration of Energy and Energy-Related Projects Under the CREATE Law. Board of Investments presentation. https://www.doe.gov.ph/sites/default/files/pdf/e_ipo/3_Impact%20of%20the%20CREATE%20Law%20on%20Energy%20Projects.pdf?withshield=1

of zero percent (0%) on ninety- nine percent (99%) of all products listed in their Inclusion List (IL).[21]

In addition to the rate schedule, the Philippines is implementing the 2017 ASEAN Harmonized Tariff Nomenclature (AHTN) in naming and classifying imported goods. This classification system is also followed by other ASEAN member states – Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Singapore, Thailand, and Vietnam – to facilitate smoother trade flow in the region.

Section V, Chapter 27.11 of the 2017 AHTN focuses on natural gas and classifies it in liquid and gaseous states as one of the import/ export products given a zero percent (0%) rate of duty both under the MFN and ATIGA. This free import duty is granted to all ASEAN member states.

- **Excise Tax Exemption**

The Tax Reform for Acceleration and Inclusion (TRAIN) Act exempts locally-extracted or indigenous natural gas in liquid and gas forms from any excise tax.[22] This Act amended Republic Act No. 8424 or the National Internal Revenue Code (NIRC), which previously imposed an excise tax rate of two percent (2%) on locally-extracted natural gas (gas and liquid). This excise tax exemption also came after the restructuring of excise tax levied on petroleum products as provided in Bureau of Internal Revenue (BIR) Regulation No. 8-96 or the "Act Restructuring the Excise Tax on Petroleum Products, Reclassifying Natural Gas and Liquefied Natural Gas under Non-Metallic Mineral and Quarry Resources and Reducing the Excise Tax on Indigenous Petroleum."

C. PROPOSED REGULATORY PROCESS[23]

The Proposed Regulatory Process (PRP), one of the key outputs of the GPDP 2 under its Technical Assistance Component, provides technical guidance for the effective and efficient implementation of the PDNGR and related policies that incorporate globally accepted codes, standards, and best practices. This review of regulatory process included eleven (11) regulatory agencies and two (2) local government units namely: Department of Environment and Natural Resources – Environment Management Board (DENR-EMB); Laguna Lake Development Authority (LLDA), Department of Labor and Employment – Bureau of Working Conditions (DOLE-BWC), BOC, Philippine Ports Authority (PPA), Philippine Coast

The full version of the GPDP's Proposed Regulatory Process is available in Annex C

[21] See Chapter VII on tariff and customs duties of National Tax Research Center (NTRC) 2016 Guide to Philippine taxes.
[22] See Bureau of Internal Revenue (BIR) Index for excise tax.
[23] This section provides an overview of the GPDP's Proposed Regulatory Process, one of the key outputs of the project under its Technical Assistance Component. The GPDP technical team members includes: Engr. Carl Chester Ragudo and Prof. Ulpiano Ignacio, Jr. (Civil & Geotechnical Engineering); Engr. Michelle Batad and Dr. Allan Nerves (Electrical Engineering); Engr. Jennelyn Zapanta and Dr. Joseph Gerard Reyes (Mechanical Engineering); Engr. Georgia Asistin, Prof. Paul Rodgers (Marine Engineering) and Dr. Eric Cruz (Coastal and Port Engineering); Engr. Paolo Miguel Bartolo and Engr. Carmelita Villanueva (Process Safety & Occupational Health); Engr. Eldrick Stanley Ong and Engr. Kristian July Yap (Environmental Engineering); Engr. Alexandra Apuya (Technical Assistant).

Guard (PCG), Maritime Industry Authority (MARINA), Department of Transportation - Civil Aviation Authority of the Philippines (CAAP), Department of Transportation - Land Transportation Office (LTO) and Bureau of Fire Protection (BFP), and the two LGUs— Batangas City and Pagbilao, Quezon.

The PRP is comprised of the following items:

1. Itemized technical, administrative, and regulatory recommendations for eleven (11) agencies and two (2) LGUs
2. Process flowcharts that show the recommended regulatory process for securing permits or clearances
3. List of current and proposed documentary requirements
4. Checklist of Codes and Standards to be adopted by each agency

The PRP covers all the relevant types of facilities at different business phases (i.e. NTP, PCERM, and POM). It likewise includes different types of facilities given different business types based on the PDNGI value chain, in particular: the onshore import terminal (OIT), FSRU, FSU, and LNG ships/carriers, LNG trucks and bunkering operations.

Various engineering disciplines were carefully looked into in drafting the PRP, including marine and naval, coastal and port, civil, structural, geotechnical, mechanical, electrical, process safety, occupational health, and environmental, noting that these are the critical areas by which the facilities are designed, constructed, and operated.

Aside from the four (4) items that comprised the PRP, each of the agencies and LGUs covered in the study are specifically provided with a list of regulatory recommendations that describe issues or concerns associated with every permit, certificate, or clearance the agency or LGU is mandated to provide. The list also contains the corresponding regulatory proposals to address the issues described in the study.

Details on data gathering and validation as well as subsequent trainings on PRP are provided in Box 2.

Codes & Standards Checklist

A main feature of the PRP is the checklists of recommended codes and standards for adoption per agency or LGU that are deemed pertinent to the various units, equipment, structures, processes, and systems in the different LNG facilities or business types. These standards, which are internationally accepted and recognized as best practices, were carefully reviewed based on its applicability to a tropical country like the Philippines.

