ANALYSIS: IMPACTS OF A DISRUPTION OF MYANMAR GAS IMPORTS ON THAILAND'S ENERGY SECURITY

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SUMMARY

If the international community uses sanctions to target the Myanmar military's access to natural gas revenues, the military could potentially retaliate by cutting off natural gas supplies. Currently, Myanmar (Burma) exports most of its natural gas to Thailand and China, while using a portion of this gas to supply power to Myanmar military-owned companies and domestic energy production, including for the city of Yangon. While a disruption or cessation of Myanmar gas exports is unlikely, even if sanctions halt the revenues from the gas projects, this analysis examines how such a disruption might affect Thailand's energy security.

In 2018, the Economic Research Institute for ASEAN and East Asia (ERIA), an international organization created by the 16 East Asia Summit member countries, published an *Assessment of Readiness for Fossil Fuel Disruption*.[1] This study concluded that Thailand has the resilience to withstand a disruption of up to 21% of its natural gas supply for 180 days.[2] Myanmar gas provides 13.4% of Thailand's gas demand (of which Total's Yadana project provides around two-thirds), which means that Thailand would be resilient to a complete disruption of gas imports from Myanmar for this period.

Thailand's resilience is based on its high reserve margin and the fuel-switching capability of its gas plants. Thailand already has substantial unused liquid natural gas (LNG) import capacity—Myanmar gas could be replaced by increasing LNG imports in the medium term. Based on the ERIA assessment, in the days immediately following a disruption of Thailand's gas imports (i.e. prior to securing additional LNG):

- Most power plants that use gas are equipped to use backup fuel (fuel oil or diesel) to maintain three to five days' supply.
- Fuel switching and LNG stores should provide a continuation of electricity generation during the time that it takes to increase LNG imports, which would likely take a few weeks to a month.
- If more time was needed to replace a disrupted gas supply (up to 180 days), other options exist. They include increasing domestic gas output and using a higher proportion of domestic gas for power generation (as some is refined and sold for other uses).

Thailand would incur additional costs in the immediate to medium term, which are difficult to estimate. In the long term, however, a disruption of Myanmar gas supplies will be irrelevant: Thailand is already well along a path of increasing its use of LNG and reducing its use of Myanmar gas, with the Yadana field expected to have depleted within five years.

1 "Assessment of Readiness of Fossil Fuel Import Disruption," ERIA Research Project Report 2017, No 6. Available at https://eria-development.website/eria/NewsMultimedia/detail/assessment-of-readiness-for-fossil-fuel-import-disruption referred to as ERIA Report.

2 The ERIA assessment focused on a disruption of LNG imports, rather than a disruption of Myanmar gas imports. However, as described in more detail in this analysis, many of ERIA's findings are applicable to a scenario where there is a disruption of Myanmar gas imports.

