Chapter 4

Natural Gas Supply Outlook

1. Current Natural Gas Production

1.1 Brief History of Upstream Development in Myanmar[1]

Myanmar has a long history of upstream oil and gas development. The first modern well was drilled in the Yenangyaung field in the Magway region, a central inland area of the country, in 1855. As the country was under British colonial rule until 1948, early upstream operations were mainly carried out by British oil companies, particularly Burma Oil, a private British oil company that initially enjoyed what was almost a monopoly on the country's upstream sector. In 1901, other foreign companies began to enter Myanmar and commence operations, starting with Standard Oil, a private American company. Most foreign companies targeted the Yenangyaung field, with more than 4,000 wells drilled in the field as of 1915.

When the Japanese army invaded Myanmar looking for resources to fuel its military operations during World War II, British companies operating in the country destroyed their oil production facilities and evacuated the country. After the war, Burma Oil resumed its upstream operations, once more under almost monopolistic conditions. In 1961, Unocal (now merged with Chevron) entered the county, and operating companies became more diversified. In 1963, however, the country's oil industry was nationalised by the U Ne Win administration. All upstream assets were transferred to a newly established state-owned entity, Myanma Oil and Gas Enterprise (MOGE), which then engaged the country's upstream operation exclusively.

In 1988, Myanmar decided to invite foreign companies to its upstream sector again, and the first bid round was conducted in 1989. Total, a French oil company, entered the country by acquiring an undeveloped gas field in Yadana, and partnered with Unocal to begin production. Since then several large gas fields have been discovered by foreign companies: Texaco (United States), Premier Oil (United Kingdom), and Nippon Oil (Japan) discovered the Yetagun field in 1992; and Daewoo (Republic of Korea, henceforth Korea) discovered Shwe in 2000.

[1] The descriptions in this section are drawn from Thornton, S.E. (2015).

Thanks to this series of discoveries, Myanmar began exporting natural gas to Thailand and China, and natural gas accounted for 26.7% of the country's total export revenues in 2017 (JETRO, 2017). As mentioned in Section 4.2, MOGE plans to develop two new offshore blocks, and the country's upstream sector is continuing active operations.

Table 4.1: Status of Major Offshore Natural Gas Field Developments

Gas field	Initial recoverable reserves (tcf)	Block	Production capacity (mcfd)	Start of operation
Yadana	6.354	M-5, M-6	850	1998
Yetagun	2.276	M-12, M-13, M-14	200	2000
Shwe	3.315	A-1, A-3	550	2013
Zawtika	1.690	M-9	300	2014

mcfd = million cubic feet per day, tcf = trillion cubic feet.
Source: Asian Development Bank (2016).

1.2. Current Production

Myanmar has four large offshore natural gas fields (Table 4.1), the largest of which is the Yadana field. In 1992, Total and MOGE set up a joint-venture company to develop the proven and probable large natural reserves at Yadana. After exploration began, the Thai state-owned company PTT Exploration and Production (PTTEP), and an independent American oil company Unocal (now merged with Chevron) joined the development consortium. The equity structure of the project is as follows: Total (31.24%), Chevron (28.26%), PTTEP (25.50%), and MOGE (15.00%). Production at the field began in 1998 after the pipeline network was developed; and it currently supplies approximately 54% of the natural gas exported from Myanmar and almost half of the domestic gas supply.

Myanmar's second largest gas field, Yetagun, was discovered in 1992, and production commenced in 2000. All of the produced gas is exported to Thailand without supplying the domestic market. The field also produces condensate, which is stored in a floating storage and offloading system and sold on the international market or supplied to domestic refineries. The operator of the field is the Malaysian national oil company Petronas, which holds 40.91% of the total equity. Its partners are MOGE (which holds 20.45%), PTTEP (19.32%), and JX Nippon Oil and Gas Exploration Corporation (19.32%).

The other offshore gas field in the southern basin is the Zawtika field. The newest offshore gas field, it began production in 2014. Two-thirds of the produced gas is exported

to Thailand by pipeline, and the remaining one-third is supplied to the domestic market. Of the gas field's equity, PTTEP owns 80% and MOGE owns 20%.