The PRP is limited to the codes, standards, and manuals/handbooks of best practices that are specific to the handling and storage of LNG. Among materials reviewed are the following;

1. NFPA 59A: Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG) developed by the National Fire Protection Association (NFPA);
2. 33 CFR 127, 49 CFR 192, and 49 CFR 193 developed by the Code of Federal Regulations (CFR) to regulate waterfront facilities, pipelines, and other LNG facilities;
3. ISO 16904:2016, ISO 28460:2010, ISO 19902, ISO 19903:2019, and ISO 20257 developed by the International Organization for Standardization (ISO);
4. BS EN 1474-3:2008 standard for installation and equipment for LNG and design and testing of marine and offshore transfer systems developed by the British Standards Institution (BSI);
5. Society of International Gas Tanker and Terminal Operators (SIGTTO) Liquefied Gas Handling Principles on Ships and in Terminals developed by the Society of International Gas Tanker and Terminal Operators;

6. LNG bunkering guidelines developed by the International Association of Classification Societies (IACS); and
7. The guidance on LNG Bunkering to Port Authorities and Administrations developed by the European Maritime Safety Agency (EMSA).

Other codes and standards for general applications were also reviewed as deemed needed.

D. DEVELOPMENT OF PRODUCTS, FACILITY, AND CODES OF SAFETY PRACTICE STANDARDS

Gas industry networks and its associated technologies are fundamentally dependent on industry standards to ensure consistency and continuity among all the various elements. Standards are used to establish procedures and properties relevant to processes and requirements. They are likened to a form of law and are policed by various regulators with common protocols, interfaces, and form factors, which allow the industry to move forward without each individual company having to do the ground up implementation on its own. Without industry standards, there will be no guidance as to how to improve efficiency and there will be no assurance in safety compliance in the facilities and operations within the gas value chain.

Establishing industry standards for the downstream natural gas sector is a challenge. To address this concern, the DOE has entered into a Memorandum of Agreement (MOA) with the Department of Trade and Industry (DTI) through its Bureau of Philippine Standards for closer coordination and collaboration in the development and promulgation of Philippine National Standards (PNS) on natural gas products, facilities, and code of practices of the downstream natural gas industry. The DOE under this MOA, and provided by the DTI Department Administrative Order (DAO) No. 19-08 of 2019, is recognized as a Public Standards Development Organization (SDO).

Box 2

Data Validation, Stakeholders Consultations, and Trainings on the PRP

The PRP was developed through extensive desktop research. To validate the data gathered, a series of consultations with the agencies and LGUs were conducted in the form of key informant interviews (KIIs), focus group discussion (FGDs), and simulation runs. After this validation period, a final presentation to stakeholders was held in 28-October 2021 via the Zoom platform. The list of recommendations, along with the supporting output such as the process flowchart and standards checklist, were consolidated and presented. Attendees included the DOE, critical government agencies, and the LGUs. During the presentation, further comments and clarifications from the stakeholders were gathered and were taken in consideration for the final version of the study.

After the completion of the study, a series of trainings were conducted with concerned agencies and LGUs on the PRP as part of GPDP 2's capacity strengthening activities. The trainings were implemented into two parts; the first series aimed to introduce the fundamentals of LNG, its product(s), processes, operations, and facilities, while the second series focused on the checklist of regulatory requirements and the proposed codes and standards for adoption. The trainings also highlighted the importance of understanding and aligning the different engineering disciplines—marine/ naval, coastal and port, civil, structural, geotechnical, mechanical, electrical, process safety, occupational health and environmental—in the overall PDNGI value chain. The modules used in the said trainings were developed after a series of consultations with the concerned agencies, LGUs, and with the DOE-OIMB-NGMD to ensure that the training design fits the capacity building needs of the agencies.

- **Establishment of Technical Committee**

Part of the standard development is the creation of a Technical Committee (TC) on Downstream Natural Gas Standards on Product, Facility and Code of Practice. In order to achieve the purpose of standardization, transparency, and consensus, the TC shall be composed of representatives from the following sectors: academe, trade/industry, consumer sector, professional association(s), research institution(s), government agencies, and testing institution(s).

TC membership is open to qualified and competent technical representatives officially nominated by their respective organizations. The technical committee will be comprised of seven (7) to fifteen (15) members and shall be headed by a Chairman and a Vice Chairman.

The Chairman will be appointed for a period of three (3) years and may be re-appointed for a consecutive period of three (3) years as recommended by the TC members. The Chairman will be responsible for the overall management of the TC including setting the program of activities and timeframe for their accomplishment.

The Vice Chairman will be appointed for a period of three (3) years. After a review of his/her performance, he/she may be re-appointed for another consecutive period of three (3) years. The Vice Chairman will act and perform the responsibilities of the Chairman in the event the former is absent in the meeting.

The TC will develop the standards by consensus and promulgate standards and technical regulations for natural gas products and facilities as well as adoption and consideration of relevant International Organization for Standardization (ISO) standards, International Electrotechnical Commission's (IEC) standards, and other internationally accepted standards.

- **Membership Qualification**

Nominees to the technical committee should meet the minimum qualifications as follows:

- Should be a Filipino Citizen
- Should have minimum educational attainment relevant to the scope of the technical committee he/she intends to join
- Should have at least five (5) years of experience and technical expertise in the scope of the technical committee he/she intends to join
- Should be willing to share his/her technical expertise
- Should have the commitment to participate actively in the technical work of the Technical Committee
- Considers national interest above all
- Shall come from a reputable organization with no legal case from the DTI/DOE
- Have tact and diplomacy

- **Development of Philippine National Standards (PNS)**

The primary responsibility of the TC is to develop the PNS or adopt international and other relevant standards as PNS. The PNS shall be developed using the project approach, in which every PNS developed or adopted should result from a project undertaken by a TC with clear timelines for completion. The following are the downstream natural gas facilities for PNS development:

