SUSTAINABLE DEVELOPMENT OF THE NATURAL GAS MARKET IN THE EAS REGION

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Edited by

ICHIRO KUTANI

Economic Research Institute for ASEAN and East Asia

Book design by Fadriani Trianingsih.

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DISCLAIMER

This report was prepared by the Working Group for the Sustainable Development of the Natural Gas Market in the East Asia Summit (EAS) Region under the Economic Research Institute for ASEAN and East Asia (ERIA) Energy Project. Members of the Working Group, who represent the participating EAS region countries, discussed and agreed to utilize certain data and methodologies proposed by the Institute of Energy Economics, Japan (IEEJ) to analyse market trends. These data and methodologies may differ from those normally used in each country. Therefore, the calculated result presented here should not be viewed as the official national analyses of the participating countries.

The views in this publication do not necessarily reflect the views and policies of the Economic Research Institute for ASEAN and East Asia (ERIA), its Academic Advisory Council, and the Management.

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Foreword

The role of natural gas in energy supply is increasing in the East Asia Summit (EAS) region where energy demand is steadily growing. The driving factor of this trend includes the effective use of domestic resources, diversification of energy sources, and reduction of environmental load. Meanwhile, at the same time, we see rising import dependency of natural gas supply in many member countries.

As such, there is a need to implement necessary and appropriate policy measures that can respond to this changing natural gas supply–demand structure. What will be required to achieve sustainable development of the natural gas market, and thus contribute to the economic growth of the region and its countries? It is my hope that this study succeeds in finding and presenting some clues to answer this important and difficult question.

Ichiro Kutani

Leader of the Working Group

June 2014

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I also would like to acknowledge Mr. Victorino S. Bala, Secretary In-Charge of the ASEAN Council on Petroleum (ASCOPE), for providing his insights on the issue studied.

Mr. Ichiro Kutani

Leader of the Working Group

June 2014

List of Project Members

Working Group Members

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

MR. SHIMPEI YAMAMOTO (ORGANIZER): Managing Director for Research Affairs, Economic Research Institute for ASEAN and East Asia (ERIA)

MR. SHIGERU KIMURA (ORGANIZER): Special Advisor to Executive Director on Energy Affairs, Economic Research Institute for ASEAN and East Asia (ERIA)

DR. HAN PHOUMIN (ORGANIZER): Energy Economist, Energy Unit, Research Department, Economic Research Institute for ASEAN and East Asia (ERIA)

DR. ANBUMOZHI VENKATACHALAM (ORGANIZER): Energy Economist, Energy Unit, Research Department, Economic Research Institute for ASEAN and East Asia (ERIA)

DR. YANFEI LI (ORGANIZER): Energy Economist, Energy Unit, Research Department, Economic Research Institute for ASEAN and East Asia (ERIA)

DR. WANG YUE: Associate Researcher, Strategic Research Center of Oil and Gas Resources, Ministry of Land and Resources, China

MR. TETSUO MORIKAWA: Senior Economist and Manager, Gas Group Coal and Gas Subunit, Fossil Fuels and Electric Power Industry Unit, The Institute of Energy Economics, Japan (IEEJ), Japan

MR. ROSLEE BIN ESMAN: Head, Gas Supply, Energy Commission, Malaysia

MR. HAN TUN OO: Staff Officer, Energy Planning Department, Ministry of Energy, Myanmar

MR. JESUS T. TAMANG: OIC-Director, Energy Policy and Planning Bureau, Department of Energy, Philippines

DR. WOONAM SEOK: Associate Research Fellow, International Energy Cooperation Group, International Cooperation Research Division, Ministry of Commerce, Industry and Energy, Republic of Korea

Mr. Veerapat Kiatfuengfoo: Director, Petroleum Business Group, Energy Policy and Planning Office, Ministry of Energy, Thailand

Mr. Ngo Xuan Anh: Deputy Director, Oil & Gas Transportation and Processing, General Directorate of Energy, Ministry of Industry and Trade, Viet Nam

List of Abbreviations and Acronyms

ASCOPE = ASEAN Council on Petroleum
ASEAN = Association of Southeast Asian Nations
BCM = billion cubic metre
CBM = coal bed methane
EAS = East Asia Summit
EIA = Energy Information Administration
ERIA = Economic Research Institute for ASEAN and East Asia
HOA = Heads of Agreement
IEA = International Energy Agency
IEEJ = The Institute for Energy Economics, Japan
LNG = liquefied natural gas
LPG = liquefied petroleum gas
MIT = Ministry of Trade and Industry (Viet Nam)
MMBtu = Million British thermal unit
MMscfd = Million standard cubic feet per day
MMscmd = Million standard cubic meter per day
MT = million tonnes
Mtoe = million tonnes of oil equivalent
Tcf = Trillion cubic feet
Tcm = Trillion cubic metre

Executive Summary

This essay explores the necessary measures to achieve the sustainable development of the natural gas market in the East Asia Summit (EAS) region where demand for natural gas is increasing, considering the currently observed and anticipated changes in market conditions.

MAIN ARGUMENT

The role of natural gas in energy supply is increasing in the EAS region where energy demand is steadily growing. The driving factors of this trend include the effective use of domestic resources, diversification of energy source, and reduction of environmental load. At the same time, we see rising import dependency for natural gas supply in many member countries. Also, we are experiencing and anticipating structural changes in the global gas market, particularly as regards the shale revolution in the United States. As such, the region needs to implement necessary and appropriate policy measures that can respond to this changing situation.

The essay first examines recent changes in the global gas market that may have an influence on the EAS region. Subsequently, natural gas supply–demand and policy trends in the region are explored. By having this background information, the second part of the study analyses the natural gas/liquefied natural gas (LNG) supply–demand outlook of the region. Lastly, the study discusses major issues that policy makers need to address.

KEY FINDINGS

- The region will see strong growth of natural gas demand, which is assumed to outpace the increase of regional natural gas production. As a consequence, the demand and supply gap is likely to increase by about five times from the current 105 billion cubic metres (BCM) per year to approximately 499 BCM per year in 2035.

- Even though the region cannot be self-sufficient in gas supply in the future, global supply can fulfil import demands in the region.
- Major uncertainty in the demand side includes economic growth rate, particularly in China and India, the amount of nuclear use in Japan, and the domestic price system in developing countries, whilst production side uncertainty lies at unconventional gas development in the region, and timing and degree of investment decision.

POLICY IMPLICATIONS

- If the region can diversify power supply mix and improve the efficiency of natural gas use, the risk of natural gas import dependency could be mitigated.
- If the domestic price of natural gas can appropriately and timely reflect its supply cost, member countries will not only avoid wasteful use of natural gas but also facilitate development of domestic natural gas resource.
- If the regional and global natural gas market can have more flexibility in natural gas/LNG supply, the region may be able to attain the same level of supply stability at lower cost or a higher level or stability at the same cost. Also, flexible trade of natural gas/LNG may provide more opportunities for suppliers to earn profits.
- If net exporting and net importing countries can share and hopefully form a common view on future prospects, the international and regional market can be more stable.

CHAPTER 1
Introduction

Many East Asia Summit (EAS) countries show a growing trend in energy demand. The role of natural gas in energy supply becomes more and more important in several aspects which include the effective use of domestic resources, diversification of energy supply, and reduction of environmental load. However, since the share of natural gas in total primary energy supply is relatively low in the region, except in a few countries, there seems to be much room to expand the use of natural gas and thus gain maximum benefit from its use.

To make the use of natural gas sustainable, appropriate actions shall be taken throughout the supply chain, such as exploration and production, import if necessary, transmission, distribution, and consumption. For instance, specific actions are needed to maintain investment for developing gas fields to enhance natural gas supply, increase the efficiency of natural gas use to avoid wasting resources and expenditure, and develop the required infrastructure for natural gas supply. There is also a need to strengthen the capability of adjusting supply–demand balance and enhance the transparency of the gas market by improving liquidity in the natural gas/liquefied natural gas (LNG) market.

As such, in the EAS region where natural gas demand seems to increase in the future, formulating the ground for sustainable growth of natural gas market is desired.

Rationale

The rationale of this study is derived from the 18th ECTF[1] meeting held in Bali, Indonesia on June 27, 2013. In this meeting, Japan proposed new ideas

[1] Energy Cooperation Task Force under the Energy Minister Meeting of EAS countries.

of study, namely, Sustainable Development of Natural Gas Market in the EAS Region. The participants of the ECTF meeting exchanged views and noted to commence the proposed new study.
As a result, the Economic Research Institute for ASEAN and East Asia (ERIA) has formed the working group for the study. Members from EAS countries are represented in the working group with Mr. Ichiro Kutani of the Institute of Energy Economics, Japan (IEEJ) as leader of the group.

Objective

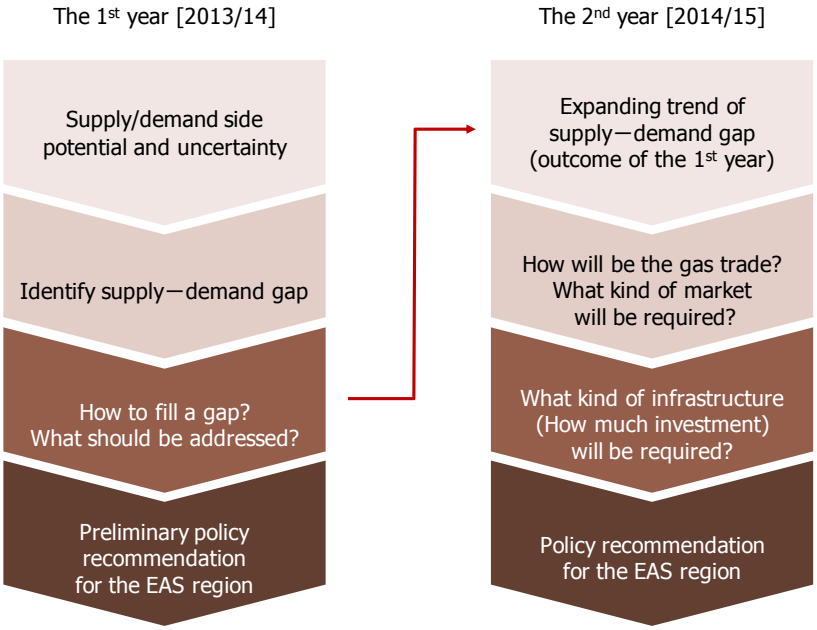
This study aims to have suggestions for formulating better market conditions for natural gas in the future in the EAS region. Natural gas market in said region is facing increased demand and import dependency for supply. In the meantime, outside the region, instability in the Middle East still exists. On the other hand, there is also high expectation for new supply from North America. It is, therefore, necessary to investigate how the region could address these changing circumstances

Work Stream and Working Group Activity

The study is designed to be conducted in two years.

In the first year, the study will focus on estimating natural gas outlook in the region to grasp possible changes in future market, and on assessing the current policy directions in each country. In the second year, the study will discuss market and infrastructure issues that seem to be critical under the future market conditions. Finally, the study will draw out policy implications with the above considerations.

Figure 1-1 Study Flow



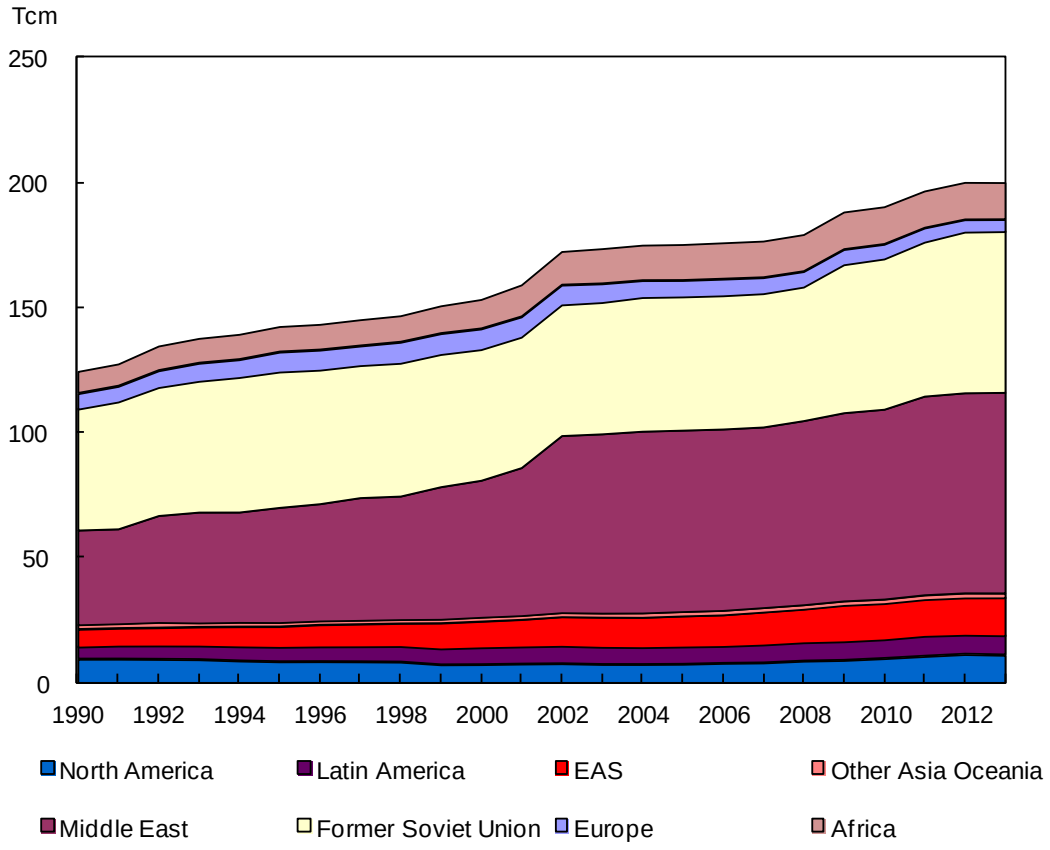
CHAPTER 2
Global Gas Market Trend

This chapter looks at global natural gas market trend in resources, production, consumption, international trade, and international prices. While conventional gas reserve and production are dominated by certain countries, unconventional gas is increasingly recognized as a game changer of the world gas market. International trade is growing faster than the demand, and regional gap has widened to an unprecedented extent.

Resources

Proven reserves of natural gas in the world at the beginning of 2013 were 200 trillion cubic metre (Tcm). The Middle East and the Commonwealth of Independent States took a share of 40 percent and 32 percent, respectively. Indeed, Russia, Iran, and Qatar together took a share of as much as 54 percent of the world total. As far as the reserve growth is concerned, the Middle East and the EAS region increased their respective growth at three percent per annum since 1990. Europe, on the other hand, decreased its reserves by one percent per annum for the same period.

Figure 2-1 Proven Reserves of Natural Gas, by region



Source: Cedigaz Statistical Database.

Whilst the above figures are those of conventional gas, it is increasingly known that the world possesses vast amounts of unconventional gas resources, especially shale gas. For example, the *World Energy Outlook 2013* of the International Energy Agency (IEA) estimates that technically recoverable resources of natural gas are as much as 810 Tcm, comprising 468 Tcm of conventional gas and 343 Tcm of unconventional gas. This resource is equivalent to 235 years of current world demand (Table 2-1).

Unconventional gas is important not only because the world possesses much more gas resources than previously thought, but also because natural gas resources, including unconventional gas, are more evenly distributed geographically. Although Eastern Europe and Eurasia—majority of which is Russia—and the Middle East to which Iran and Qatar belong still share 23 percent and 17 percent, respectively, of the world total, it is important to note that major consuming regions like Asia-Pacific and North America can

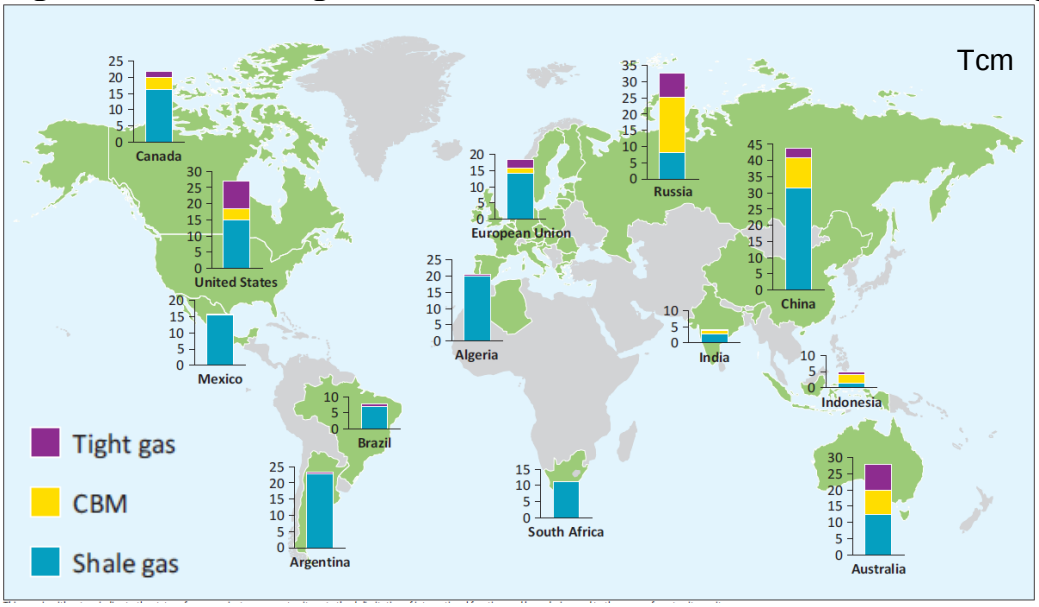
become major resource holders, with their share at 17 percent and 14 percent, respectively.

Table 2-1 Technically Recoverable Resources of Natural Gas, at end 2012 (Tcm)

	Conventional	Unconventional			Total
		Tight gas	Shale gas	CBM	
Eastern Europe and Eurasia	143	11	15	20	190
Middle East	124	9	4	-	137
Asia-Pacific	44	21	53	21	138
OECD North America	46	11	48	7	112
Africa	52	10	39	0	101
Latin America	32	15	40	-	86
OECD Europe	26	4	13	2	46
Total	468	81	212	50	810

Note : CBM = coal bed methane, OECD = Organisation for Economic Co-operation and Development.
Source: International Energy Agency (IEA), *World Energy Outlook 2013.*

Figure 2-2 Remaining Unconventional Gas Resources in Selected Regions



Note : CBM = coal bed methane.

Source: IEA, *World Energy Outlook 2013.*

According to the Energy Information Administration (EIA) of the United States (US), technically recoverable resources of shale gas in the world are estimated to be 7,299 trillion cubic feet (Tcf) (or 207 Tcm), which is the similar figure as the IEA assessment. China holds the largest shale gas resources of 32 Tcm, followed by Argentina of 23 Tcm, Algeria of 20 Tcm, the US of 19 Tcm, Canada of 16 Tcm, and Mexico of 15 Tcm (Table 2-2).

Table 2-2 Technically Recoverable Resources of Shale Gas

Tcm

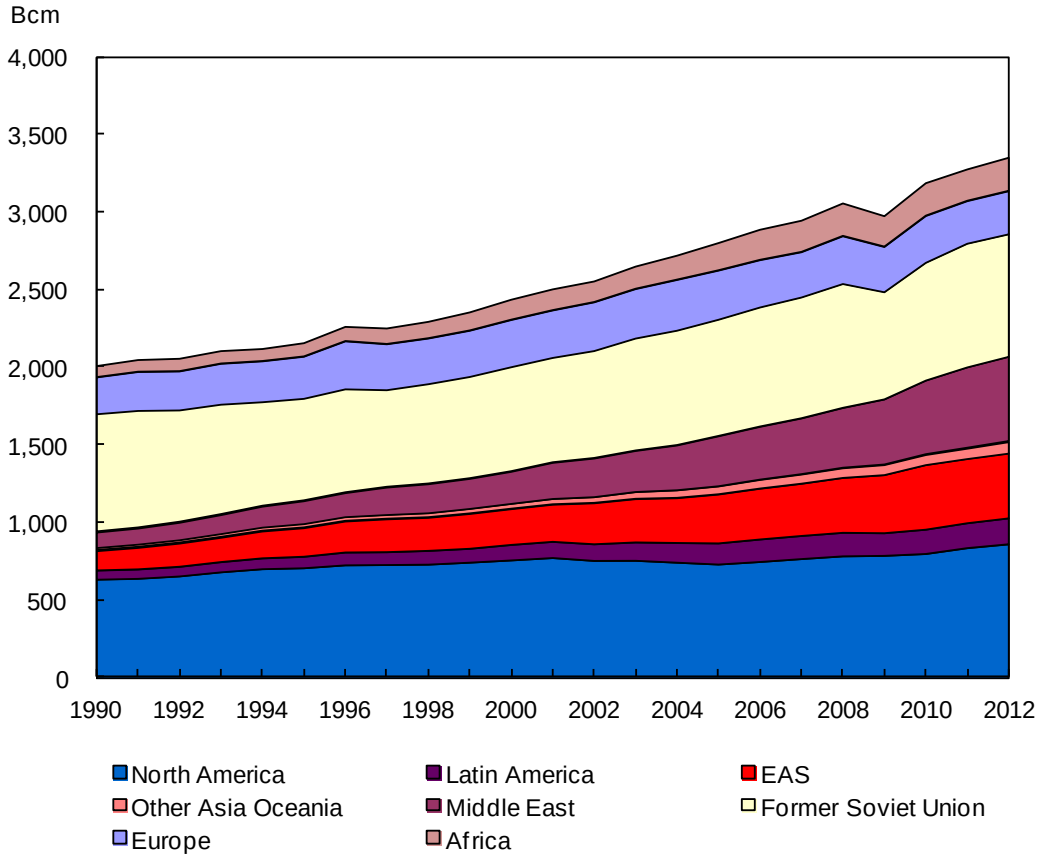
Country	Risked Gas in-Place	Technically Recoverable Resources
USA	-	18.8
Canada	68.3	16.2
Mexico	63.2	15.4
North America Total	**131.5**	**50.5**
Columbia	8.7	1.6
Venezuela	23.1	4.7
Argentina	91.8	22.7
Brazil	36.2	6.9
Bolivia	4.4	1.0
Chile	6.5	1.4
Paraguay	9.9	2.1
Uruguay	0.4	0.1
Latin America Total	**180.8**	**40.5**
Poland	21.6	4.2
Lithuania	0.1	0.0
Kaliningrad	0.6	0.1
Russia	54.4	8.1
Burgalia	1.9	0.5
Romania	6.6	1.4
Ukraine	16.2	3.6
UK	3.8	0.7
Spain	1.2	0.2
France	20.6	3.9
Germany	2.3	0.5
Netherlands	4.3	0.7
Denmark	4.5	0.9
Sweden	1.4	0.3
Europe Total	**138.5**	**25.0**
Morocco/West Sahara/Mauritania	2.7	0.6
Algeria	96.8	20.0
Tunisia	3.2	0.7
Libya	26.7	3.5
Egypt	15.1	2.8
South Afrida	44.1	11.0
Africa Total	**188.6**	**38.5**
China	134.3	31.6
Mongolia	1.6	0.1
Thailand	0.6	0.1
Indonesia	8.6	1.3
India	16.5	2.7
Pakistan	16.6	3.0
Jordan	1.0	0.2
Turkey	4.6	0.7
Australia	57.9	12.4
Asia Pacific Total	**241.7**	**52.0**
Total	**881.2**	**206.6**

Note : UK = United Kingdom, USA = United States of America.
Source: Energy Information Administration (EIA), Technically Recoverable Shale Oil and Shale Gas Resources

Production

World natural gas production increased at two percent per annum from 2,009 BCM in 1990 to 3,350 BCM in 2012. North America and the Former Soviet Union currently share 26 percent and 24 percent, respectively, followed by the Middle East at 16 percent, the EAS region at 12 percent, Europe at 8 percent, Africa at 6 percent, and Latin America at 5 percent. Regionally, production in the Middle East and the EAS region has grown rapidly at eight percent and six percent per annum, respectively, since 1990.