The only producing mid-northern offshore field is the Shwe field, which commenced operations in 2013. Of the produced gas, 80% is exported to China via pipeline and 20% is supplied to the domestic market. Daewoo, a private Korean company, operates the project and owns 51% of the block. Other partners include two Indian state-owned companies, the Oil and Natural Gas Company (which holds 17.0%) and the Gas Authority of India (8.5%); a Korean state-owned gas company, Kogas (8.5%); and MOGE (15.0%).

Two-thirds of Myanmar's offshore natural gas production is exported (Table 4.2).

Table 4.2: Export and Domestic Supply of Gas Fields in Myanmar

Gas field	Allocation to export (mmcfd)	Direction of export	Allocated to domestic market (mmcfd)	Partners (%)
Yadana	560	Thailand	200	Total (31.24%) Chevron (28.26%) PTTEP (25.50%) MOGE (15.00%)
Yetagun	150	Thailand	0	Petronas (40.91%) Nippon (19.32%) PTT (19.32%) MOGE (20.45%)
Shwe	340	China	100	Daewoo (51%) ONGC (17%) GAIL (8.5%) Kogas (8.5%) MOGE (15%)
Zawtika	200	Thailand	100	PTTEP (80%) MOGE (20%)
Onshore fields	0	Domestic	50	MOGE
Total	1,500		450	

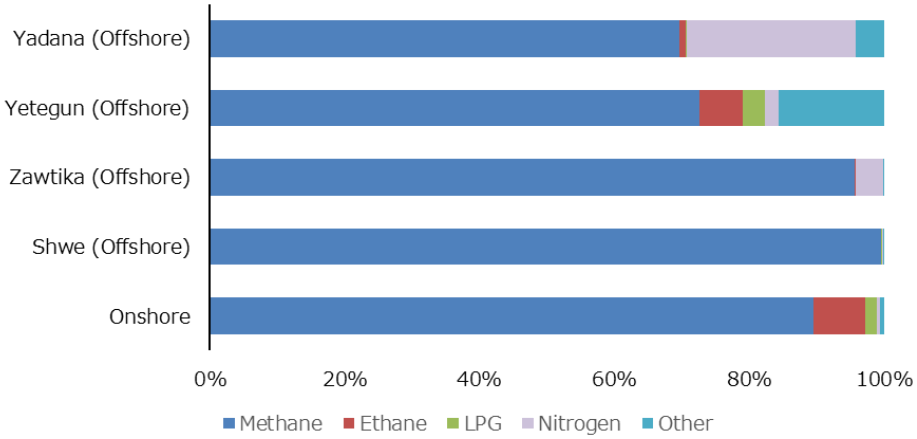
mmcfd = million cubic feet per day, MOGE = Myanma Oil and Gas Enterprise, ONGC = Oil and Natural Gas Company, PTTEP = PTT Exploration and Production.
Source: Presentation material of the Ministry of Electricity and Energy (July 2017).

The quality of the natural gas produced in Myanmar varies from field to field. The natural gas from the northern Shwe field is very 'lean' (having a high methane content) while that from Yetagun in the south has a higher share of ethane or propane, indicating a high calorific content. Natural gas produced from Yadana contains a high volume of nitrogen lowering its heat value significantly (even lower than that from Shwe).

Because the natural gas supply is operated separately in the north and south due to

the cutoff of the north–south pipeline network, these differences in quality have not yet been considered a significant issue. Yet, as the country's natural gas demand grows, and it becomes increasingly necessary to interchange natural gas across regions, the heat value of natural gas may need to be adjusted in the future. Generally speaking, the power generation and residential sectors can accommodate a wider range of calorific values of natural gas as fuels; however, the industry sector sometimes requires a stable calorific value because changing calorific values cause fluctuations in heat content and might adversely affect the quality of manufactured products (such as ceramics).

Figure 4.1: Quality of Offshore Natural Gas in Myanmar



LPG = liquefied petroleum gas.
Note: The quality of 'onshore' shows the quality of the Maubin field.
Source: Institute of Energy Economics, Japan based on data provided by the Ministry of Electricity and Energy.

Myanmar also produces a small volume of natural gas onshore, 53 million cubic feet per day (mmcfd) in 2018 (3% of total production). The largest onshore field, Maubin in the Ayeyarwady region, produces 25 mmcfd, almost half the total onshore production. Most of the country's onshore fields exist in the central and southern regions. Natural gas from onshore fields is used in various demand sectors such as power generation, compressed natural gas for automobiles, industry fuel, and fertiliser feedstock. Onshore exploration and development works are being actively pursued, and onshore production is expected to grow significantly through 2030.