1. LNG Import Receiving Terminal and Regasification Facility

- Jetty Area (LNG Receiving & Mooring facilities)
- Piping System & Component LNG transmission pipelines & expansion loops from jetty to LNG tanks
- LNG Storage
- LNG Offloading & Boil-off gas (BOG) Handling System /Compressor system
- Piping System & Components: Regasified LNG/Natural Gas Pipeline from Regasification facility to the power plant or to distribution
- Port Control System
- Power/Communication/Control System
- Fire Protection System, Firewater Monitoring/Pumps/Equipment
- Hazard Detection (flame, heat, smoke, gas) Equipment
- Fire Areas (Marine facilities, LNG storage, utilities, auxiliaries building)
- Waste Water System
- Flare system
- Waste Management System
- Fire Station and Medical Station
- Health, Safety, Security, Environment Warning Signs
- Odorization

2. Offshore Facility

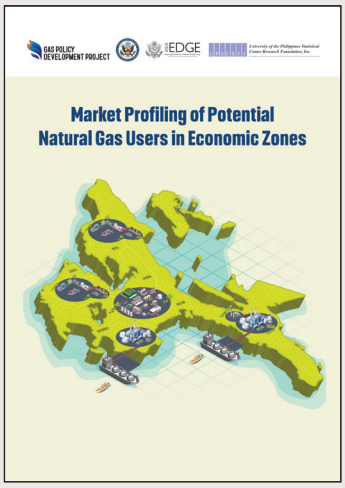
- Floating Storage & Regasification Unit (FSRU)
- Floating Storage Unit (FSU) with Onshore Regasification Unit

3. Transmission Pipeline System

4. Distribution Pipeline System

5. Refueling Stations

- Compressed Natural Gas (CNG) Daughter Station
- On-line Station



The full version of the "Market Profiling with Emphasis on the Use of Liquefied Natural Gas (LNG) to Power Economic Zones" and the "Market Profiling of Potential Natural Gas Users in Economic Zones" is available in Annex D and E, respectively.

E. MARKET PROFILING OF POTENTIAL NATURAL GAS USERS IN ECONOMIC ZONES

As the Philippines' LNG industry continues to develop, an opportunity arises to expand natural gas utilization from its current use in power generation to other sectors, such as in industrial, commercial, transport, among others. This expansion would entail substituting or replacing coal, oil, and diesel, allowing the country to pursue a low-carbon economic growth whilst maintaining industry competitiveness by averting the cost and intermittency issues of renewables.

The potential of expanding natural gas use is considerable specifically among firms or locators found in Special Economic Zones (SEZs). Due to their specialized facilities and technology, SEZ locators' energy demand and intensity are recognizably much greater than those of their non-SEZ counterparts, making them good candidates as direct users of LNG. As of May 2020, there are 74 manufacturing economic zones, 291 information technology centers and parks, 19 tourism ecozones, 3 medical tourism centers and parks, and 21 agro-industrial economic zones in the country. The manufacturing and agro-industrial economic zones are particularly important given the role of these industries in the structural transformation of an economy[24]. Currently, these SEZ locators use the more expensive and less environment-friendly diesel fuel in their heating production process.

Two research studies conducted by the GPDP explored the potential use of LNG in SEZs. The first study[25] determined the profile of power and fuel use among locators in manufacturing and agro-industrial SEZs in Laguna, Batangas, Cavite, Cebu, Pampanga, Benguet, Bulacan, and Metro Manila. The second research[26] augmented the initial study, widening the scope to all types of SEZs, particularly identifying locators with energy-intensive operations in the Cavite, Laguna, Batangas, Rizal, Quezon (CALABARZON), Clark, Subic, and Bataan areas. Both studies ascertained the locators' willingness to switch to LNG and the factors influencing their stance. Economic, technical, and technological requirements for doing the conversion (e.g., savings that can be derived from the switching; costs that will be incurred for the required technology, etc.) were also looked into.

Details on the data gathering are provided in Box 3 while the pertinent highlights of the studies are as follows:

[24]Daway-Ducanes, S. & Fabella, R. (2015). Development Progeria: The Role of Institutions and the Exchange Rate." Philippine Review of Economics, 52, 84-99 | Ravago, M-L, Brucal, A. Roumasset, J., and Punongbayan, J. (2019). The role of power prices in structural transformation: Evidence from the Philippines. Journal of Asian Economics, 61, 20–33. https://doi.org/https://doi.org/10.1016/j.asieco.2019.02.001

[25]Ravago, M.-L., Fabella, R., Jandoc, K. R., Frias, R., & Magadia, J. K. (2021). Gauging the market potential for natural gas among Philippine manufacturing firms. Energy. https://doi.org/10.1016/j.energy.2021.121563

[26]Ravago, M.-L., Fabella, R., Jandoc, K. R., & Frias, R. (2022). Market Profiling of Natural Gas Potential Users in Economics Zones

Profile of locators open to natural gas use. The use of natural gas showed most potential among firms that operate boilers and other intensive heating equipment in their production process. Currently, boilers are being generated by burning less environmentally friendly fuels (e.g., diesel or coal). Other locators that have shown openness to switching include those involved in warehousing and transportation support, and manufacturing of motor vehicles and basic metals. Moreover, export-oriented locators have shown more willingness to switch to natural gas relative to those catering to domestic markets only.

Conversely, among those who are unlikely to shift are locators which mainly depend on electricity for their operations. Currently, electricity is the main fuel used by the locators in production. This is followed by diesel and liquefied petroleum gas (LPG).

For locators that are considering the adoption of natural gas, diesel is the fuel that will most likely be replaced by natural gas in the main production processes, self- and back-up power generation. In the production processes, diesel is followed by biodiesel, gasoline, and LPG as fuel to be replaced by natural gas. Moreover, natural gas is a likely replacement for gasoline, solar, and LPG in self- and back-up power generation.

Top considerations for switching to natural gas. For most locators, switching to natural gas depends on the existence of needed infrastructure onsite, such as regasification facilities inside the economic zones. Environmental concerns, price, and safety and security also emerged as top considerations in using natural gas in their production process. Among manufacturing and agro-industrial firms in particular, openness to natural gas is contingent to the compatibility of their machines and equipment. Retrofitting costs, product quality, and supply stability came out as the least important considerations for the locators.