Figure 2-3 Natural Gas Production, by region

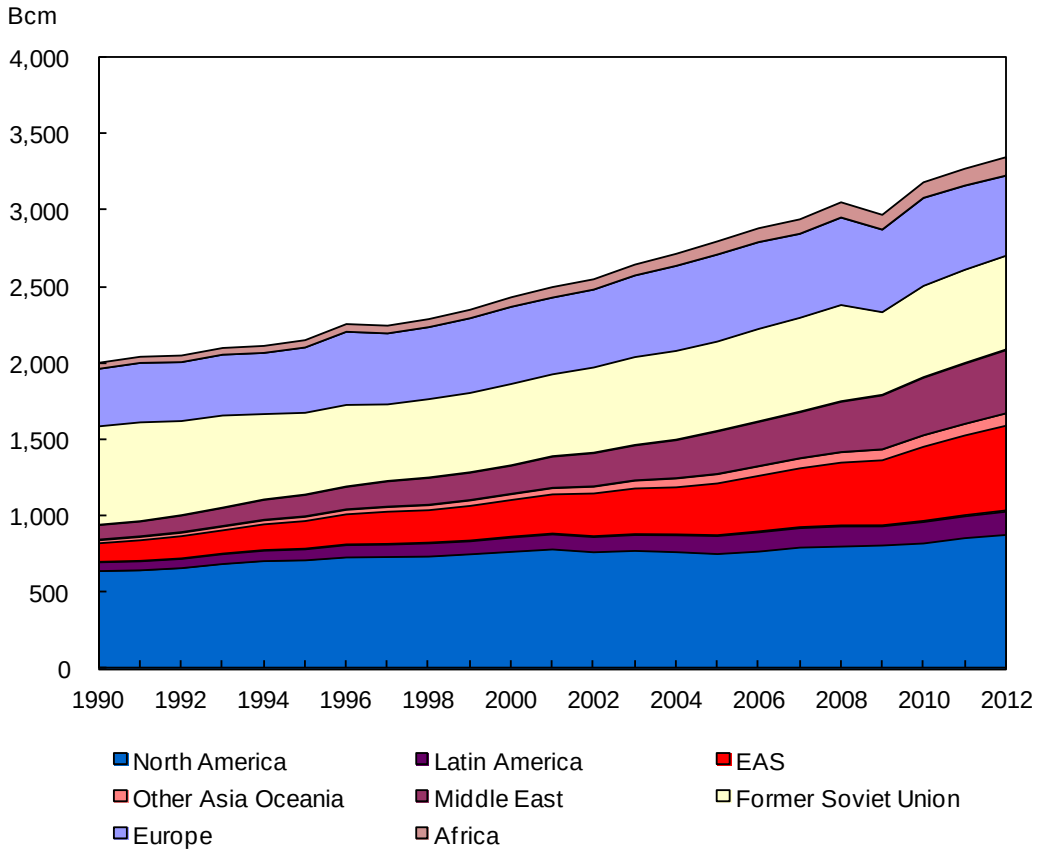


Source: Cedigaz Statistical Database.

Demand

World natural gas demand declined to 2,992 BCM in 2009, resulting from a global economic downturn. However, demand decreased only in Europe, the Former Soviet Union, and Africa, whilst demand in North America, Middle East, and the EAS region actually increased even in 2009.
Demand in Japan expanded significantly after the Fukushima Daiichi nuclear accident in March 2011. On the other hand, demand in Europe decreased in 2011 and 2012. North America is the largest demand region, sharing 26 percent of the world, followed by the Former Soviet Union at 18 percent, the EAS region at 17 percent, Europe at 16 percent, the Middle East at 12 percent, Latin America at 5 percent, and Africa 4 percent. Demand has increased rapidly particularly in the Middle East and the EAS region (both seven percent per annum) since 1990.

Figure 2-4 Natural Gas Demand, by region



Source: Cedigaz Statistical Database.

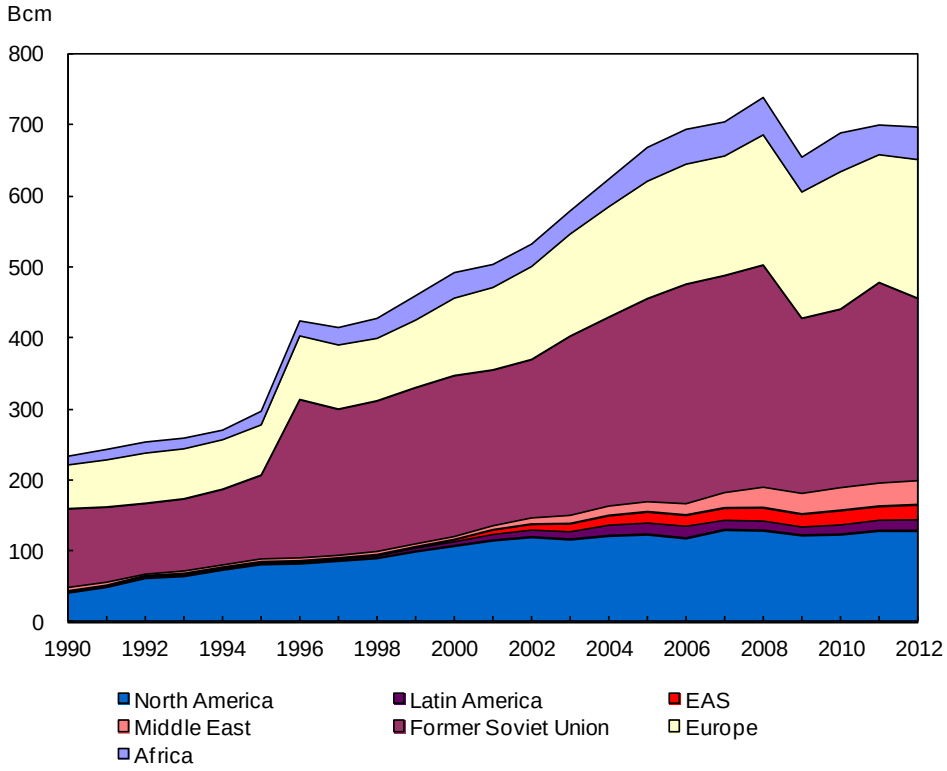
International Trade

In 2012, 1,011 BCM—30 percent of total production—was traded internationally. Sixty-nine percent of international trade was via pipeline, and 31 percent in the form of LNG, in the same year.

Pipeline Gas

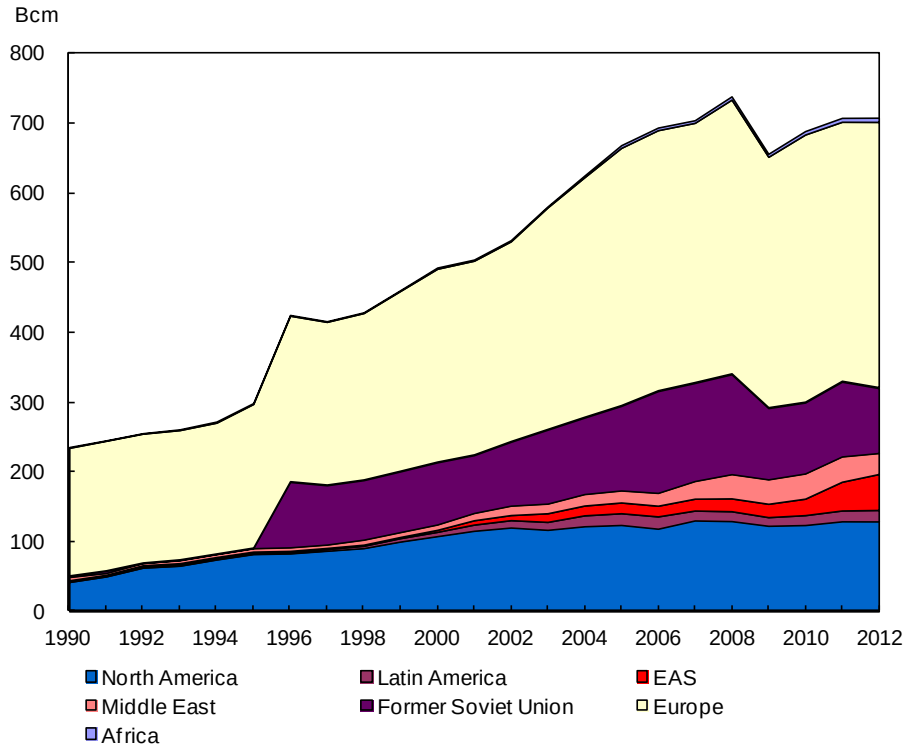
A total of 698 BCM of natural gas was traded via pipeline in 2012. International pipeline gas trade has grown yearly at five percent since 1990. However, weak demand in Europe led to significant decline of pipeline gas imports by Europe in recent years. Indeed, the European imports have not yet recovered to the pre-Euro crisis level. The largest pipeline gas–exporting region is the Former Soviet Union, sharing 36 percent of the world total. European (mainly Norway and Netherlands) and North American (mainly Canada) exports are for respective regional markets: Norwegian and Dutch gases are consumed mainly in the United Kingdom, Germany, and France, whilst Canadian gas is consumed in the USA.

Figure 2-5 Pipeline Gas Exports, by region



Source: Cedigaz Statistical Database.

Figure 2-6 Pipeline Gas Imports, by region

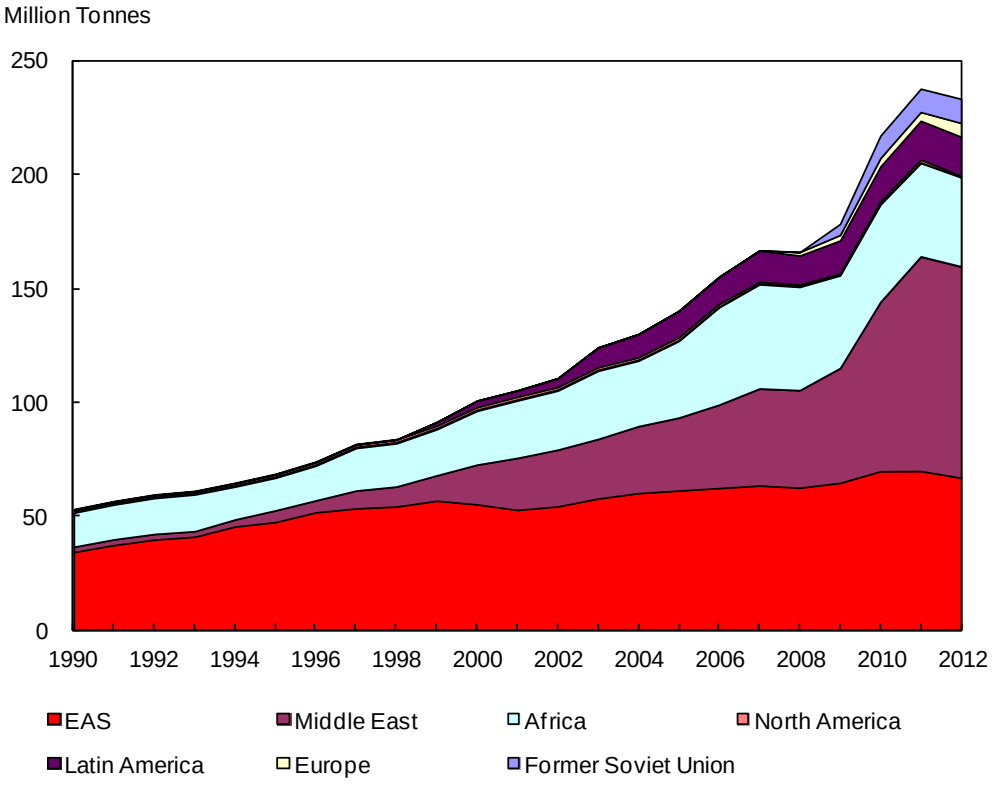


Source: Cedigaz Statistical Database.

Liquefied Natural Gas

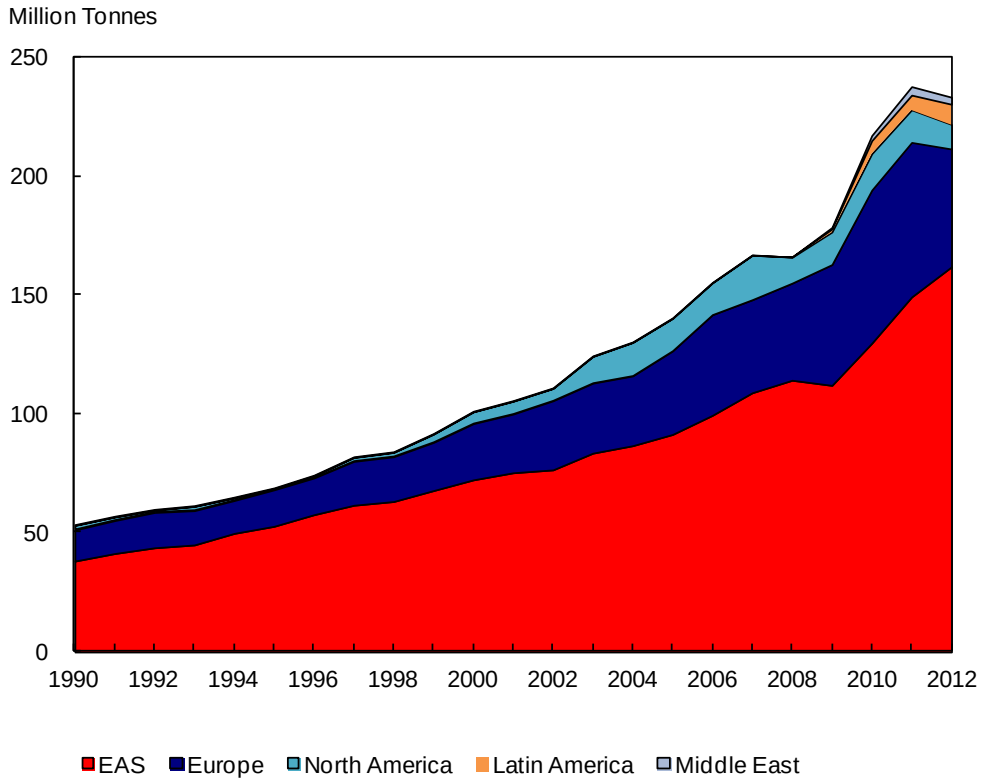
In 2012, 230 million tonnes (MT) (313 BCM) of LNG was traded worldwide. The LNG trade increased at seven percent per year since 1990, more rapidly than that of pipeline gas. However, the year 2012 saw a decline of LNG trade mainly due to weaker demand in Europe and the United States. Major LNG-exporting regions are the Middle East, the EAS region, and Africa, sharing 40 percent, 25 percent, and 17 percent of the world total, respectively. The EAS region and Europe import most of the LNG.

Figure 2-7 LNG Exports, by region



Source: Cedigaz Statistical Database.

Figure 2-8 LNG Imports, by region



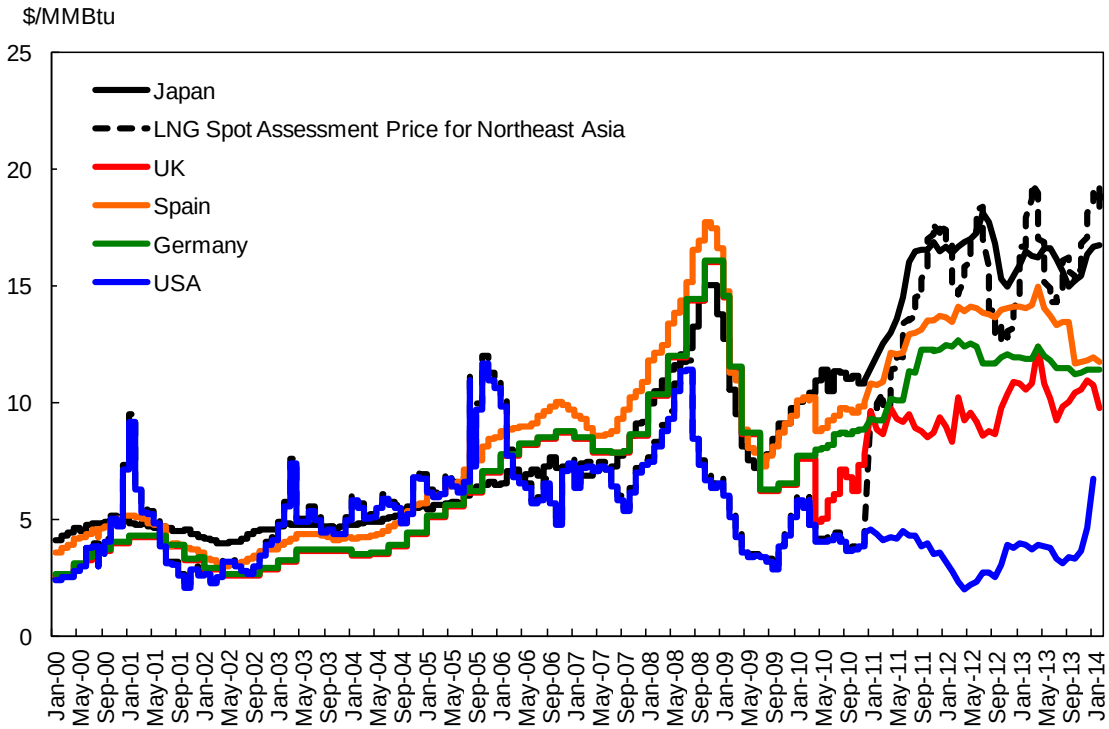
Source: Cedigaz Statistical Database.

International Price

Figure 2-9 represents the import prices of natural gas of Japan, the USA, and European countries. As crude oil prices started to rise in the 2000s, the import prices of Japan and European countries also increased partly because of oil-linked pricing formula applied to long-term contracts for these countries. The USA price also increased until 2008 mainly due to tight domestic market balance.

Post-2009 period is characterized by widening regional price gap, especially between the USA and Japan, at an unprecedented level. This Asian Premium resulted from a combination of factors, such as the shale gas revolution in the USA, high oil prices, robust demand increase in Asia, and illiquidity of the Asian LNG market.

Figure 2-9 International Natural Gas Prices



Note : LNG = liquefied natural gas, UK = United Kingdom, USA = United States of America.

Source: Energy Intelligence.

CHAPTER 3
Country Analysis

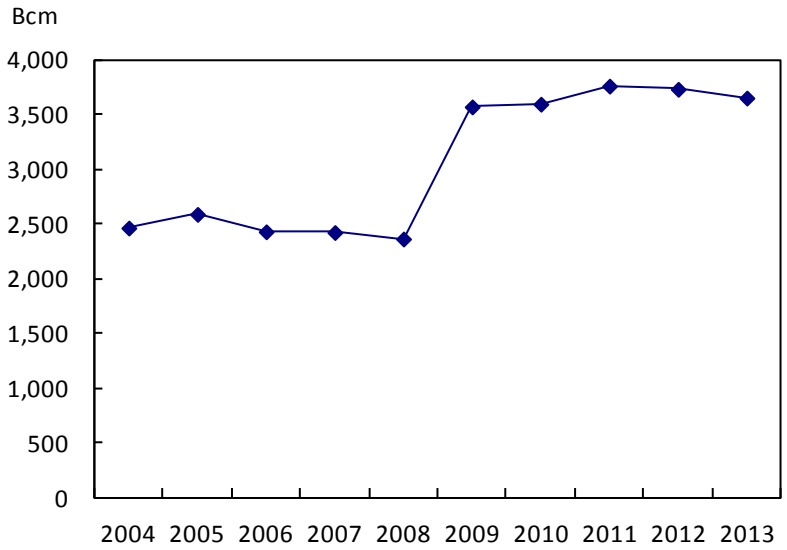
This chapter examines demand, supply, international trade, and policies of the major natural gas–producing and –consuming countries in the EAS region. Countries described here are Australia, Brunei Darussalam, China, India, Indonesia, Japan, Korea, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam. Other EAS countries—Cambodia, Lao PDR, and New Zealand—are excluded because of non-usage, at least statistically, or absence of international trade of natural gas.

Australia

Resources

Proven reserves of natural gas in Australia total 3,650 BCM, which is the largest in the EAS region. The major sedimentary basins are Carnarvon and Browse in Western Australia, and Bonaparte in the Northern Territory. Proven reserves of coal bed methane (CBM) amount to 960 BCM, accounting for 26 percent of total proven gas reserves.