2. Natural Gas Production Outlook

While production from existing fields will decline in the future, this will be partially offset by production from several newly discovered fields, both offshore and onshore.

Table 4.3: Major Discoveries in Myanmar

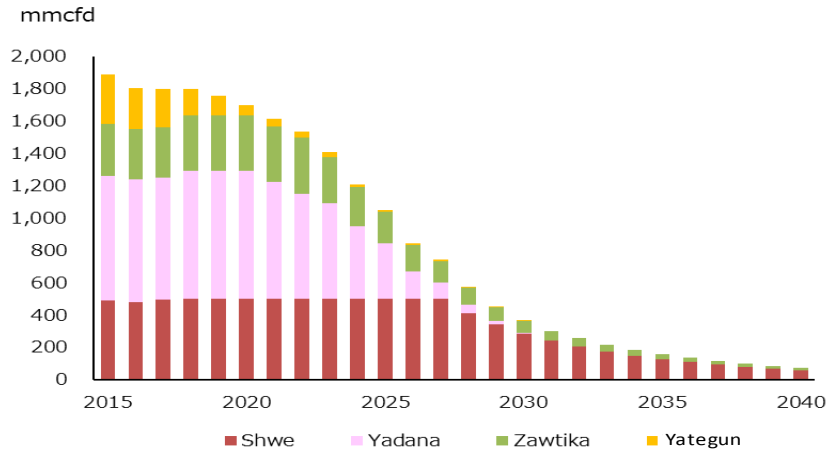
Block	Basin	Expected production (mmcfd)	Start of operation
M-3	Moattama offshore	n/a	2023
A-6	Rakhine offshore	60	2025

mmcfd = million cubic feet per day; n/a = not available
Source: Institute of Energy Economics, Japan, based on interviews with Myanma Oil and Gas Enterprise in May 2018.

Natural gas from existing offshore fields, which account for more than 90% of the country's total production, will decline from about 1,900 mmcfd in 2015 to less than 100 mmcfd in 2040. Production from the relatively new Shwe field will plateau at 500 mmcfd until the mid-2020s, after which point it will decrease.

The development of two new fields, the M-3 and A-6 blocks, will be pursued. Production from M-3 will be onstreamed in 2023 and production from A-6 will be onstreamed in 2025. Supplies from these new sources will partially offset the decline in production from existing offshore fields, but to make up the production losses fully, Myanmar will need to secure additional supply sources such as onshore production or LNG imports.

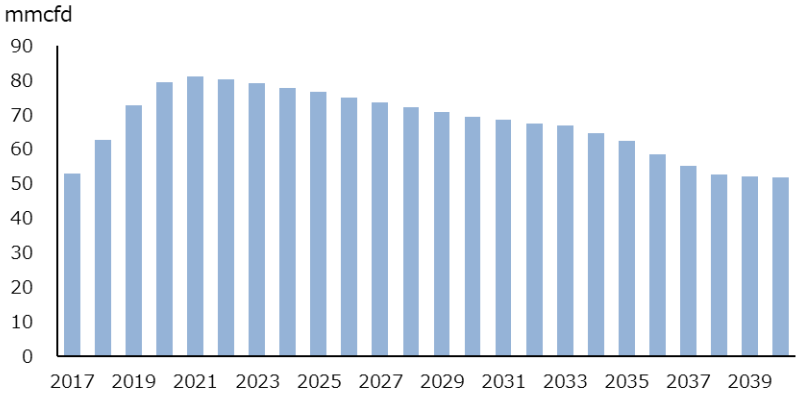
Figure 4.2: Production Outlook of Existing Offshore Fields



mmcfd = million cubic feet per day.
Note: Production from newly developed fields is NOT included.
Source: Institute of Energy Economics, Japan based on data provided by the Ministry of Electricity and Energy.

Onshore production on the other hand is expected to grow in coming years. As of 2018, more than 70% of Myanmar's onshore production comes from its southern fields such as Maubin, Nyaundon, and Apyauk. Production from the mid-northern onshore field in Magway is expected to grow and make up for declining production through 2040. However, most of these additional onshore fields are still in the planning stages and the actual supply is not guaranteed. A more detailed and precise analysis of potential production from onshore sources must be conducted to ensure a more correct supply picture in the future.