Knowledge and perception of natural gas. The locators' extent of knowledge about natural gas and their production technology process are the primary determinants of the likelihood to switch in those locators with limited to average knowledge of natural gas tend to be more hesitant in adopting it as a fuel, while those with more advanced knowledge tend to be more receptive to switching. In terms of safety, more than half of the respondent locators deemed that natural gas is safe to use as a fuel in their existing production processes. A considerable percentage of the respondent locators likewise consider natural gas as a competitive fuel in terms of cost relative to their existing fuels and energy sources.

Knowledge on environmental issues. Respondent locators display an average knowledge on the relation and impact of carbon emissions to global warming, the Philippines' commitment to the Paris Agreement on climate change, and renewable energies. Most firms are aware about pressing environmental concerns, especially those that are being caused by their production process. Consistent with this, environmental issues are foremost considerations in these locators' openness to switch, considering natural gas as a cleaner alternative to more polluting fuels.

Technical requirements for switching. Requirements for switching to natural gas is assessed on a case-to-case basis. On-site inspections must be conducted to determine the current conditions of the facilities. Majority of the respondent locators are not familiar with the high-efficiency equipment that can be retrofitted to optimize natural gas use in the production processes. Thus, there is a need to establish the market for these types of equipment to increase the pace of adoption of natural gas.

For direct connection via pipelines, which is the preferred mode of delivery of most respondent locators, constructing an onsite storage facility may not be necessary. However, existing LPG pipelines must be replaced because their capacities are insufficient to transport natural gas. Specifically, natural gas has a lower caloric value per volume than LPG, thus pipelines customized to LNG must be used.

For delivery via lorry, constructing one or more storage tanks is necessary. In addition, existing LPG tanks also must be replaced to accommodate storage requirements of LNG (e.g., -162 °C temperature, ventilation).

Rationalizing reluctance to natural gas. Hesitancy among respondent locators to switch to natural gas is anticipated. There are practical reasons for non-switching from oil or LPG to natural gas. The economic benefits (e.g., lower fuel cost, lower labor cost) may be smaller than the total cost of fuel conversion (e.g., pipeline expansion and replacement costs, combustion system replacement cost). Locators who operate 24/7 may not have enough time to convert their distribution and combustion systems since the conversion can only take place during inventory adjustments and production downtimes.

Box 3

About the GPDP Market Profiling Studies

GPDP 1 Study - Market Profiling with Emphasis on the Use of Liquefied Natural Gas (LNG) to Power Economic Zones

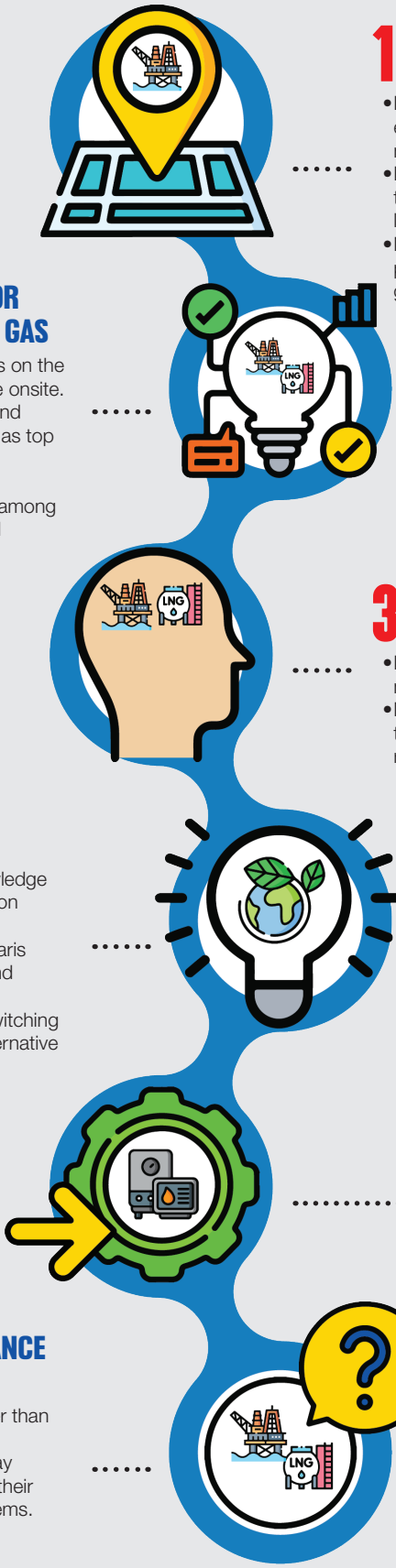
- Areas covered: SEZs in Laguna, Batangas, Cavite, Cebu, Pampanga, Benguet, Bulacan, and Metro Manila
- Types of Ecozones: Manufacturing and agro-industrial ecozones
- Methodology: FGD to pretest survey instrument and online survey
- Sample size: 115 locators out of 1,613 (95% confidence level and 10% margin of error)
- Survey period: August – September 2019

GPDP 2 Study - Market Profiling of Potential Natural Gas Users in Economic Zones (2022)

- Areas covered: SEZs in CALABARZON, which includes the provinces of Cavite, Laguna, Batangas, Rizal, and Quezon, and the other contiguous area of the province of Zambales (Subic), Pampanga (Clark), and Bataan
- Types of ecozones: Manufacturing, information technology, tourism, agro-industrial, medical tourism, and logistics services ecozones
- Methodology: Online FGD to pretest survey instrument; online survey; Online FGD with Tokyo Gas to determine technical requirements for switching
- Sample size: 283 locators out of 1,864 (95% confidence level and 5.4% margin of error)
- Survey period: September – October 2021

Market Profiling of Potential Natural Gas Users in Economic Zones

The Study in a Nutshell



1 PROFILE OF LOCATORS OPEN TO NATURAL GAS USE

- Locators with boilers and other intensive heating equipment in their production process showed the most potential in using natural gas.
- Export-oriented locators are more willing to switch to natural gas versus domestic market-oriented locators.
- Natural gas can most likely replace diesel in the main production processes, self- and back-up power generation.