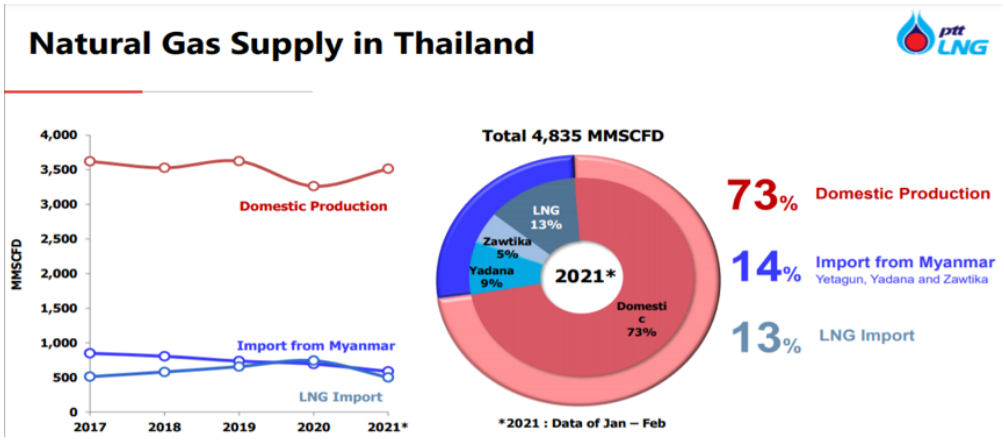
THAILAND'S ENERGY SURPLUS

Thailand has a significant over-capacity in its energy sector due to over-investment, poor planning, and reduced demand. As of April 2021, Thailand's power generation consisted of 56% gas, 17% coal, 12% renewables, 13% imports, and 2% domestic hydroelectric.[3] Thailand aims to maintain a 15% reserve margin[4] (surplus capacity over peak demand) to ensure sufficient resource adequacy and system reliability. According to the Electricity Generating Authority of Thailand (EGAT), Thailand's peak demand in 2021 (which takes place in the April/May hot season) will be 30,135 MW, while the total generation capacity as of 31 July 2021 is 46,102 MW.[5] This is equivalent to a 53% reserve margin.

In April 2021—the hottest month of the year in Thailand, with the highest annual peak consumption—7 out of the 12 Independent Power Producers (IPPs) were essentially idle for the entire month. All of these idle IPPs were gas-fired and had a 0-1% utilization rate, as shown in Diagram 4 at Annex 1.[6]

Approximately 14% of Thailand's gas supply comes from Myanmar (see Diagram 1). This includes 9% from Total/Chevron's Yadana field and 5% from PTTEP's Zawtika field. A similar amount is provided by LNG. Thailand uses 58% of its overall gas consumption for power generation.[7]

Diagram 1: Natural Gas Supply in Thailand[8]



3 Source: EPPO, http://www.eppo.go.th/index.php/th/component/k2/item/download/2120453963a52b3689f0937ae2df246483241

4 15% is similar to reserves margins in the U.S., with Texas for example having a reserve of 15.5%, see https://www.spglobal.com/platts/en/market-insights/latest-news/electric-power/121620-ercot-sees-155-reserve-margin-up-from-2020s-126-down-from-may-forecast

5 EGAT Website: https://www.egat.co.th/index.php?option=comcontent&view=article&id=348&Itemid=116. The 2020 peak was similar. Demand in July 2021 peaked at 28,991.

6 Source: EGAT, Ft charge calculations, https://www.egat.co.th/ft/Web/Purchase%20may64aug64.htm

7 Source: https://erranet.org/wp-content/uploads/2021/03/9.-A.DetwarasitiTH-case-study-PTTLNGfinalV2.pdf. The remainder is 22% "Separation Plant" where it is refined for other uses, 18% industrial usage and 2% for gas powered vehicles. See Diagram 3 at Annex 1.

8 Source: https://erranet.org/wp-content/uploads/2021/03/9.-A.DetwarasitiTH-case-study-PTTLNGfinalV2.pdf

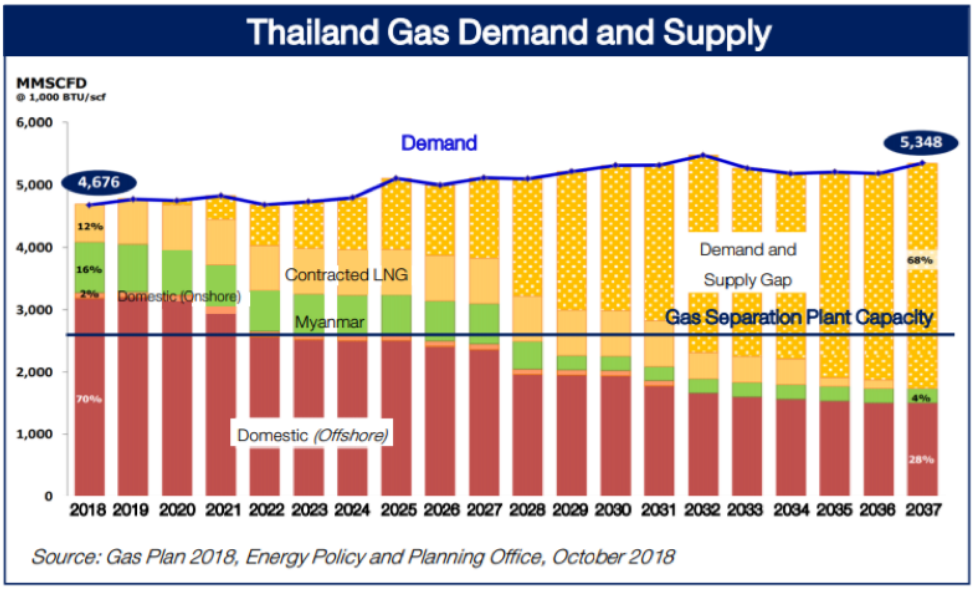
THAILAND'S LONG-TERM SHIFT FROM MYANMAR GAS TO LNG