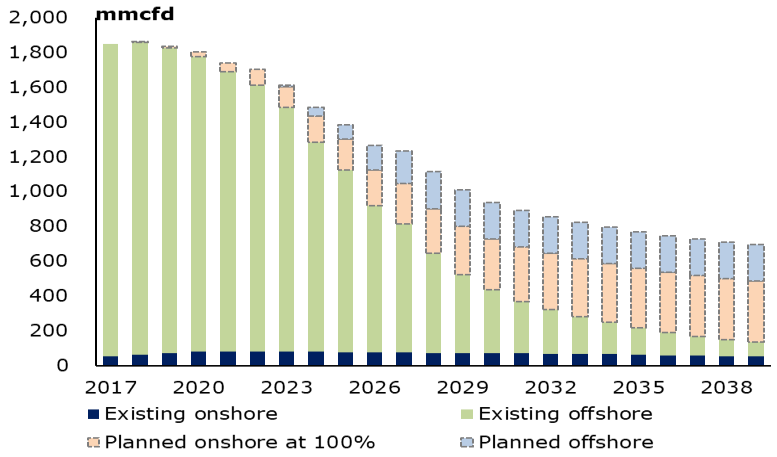
Figure 4.3: Outlook of Existing Onshore Fields



mmcfd = million cubic feet per day.
Note: Production from newly developed fields is NOT included.
Source: Institute of Energy Economics, Japan based on data provided by the Ministry of Electricity and Energy.

Total domestic natural gas production will remain close to current levels through the mid-2020s, but will gradually decline afterward. The most prominent reason for this decline is the depletion of existing offshore fields. Although this will be temporarily offset by increased production from onshore fields, from the mid-2020s the total domestic production will begin to decline. Production is expected to fall to 1,350 mmcfd by 2030 and 810 mmcfd by 2040. The supply source of domestic gas is also expected to change over time. The share of the domestic supply sourced from offshore fields is projected to slide from more than 97% as of 2018 to almost 50% by 2040 (Figure 4.4).

Figure 4.4: Domestic Production Outlook in Myanmar



mmcfd = million cubic feet per day.
Note: Assuming that planned onshore field developments produce 100% of the targeted volume.
Source: Institute of Energy Economics, Japan based on data provided by the Ministry of Electricity and Energy.

If the planned onshore production is not realised, Myanmar will need to import LNG as another natural gas supply option. Since Myanmar lacks a natural gas import pipeline, it will need to import natural gas in the form of LNG. Myanmar is considering three LNG import projects (Table 4.4), all of which are planned in the southern coastal areas where demand is expected to be large. Declining domestic production from southern offshore fields may also drive the country to secure an alternative natural gas supply in the region.

Table 4.4: Planned Liquefied Natural Gas Receiving Terminals

Project	Import capacity (mtpa)	Installed generation capacity
Alone	0.4	356
LNG to Power project		
MeeLongGyaing	1.6	1,390
LNG to Power project		
Kaunbauk	1.0	1,230
LNG to Power project		

LNG = liquefied natural gas, mtpa = million tonnes per annum, MW = megawatt.
Source: Information provided by the Ministry of Electricity and Energy.

LNG will be another natural gas supply source for Myanmar. Three LNG receiving projects are being planned. These planned LNG receiving capacities are smaller than the

standard receiving capacity (3 million–5 million tonnes per year). This is mainly because the demand is not large.

All planned LNG projects in Myanmar are so-called gas-to-power projects, or the combined LNG receiving facility and gas-fired power generation construction. Most of the imported LNG will be consumed by power plants, and some surplus LNG will be supplied to the domestic pipeline network for city gas use. The shallow draft in the southern coastal areas also prohibits standard-size LNG tankers from berthing. To meet the demand for imported LNG, Myanmar will need to adopt floating storage and regasification unit technology, an effective means of fast-tracking LNG imports currently used by a number of new LNG importing countries (see Chapter 2).

A potential impediment to introducing LNG to Myanmar is the difference between the international LNG price and domestic natural gas price. As the Government of Myanmar sets the domestic natural gas price at a lower level than the international price, it may need to subsidise this gap. Such additional fiscal expenses will become a heavy burden on the government. In fact, all LNG import projects are expected to supply electricity at $0.09 cents per kilowatt-hour as the power tariff is also regulated and set at a lower level by the government. Therefore, designing an economically viable LNG import scheme is a very challenging task for potential project developers and investors.