2 TOP CONSIDERATIONS FOR SWITCHING TO NATURAL GAS

- Switching to natural gas depends on the existence of needed infrastructure onsite.
- Environmental concerns, price, and safety and security also emerged as top considerations.
- Compatibility of machines and equipment is an important factor among manufacturing and agro-industrial locators.

3 KNOWLEDGE AND PERCEPTION OF NATURAL GAS

- Locators with more advanced knowledge tend to be more receptive to switching.
- Majority of locators deemed that natural gas is safe to use and is a competitive fuel in terms of cost relative to their existing fuels and energy sources.

4 KNOWLEDGE ON ENVIRONMENTAL ISSUES

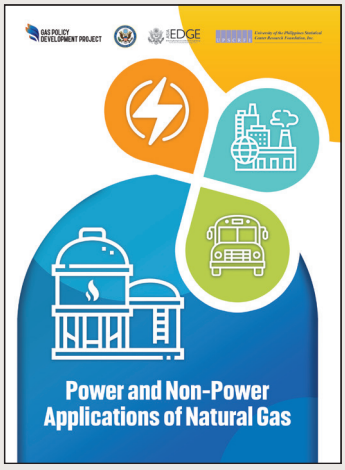
- Locators displayed average knowledge of the relation and impact of carbon emissions to global warming, the Philippines' commitment to the Paris Agreement on climate change, and renewable energies.
- Locators showed openness to switching to natural gas being a cleaner alternative to more polluting fuels.

5 TECHNICAL REQUIREMENTS FOR SWITCHING

- Requirements for switching to natural gas are assessed on a case-to-case basis.
- Majority of the locators are not familiar with the high-efficiency equipment that can be retrofitted to optimize natural gas use in the production processes.
- For direct connection via pipelines: constructing an onsite storage facility may not be necessary.
- For delivery via lorry: constructing one or more storage tanks is needed.
- Existing liquefied petroleum gas (LPG) pipelines and tanks must be replaced because their capacities are insufficient to transport or store natural gas.

6 RATIONALIZING RELUCTANCE TO NATURAL GAS

- Economic benefits may be smaller than the total cost of fuel conversion.
- Locators with 24/7 operations may not have enough time to convert their distribution and combustion systems.



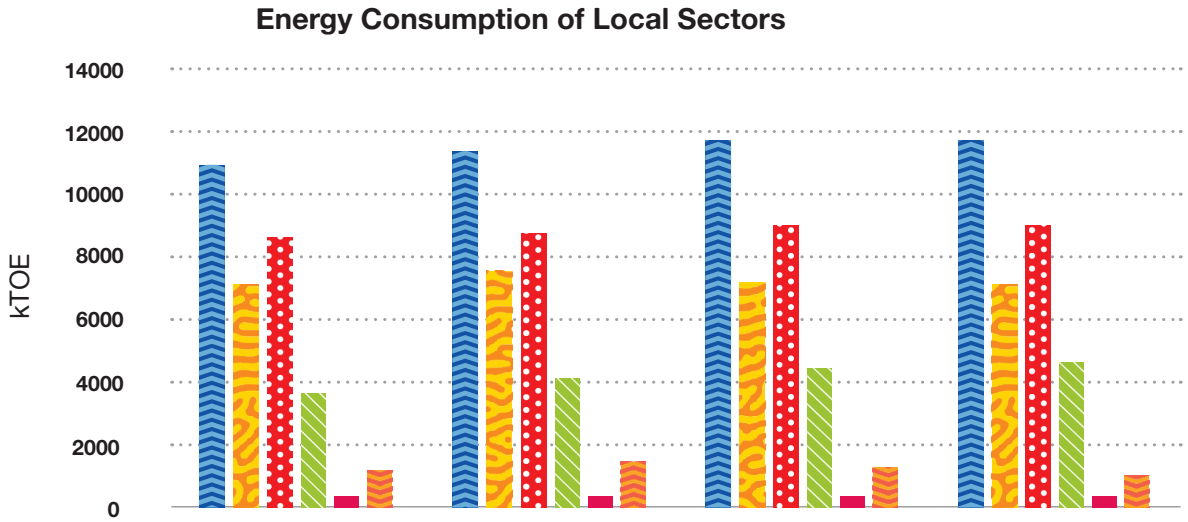
The full version of the "Power and Non-Power Applications of Natural Gas" in Annex F

F. POWER AND NON-POWER APPLICATIONS OF NATURAL GAS

The natural gas industry in the Philippines remains to be an emerging and nascent sector. To date, much of the use and application of natural gas is only in power generation despite it having great potential use in other sectors. In particular, LNG can be an efficient energy source in the industrial sector for processes that require large high-calorific fuel to function. In many developing countries, industries that utilize biomass for heating are being replaced with LNG to decrease the harmful emissions into the environment. In the same manner, LNG can supply energy for heavy duty transportation that could lead to lower greenhouse and particulate emissions as compared to utilizing traditional energy sources. (GIIGNL, n.d.-b).

As natural gas is envisioned to play a bigger role in the country's energy mix in the coming decades, the Philippine Department of Energy is moving towards expanding the use of natural gas to non-power applications. Among the top sectors with the highest consumption in the country are the industrial and transport sectors (see Figure 11), making them viable options for conversion to LNG-based energy sources.