Figure 3-1 Proven Reserves of Natural Gas in Australia



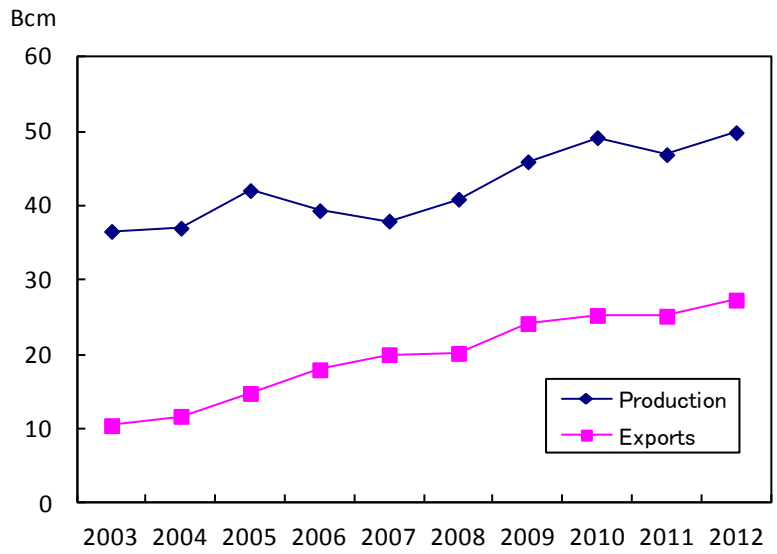
Source: Cedigaz Statistical Database.

Whilst CBM already shares a considerable amount in Australia's proven reserves, the country is believed to possess considerable shale gas resources. According to the EIA, technically recoverable resources of shale gas in Australia are 12 Tcm.

Supply and Demand

Australia is not only a major producing country but also the third largest exporter of natural gas in the EAS region. According to Cedigaz statistics, Australia produced 49.9 BCM and exported 27 BCM of natural gas in 2012. Exports amount has increased steadily due to capacity addition of LNG liquefaction plants.

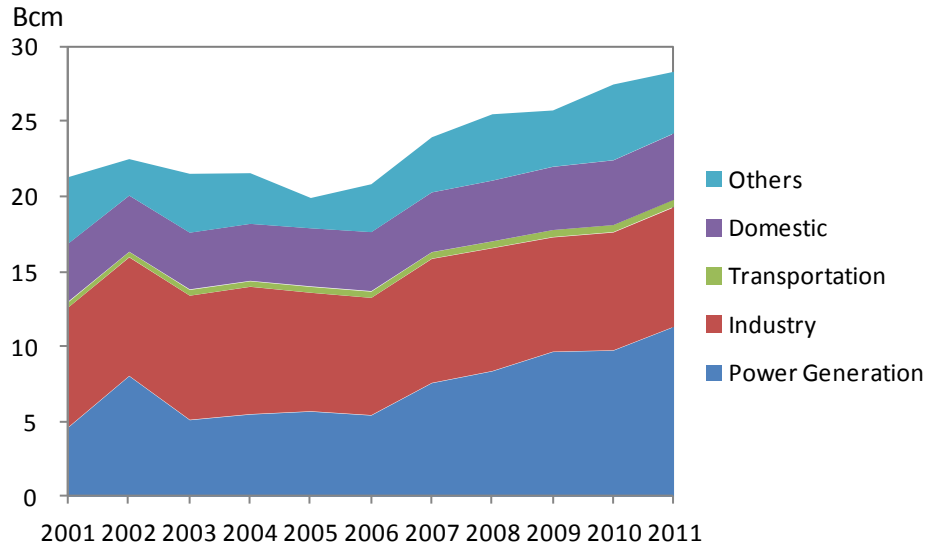
Figure 3-2 Natural Gas Production and Exports of Australia



Source: Cedigaz Statistical Database.

Natural gas consumption in 2011 was 27 Mtoe (28 BCM). Power generation is the largest demand sector, sharing 40 percent of the total, followed by the industry sector of 28 percent.

Figure 3-3 Natural Gas Demand in Australia, by sector



Source: IEA.

According to the Bureau of Resources and Energy Economics,[1] gross natural gas production will increase yearly at 2.9 percent to reach 8,595 PJ (215 BCM) in 2049–50. Meanwhile, the bureau forecasts that natural gas demand is expected to increase to 2,469 PJ (62 BCM) in the same fiscal year. The share of natural gas in the energy mix will expand from 26 percent in 2012–13 to 34 percent in 2049–50.

Therefore, Australia's export potential will increase significantly. Indeed, Australia has a number of new LNG projects. The total liquefaction capacity of those projects with FID (Final Investment Decision) has already amounted to 62 MT, which is expected to be on stream in several years. As a result, Australia will be the largest LNG exporter in the world by 2020.

Energy Policy

In Australia, the Department of Industry is responsible for gas and other energy policies. The Energy White Paper published in 2012 under the Labour government expects natural gas production to quadruple by 2017. The paper also anticipates not only conventional but also CBM, shale gas, and tight gas to contribute to this dramatic production increase. With this supply expansion potential, the paper targets more energy exports especially for Asia. However, the following challenges are recognized:

- attracting timely and efficient investment in our energy sector,
- minimizing energy price pressures,
- improving energy productivity and reducing inefficient peak demand,
- managing transitional pressures in the gas markets,
- bringing new technologies to market,
- ensuring our long-term liquid fuel security,
- safely and sustainably developing our energy resources, and
- promoting informed energy choices.

Whilst Australia is expected to be the largest LNG exporter in this decade, it is true that many new LNG projects face considerable cost overruns. After the

[1] 'Australian Energy Projections', Bureau of Resources and Energy Economics, http://www.bree.gov.au/publications/australian-energy-projections-2049%E2%80%9350 (accessed December 19, 2012).

Liberal Party took over the power in 2013, the Department of Industry has been working on a new Energy White Paper to be published in September 2014. The new paper will consider the following:[2]

- policy and regulatory reform to secure reliable, competitively, and transparently priced energy for a growing population and productive economy, including the efficiency and effectiveness of regulatory bodies;
- the appropriate role of government in the energy sector;
- opportunities to drive the more productive and efficient use of energy;
- energy-related distribution infrastructure to deliver efficient national markets;
- alternative transport fuel sources;
- workforce issues, including national skills development needs;
- emerging energy technologies and new energy sources; and
- future growth in exports of energy products, including the world leading services industries.

Initiating the formulating work of the new paper, Minister Macfarlane stated:

> 'the White Paper will deliver on the Government's economy-wide reforms relevant to the energy sector. Reforming regulation, improving workforce skills and encouraging innovation will help drive the efficiencies and productivity to put downward pressure on domestic costs and grow energy exports.'[3]

Brunei Darussalam

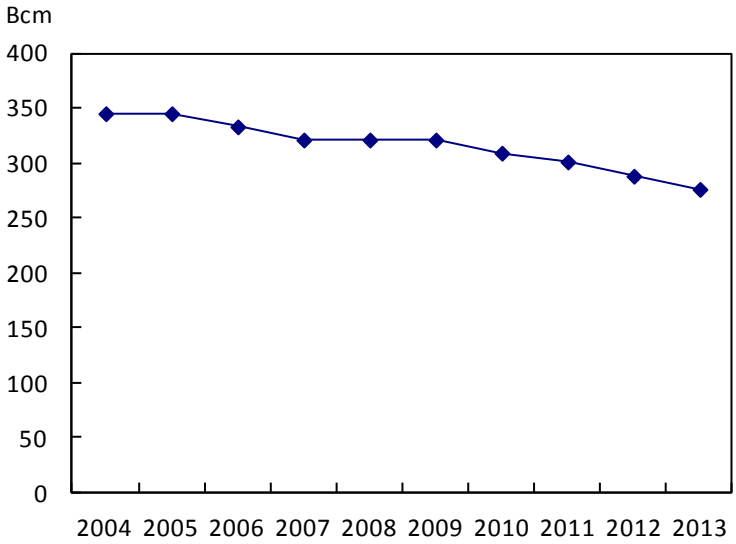
Resources

Proven reserves of natural gas in Brunei Darussalam are 276 BCM. Since there is little new development happening, proven reserves have been declining in recent years.

[2] Energy White Paper Issue Paper, Department of Industry, http://ewp.industry.gov.au/documents/issues-paper (accessed December 2013).

[3] 'Work begins on Energy White Paper', Ministry of Industry press release, http://minister.industry.gov.au/ministers/macfarlane/media-releases/work-begins-energy-white-paper (accessed December 5, 2013).

Figure 3-4 Proven Reserves of Natural Gas in Brunei Darussalam

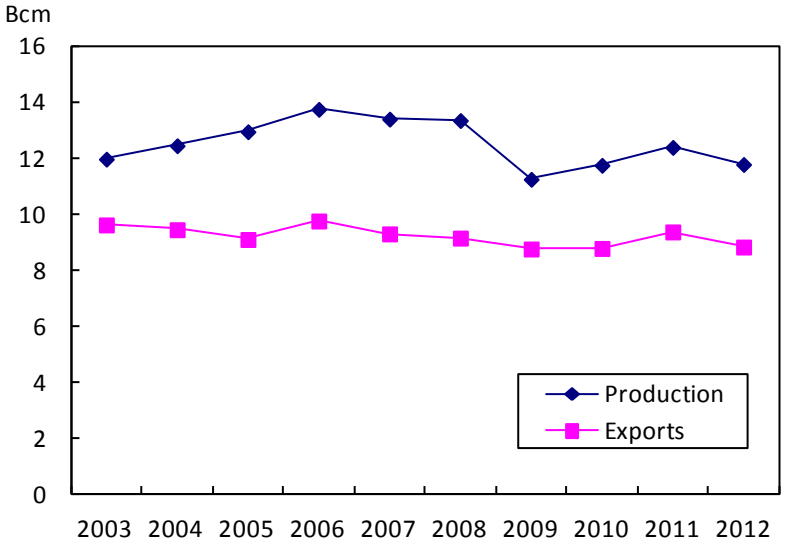


Source: Cedigaz Statistical Database.

Supply and Demand

With little new developments, natural gas production in Brunei Darussalam has stagnated for the past decade. Production in 2012 was 12 BCM, slightly declined from the previous year due to infrastructure refurbishment work.

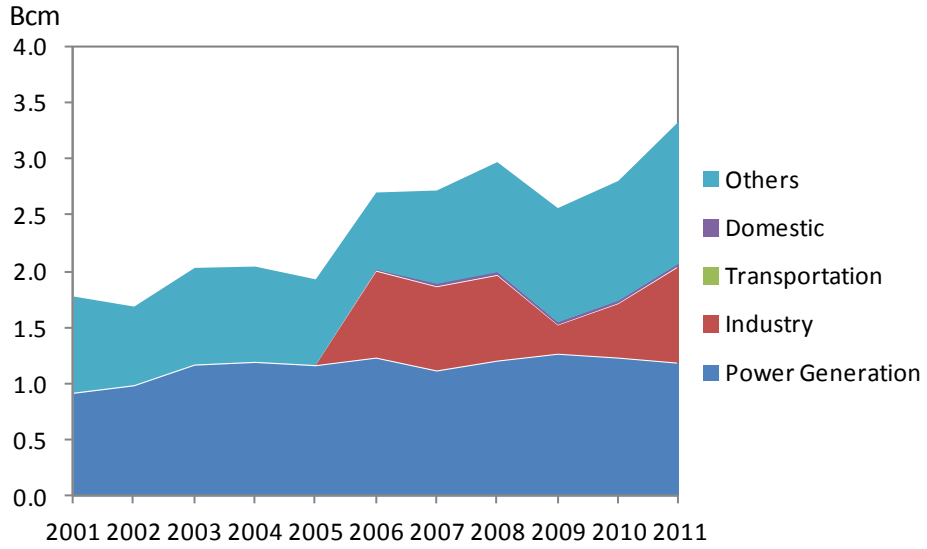
Figure 3-5 Natural Gas Production and Exports of Brunei Darussalam



Source: Cedigaz Statistical Database.

Natural gas consumption in 2011 was three BCM. Own use at energy plants is the largest demand sector, sharing 38 percent of the total, followed by the power generation sector at 36 percent.

Figure 3-6 Natural Gas Demand in Brunei Darussalam, by sector



Source: IEA.

According to the Prime Minister's Office, Brunei Darussalam's energy production will increase to 27 MToe in 2020 and remain around the same amount in 2035.[4] Natural gas production, too, will be in a similar trend to reach 18 MToe (19 BCM) in 2020 and stay at the same level in 2035. Natural gas exports are expected to be stable at 15 MToe (16 BCM) for both 2020 and 2035. Natural gas demand in the country will expand to 2.9 MToe (3.0 BCM) in 2020 and 3.3 MToe (3.5 BCM). The power generation and industry sectors are expected to share 44 percent and 33 percent, respectively, in both 2020 and 2035.

Energy Policy

Oil and LNG exports account for 96 percent of Brunei Darussalam's export value in 2012. The core of the country's energy policy is, therefore, maintaining stable production and export of oil and gas. However, slow progress of new gas developments casts shadows on maintaining the current level of production and exports. Offshore deep-water blocks adjacent to

[4] Data submitted to IEEJ.

Malaysia's maritime water were hoped to be the breakthrough, but no gas discovery has been successful so far.

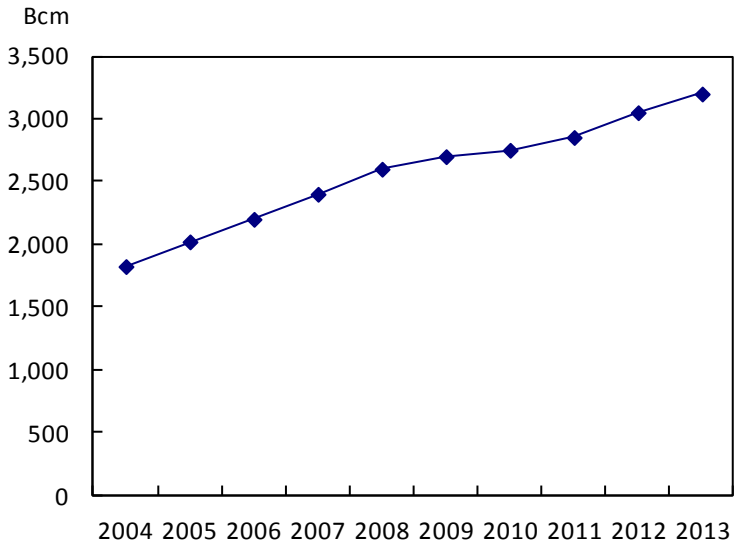
The Energy Department formulates and executes energy policies. Domestic energy developments are stipulated by the Petroleum Mining Act that was established in 1963. According to the Act, oil and gas upstream developments are controlled by the development plans of the government.
Another pillar of the country's energy policy is diversification away from heavy dependency on oil and LNG exports. The government has been investing on petrochemical and refinery industries and energy efficiency programs.

China

Resources

With 3,200 BCM in 2013, China holds the second largest proven reserves of natural gas in the EAS region. Exploration and production activities in major basins like Tarim, Ordos, Songliao, Sichuan, and Bohai Bay have contributed to steady reserve additions in the past decade.

Figure 3-7 Proven Reserves of Natural Gas in China



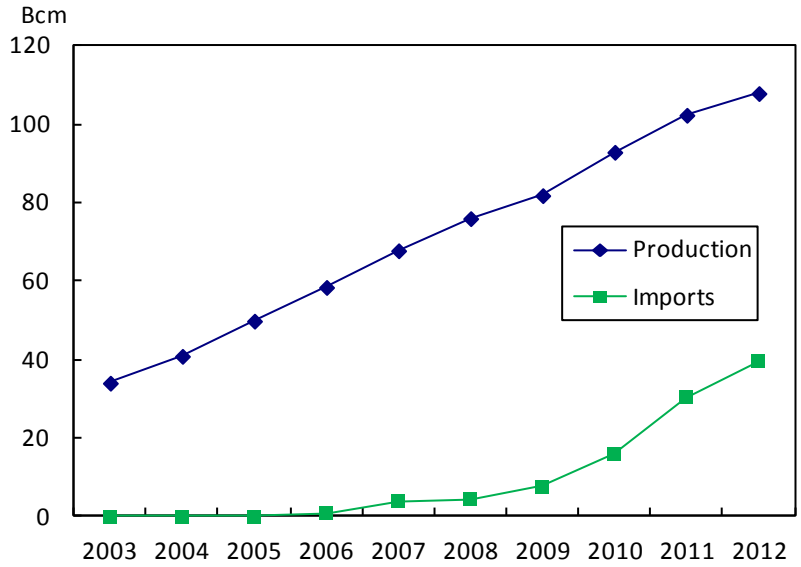
Source: Cedigaz Statistical Database.

China also has a substantial potential for unconventional gas resources. The Ministry of Land and Resources of China estimates that recoverable resources of tight gas, CBM, and shale gas are 3.3 Tcm, 10.9 Tcm, and 25.1 Tcm, respectively.

Supply and demand

China produced 108 BCM of natural gas in 2012. The production has increased dramatically at 13 percent per annum since 2003, yet imports have increased even faster in recent years. China started to import LNG in 2006 and pipeline gas in 2009 to keep up with the rapidly rising demand.

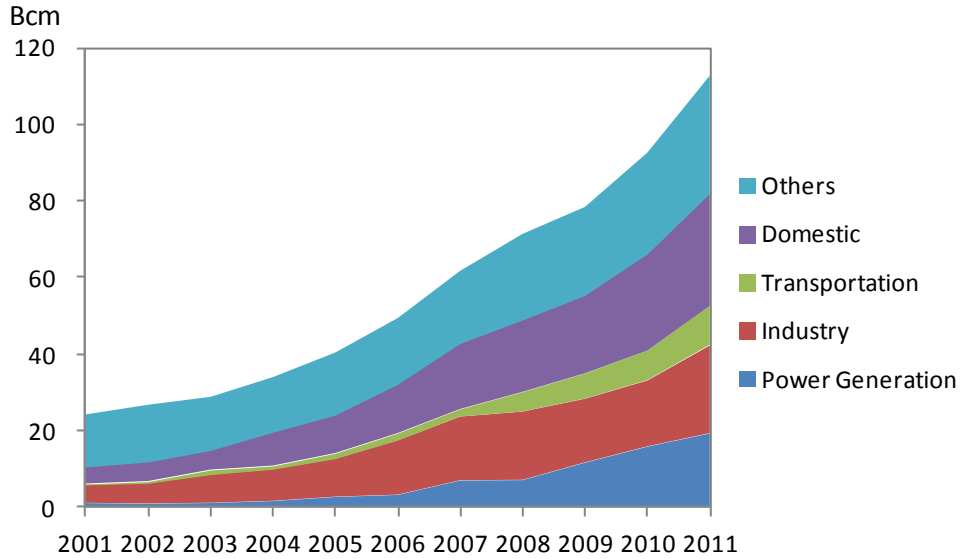
Figure 3-8 Natural Gas Production and Imports of China



Source: Cedigaz Statistical Database.

China consumed 113 BCM of natural gas in 2011. The consumption has grown at 17 percent per annum for the past 10 years. 'Others', mainly own use by energy industries and feed stocks for petrochemical, shares 27 percent of the total, followed by domestic at 26 percent, industry at 20 percent, and power generation at 17 percent.

Figure 3-9 Natural Gas Demand in China, by sector

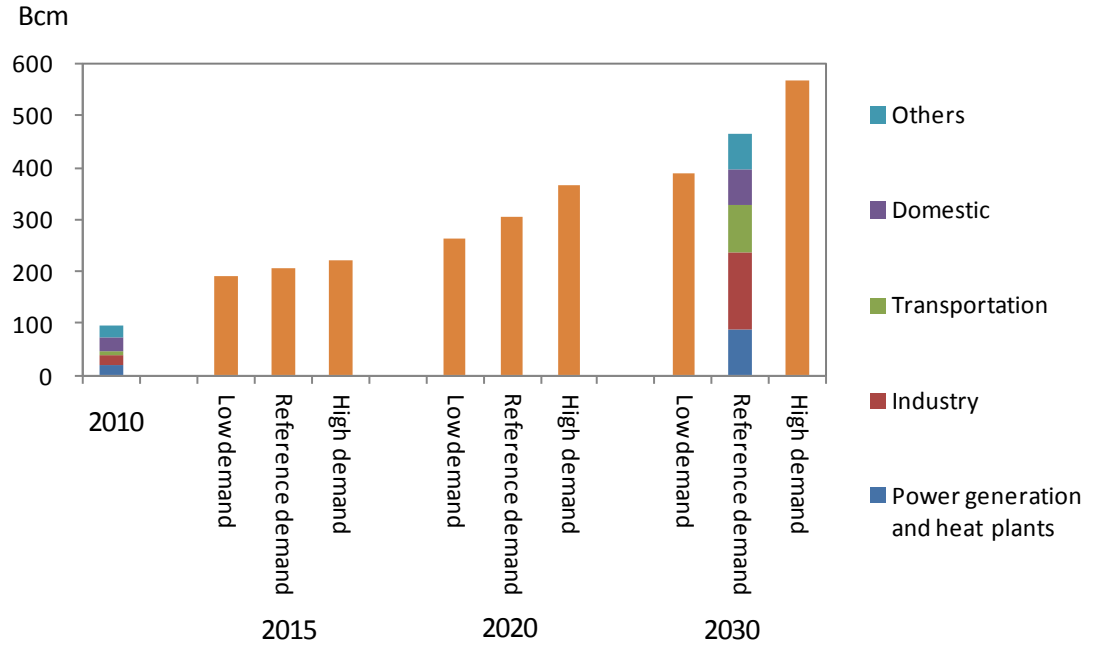


Source: IEA.

According to CNPC (China National Petroleum Corporation) Economics & Technology Research Institute (ETRI), natural gas production in China will increase to 150 BCM in 2015, 200 BCM in 2020, and 240 BCM in 2030 (including 60 BCM of CBM and 50 BCM of shale gas). Pipeline gas import is expected to reach 40 BCM in 2015, 70–95 BCM in 2020, and 100–125 BCM in 2030. LNG import is expected to reach 40 BCM (29 MT) in 2015, 50–70 BCM (37–51 MT) in 2020, and 70–95 BCM (51–70 MT) in 2030.

As for natural gas demand, CNPC ETRI forecasts that the demand will increase to 190–222 BCM in 2015, 265–365 BCM in 2020, and 389–568 BCM in 2030, depending on the scenarios. The demand growth will be driven mainly by industry and transportation.

Figure 3-10 Natural Gas Demand Outlook in China



Source: CNPC Economics & Technology Research Institute.

Energy Policy

The National Energy Administration, under the supervision of the National Energy Commission chaired by Prime Minister Li, draws up and exercises China's energy policy. Such policy is outlined in the 12th Five Year Plan adopted in 2011, which emphasizes energy efficiency, energy source diversification, environmental protection, international cooperation, optimization of demand/supply structures, and establishment of stable/competitive/clean energy supply system. Bohai Bay, Jungar, Ordos, Sichuan, and Tarim are mentioned as the major producing areas. Additionally, offshore oil and gas and CBM developments are also promoted. With aggravating air pollution, the Government of China published the *Action Plan for Air Pollution Prevention and Control* in 2013 that prohibits new coal-fired power plants by auto producers in major cities, and promotes combined heat and power and use of natural gas.