3. Natural Gas Exports

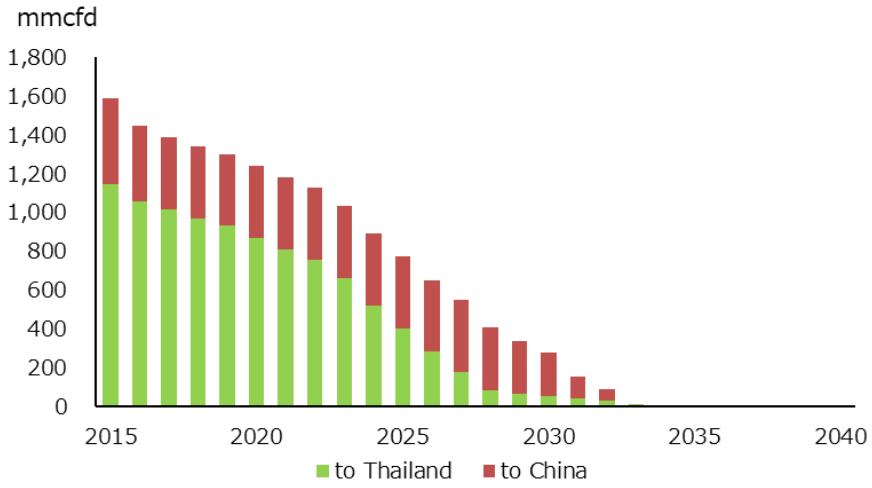
In 2017, approximately two-thirds of Myanmar's natural gas production was exported to Thailand (10.4 billion cubic metres [bcm] or 1,016 mmcfd) and China (3.8 bcm [371 mmcfd). The exported volume to these countries has remained stable. Exports to Thailand are provided under a 30-year contract that expires in 2028, and the volume has remained stable at around 8 bcm–10 bcm since 2000. These exports are sourced from the southern offshore gas fields including Yadana, Zawtika, and Yetagun. Myanmar began exporting natural gas to China in 2014, after the completion of the export pipeline from the northern offshore Shwe gas field to the Chinese border. In 2017, 3.8 bcm, approximately 80% of the Shwe gas field production, was exported to China.

Due to a growing demand for natural gas in Thailand and China and both countries' increasing dependence on imports, the export market for Myanmar's gas is promising. In Thailand, declining domestic natural gas production and surging domestic power demand

are driving the country to secure more natural gas. Meanwhile, the Government of China's 'Blue Sky' policy to improve air quality has created a large demand for natural gas by switching from coal as a fuel. The question is whether Myanmar has enough gas to sustain the level of exports needed by these two countries.

This study assumes that exports to Thailand and China will decrease and eventually stop during the study period. Data provided by the Ministry of Electricity and Energy suggest that all exported natural gas comes from offshore natural gas fields as of 2018, and that the existing fields will be depleted around 2030. The Yadana, Yetagun, and Zawtika fields supply gas for export to Thailand; and Shwe supplies gas for export to China. This study assumes that exports to Thailand will stop in 2035, and exports from Shwe will stop in 2033. This is mainly because production from these fields will decline and the additional potential supply from onshore fields will be prioritised to supply the domestic market. As the southern offshore fields will start to deplete earlier than Shwe, exports to Thailand will stop earlier.

Figure 4.5: Export Volume Assumption of this Study



mmcfd = million cubic feet per day.
Source: Institute of Energy Economics, Japan based on data provided by the Ministry of Electricity and Energy.

In both cases, it is still possible that the export pipeline will continue to be used to transport imported and regasified gas from LNG receiving terminals in Myanmar. If a receiving facility is built in Kyaukpyu (the feeding point of the existing export pipeline to China), LNG may by imported and regasified at the Kyaukpyu terminal, then shipped through Myanmar to the Chinese border. The same arrangement will be possible if an LNG receiving

facility is developed along Myanmar's southern coast (e.g., in Dawei). This is more likely for a pipeline to China because China has been keen to diversify its natural gas supply routes. The country has developed a pipeline network from Central Asia and Myanmar, and is currently developing another pipeline from Russia. The existing Myanmar–China pipeline has become an important supply route in light of China's aim to diversify. Even if production from the Shwe gas field declines, China may want to import natural gas through the pipeline by building an LNG terminal in Kyaukpyu and sending regasified gas through the pipeline.

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