Figure 11. Total Energy Consumption of Various Local Sectors, 2016 to 2019 (DOE, 2019)



	2016	2017	2018	2019
Transport	11425	11823	12238	12689
Industry	7449	7925	7523	7389
Household	9035	9192	9431	9711
Services	3865	4404	4668	4915
Agriculture	450	516	440	472
Non-energy Use	1306	1613	1423	1137

To support the objectives of fuel switching and expansion of natural gas use in the country, a research study on "Power and Non-Power Applications on Natural Gas," conducted by the GPDP 2[27] developed a comprehensive inventory of existing technologies and emerging trends for generating power from natural gas. It likewise explored the diverse use of LNG to cater to non-power applications, particularly in the industrial and transport sectors. Technical and economic feasibility case studies for these sectors were conducted to evaluate the potential of LNG to replace other fossil fuels. Criteria for the selection of the case studies can be seen in Box 4.

- **Power applications**

Combined cycle plant technologies have long been established as reliable options for generating power from natural gas. The high-efficiency process and the relatively cheaper cost to construct the plant makes the technology an attractive option. Unfortunately, natural gas is still a fossil fuel, and the benefits that come with using it could be overshadowed by the fact that it is still a carbon-emitting energy source.

The study identified two tools that could be used to evaluate the technical and environmental performance of gas-fired power plants. The first section discussed the governing principles on thermodynamic analysis, and how it could be used to identify process zones with the lowest efficiency and the highest irreversibility. Most thermodynamic analysis studies in literature focused on identifying process improvements for combined cycle power plants. These studies identified that the combustion chamber and the heat recovery steam generator are the most inefficient equipment in the process, owing to irreversibilities that are inherent in processes that involve reactions or finite temperature differences. Efforts should be directed towards improving combustion efficiency and heat transfer. Future studies could also focus on integrating thermodynamic analysis with optimization, so that a set of operating conditions for the plant could be determined such that cost and emissions are minimized, and efficiency is maximized.

The study also presented ongoing research on decarbonizing the power sector, particularly the role of natural gas in energy transition. Combined cycle power plants have a low LCOE that could compete with coal-fired power plants. Fuel switching from coal to gas assures significant reductions in SOx and NOx emissions. Life-cycle assessment studies, however, show that fugitive and process emissions from upstream processes could outweigh the low-carbon benefit of natural gas use. Hence, emission reduction strategies should target these upstream processes. The study has summarized most of those strategies, not only for the power sector, but also for the industrial and transport sectors. Examples of these strategies include utilizing high-efficiency technologies in power generation and industrial heating, proper leak detection and control to mitigate fugitive emissions, and carbon capture and storage.

Finally, since natural gas is touted to be a transition fuel, efforts must also be exerted to streamline the transition to a zero-carbon future by coupling the use of natural gas with additional CO_2 mitigation strategies. Examples of these strategies include developing flexible plants for renewable energy sources, encouraging small-/microscale distributed generation, and strengthening power-to-gas research and development.

[27]Research team includes Engr. Bemboy Niño F. Subosa, Engr. Paul Jake B. Nalzaro, and Ms. Thea Mae Q. Baltazar.

Box 4

Case Study Selection Criteria

Industrial Sector - Greenfield Automotive Park*

1. Likelihood of switching to natural gas as fuel for production processes
2. Existence of equipment for heating and other production processes that involve energy
3. Proximity to available LNG import terminal
4. Available land area
5. Availability of engineering drawings

**Based on raw data of GPDP 1 Mark Market Profiling study (Ravago, et al, 2020)*

Transport Sector - Passenger Bus

1. Type of project pursued
2. Route where the selected project will be plying
3. Option for switching to CNG vehicle
4. Type of engine

1 Thermodynamic analysis could recommend strategies that can increase efficiency and reduce irreversibilities in gas-fired power plants.

2 Life-cycle assessment can be used to identify hotspots in a product's life cycle where environmental impacts are the greatest.

3 Based on the levelized cost of electricity value, a combined cycle gas plant is a cost-effective option and may be even at par with a conventional coal-fired plant.

4 Since natural gas is a much cleaner fuel than fuel oil in terms of sulfur content, fuel switching can ensure significant reductions in SO_2 emissions.

Technical Research on Power Applications of Natural Gas

An Overview

5 The hotspots of a gas-fired power plant occur at the plant operation and the gasification stages. Emission reduction strategies such as energy efficiency measures and carbon capture and storage should target these stages.

6 The use of natural gas should be coupled with additional CO_2 mitigation strategies to ensure a streamlined transition to a zero-carbon future.

7 Lower carbon emissions during the use phase of natural gas could be outweighed by the high fugitive emissions in upstream processes (i.e., gas extraction, gas cleaning, liquefaction, and transportation).

- **Industrial Applications**

The study proposed a regasification facility with an annual capacity of 6.35 MT of LNG to be erected within the vicinity of the selected SEZ—the Greenfield Automotive Park (GAP) in Sta. Rosa, Laguna. The most common energy-intensive production operations in GAP include air conditioning, air compression/ vacuuming, steel fabrication, welding, and forklift operations.

Gas treatment and liquefaction is not covered in the technical discussion as the project proposed to only rely on LNG imports, with Pagbilao, Quezon as the chosen LNG import terminal. Therefore, only technologies for LNG storage, regasification, and distribution is included in the proposed LNG facility. A full containment tank is recommended for storage of LNG to maximize efficiency and minimize risks. For heat exchangers, ambient air vaporizers (AAVs) are generally better options for small-scale LNG facilities. AAVs are more environment-friendly and cheaper than other types of vaporizers. A boil-off gas recondensation system with high-pressure and low-pressure sendout pumps should also be included to recover boil off gas. Safety measures from NFPA 59A should be adopted, especially on general requirements for each LNG infrastructure and plant layout.