As far as natural gas is concerned, priority is given to reforming domestic gas pricing so that the gap between import and domestic prices can be narrowed down, the demand can be optimized, and domestic gas developments can be incentivized. A series of pricing reforms has been conducted over the last decade to achieve these goals. Recently, in 2013, the National Development

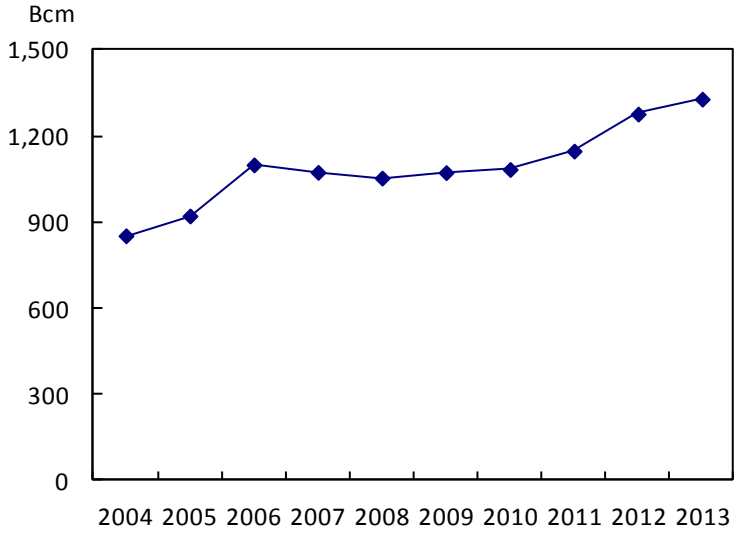
and Reform Commission altered the wholesale pricing point from wellheads to city gates, and increased the average wholesale price from 1.69 yuan/m^3 ($7.39/MMBtu) to 1.95 yuan/m^3 ($8.52/MMBtu).

India

Resources

India possesses substantial natural gas reserves of 1,330 BCM as of 2013; thanks to domestic gas exploration and development promotion policy since the 1990s that contributed significant reserve additions, especially in the early 2000s, although the reserve increase has slowed down in recent years.

Figure 3-11 Proven Reserves of Natural Gas in India



Source: Cedigaz Statistical Database.

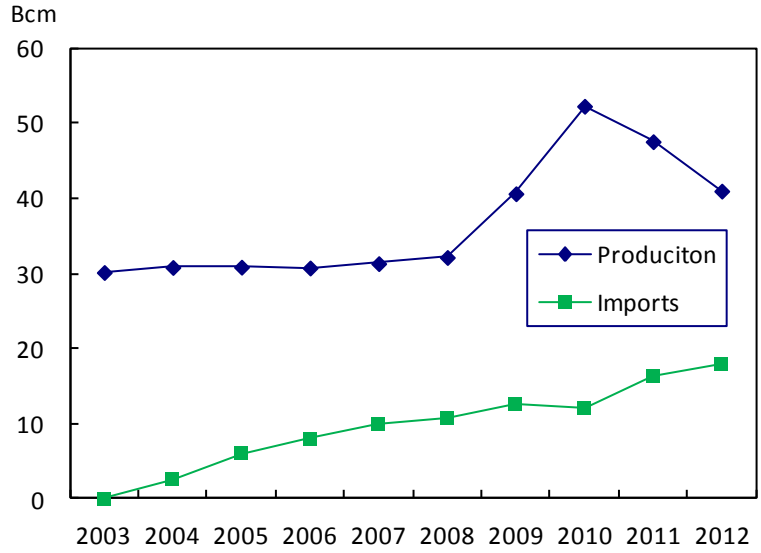
India is also rich in unconventional gas resources. According to the Directorate General of Hydrocarbons under the Ministry of Petroleum and Natural Gas, CBM resource in India is 2,609 BCM.[5] As for shale gas, the US EIA estimates India's technically recoverable resources amounts to 63Tcf (1.8 Tcm).[6]

[5] Directorate General of Hydrocarbons, 'Hydrocarbon Exploration and Production Activities – 2012-13', p. 7.
[6] Energy Information Administration (EIA), 'Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States',

Supply and demand

Natural gas production in India in 2012 was 41 BCM. With the start of gas production of Krishna-Godavari, the country's total production increased dramatically in 2009 and 2010. However, geological complexity and lower performance of the current wells in Krishna-Godavari resulted in sharp decline of the production in 2011 and 2012. Stagnating domestic gas production tightens the demand/supply in the country, leading to more LNG imports.

Figure 3-12 Natural Gas Production and Imports of India

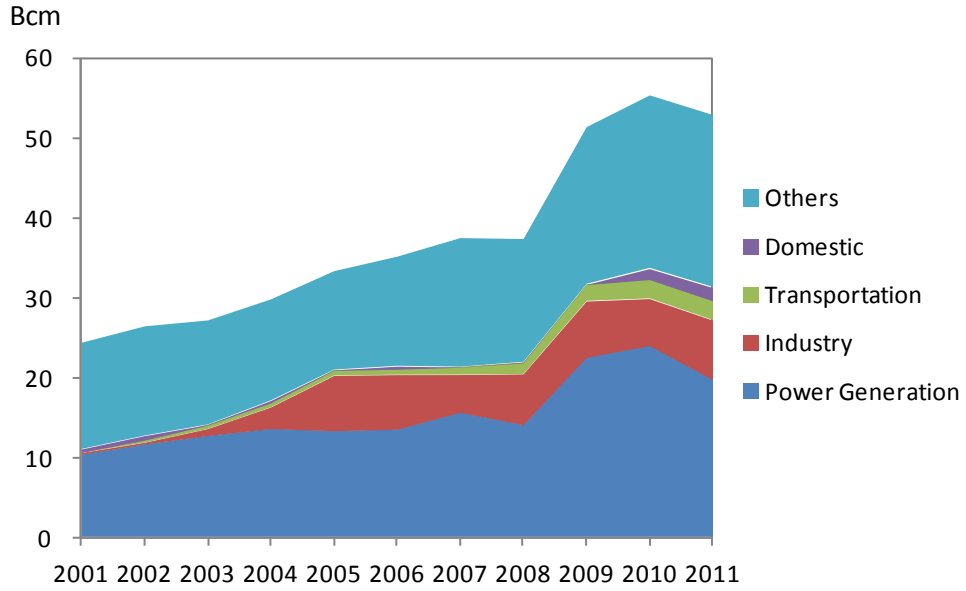


Source: Cedigaz Statistical Database.

Gas consumption in India in 2011 was 53 BCM. The consumption has grown at eight percent per annum for the past decade. Like in China, 'Others', mainly own use by energy industries and feed stocks for petrochemical, shared the largest portion of 41 percent of the total, followed by power generation at 37 percent and industry at 14 percent.

http://www.eia.gov/analysis/studies/worldshalegas/

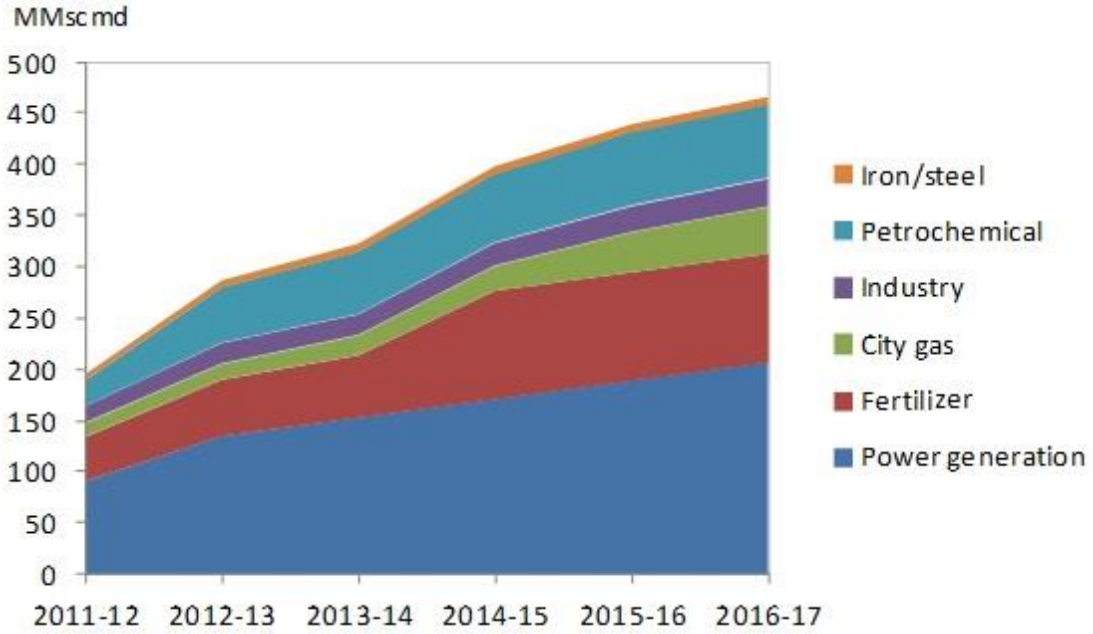
Figure 3-13 Natural Gas Demand in India, by sector



Source: IEA.

According to the 12th Five Year Plan, India's natural gas demand will increase at an astonishing 19 percent per annum to 466 million standard cubic meter per day (MMscmd) (161 BCM) in 2016–2017. However, majority of the demand growth is expected to accrue in power generation and fertilizer sectors which are regarded as 'price elastic'. Therefore, the demand growth is highly dependent on cost competitiveness of natural gas for those sectors.

Figure 3-14 Natural Gas Demand Outlook in India



Source: Planning Commission, 12th Twelfth Five Year Plan.

Energy Policy

India's energy policy administration is divided among several ministries, namely, Planning Committee, Ministry of Petroleum and Natural Gas, Ministry of Power, Ministry of Coal, Ministry of New and Renewable Energy, and Department of Atomic Energy. The Five Year Plan, the basic policy paper not only on energy but also on many other policy fields, is formulated by the Planning Committee based on proposals by the above ministries.

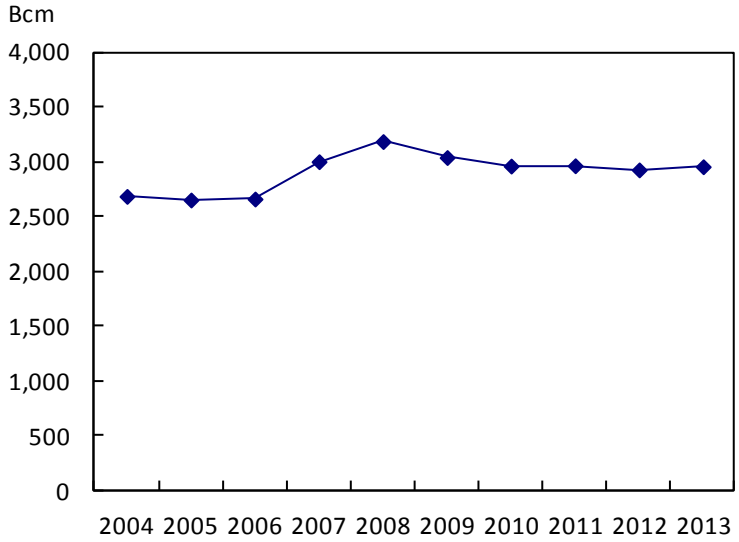
The current 12th Five Year Plan recognizes achieving low-cost energy supply and emphasizes the need for energy efficiency and domestic resource developments. India is similar to China in terms of gas policies. The plan calls not only for conventional but also for CBM and shale gas developments, and addresses domestic gas pricing reform.

Indonesia

Resources

After Australia and China, Indonesia is the third largest proven gas reserve holder of 2,954 BCM as of the beginning of 2013. The major reserves are located in Natuna, Sumatra, East Kalimantan, Maluku, and Papua. Additionally, there are CBM recoverable reserves of 113 Tcf (3 Tcm).

Figure 3-15. Proven Reserves of Natural Gas in Indonesia

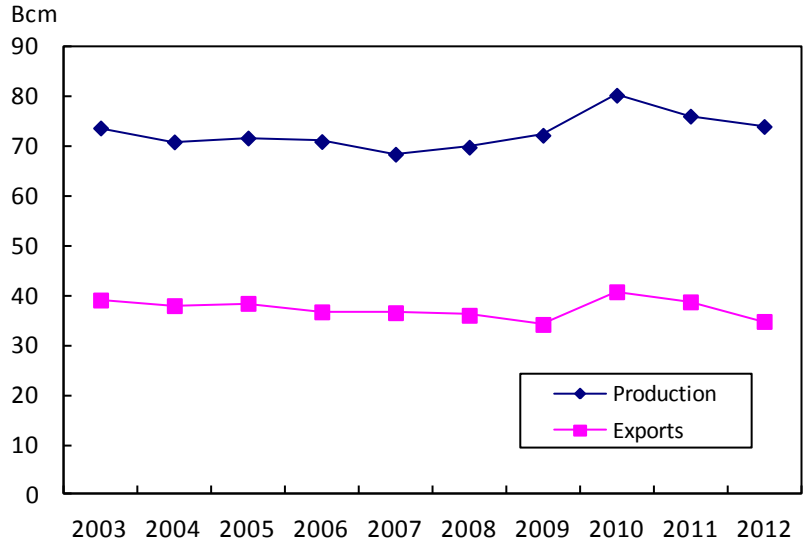


Source: Cedigaz Statistical Database.

Supply and demand

Natural gas production in Indonesia has hovered around 70–80 BCM per annum in the past decade. Both production and exports decreased in two consecutive years in 2011 and 2012.

Figure 3-16 Natural Gas Production and Exports of Indonesia

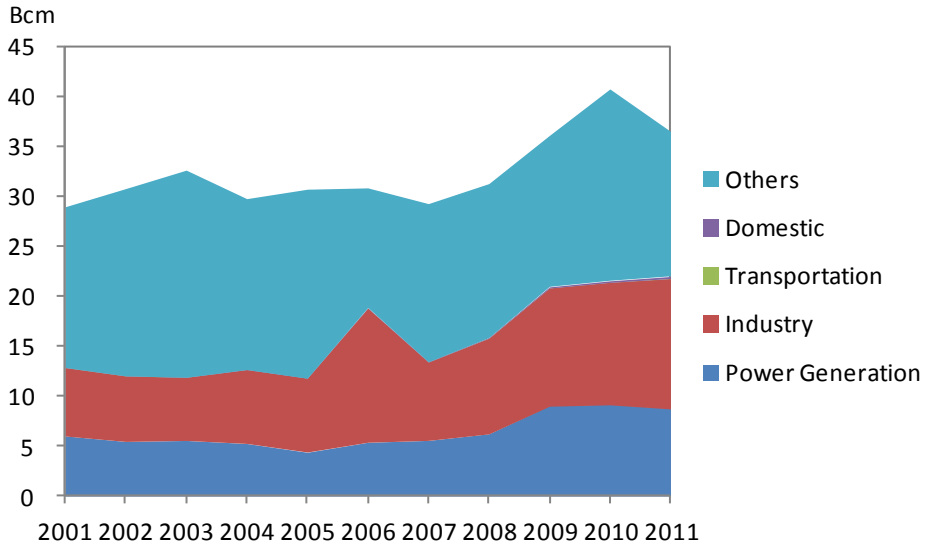


Source: Cedigaz Statistical Database.

Indonesia consumed 36 BCM of natural gas in 2011. 'Others' that include fertilizer production and own use by energy plants shared 40 percent of the

total, followed by industry at 36 percent and power generation at 24 percent. In 2011, the demand decreased by four BCM, partly because slower upstream activities reduced own use by energy plants.

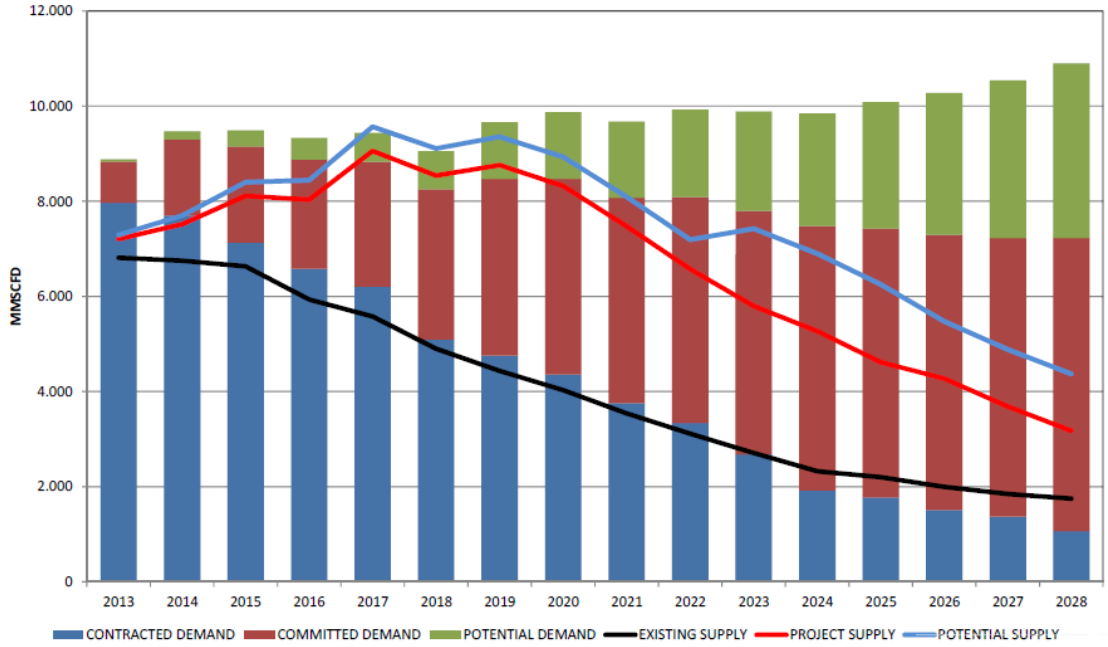
Figure 3-17 Natural Gas Demand in Indonesia, by sector



Source: IEA.

According to a forecast by the Ministry of Energy and Mineral Resources, domestic natural gas production will peak in 2017, and will meet less than half of the demand in 2028. This means Indonesia is likely to turn into a net import country in the long run. Indeed, the state-owned oil company Pertamina signed a sale and purchase agreement with Cheniere Energy to import 0.8 MT of LNG per year from the Sabine Pass project in the USA. If potential demand is included, Indonesia's natural gas demand could rise steadily to about 11,000 million standard cubic feet per day (MMscfd) (107 BCM) in 2028. However, because potential demand shares as much as 40 percent of the total demand in 2028, whether the demand of 107 BCM will be generated seems to depend on the availability and import cost of domestic gas.

Figure 3-18 Natural Gas Demand/Supply Outlook in Indonesia



Source: Ministry of Energy and Mineral Resources.

Energy Policy

Indonesia's energy policy is controlled by the Ministry of Energy and Mineral Resources. The main policy paper is the National Energy Policy of 2006, which envisaged oil consumption replaced by coal, natural gas, and renewable energy. The principle of reducing oil dependency seems to remain the same in the new energy mix target that the government is currently formulating.[7] The policy intention of less oil dependency reflects the expanding oil subsidies, aggravated by the demand growth and increasing expensive oil imports. Therefore, the importance of natural gas as alternative fuel is rising. Indeed, in principle, 25 percent of gas production is required to be supplied to the domestic market which is known as Domestic Market Obligation policy.

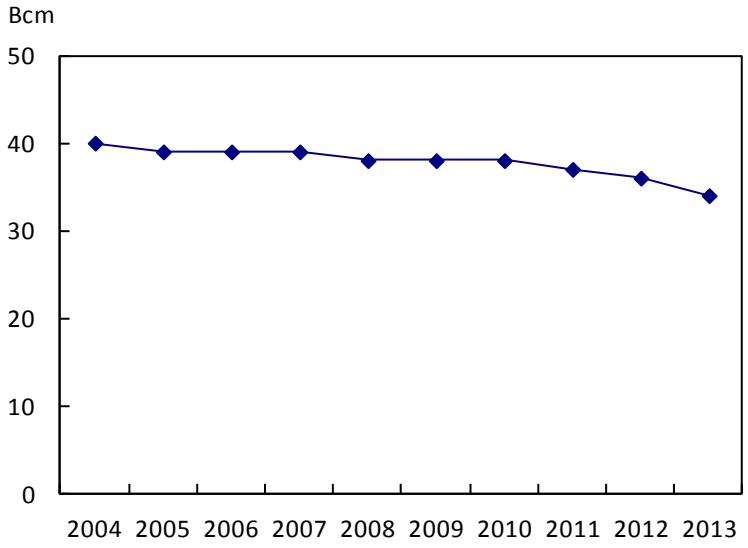
[7] *Jakarta Post*, 'RI turns to renewable resources for future energy use', January 29, 2014.

Japan

Resources

Japan has little gas resources. In the beginning of 2013, proven reserves in the country totalled merely 34 BCM. No significant unconventional gas resources were reported. Although the government has been researching on methane hydrate resources for the past decades, there is no concrete schedule for any reserve additions and commercialization of methane hydrate.

Figure 3-19 Proven Reserves of Natural Gas in Japan

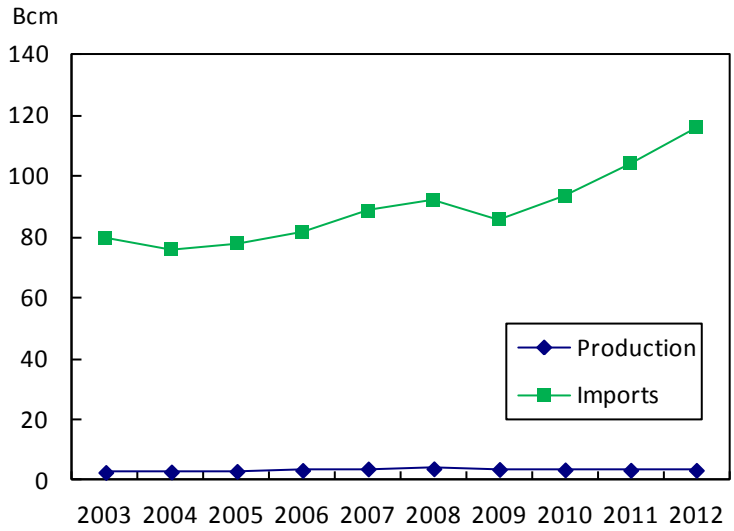


Source: Cedigaz Statistical Database.