As part of its effort to reduce its overcapacity, Thailand is seeking to decrease its reliance on Myanmar gas and increase its reliance on LNG imports. The planned phase-out of Myanmar gas is described in Diagram 2. Overall, this 2018 diagram shows a gradually increasing demand for gas, although the drop in the cost of renewables since 2018 should result in a leveling off or decrease.

Power plants that rely solely on Myanmar gas[9] are located in Ratchaburi Province in western Thailand and have a capacity of around 5,000MW. Even if Thailand stopped importing Myanmar gas and terminated the Power Purchase Agreements (PPAs) with the IPPs that operate them, the remaining generation capacity is still 40,771 MW and the reserve margin is 35.3%. Thus, the Thai government would still have to cut its supply further to reduce its energy surplus to 15%.

A presentation from a Thai government meeting[10] to revise and develop a new Power Development Plan suggests that one option is the early retiring of some of the surplus power plants that use Myanmar gas at a net cost of around 0.5% of Thailand's annual electricity costs. This indicates that Thailand is not reliant on Myanmar gas and has instead considered terminating its supply.

Diagram 2: Thailand's Gas Demand and Supply



9 Myanmar ("West") gas is also mixed into the gas used by EGAT-operated power plants at North Bangkok (1552 MW) and South Bangkok (2492MW). These plants could operate on Thai domestic ("East") gas. Wang Noi (1436MW) normally use East gas, but is connected to and could use Myanmar gas too. In 2016, these plants used around 28% of the gas from Myanmar, but this is understood to have declined since then.

10 Presentation (slide 19 and 20) at the 29 March 2021 meeting of the Subcommittee on Demand Forecast and Power Development Plan.

SHORT TO MEDIUM-TERM IMPACT OF A REDUCTION OR CESSATION OF MYANMAR GAS IMPORTS

If sanctions halt the Myanmar military's gas revenues, stopping the gas exports would likely compound the regime's problems; they are unlikely to take such a step. Although such a disruption cannot be ruled out entirely, Thailand has several options available to mitigate the short- to medium-term (i.e. one month to two years) impact of reducing or cessation of Myanmar gas imports.

IPPs that currently lie idle can utilize LNG.[11] The Map Tha Phut LNG terminal - Thailand's LNG import and storage site - has the capacity to import 1,534 MMSCFD per month. It currently imports only 840 MMSCFD per month, and in February 2021, Thailand even re-exported LNG to Japan.[12] Myanmar gas exports to Thailand in 2021 have averaged 674 MMSCFD per month. Map Tha Phut, therefore, has sufficient capacity to import additional LNG to replace Myanmar gas completely. In the second quarter of 2022, a second LNG terminal (Nong Fab) is due to come online, providing another 1,001 MMSCFD of LNG import capacity.[13] This will give Thailand a considerable LNG import and storage capacity, with additional facilities planned for 2024 and 2025. However, it must be noted that these developments carry the risk of locking Thailand into a long-term reliance on LNG instead of making a transition to renewable energy.

Thailand could also increase LNG imports in the shorter term with purchases from spot markets. It would take a few weeks to a month to procure LNG from short-term markets.[14] In the medium term, Thailand could expand its existing import contracts with Qatar and other suppliers or enter new ones.