Compatibility of existing equipment remains to be the topmost consideration for Philippine locators when it comes to fuel switching. Fuel switching in the industrial sector can be categorized depending on the power mix of a certain location. For regions that are highly dependent on thermal sources, coal-to-gas (C2G) retrofits could bring about significant CO_2 emission reduction at lower costs. For regions whose power mix is renewable- based, the cost increment and CO_2 emission reductions of C2G retrofits are lower than coal-to- electricity (C2E) retrofits.

Technical Research on Industrial Applications of Natural Gas

An Overview

1 The study proposed constructing a small-scale regasification and distribution facility at the Greenfield Automotive Park in Sta. Rosa Laguna with an annual capacity of 6.35 MT of LNG.

2 The top three local sectors that consume the most energy are transport, household, and industry sectors. The transport and industry sectors require the most attention when exploring the possibility of switching to natural gas as fuel.

3 Compatibility of existing equipment remains to be the topmost consideration for Philippine locators when it comes to fuel switching.

4 For regions that are highly dependent on thermal sources, implementing coal-to-gas (C2G) retrofits brings about significant CO_2 emission reduction at lower costs. For regions whose power mix is renewable-based, coal-to-electricity (C2E) retrofits provide higher emission reductions, albeit with higher costs.

- **Transport Applications**

The study reviewed several case studies on the feasibility of deploying compressed natural gas (CNG) buses as an alternative to using diesel-powered buses. In general, the studies concluded that CNG buses are technically and economically feasible according to the net present value (NPV), internal rate of return (IRR), and payback criteria. The primary challenge expressed in most articles concerns the lack of access to the supply of CNG as fuel. Similar to the circumstance experienced in the Philippines, several institutions, including those in Thailand, Canada, and Eastern Europe, stressed the importance of refueling infrastructure in the seamless rollout and sustainability of CNG projects. In a transportation sector that has been embedded in and dominated by diesel and gasoline fuels, this puts forward the dilemma on which investment should be prioritized first: the procurement of CNG buses, or the establishment of operational refueling stations.

The study also conducted a financial analysis that used cost estimations and secondary data gathered from available sources, on the assumption of a uniform series cash flow. The results suggested that investment in a CNG-bus project would result in a positive NPV of $2 million at 12 percent discount rate. Moreover, an IRR of 13.4 percent implies a decision of acceptance of the project. Sensitivity analysis showed that the viability of the project is flexible up to a discount rate of 13.4 percent, which is equal to the value of the IRR. In terms of the changes in the price of natural gas, an additional 5 percent to the current price of natural gas would produce an unfavorable result. The natural gas market in the Philippines, especially for transport applications, is quite new, and investments would thus have to bear the burden of high initial capital cost on necessary transport infrastructures, as seen in the price sensitivity of CNG vehicles and CNG refueling stations. Furthermore, the price of natural gas in the world market is volatile and heavily influenced by geopolitical situations, such as the threat of Russia constricting its gas supply in relation to the Russian invasion of Ukraine. However, this is seen as a short-term disruption in supply, and Fitch Ratings is positive that gas prices will improve to $3.25/MMBtu in 2024 and $2.75/MMBtu beyond 2025 (Wong, 2022).

The growing literature on the decarbonization of the transport sector has also been reviewed. While CNG is not technically emission-free, it offers less environmental impact than diesel. Technological improvements have been made to conform to more stringent vehicle emission standards, and these have manifested in the results of performance and emission tests conducted by several studies. CNG buses have exhibited higher CO_2 and CO emissions than diesel-powered buses in tests performed in 2003 and 2015, but have recorded lower emissions of the same compounds in studies conducted in 2019 and 2021. Related studies on life-cycle analysis were also reviewed. The findings show the consistent advantage of CNG buses over diesel-powered buses in reducing pollution and global warming potential (GWP) and in mitigating the overall damage to human health and the environment.

In sum, this study provides three recommendations: (1) CNG supply for the transport sector needs to be consistent and operational refueling stations have to be present in strategic locations should the sector seek to expand the CNG bus operation in the country; (2) the adoption of CNG buses as an alternative means of public transport mitigates the pernicious effects of road transport pollution caused by diesel-powered vehicles; and (3) while this study utilized secondary data for the analysis, further studies could use primary data on costs and emissions to confirm this study's results.

1 Case studies in Europe, North America, South America, and Asia showed that CNG buses could be a viable alternative for intercity and intracity deployment.

2 Financial analysis of a CNG bus project taking the case of the Batangas-Manila route suggested that the project may be financially viable, with a net present value (NPV) of $2 million and an internal rate of return (IRR) of 13.4%.

3 Fitch Ratings projects the medium-term commodity price outlook for Henry Hub natural gas to decline to $3.25/MMBtu in 2024 and $2.75/MMBtu beyond 2025.

Technical Research on Transport Applications of Natural Gas
An Overview

4 A study showed that CNG buses have a global warming potential (GWP) of 1.67 kg CO_2 eq per km. Compared to the GWP of diesel buses (2.14 kg CO_2 eq per km), CNG buses can provide a GHG savings of at least 20 percent.

6 Investors would have to bear the initial high capital cost of establishing necessary CNG transport infrastructures given that the natural gas market in transport application is not yet developed in the Philippines.

5 The supply of CNG and the abundance of refueling stations are two of the important determinants in the successful roll-out and sustainability of a CNG bus project. In the EU, the requirement calls for the establishment of CNG refueling stations every 150 km.

G. WAY FORWARD

Various developments on the PDNGI have emerged in recent years—legal and regulatory frameworks are being strengthened; research on expanding natural gas use are being conducted; LNG infrastructure are being built; among others. However, given that the industry is still on its nascent stage, there are much more moving parts needed to be put in place and addressed.

The results of the regulatory analyses and technical research carried out by the GPDP can be used to conduct future activities that will promote the use of natural gas as a transition fuel. In particular, the data and findings that emerged can feed into the realization of the PDNGI, contributing to the objectives of market and infrastructure development.