Supply and Demand

Japan produced three BCM of natural gas in 2012, which is three percent of the demand. Production has been stable for the past 10 years. Lacking international pipeline connections, imports are only in the form of LNG. After the Fukushima nuclear accident, import amount jumped to reach 116 BCM in 2012, making Japan the largest natural gas importer in the world.

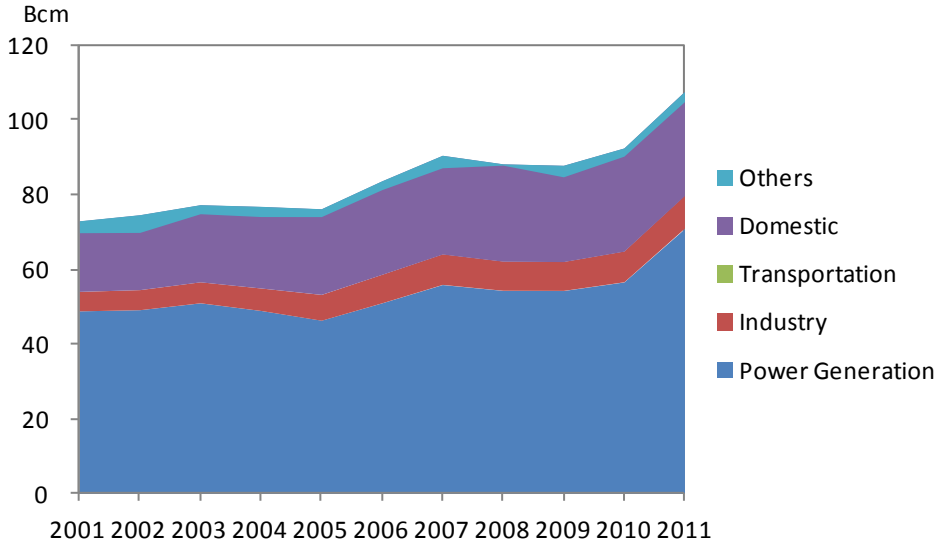
Figure 3-20 Natural Gas Production and Imports of Japan



Source: Cedigaz Statistical Database.

Japan consumed 105 BCM of natural gas in 2011. Sharing 68 percent of the total, power generation is the largest demand sector, followed by domestic at 27 percent.

Figure 3-21 Natural Gas Demand in Japan, by sector

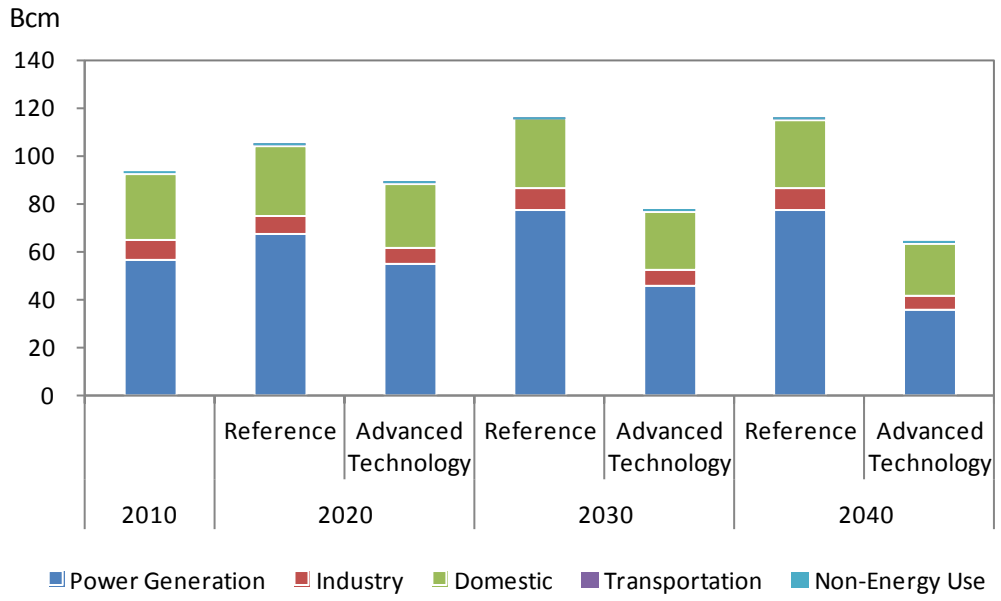


Source: IEA.

IEEJ forecasts that natural gas demand will fluctuate from 93 BCM in 2010 to 89–102 BCM in 2020, 74–113 BCM in 2030, and 61–112 BCM in 2040,

highly dependent on the extent of nuclear restart and decommissioning. Demand will be met primarily by imported LNG. Whilst methane hydrate has great potential, this forecast does not consider any significant production, given the uncertainty on technology development.

Figure 3-22 Natural Gas Demand Outlook in Japan



Notes: Advanced Technology scenario assumes energy conservation and low-carbon technologies, including renewable and nuclear, to a maximum extent to enhance energy security and address climate change issues.
Source: IEEJ.

Energy Policy

The Ministry of Economy, Trade and Industry is responsible for formulating and executing energy policy in Japan. Traditionally, energy security, environmental protection, and economic efficiency are the three pillars of Japan's energy policy. Concerned about high dependency on imported fossil fuels, Japan has been working on energy diversification, especially away from oil, energy efficiency, reducing CO_2 (carbon dioxide) emission, and other measures.

The Fukushima Daiichi accident in 2011 forced the government to fundamentally alter its nuclear-oriented energy policy. The Basic Energy Plan

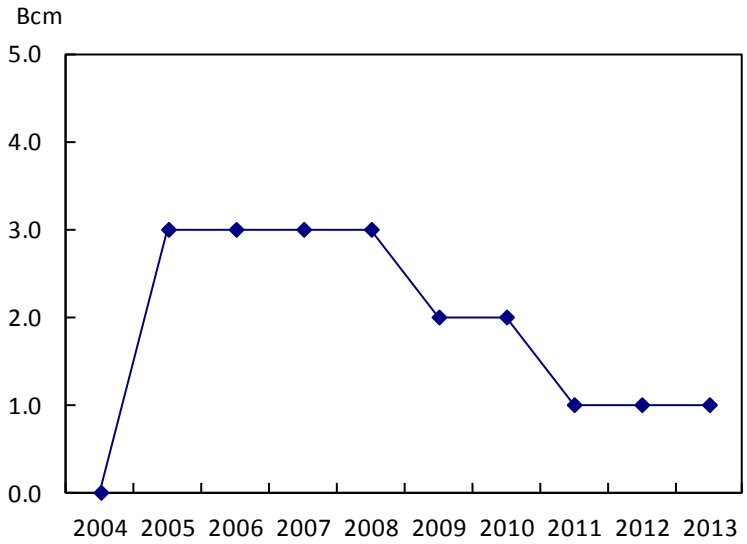
of 2014 toned down the emphasis on nuclear power to a significant extent, although it promotes nuclear restart as long as safety standards are met. With the rising import cost of LNG, reducing import cost has been given priority in the plan. In relation to that priority, the plan calls for LNG market flexibility by, for instance, introducing the USA LNG, abolishing destination clause, and jointly purchasing LNG. The plan also mentions fully liberalizing the power market and unbundling the electricity supply industry by 2020. The government is also discussing the similar liberalization of the gas industry.

Korea

Resources

Korea is similar to Japan in terms of its lack of gas resources. Proven reserves of natural gas in Korea are as little as one BCM as of January 2013. The reserve, discovered in 1997, exists at the offshore East Coast.

Figure 3-23 Proven Reserves of Natural Gas in Korea

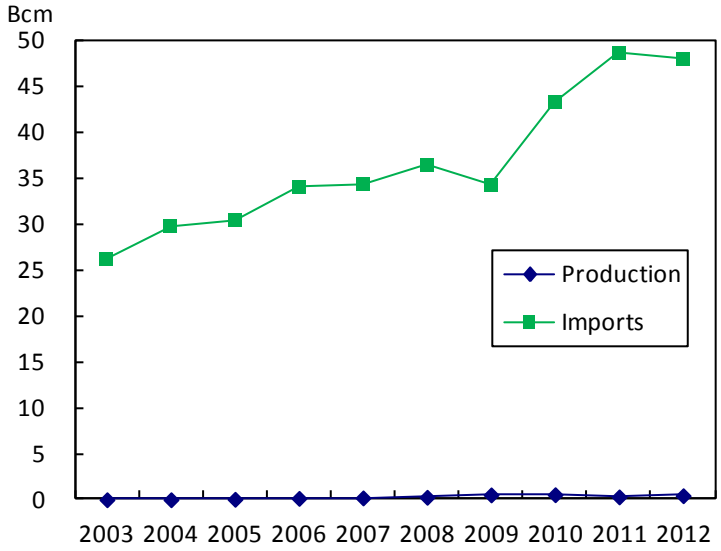


Source: Cedigaz Statistical Database.

Supply and demand

Natural gas production in Korea in 2012 was 0.4 BCM. The current Donghae-1 field is expected to be depleted in the near future. Almost all demand is met by imported LNG. Korea is the second largest LNG importer in the world, having imported 48 BCM in 2012.

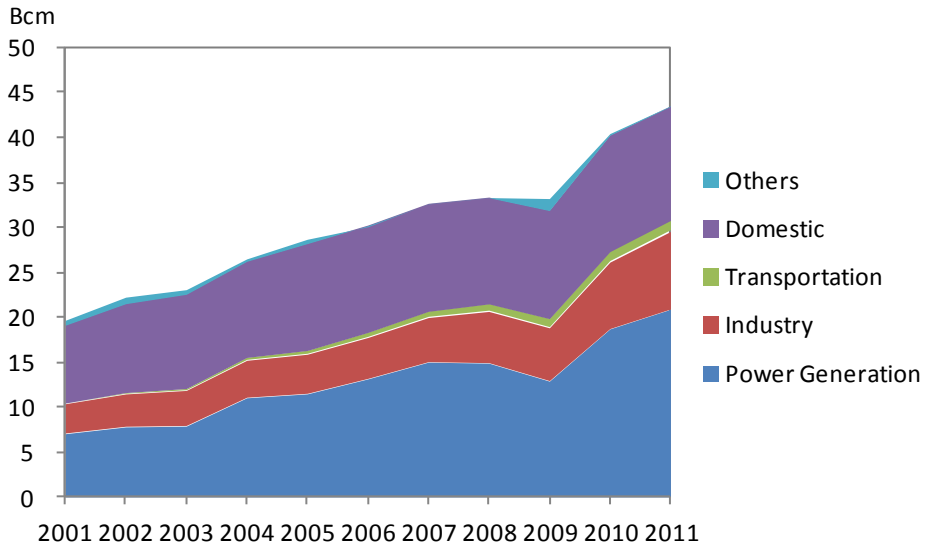
Figure 3-24 Natural Gas Production and Imports of Korea



Source: Cedigaz Statistical Database.

Korea consumed 43 BCM of natural gas in 2011. With a share of 48 percent of the total, power generation is the largest demand sector. Domestic and industry sectors followed at 30 percent and 20 percent shares, respectively. The demand has been growing eight percent per annum for the past decade.

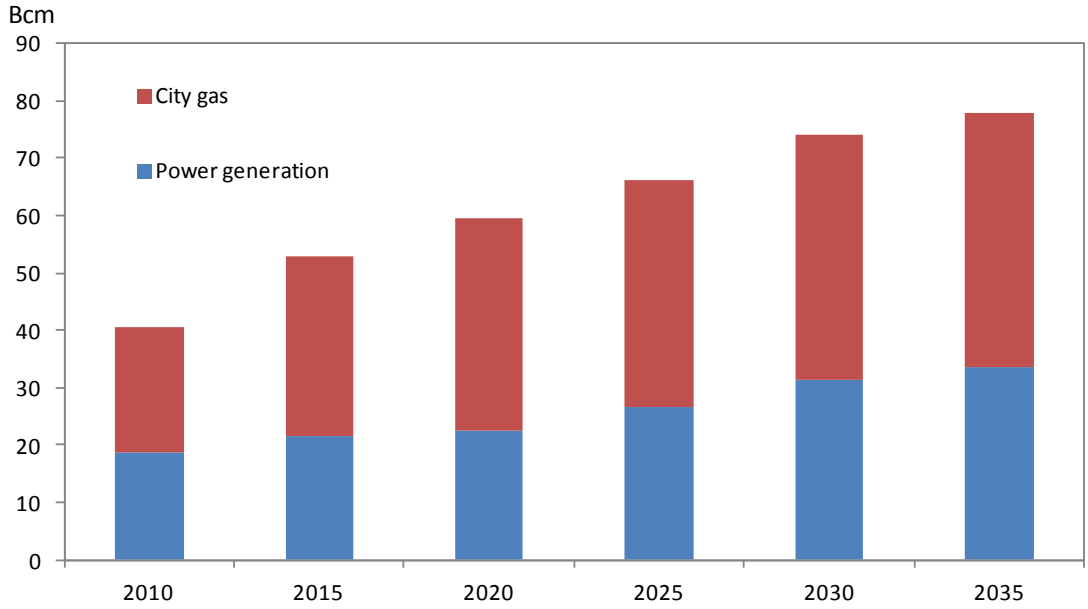
Figure 3-25 Natural Gas Demand in Korea, by sector



Source: IEA.

According to the Korea Energy Economics Institute, natural gas demand in Korea will increase from 40 BCM in 2011, to 59 BCM in 2020, 74 BCM in 2030, and 78 BCM in 2035. City gas sector and power generation will share 56 percent and 44 percent, respectively, in 2035. Like in Japan, there is substantial uncertainty in demand growth for power generation, depending on the development of nuclear, coal-fired, and renewable generation capacities. Anticipating the only domestic gas production will terminate in 2018, the demand is assumed to be supplied primarily by imported LNG. There are plans to import Russian pipeline gas; however, there is no concrete contract or schedule to do so at the moment.

Figure 3-26 Natural Gas Demand Outlook in Korea



Source: Korea Energy Economics Institute.

Energy Policy

Korea's energy policy is under the supervision of the Ministry of Trade, Industry and Energy. The National Basic Plan for Energy, Korea's principal energy policy document, emphasizes the importance of nuclear power in the energy mix, energy demand management, and distributed energy. Priority on non-fossil fuel and energy demand control is the reflection of Korea's heavy dependence on imported fossil fuels.

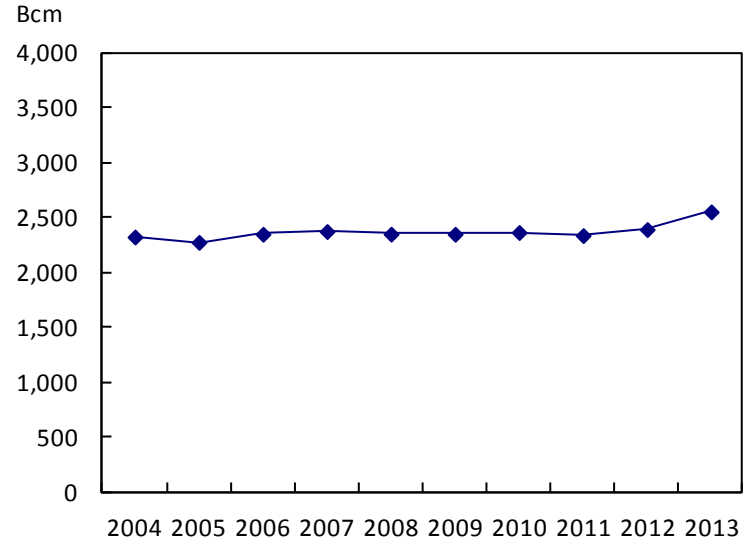
In accordance with the principle of the Plan, the ministry's *11th Long Term Natural Gas Supply/Demand Plan* published in 2013 targets demand for natural gas to remain at the similar level in 2027; however, it is generally considered pessimistic. To alleviate the burden of rising energy cost, the *National Basic Energy Plan* published in January 2014 states that taxes on LNG, liquefied petroleum gas (LPG), and gas oil will be reduced to a different extent.

Malaysia

Resources

Proven reserves of natural gas in Malaysia in 2013 totalled 2,550 BCM,[8] which makes the country the fourth largest gas reserve holder in the EAS region. The reserves have been fairly stable in the last decade, although there is some sign of reserve additions, thanks to gas discovery offshore Sawarak and Sabah.

Figure 3-27 Proven Reserves of Natural Gas in Malaysia



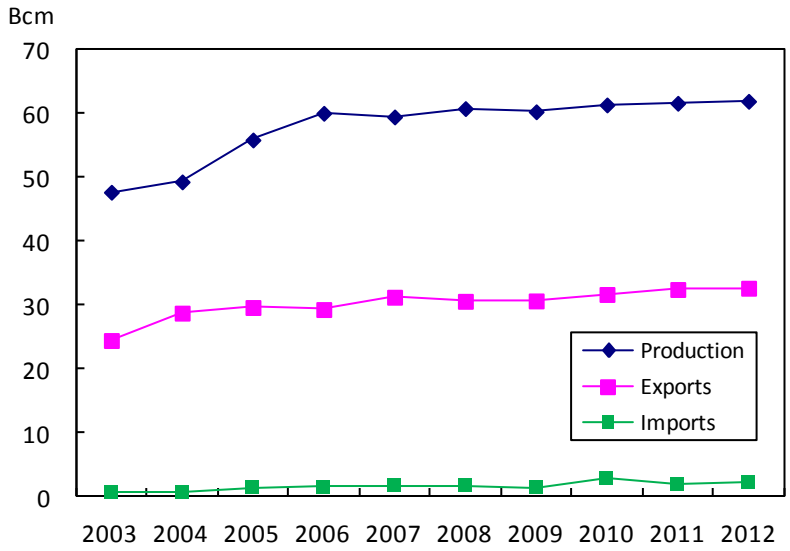
Source: Cedigaz Statistical Database.

Supply and Demand

Malaysia produced 62 BCM of natural gas in 2012. Geographical mismatch of gas production and demand makes the country both an importer and exporter of natural gas. Whilst Sarawak state is the major LNG export centre, Peninsula Malaysia imports pipeline gas from Indonesia and exports to Singapore. Malaysia also started LNG imports in 2013.

[8] There is discrepancy between the figures of Cedigaz and Malaysia's Energy Commission; the latter is 2,784 BCM.

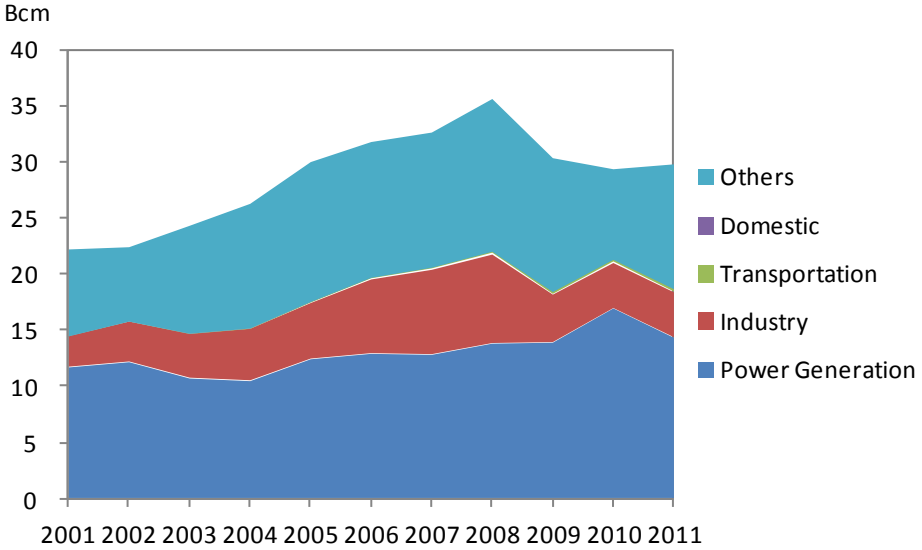
Figure 3-28 Natural Gas Production and Imports/Exports of Malaysia



Source: Cedigaz Statistical Database.

Natural gas consumption in Malaysia in 2011 was 30 BCM.[9] Power generation shared 48 percent of the total. Being a major gas producer, own use at energy plants made 'Others' the significant demand sector at the share of 37 percent of the total.

Figure 3-29 Natural Gas Demand in Malaysia, by sector

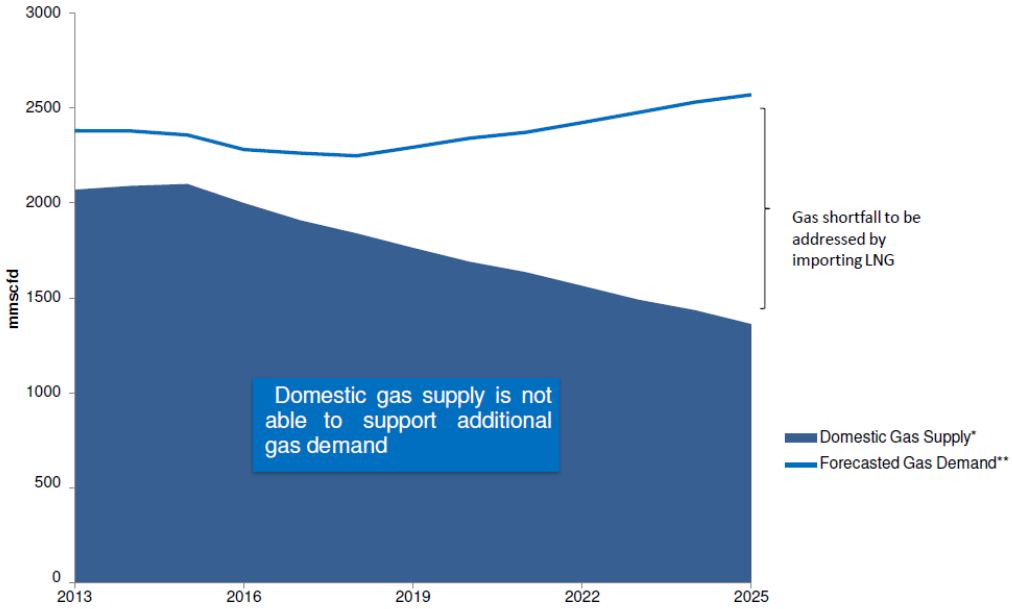


Source: IEA.