Additionally, Thailand's national grid has the capacity to adapt to a disruption of Myanmar gas supply. Most of the power generated by Myanmar gas is not used in Ratchaburi, which only has a demand of 400MW. The area is connected to four large 500kv transmission lines linking the central, western, and southern regions of Thailand and which could supply energy to Ratchaburi.[15]Instead, power from Myanmar gas is primarily transmitted to Bangkok and the Central region, which are well-connected to the national grid and Thailand's other idle IPPs.

IMMEDIATE TERM IMPACT OF REDUCTION OR CESSATION OF MYANMAR GAS IMPORTS

Myanmar gas was disrupted with limited warning in 2009 and 2013. In 2013 this was done by the gas companies themselves for maintenance work during the April 2013 hot season, a month where Thai energy demand is usually at its peak, despite objections by the Thai government.[16]

11 There is no need to transport gas the Ratchaburi plants that use Myanmar gas; LNG would be shipped to the underutilized IPPs through gas pipelines from the LNG terminal in Rayong in the Gulf of Thailand.

12 "Thailand's PTT ships LNG to Japan for first time amid winter squeeze," Today, 5 February 2021, available at: https://www.todayonline.com/world/thailands-ptt-ships-lng-japan-first-time-amid-winter-squeeze

13 The output of Thailand's largest domestic gas field, Erawan, may be 200-300 MMSCFD less than had been forecast. PTTEP will be operating it from 2022 and PTTEP plans to increase production from its other domestic fields (Bongkot and Arthit) to cover 80% of the shortfall with the remainder from LNG (40-60 MMSCFD). PTTEP won an auction in 2018 to take over Erawan from Chevron. A dispute over decommissioning costs between Chevron and the Thai government has led to an arbitration and lack of cooperation that will delay PTTEP taking over the field as planned in 2022, leading to a reduced output.

14 ERIA report, see Table 2.5 (Risk Sources of LNG Disruption and Its Amount and Duration), chapter 2, page 12.

15 Source: Thai Energy Policy and Plan Office documents available at http://www2.eppo.go.th/EDV/

16 "Myanmar gas cutback a worry", Bangkok Post, 15 Feb 2013, available at: https://www.bangkokpost.com/business/336124/myanmar-gas-supply-disruption-a-worry

This caused disruption but not black or brownouts,[17] and at the time, Thailand was much more reliant on Myanmar gas; in 2013, Myanmar gas provided around 25%[18] of Thailand's gas supply but now it provides only 13.4%.[19] Thailand has now had six months since the coup to prepare for the increased vulnerability of Myanmar gas disruption.

If Myanmar gas was turned off without warning, in the immediate term (one month), Thailand would likely implement emergency measures and then bring online unused capacity that is not reliant on Myanmar gas. ERIA's 2018 assessment concluded that Thailand's high reserve margin and fuel-switching capability protect the country from a LNG disruption.[20] Although ERIA's analysis focuses on a disruption to LNG imports, we can apply many of these findings to a disruption of Myanmar gas imports, as described in more detail below.

ERIA reviewed various supply disruption scenarios and concluded that Thailand was resilient to disruptions to LNG imports. In the most serious scenario, ERIA assessed the consequences of damage to the LNG terminal, resulting in an inability to use LNG stocks and stopping of LNG imports for 180 days. In this scenario, ERIA concluded that there would be no serious impacts. The assessment was based on assumptions that coal power plants were already at full capacity and that hydroelectric imports and Myanmar gas imports could not be increased. Crucially, it also assumed that LNG provided 21% of Thailand's natural gas (measured by heating value). This means Thailand should be resilient to losing 13.4% of its gas imports (by volume) from Myanmar gas, noting that the Myanmar gas has a heating value 28% lower than LNG.[21]

If Myanmar gas were turned off without warning, the majority of natural gas-fired power plants operated by IPPs in Thailand can switch to diesel or fuel oil, and their PPAs require them to store and be able to operate under alternative fuels for at least 3–5 consecutive days.[22] This includes the RATCH plant that is the only plant currently operating that is reliant solely on Myanmar gas.