This section provides details on the foreseen necessary next steps to provide a strong foundation to the sector, thus allowing for a dynamic and competitive PDNGI:

• Legal / Regulatory Framework

1. Natural Gas or LNG Law

While the PDNGR is quite comprehensive in its coverage of the PDNGI, a law is needed to have a more encompassing scope and strength for implementation. It is expected that the Senate and the Lower House will be able to finalize the merging of the two draft bills:

° Draft Senate Bill "Providing For The National Energy Policy And Framework For The Development And Regulation Of The Philippine Midstream Natural Gas Industry, And For Other Purposes".

° Draft House Bill on "Ordaining the Development of the Philippine Downstream Natural Gas Industry, Consolidating for the Purpose all laws relating to the transmission, distribution and supply of natural Gas."

2. Update of Existing PDNGR

The proposed regulatory process output of the GPDP project has identified codes and standards, as well as agency-specific and inter-agency regulatory processes that need reform. These can be integrated into the PDNGR. A Technical Committee TC has been formed by the DOE to adopt global LNG standards and draft Philippine National Standards for LNG. The PDNGR can serve as the initial draft of the IRR if and when a natural gas law is passed.

3. Development of Philippine National Standards on Natural Gas Product, Facility, and Code of HSSE Best Practices

With the existing bilateral agreement with BPS to develop standards and the recognition as an SDO; the DOE shall develop and adopt existing international standards on natural gas product, facility, and code of HSSE best practices to establish the Philippine National Standard for Downstream Natural Gas Industry.

4. Adoption and drafting of PRP-based recommended LNG regulations by concerned agencies

An envisioned project continuation is the GPDP-3. It is proposed to provide assistance to the agencies in drafting the new or revised agency's regulations and in drafting the recommended inter-agency joint memorandum circulars or memoranda of agreement. The proposed regulations are envisioned to provide the overall rationalization of permitting and monitoring process of agencies for LNG proponents.

• Research

1. Potential Markets of Natural Gas in Visayas and Mindanao

Current LNG infrastructure projects being built are all concentrated on the island of Luzon. Natural gas potential has yet to be explored for the islands of Visayas and Mindanao. Research studies focused on these areas which identify anchor markets for gas-to-power LNG terminal projects in Cebu and Iloilo for Visayas, and Davao, General Santos, Iligan, and Cagayan de Oro for Mindanao, are deemed useful in order to support natural gas development projects in the island groups. A market profiling study can also be carried out to identify energy-intensive locators in the special economic zones in Visayas and Mindanao and determine their interest to convert to natural gas.

2. Further Research on the Power and Non-Power Applications on Natural Gas

The review of thermodynamic analysis papers indicated that carbon capture and storage technologies can be introduced in power generation facilities to improve process efficiency and reduce emissions. Design considerations are available in the literature to aid in the engineering design of small-scale LNG regasification facilities for the ecozones in the country.

The next step would be to explore challenges in constructing and operating these facilities that will provide natural gas as fuel for manufacturing and agro-industrial processes. Several studies have also shown that the use of natural gas vehicles is feasible in other countries; the studies' recommendations and documented best practices could serve as a guide in reviving the defunct Natural Gas Vehicle Program.

The results of the research could serve as a precursor to determining the environmental impacts of transitioning to natural gas as a fuel source for industrial processes and transport.

3. Economic feasibility of small-scale LNG carriers for inter-island supply

Being an archipelagic country, the Philippines will benefit from exploring modes of delivering natural gas to other island groups sans pipelines. In other Southeast Asian countries, small-scale LNG carriers have been utilized heavily as one of the major channels for distributing LNG to different islands. A study exploring the feasibility of small-scale LNG carriers as a flexible and low-cost means to supply natural gas in other major islands would provide the government with evidence to support the construction of storage and regasification units in Visayas and Mindanao.

Annex A. Ongoing LNG Terminal Projects

Proponent	Partner Company	Project	Location	Capacity	Application Status	Target Operation
FGEN LNG Corporation	Tokyo Gas Co. Ltd,	Interim Floating Storage and Regasification Unit (FSRU) LNG terminal	Barangays Sta. Clara, Sta. Rita Aplaya, and Bolbok in Batangas City	5.26 metric tons per annum (MTPA)	Permit to Construct issued on Sept. 23, 2020	Mar 2023
Excelerate Energy L.P.	Topline Energy & Power Dev Corporation	FSRU LNG Terminal	About 9.5 km offshore in Bay of Batangas	4.4 MTPA	Ongoing evaluation of its Application for Permit to Construct and NTP Transfer	Third Party Access (TPA)
Energy World Gas Operations Philippines Inc.	None	LNG Storage and Regasification Terminal	Barangay Ibabang Polo, Pagbilao Grande Island, Quezon Province	3 MTPA	Permit to Construct Extension for 24 months issued on Oct. 22, 2021	Mar 2023
Linseed Field Corporation Previously Atlantic Gulf & Pacific Company of Manila, Inc. (AG&P)	Osaka Gas Co., Ltd	Floating Storage Unit (FSU) and Onshore Regasification and 60,000 cbm buffer LNG storage tank	Barangay Ilijan and Dela Paz, Batangas City	3 MTPA	Permit to Construct issued on Dec. 28, 2021	FSU and Onshore Regasificati on – Dec 2022 Buffer LNG storage tank – Sept 2023
Shell Energy Philippines, Inc.	None	FSRU Terminal	Tabangao, Batangas City	3 MTPA	NTP Extension of 10 months issued on Oct. 22, 2021	Third Party Access (TPA)
Vires Energy Corporation	None	FSRU Terminal	Barangay Simlong, Batangas City	3 MTPA	Ongoing evaluation of its Application for NTP Extension	2025

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GPDP

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