[9] Like proven reserves, there is discrepancy between IEA and Energy Commission figures: the latter is 22.5 BCM.

According to the Energy Commission of Malaysia, domestic gas supply will not keep up with rising demand in the future, and the gap (about 1,200 MMscfd or 8.5 MT per year by 2025) will be met by imported LNG.

Figure 3-30 Natural Gas Balance Outlook in Malaysia



* Includes JDA, Natuna and PM3
** Demand growth projected for power and non-power sectors

Source: Energy Commission of Malaysia.

Energy Policy

The 10th Malaysia Plan, the comprehensive general policy of the country, identifies the following aspects as five strategic pillars of the new energy policy:

- initiatives to secure and manage reliable energy supply,
- measures to encourage energy efficiency,
- adoption of market-based energy pricing,
- stronger governance, and
- managing change.

The above pillars are based on the fundamental change happening in the country in the energy demand and supply structures. Energy demand has been increasing rapidly and domestic supply is struggling to keep up. Therefore,

the country will need more energy imports which will lead to more exposure to potentially volatile international energy markets. Emphasis on energy security, energy efficiency, and rationale energy pricing is aimed especially for adaption of the changing energy structure.

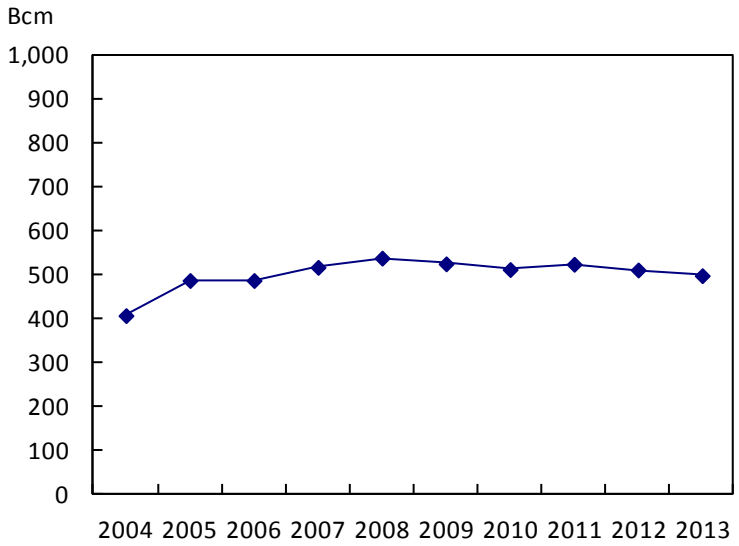
In accordance with the above pillars, the basis of gas policy is to encourage gas resource development, shift to market-oriented pricing for domestic gas, and import LNG. In relation to resource development, the government introduced tax incentives in 2010 to promote developing low-profitable marginal oil and gas fields.

Myanmar

Resources

Myanmar possesses 496 BCM of natural gas reserves as of January 2013. The reserves mainly exist in Yadana field and Yetagun fields in Andaman Sea.

Figure 3-31 Proven Reserves of Natural Gas in Myanmar

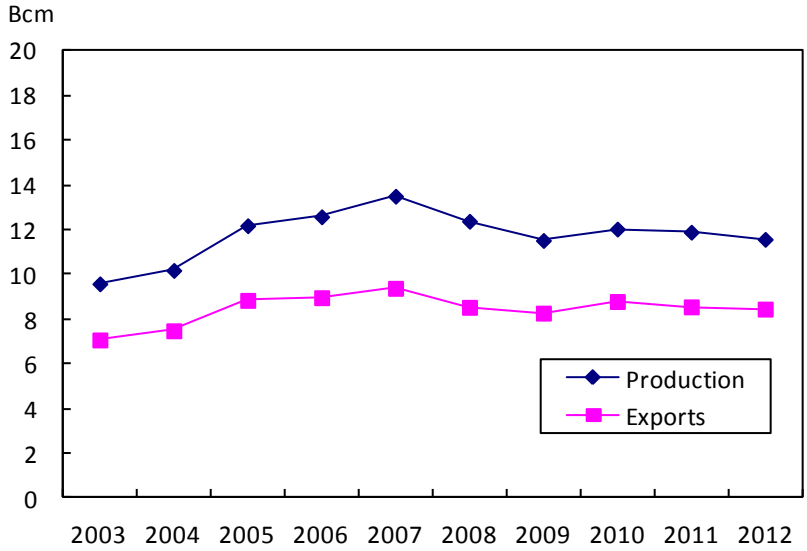


Source: Cedigaz Statistical Database.

Supply and Demand

Myanmar produced 12 BCM of natural gas in 2012, of which nine BCM was exported to Thailand. Exports are expected to increase significantly in the near future with the completion of the Myanmar–China pipeline in 2013.

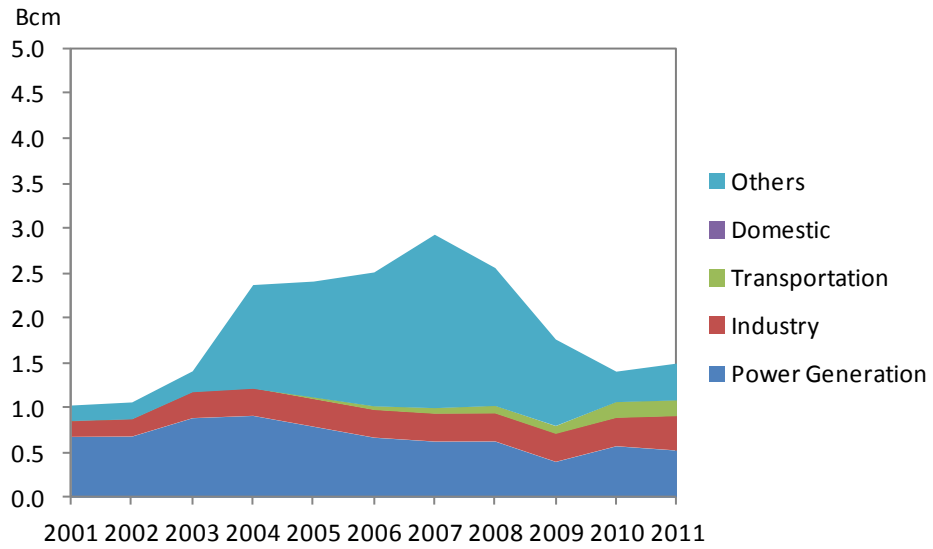
Figure 3-32 Natural Gas Production and Exports of Myanmar



Source: Cedigaz Statistical Database.

Natural gas use in Myanmar was fairly limited at 1.5 BCM in 2011. Power generation was the largest demand sector at 35 percent, followed by 'Others', mainly own use at energy plants and petrochemical feed stock, at 28 percent, and industry at 26 percent. Gas use for transportation has been growing rapidly in recent years to reach 12 percent of the total demand in 2011.

Figure 3-33 Natural Gas Demand in Myanmar, by sector



Source: IEA.

According to the Ministry of Energy, natural gas production from four major gas fields—M-3, Shwe, Yadana, Zawtika—in Myanmar is planned for additional domestic supply of 380 MMcfd (4 BCM per annum) from 2013 to 2018.[10] No official demand forecast is available but, considering the government recognizes the need to import LNG, domestic gas production is not thought to increase as fast as the demand.

Energy Policy

Political and economic reforms in recent years are transforming the country dramatically, and reintegration to the international community is taking place. The National Energy Management Committee supervises the Ministry of Energy, Ministry of Electric Power, and energy-related ministries in terms of national energy policy formation and execution. The basic principle of energy policy, especially after the recent reforms, is to give more attention to domestic energy supply and foreign investment on upstream developments. As far as natural gas is concerned, the government addresses the need for more domestic gas supply whilst maintaining the current export contracts. The action plans up to 2018 by the Ministry of Energy emphasize supply expansion by not only domestic conventional gas but also unconventional gas

[10] '1st ERIA Working Group Meeting for Sustainable Development of Natural Gas Market in EAS region', Ministry of Energy, Jakarta, December 2013.

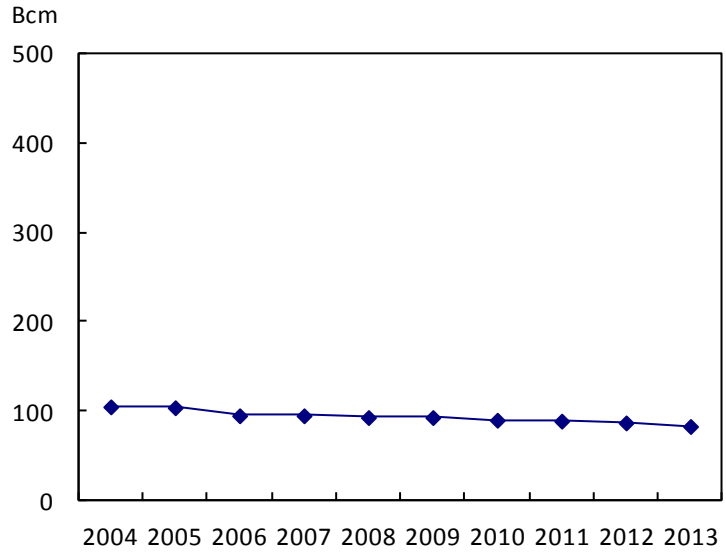
development and LNG imports.[11] A number of international oil and gas companies have already entered into resource development in the country for the past few years. The government expects new gas developments to secure the supply for the domestic market whilst seeking for the possibility of more exports.

Philippines

Resources

Proven reserves of natural gas in the Philippines were 83 BCM as of January 2013. Virtually all the reserves exist in the Malampaya/Camago gas fields in the West Philippine Sea. With the lack of new reserve additions, proven reserve figures have been declining slowly for the past decade. No unconventional resources in the Philippines were reported at the time of writing.

Figure 3-34 Proven Reserves of Natural Gas in the Philippines



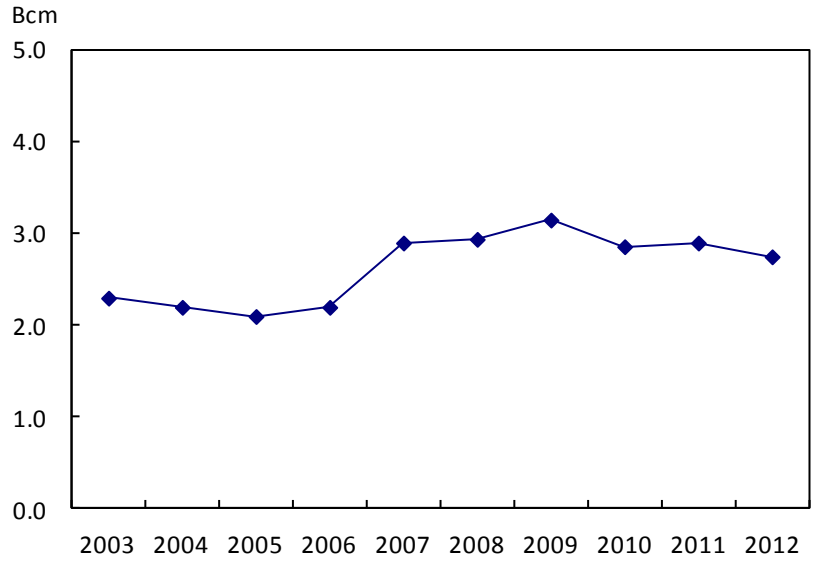
Source: Cedigaz Statistical Database.

[11] Ibid.

Supply and demand

The Philippines produced three BCM of natural gas in 2012. Most of the production takes place in the Malampaya/Camago fields. No international trade exists so far, although there are plans for LNG import projects.

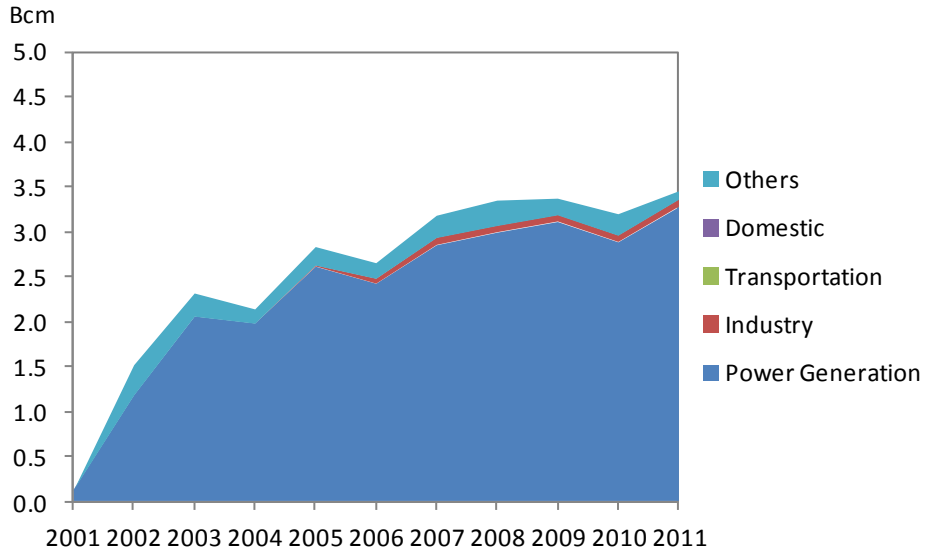
Figure 3-35 Natural Gas Production of the Philippines



Source: Cedigaz Statistical Database.

Natural gas demand in the Philippines in 2011 was three BCM. Power generation consumed 95 percent of natural gas supplied in the country.

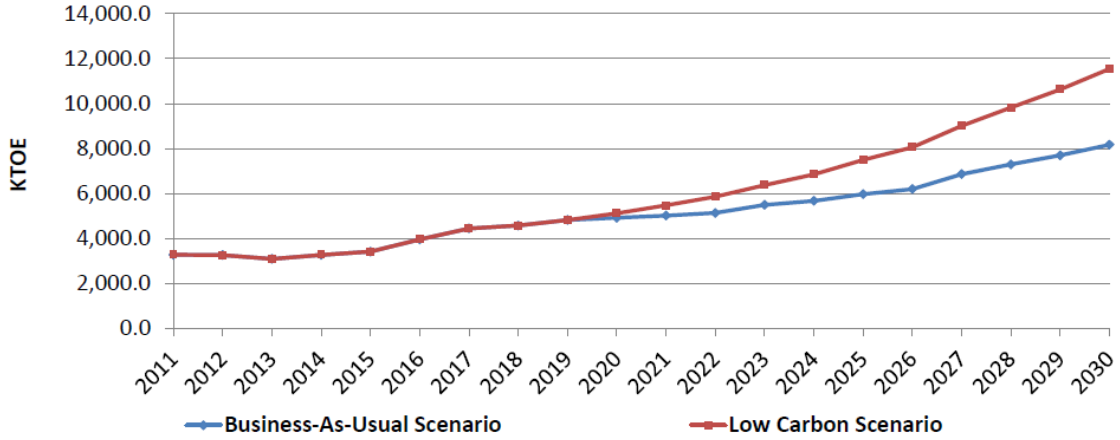
Figure 3-36 Natural Gas Demand in the Philippines, by sector



Source: IEA.

According to the Department of Energy, natural gas demand in the Philippines is expected to increase to reach 8.2–11.6 MToe (8.6–12.1 BCM) in 2030, driven by the power generation sector. Domestic production will unlikely keep up with the demand growth, and LNG imports are being planned.

Figure 3-37 Natural Gas Demand Outlook in the Philippines



Source: Department of Energy.

Energy Policy

The Department of Energy is in charge of energy policy in the Philippines. According to the Philippine Energy Plan 2012–2030, the basic energy policy paper by the Department of Energy, the following major policy thrusts are set:

- Ensure energy security.
- Expand energy access.
- Promote a low-carbon future.
- Climate-proof the energy sector.
- Promote investment in the energy sector.
- Develop regional energy plans.

There is significant policy focus on renewable energy to achieve many of the above policy targets. The government aims to triple renewable generation capacity to 9,931MW in 2030, consisting mainly of hydro, wind, and geothermal energy. Natural gas production target in 2030 in the plan is 752Bcf (21 BCM) for 2026–2030 period (i.e., 188Bcf or 5 BCM per annum).

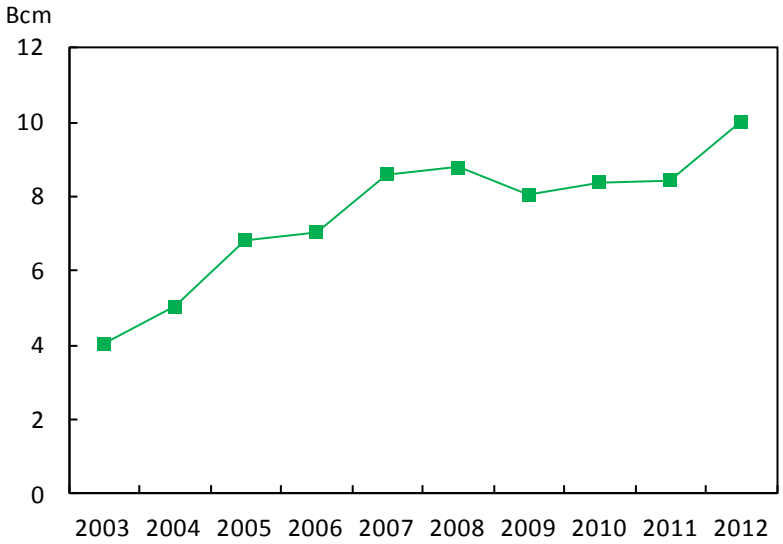
The plan also mentions plans of three LNG import terminals in Bataan, Batangas, and Pagbilao, as well as pipeline construction in Luzon.

Singapore

Supply and Demand

Being a city-state with a land area of 715 km^2, Singapore does not have any recorded gas resources. All demand is met by imported pipeline gas or LNG. In 2012, Singapore imported 10 BCM of pipeline gas from Indonesia and Malaysia. LNG imports started in 2013 from Equatorial Guinea, Trinidad and Tobago, and Qatar, aggregated by the BG Group.

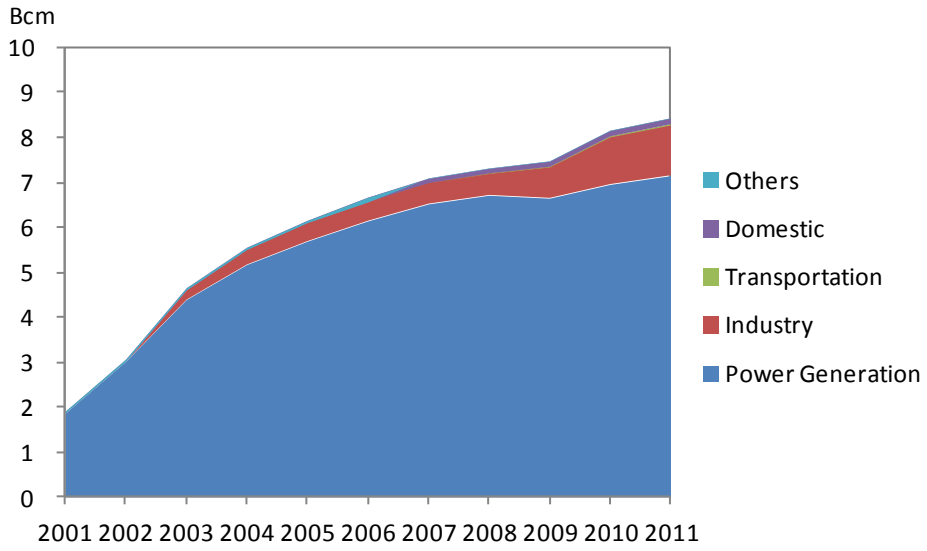
Figure 3-38 Natural Gas Imports of Singapore



Source: Cedigaz Statistical Database.

Singapore's natural gas demand in 2011 was eight BCM. Eighty-five percent of natural gas is consumed by the power generation sector, followed by the industry sector at 13 percent. Gas-fired generation was introduced in the early 1990s, and demand has been growing rapidly.

Figure 3-39. Natural Gas Demand in Singapore, by sector



Source: IEA.

According to a forecast by the Asia Pacific Energy Research Centre, natural gas demand in Singapore will expand to 8.9 Mtoe (9.3 BCM) in 2020 and 9.8 MToe (10.3 BCM) in 2035. The demand is expected to be increasingly met by imported LNG. The current capacity of LNG import is 3.5 MT per annum, and there are plans to expand it to nine MT per annum by adding fourth and fifth tanks as well as building a second import terminal at unspecified location.

Energy Policy

Lacking any significant energy resources and high dependency on oil, Singapore is diversifying its energy sources away from oil, although oil still shares 73 percent of the total primary energy supply in 2011. Natural gas is the major alternative fuel for the country, and fuel shift to natural gas has been taking place mainly for power generation, underpinned by pipeline gas from Indonesia and Malaysia. However, LNG imports gathered momentum mainly because erratic pipeline gas supply led to power blackouts in the 2000s.

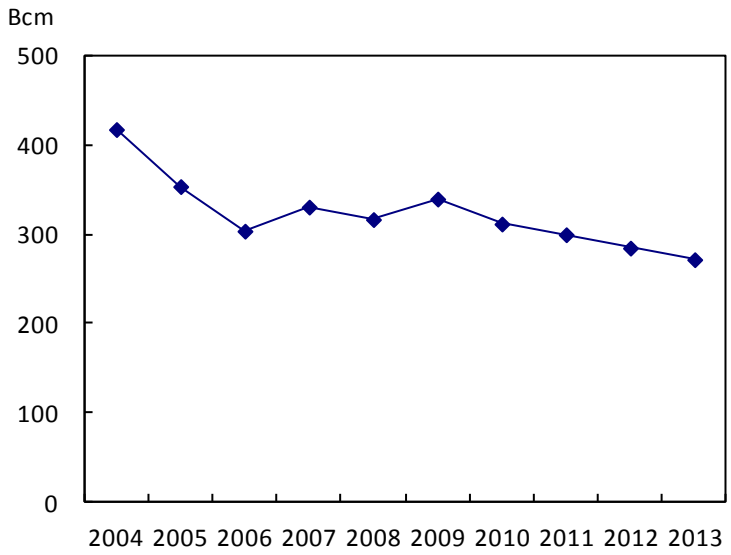
In relation to the emphasis on market-oriented policy, Singapore has liberalized the power and gas markets since the 1990s. The retail markets are fully liberalized and the transmission/transportation segment of power and gas industries is unbundled. Being a successful oil trading hub, Singapore also intends to develop an LNG trading hub although there is no concrete plan yet.

Thailand

Resources

Thailand possesses 272 BCM of proven reserves of natural gas as of January 2013. Majority of the reserves are offshore in the Gulf of Thailand. With no reserve additions and increasing production, the reserves have been on downward trend for the last decade.

Figure 3-40 Proven Reserves of Natural Gas in Thailand

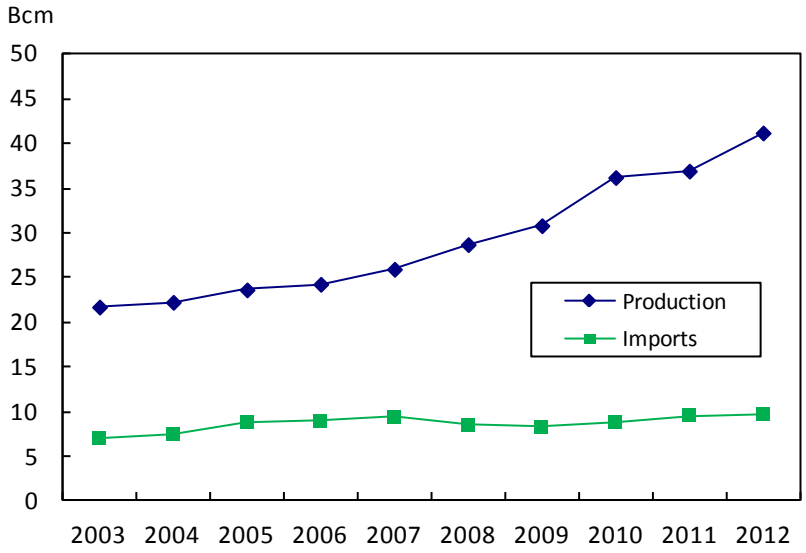


Source: Cedigaz Statistical Database.

Supply and Demand

Keeping up with the demand growth, natural gas production has been increasing rapidly at seven percent per annum. Almost all production comes from the Gulf of Thailand. Imports started in 1998 from Myanmar, and the import amounts hover around 10 BCM recently. Thailand also started to import LNG in 2010.

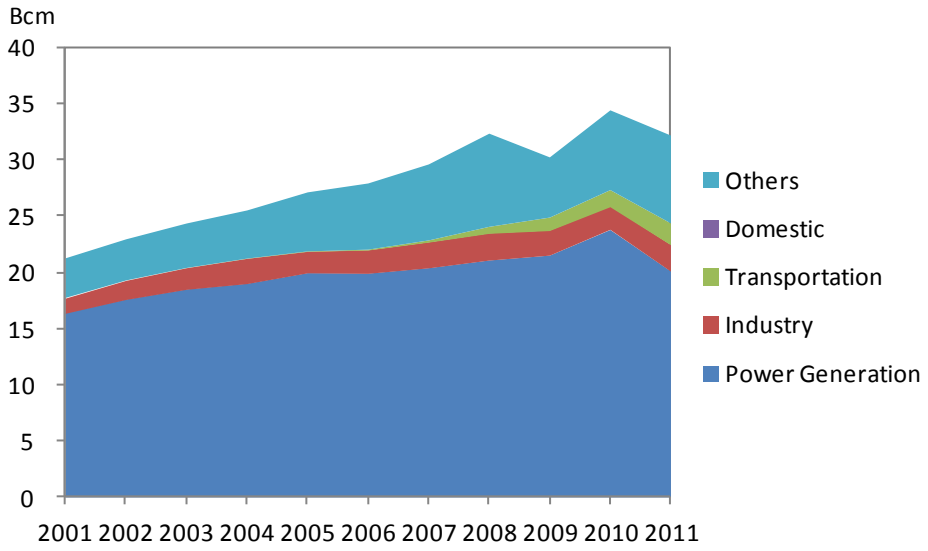
Figure 3-41 Natural Gas Production and Imports of Thailand



Source: Cedigaz Statistical Database.

In 2011, natural gas demand in Thailand was 32 BCM, down seven percent from the previous year due to pipeline leakage and massive flood in the same year. Of the total demand, 62 percent was for power generation. 'Others', including own use at energy plants and petrochemical feedstock, shared 24 percent of the total.

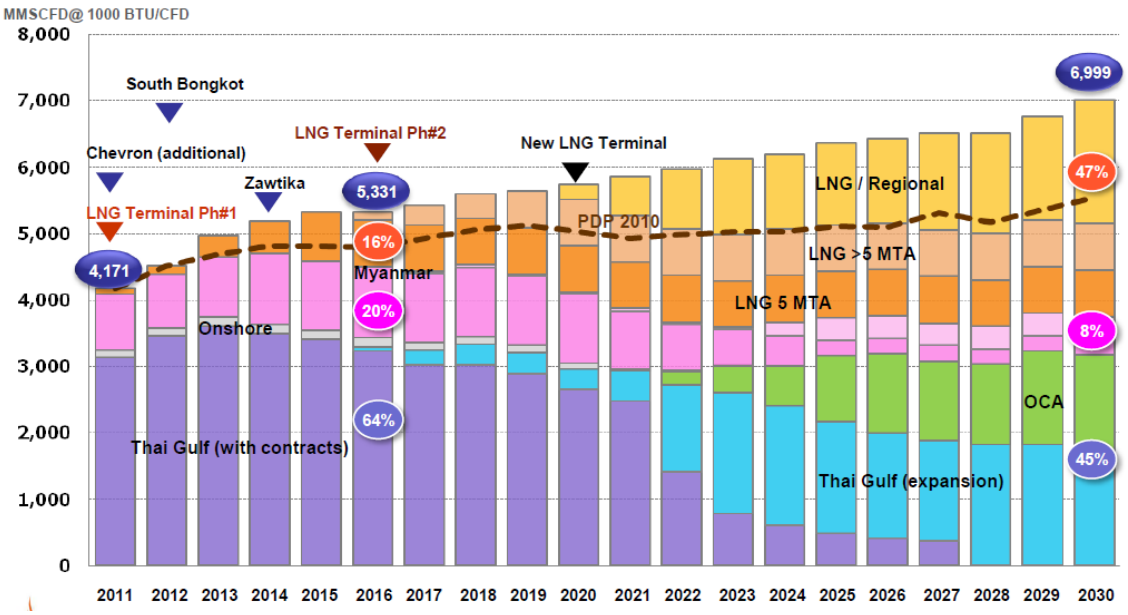
Figure 3-42 Natural Gas Demand in Thailand, by sector



Source: IEA.

The Ministry of Energy expects natural gas demand in the country to increase from 4,167 MMscfd (43 BCM) in 2011 to 6,999 MMscfd (68 BCM) in 2030, driven by power generation as is the case with many other countries in Southeast Asia. Despite the new developments in domestic gas resources, the import will need to be expanded significantly to meet the demand. Anticipating shrinking supply from Myanmar, LNG imports are expected to be more than 10 MT per annum in the future.

Figure 3-43. Natural Gas Balance Outlook in Thailand



Source: Ministry of Energy.

Energy Policy

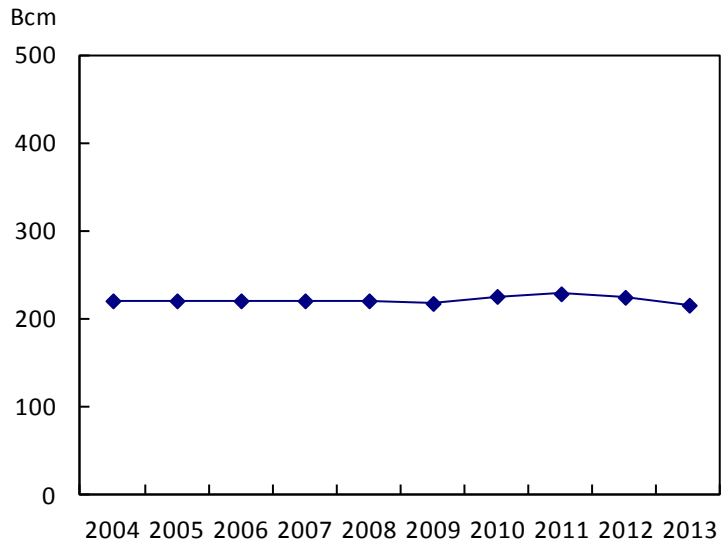
In Thailand, the Ministry of Energy is in charge of energy policy formation and execution. With rising energy demand and increasing import dependency, the core of Thailand's energy policy is ensuring supply security, alternative energy developments, and energy efficiency, although there is some element of energy supply as social welfare. In the policy statement delivered in 2011, Prime Minister Shinawatra emphasized energy infrastructure investments, domestic and international upstream developments, rationalization of domestic energy pricing, promotion of renewable and alternative energy to replace 25 percent of the fossil fuel–based electricity, and improvement of energy efficiency.[12]

Viet Nam

Resources

As of January 2013, proven reserves of natural gas in Viet Nam were 215 BCM. Proven reserves are mainly offshore basins such as Nam Con Son, Cuu Long, Malay-Tho Chu, and Song Hong.

Figure 3-44 Proven Reserves of Natural Gas in Viet Nam



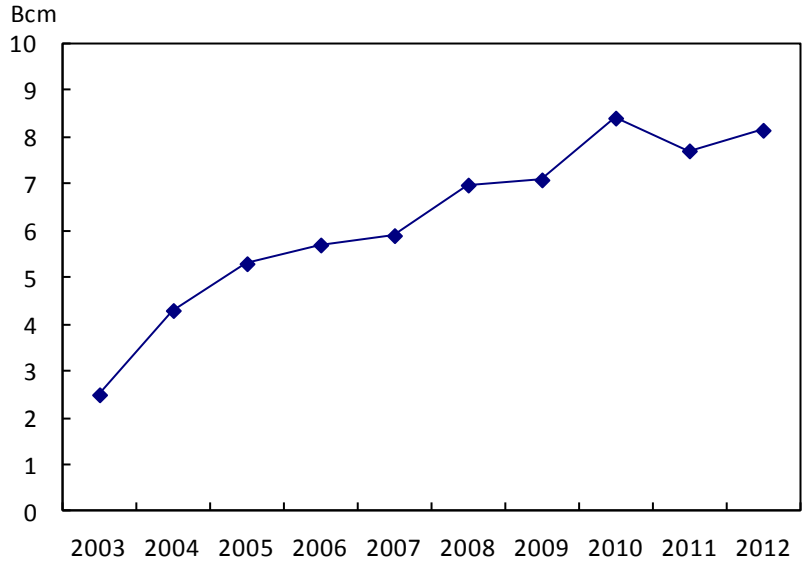
[12] 'Policy Statement of the Council of Ministers', delivered by Prime Minister Yingluck Shinawatra to the National Assembly, http://www.eppo.go.th/doc/gov-policy-2554-E.pdf (accessed August 23, 2011).

Source: Cedigaz Statistical Database.

Supply and Demand

Natural gas production in Viet Nam in 2012 was eight BCM, which was all consumed within the country. There is no international trade of natural gas, although the government is planning LNG import projects in the coming decade.

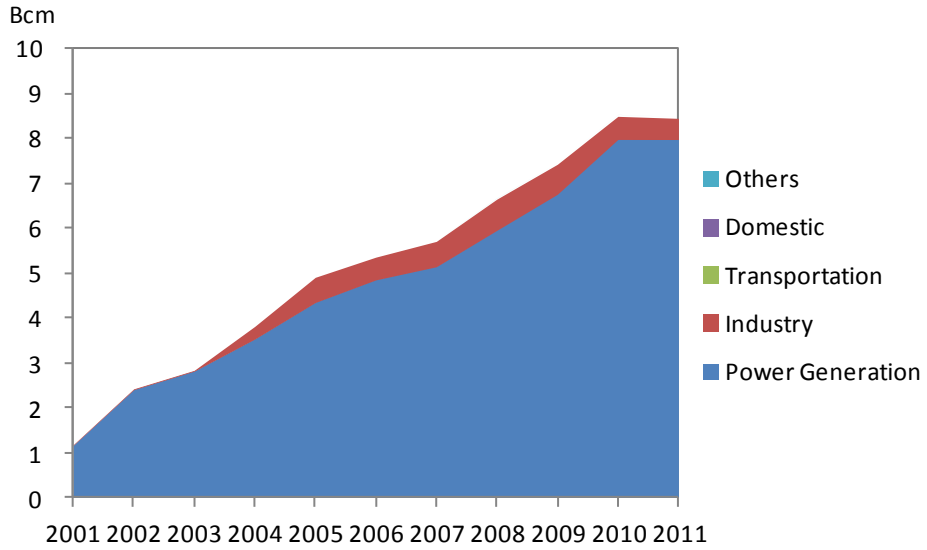
Figure 3-45 Natural Gas Production in Viet Nam



Source: Cedigaz Statistical Database.

Viet Nam consumed eight BCM of natural gas in 2011. Power generation is the dominant demand sector, and the demand has been expanding rapidly at 21 percent per annum for the past 10 years.

Figure 3-46 Natural Gas Demand in Viet Nam, by sector



Source: IEA.

According to the Ministry of Industry and Trade (MIT), natural gas production in Viet Nam will increase steadily to 10.8–12.3 MToe (11.3–12.9 BCM) in 2020 and 23.5–26.6 MToe (24.6–27.9 BCM) in 2035.[13] Power generation will be the driving force to the demand growth. Like many countries in the region, domestic production is not likely to expand fast enough, and imports will start and expand inevitably. The MIT is conducting a feasibility study of an LNG import terminal in Vung Tau in the south with target import year of 2017.[14] There is also a possibility of building import terminals in the northern and central parts of the country. The import amounts are expected to reach 14.5–17.6 MToe (11.2–13.5 MT).

Energy Policy

Energy policy in Viet Nam is under the control of the MIT. Like many other Asian countries, energy demand in Viet Nam is increasing significantly. Introducing foreign investment especially on oil and gas developments offshore Viet Nam since the 1990s resulted in substantial domestic energy supply, but import dependency is expected to rise in the future. Therefore, Viet Nam's priority is on securing energy supply, mainly through further

[13] Forecast submitted by the MIT to IEEJ.
[14] 'The 2nd ERIA Working Group Meeting in FY 2013 for Study on Sustainable Development of Natural Gas in EAS Region', MIT, Jakarta, April 2014.

domestic oil and gas developments; introducing nuclear power; demand control through improving energy efficiency; and reducing energy subsidies.

As far as natural gas is concerned, ambitious policy targets were set for production (15–19 BCM/y for 2016–2025), consumption (22–29 BCM/y for 2016–2025), LNG import terminals (import capacity of 7–10 BCM/y for 2016–2025), and pipelines (2,847 km in total).[15]

[15] 'Decision No. 2412/QD-BCT dated May 17, 2011 of the Ministry of Industry and Trade approving Planning of developing production, distribution system of gas and oil in the 2010–2020 period with orientation toward 2025', Ministry of Industry and Trade, May 17, 2011.

CHAPTER 4
Natural Gas Outlook in the EAS Region

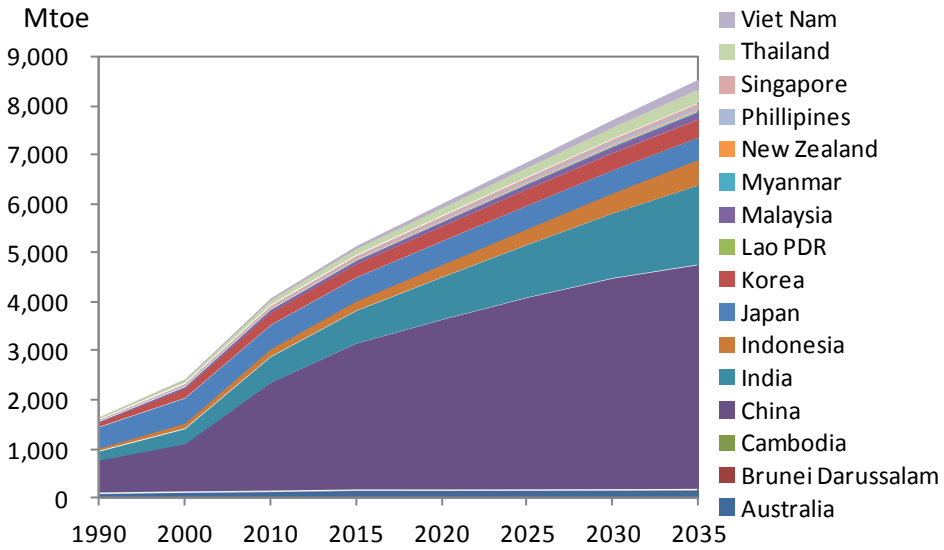
Based on the analysis of the previous chapters, this chapter will look into the perspectives of natural gas demand, supply, and international trade in and for the EAS region. The first part will present ERIA's demand outlook in the EAS region. The second part will explain supply perspective in the region based on IEEJ scenario with inputs from member countries. Taking into account the supply/demand perspectives, the last part will look at the possible picture of international trade in the region and with external regions via pipeline gas and LNG.

Demand

With robust economic growth and population expansion, the EAS region will consume substantially more energy in the future. According to the outlook by ERIA,[1] the primary energy demand in the region will increase at three percent per annum from 4,079 MToe in 2010 to 8,536 MToe in 2035. Although the ERIA outlook does not conduct worldwide forecast, there is consensus that Asia-Pacific, of which EAS countries cover the majority of energy demand, will drive world energy demand. China and, to a lesser extent, India will be the driving forces of the demand growth. Indeed, these two countries alone are expected to share as much as 73 percent of the total energy supply in the EAS region.

[1] 'Analysis on Energy Saving Potential in East Asia', Economic Research Institute for ASEAN and East Asia, http://www.eria.org/RPR-FY2012-19.pdf (accessed June 2013).

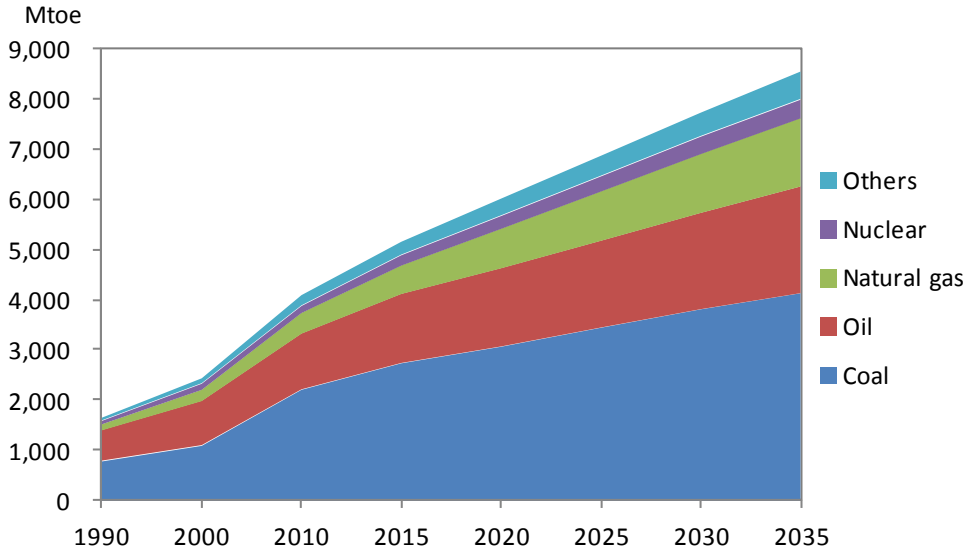
Figure 4-1 Primary Energy Supply in the EAS Region, by country



Source: ERIA.

As far as energy mix is concerned, coal will remain the main fuel for the region, reflecting heavy reliance on coal especially in China and India. Oil will take the second largest share of the total energy in the region, underpinned mainly by rapid motorization. Natural gas demand will grow fastest among the fossil fuels to reach 1,368 MToe (1,432 BCM) in 2035, sharing 16 percent of the total energy demand in the region.

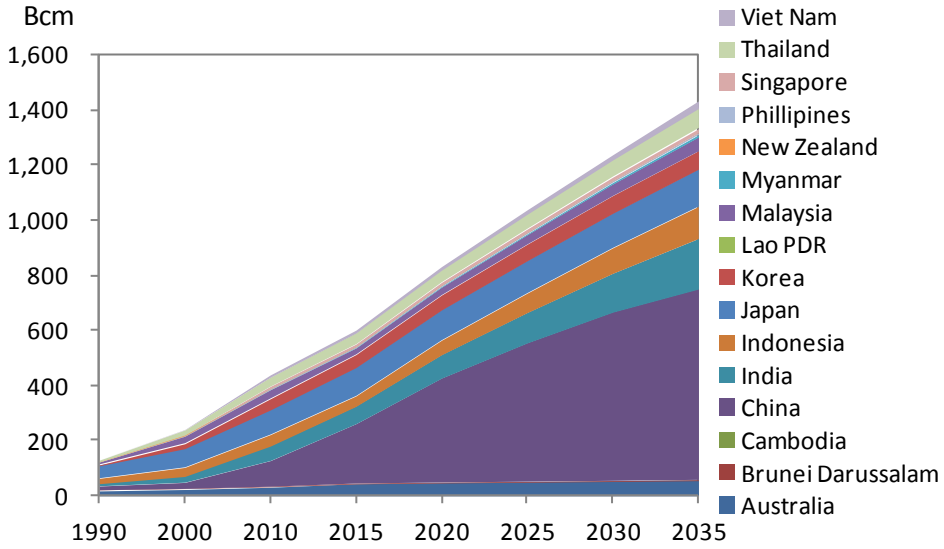
Figure 4-2 Primary Energy Supply Outlook in the EAS Region, by fuel



Source: ERIA.

Like primary energy supply, China and India will drive the natural gas demand in the EAS region. These two countries are expected to share 48 percent and 13 percent, respectively, of the total demand for natural gas in 2035 in the region, followed by Japan, Indonesia, and Korea.

Figure 4-3 Natural Gas Demand in the EAS Region, by country

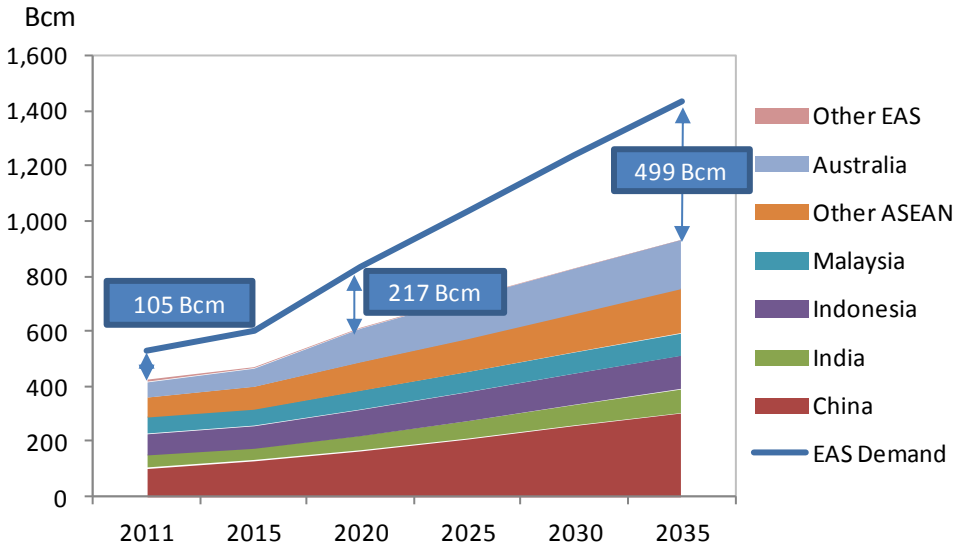


Source: ERIA.

Supply

The EAS region has substantial resource potential of natural gas, conventional or unconventional. Production in the region is, therefore, expected to increase steadily, especially in China and Australia as explained in Chapter 3. Indonesia, Malaysia, and other ASEAN countries will produce more natural gas in the long term, too. However, it is highly unlikely that regional production will be able to keep up with the demand growth. As a result, the dependency on non-EAS region will rise from 105 BCM in 2011 to 499 BCM in 2035, making the import dependency rate to reach 35 percent in the same year (Figure 4-4).

Figure 4-4 Natural Gas Supply Outlook in the EAS Region



Source: ERIA and IEEJ.

Northeast Asia—including China, Japan, and Korea as EAS member countries—is already heavily dependent on natural gas imports. Japan and Korea lack domestic production and international pipeline connections, and satisfy almost all the demand with imported LNG. With China's demand and import increase, Northeast Asia will be exposed to the international market even more in the future. Meanwhile, there is a sign of China shifting to pipeline gas imports. The country started to import pipeline gas from Central Asia in 2010 and from Myanmar in 2013, and reached an agreement to import from Russia in May 2014.

Inter-regional Trade

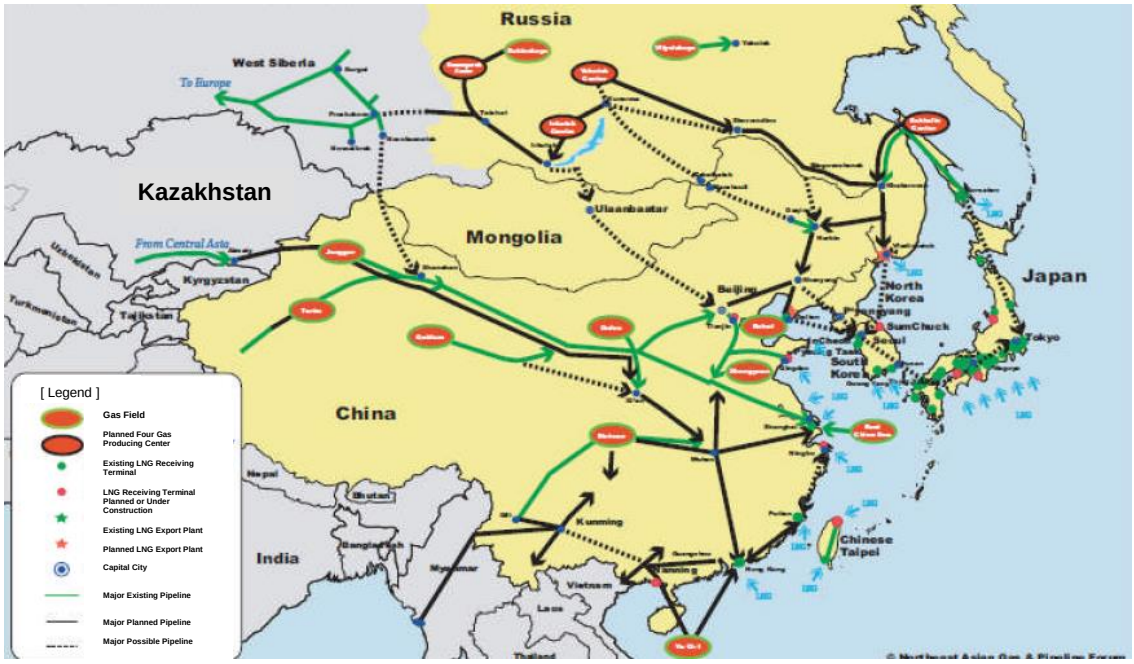
The EAS region already imports a substantial amount of natural gas from non-EAS regions, mainly the Middle East, and, to a lesser extent, Central Asia and Russia. Import dependency will rise significantly in the future. The above analysis presents that the EAS region might need to source 499 BCM of natural gas outside the region. Considering demand and supply projections,

this section will present the possible scenario in terms of inter-regional trade in the EAS region.

Pipeline Gas

Currently, only China imports pipeline gas from non-EAS countries.[2] The country started to import pipeline gas from Turkmenistan in 2010 and from Myanmar in 2013. Additionally, it has recently reached an agreement to import 38 BCM of pipeline gas from Russia soon. In the long run, the country could import 100–130 BCM of pipeline gas from these countries in 2035. There are also plans for pipeline gas imports into Japan and Korea, too.

Figure 4-5 International Pipeline Concept in Northeast Asia



Source: Northeast Asian Gas & Pipeline Forum.

India is another country that could import a significant amount of pipeline gas from non-EAS regions. The country has been in talks with Iran (IPI: Iran–Pakistan–India project) and, more recently, Turkmenistan (TAPI: Turkmenistan–Afghanistan–Pakistan–India project). Geopolitical and transit issues as well as price negotiations have been dragging the process, but both

[2] Statistically, Australia imported 11 BCM from Timor-Leste in 2012. The import is all from the Timor-Leste–Australia Joint Petroleum Development Area, not the pure jurisdiction of Timor-Leste. Thus, for convenience, this section does not consider this trade as import from a non-EAS country.

countries seem to be capable of exporting 90 MMscmd (31 BCM per annum) each while there is uncertainty as to how much gas will be consumed in transit countries, as far as the TAPI project is concerned. The Gas Authority of India considers that 14MMscmd (5 BCM per annum) and 38 MMscmd (13 BCM per annum) will be consumed in Afghanistan and Pakistan, respectively, and 38 MMscmd will reach India.

Figure 4-6 Pipeline Routes of IPI and TAPI Projects

Note : IPI = Iran–Pakistan–India, TAPI = Turkmenistan–Afghanistan–Pakistan–India.
Source: *Wall Street Journal.*

Liquefied Natural Gas

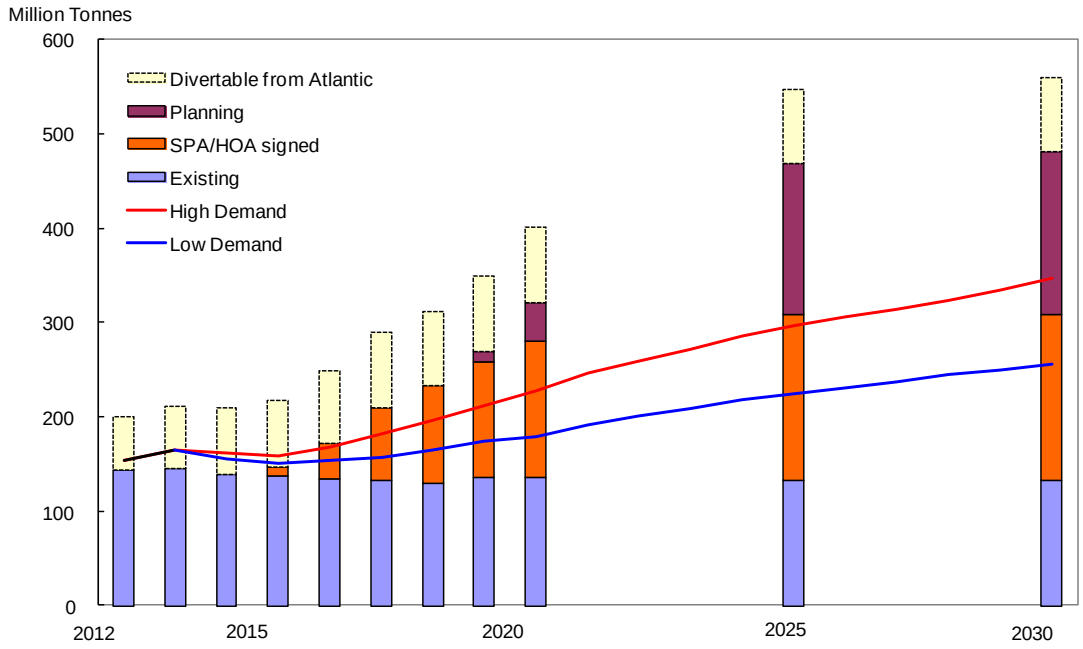
Whilst potential for pipeline gas imports is substantial, majority of non-EAS supply is expected to be in the form of LNG. According to IEEJ, LNG demand in the EAS region will increase from 155 MT (211 BCM) in 2012 to 255–346 MT (347–471 BCM). EAS countries—Australia, Brunei Darussalam, Indonesia, and Malaysia—supplied 65 MT, 42 percent of the demand, in 2012. Assuming all EAS LNG supplies will be consumed in the region, the dependency on non-EAS LNG supplies is expected to decrease to

33–40 percent in 2020, mainly thanks to capacity expansion in Australia, and to increase to 47–61 percent in 2030.

Although the demand will grow rapidly, there is ample supply potential internally and externally for the EAS region. Australia will add about 60 MT before 2020. The USA is expected to produce even more LNG around 2020, of which India, Indonesia, Japan, Korea have already committed to lift 33 MT per annum. In Canada, more than a dozen projects are in various stages of development, and more than 30 MT per annum could be emerged before 2025. Russia has a policy to supply more gas into Asia, and liberalise LNG exports in 2013. Several projects with a total capacity of also more than 30 MT per annum are either developed or studied by Gazprom, Novatek, and Rosneft, and with respective foreign partners. East Africa also has great potential. In Mozambique, a large-scale LNG project is under development to export 18 MT of LNG with target start-up year of 2018.

Considering the rich supply potential, the composition of non-EAS supply sources will depend primarily on competitiveness of those sources. Huge supply potential especially in North America, Russia, and East Africa, together with EAS supply increase, will likely ease the LNG market in the EAS region, and therefore to put downward pressure on prices especially towards 2020.

Figure 4-7 LNG Outlook in the EAS Region



Note :HOA = Heads of Agreement, SPA = sale and purchase agreement.
Source: IEEJ.

CHAPTER 5
Discussion and Key Findings

In this study, we first analysed the current situation and forecasts for the natural gas supply–demand balance in the EAS region. Based on this analysis, we then considered the measures needed for the sustainable development of the natural gas market in this region in the future.

General Perception

First, in this report, we gained a reaffirmation of the strong demand for natural gas in the EAS region. From now through 2035, demand for natural gas is expected to grow at the fastest rate among the various fossil fuels, led by demand from China and India in particular.

On the other hand, with regard to the supply of natural gas, production volume is expected to increase mostly in China and Australia. However, the increase in supply falls below that of demand. Overall, import volumes for natural gas will increase gradually across the region. Based on the results of the analysis, the demand and supply gap is likely to increase by around five times from the current 105 BCM per year, to approximately 499 BCM per year in 2035.

If we were to observe the supply sources for natural gas outside the EAS region, there is clearly potential for many additional supply sources. In particular, there is significant potential for new sources of natural gas exports from Canada, Central Asia, East Africa, Russia, and the United States. If we were to include these potential additional supply sources, even if we were to take away the demand for other regions, we believe that it will be possible to secure sufficient natural gas supplies to fulfil import demands in the EAS region.

Uncertainty in the Demand Side

However, there are uncertainties in the demand side, and we need to be fully aware of these.

On the demand side, the forecasts for future economic growth in China and India are one of the significant factors behind the uncertainty. China is exploring the possibility of making the transition from export-led economic growth to growth led by domestic demand. The speed of their economic growth is expected to slow down compared to that of the past decade. Furthermore, the rate of economic growth for India is also observed to have slowed down in recent years. As economic conditions significantly impact natural gas demand, it is important to pay close attention to the economic situation of the two big economies where natural gas demand is likely to increase significantly in the future.

With regard to LNG demand, one factor causing uncertainty is whether or not Japan will recommence the operation of its nuclear power plants. Japan is the top LNG importer in the world, and more than half of the LNG imported is used to generate power. For that reason, the timing and scale for restarting the nuclear power plants will significantly impact LNG demand.

Furthermore, the price system for domestic gas in developing countries could also be viewed as an uncertain factor on the demand side. In several countries, natural gas prices are regulated such that they remain below international market prices. Not only does this result in the negative spread of import and domestic prices but it may also generate excessive demand. In addition, low prices can reduce the motivation for enhancing energy efficiency, thereby contributing to wastage. Conversely, if domestic gas prices are an accurate reflection of costs in the future, that is to say, if prices go up, then it would be possible to suppress the rate of acceleration in the demand for natural gas.

Uncertainty in the Supply Side

How about on the supply side?

For example, it is conceivable that rich endowment of unconventional natural gas resources may exist in China, India, and Indonesia. In particular, China is said to have a higher shale gas potential than the United States. Hypothetically, if this could be connected to production in reality, it could possibly bring about major changes to the supply environment in the EAS region.

However, as of this point, other than the fact that exploration and trial production are being carried out in parts of China, little progress has been made toward commercial-scale production of unconventional gas. For this reason, the extent to which this could contribute to future supply is unclear, and we will have to wait for future assessments.

Another factor giving rise to uncertainty is the realization of investments. Undeveloped natural gas resources remain in the region, including the aforementioned unconventional sources. Whilst these sources should be utilized as far as possible, it is also necessary to invest capital into the production of resources that are currently lying under the ground. Furthermore, there is also a need to develop pipelines for transporting the natural gas that has been produced, facilities for liquefying the gas, as well as LNG ships. Large amounts of capital are needed to construct this natural gas supply chain. However, depending on the extent of the risks involved, investments are sometimes not realized.

The timing of investments can also be a factor contributing to uncertainty. One element in constructing a natural gas supply chain is the fact that the lead time from investment decision to the materialization spans many years. Hence, depending on the situation, there may be the risk of being unable to secure sufficient supply capacity during a certain period.

Policy Implications

Based on the fundamental points described above, this study raises the following policy implications.

Demand side

a. Diversifying power supply mix

If the dependency on natural gas imports were to grow in the EAS region, it would be necessary to prepare for the risks associated with import. For instance, one conceivable risk would be the possibility of being unable to secure sufficient import volumes as a result of an accident arising in the production facility in the exporting country. Prices may also likely go up as a result of tighter supply–demand balance in the international market. To prepare for such risks, it would be effective to diversify the sources of natural gas supplies to develop stockpiles within as far as it is economically viable, and to improve liquidity in the international market through highly flexible contracts. Furthermore, securing alternative energy sources other than natural gas is also an important measure.

The share of the power generation sector in natural gas demand is large. Power generation is also a sector where it is easier to secure substitute energy resources. Hence, it would be ideal for countries that can balance different types of energy in power generation to disperse the risks. Choices include coal-fired thermal power, hydroelectric power and other renewable energies, and nuclear power generation where available. In particular, coal is a promising option for diversification in the EAS region. This is because of the relatively rich coal resources in the region and because it is an economically superior option. However, as it places a heavier burden on the environment compared with natural gas, it is important to ensure that measures are taken to maximize efficiency and protect the environment when using coal. Depending on the region, renewable energy such as biomass and geothermal energy is also a viable option, and electricity import from non-EAS regions could be another choice.

Having options other than natural gas can also contribute to strengthening a country's bargaining power in negotiations to procure natural gas. Hypothetically, if a country has sufficient coal-fired thermal power capacity to replace gas-fired thermal power, it would be able to use the card of "not buying gas" in procurement negotiations. This is an extreme example, and it is difficult to replace gas-fired thermal power completely in reality. However, the availability of a substitute energy source can definitely impact natural gas procurement negotiations.

b. Efficient use of natural gas

When using natural gas, it is necessary to maximize the efficiency of utilization as far as possible. Considering the rise in the import dependence of natural gas in the EAS region, this is a natural course of action to take. There are various ways of improving the efficiency of natural gas use. These include, for example, the use of CCGT (combined cycle gas turbine) of higher temperatures, cogeneration that also uses heat, and strengthening of building insulation. There are also numerous examples of policies aimed at promoting the implementation of such measures. As members of the region possess a wide range of technologies and knowledge, the effective use of such resources can help propel the efficient and effective implementation of measures.

c. Rationalizing domestic price regulations

Within EAS member states are cases where natural gas prices for consumers are regulated to keep them below international market prices, or where cost changes cannot be reflected in prices in a timely manner. In such cases, regardless of tight supplies or significant hikes in prices, for example, there are concerns that changes in the market environment will not be communicated to consumers and the necessary responses will not be taken. These responses include reducing consumption or switching to the use of other fuels. On the supply side, there is also the possibility that low selling prices may reduce the incentive to invest for production increase. In other words, prices have to serve as appropriate signals to both the demand and supply sides. To that end, there is a need for systemic reform. Rationalizing domestic price regulations to reflect international market prices will become

increasingly important, given that import dependency is likely to rise in the future.

From this perspective, it would be meaningful to share information on the current state of the domestic price system in respective EAS countries as well as on the direction of future reviews of the systems. Information sharing can provide useful references for systemic reform in the respective countries, and is expected to generate the effect of driving forward the transition towards improvements in the situation.

However, the review of price systems also means a hike in retail prices; in short, it is a policy that is susceptible to opposition from the general public. If prices are kept low out of consideration for low-income peoples, then a system review should be carried out in phases corresponding to improvements in income level. On the other hand, keeping retail prices low can also become a form of support for high-income peoples, even if this is not the intention of the system. Hence, it would be rational to employ a different approach, such as incremental tariff system, or target/direct subsidy system.

Supply side

a. Enhancing domestic gas exploration and production

First, countries within the region need to maximize the use of domestic natural gas resources with economic viability. In particular, resource potential of unconventional gas has not been fully evaluated, and countries should gain an accurate grasp of the potential they possess.

If a country has the resources, the next step would be to develop such resources. If it is possible for the country to provide the human resources, technology, equipment, and capital needed to develop the resources, there would be no major problems. The only issues remaining would be decision making. How about cases where the country is unable to bring together the necessary resources by themselves? Few natural gas resources that are relatively easy to develop remain. If the remaining resources available are relatively difficult to develop, there are no other options than to take active steps to attract international companies with the necessary capacity. This can be achieved by providing the companies with attractive conditions. We could

say that this calls for a decision between allowing resources to lie dormant due to a lack of development capabilities, or to make effective use of the resources, no matter how minimal these may be.

b. Flexible supply arrangement

Flexibility is an important element when it comes to securing supplies. Flexibility can be considered in two ways: intra-regional flexibility and flexibility in importing from outside the region.

First, intra-regional flexibility refers to the ability to arrange for supplies from countries with excess resources when a certain country is confronted by insufficient natural gas supplies for any reason. This involves achieving supply–demand balance not only within a country but also across an entire region. Although a country has limited ability to balance supply and demand, it can strengthen this capability by cooperating with its neighboring countries. In the ASEAN region, this effort has already been concluded as the ASEAN Petroleum Security Agreement initiative. In addition, the ASEAN Council on Petroleum (ASCOPE) is launching an initiative aimed at enhancing supply stability for the entire region by utilizing regional storage capabilities.

Attempts to expand geographical balancing area from a single country to the whole region can be perceived as a measure aimed at maintaining the same level of supply stability at a lower cost, or securing a higher level of supply stability at the same cost. Efforts to enhance the supply adjustment capability, that is supply stability of an entire region, are expected to progress steadily with a focus on existing initiatives.

In EAS countries where import dependency is rising, ensuring this flexibility in their natural gas/LNG import from non-EAS regions will also become increasingly important in the future. In other words, there will be stronger calls for flexibility in the volume of natural gas/LNG delivered, as well as in the destinations that resources are delivered to. These aspects of flexibility are vital elements even in realizing flexibility for natural gas/LNG within the region, which are the aims of the ASEAN Petroleum Security Agreement and ASCOPE.

Whilst such initiatives may incur opposition from some suppliers, improvements in flexibility are also expected to contribute to creating more opportunities for suppliers to make profits. Thus, achieving a compromise between the interests of both parties is likely possible.

On the other hand, it is vital to acknowledge the existence of technological problems with regard to enhancing flexible trade. Specifically, these issues include the quality of the natural gas, harmonization of heat content standards in particular, and improvements in the compatibility between LNG ships and ports.

It also goes without saying that transportation and distribution infrastructure, such as pipelines and LNG ships, need to be improved. From this point, capital resources needed for infrastructure development may prove to be a problem, and it is necessary to engage in further discussions and consultations towards the realization of investments.

c. Sharing future perspective

One significant factor that can deter supply-side investments is the uncertainty in demand forecasts. For example, if future demand is expected to decline, it would be easy to imagine investors hesitating to inject capital into new natural gas production activities or into the development of supply infrastructure. Hence, it is important for the consuming country and the supplying country to share future prospects, and to create a secure environment for investors to undertake supply-side investment activities.

Many supply-side investments are large scale, taking several—or even more than 10—years to realize. Thus, it is important to increase supply capability to achieve long-term success, and not to change the environment over the short term. From this perspective, we could also say that it would be desirable for both the producing and consuming parties to share long-term perspectives to contribute to the stabilization of the market.

Next Step

In the study conducted for this fiscal year, we carried out priority analyses on the forecasts of the balance in natural gas supply–demand in the EAS region, as well as on the uncertainties in these forecasts. We then recommended a broad policy framework based on the premise of these future changes.

The results of the analyses showed that import dependency for natural gas is expected to rise in the EAS region in the future, and that various measures to respond to this change need to be put in place. With regard to the countermeasures, in addition to conducting regulatory systemic reviews, developing supply-side infrastructure to expand import volumes and enhancing intra-regional flexibility are also important elements. The next step in this study would be to carry out a more detailed analysis of these countermeasures, and to figure out policy implications for the sustainable development of the natural gas market in the region.