Thailand has a total gas plant switching capacity of 4,000 MW to fuel oil and 15,500 MW to diesel. As Thailand is an exporter of these fuels, ERIA concluded that there "should not be a point of concern in terms of their availability."[23] ERIA considered that fuel switching could make up 54% of the LNG supply shortfall for 30 days of disruption and 43% for the remainder of the 180 days. ERIA made this assessment for a scenario where LNG provided 21% of Thailand's gas, whereas Myanmar's currently provides only 13.4% by volume, and slightly less by heating value; this suggests that fuel switching could replace almost all Myanmar gas in the immediate term.

17 "Thailand's gas conundrum," Enerdata, 9 June 2014 available at; https://www.enerdata.net/publications/executive-briefing/thailand-natural-gas-conundrum.html

18 "Myanmar gas cutback a worry", Bangkok Post, 15 Feb 2013.

19 Source: http://www.eppo.go.th/index.php/th/energy-information/static-energy/static-gas

20 ERIA Report.

21 Myanmar gas has a low heating value. Using the Wobbe Index, Myanmar gas (970 - 1,040 BTU/scf) is lower than both Thailand's domestic gas (1,220 - 1,340 BTU/scf) and its LNG imports (1,380 - 1,400 BTU/scf). This means that if Thailand can adapt to losing 21% of its gas by heating value, and not suffer serious impacts, it could adapt to a loss of 13.4% by volume when this 13.4% is of a low heating value.

22 ERIA Report, chapter 3, page 33.

23 ERIA Report, chapter 3, Table 3.6. Possible Countermeasures in the Event of LNG Import Disruption in Thailand.

In the current circumstances, where much of Thailand's capacity is idle, it may well be able to rely on its plant-switching capacity for even longer.

The other main measure that ERIA considered was to use stored LNG. Thailand can store LNG that is equivalent to approximately 16 days of Myanmar gas.[24]

Fuel switching and stored LNG would likely provide enough time for Thailand to increase LNG imports (a few weeks to a month) to meet demand. Alternatively, ERIA identified three additional options.[25] The first was to increase domestic production, and ERIA identified domestic output as having a flexibility of around plus or minus 15%. The second was to reduce gas supply to natural gas vehicles (i.e., they would switch to gasoline). The third was to reduce the amount of gas sent to separation plants (so that valuable gases can be separated for other industrial uses) and[26] divert this to power generation.

ERIA also concluded that the pipeline capacity would not put any limitation on its analysis, noting that three main offshore trunk lines bring natural gas from the Gulf of Thailand ashore at the Map Ta Phut terminal. If LNG were to replace Myanmar gas, it would come ashore at Map Ta Phut.

As for power transmission and distribution, ERIA concluded that Thailand has an extensive power grid linking central, eastern, and western regions, and that LNG disruption would not create challenges in transmission of electricity. Myanmar gas is used by power plants that power and are located in these same well-connected central and western regions, indicating that there will not be issues with electricity transmission, especially as the large overcapacity and numerous idle IPPs increase the system's flexibility.

COST TO THAILAND

There are two main costs to consider switching from the IPPs that use Myanmar gas to other under-utilized providers, and procuring alternative fuel to Myanmar gas.

The former would only result in a small increase in costs. The nature of PPAs means that IPPs receive an Availability Payment (covering capital, financing costs, and profits for IPP owners) regardless of whether their plants are operating. For example, one of the plants connected to Myanmar gas, RPCL, has a utilization rate of 1%. Despite being essentially idle, RPCL costs Thai ratepayers at least 300 million Baht per month. Thus, a shift away from Myanmar gas does not affect RPCL in the short term.[27]

24 According to the ERIA analysis, the available stored stock has a heating value of 13,186 billion BTU. Myanmar gas imports are currently 679 MMSCFD per month with a heating value of approximately 1,000 BTU/scf. On these figures the stock should last for 15.7 days.

25 ERIA Report, chapter 3, Table 3.6. Possible Countermeasures in the Event of LNG Import Disruption in Thailand and section 3.3.3 (Assessment Results), page 46.

26 Thailand's domestic gas is "wet" gas which it sends to separation plants for refining as it contains a high proportion of ethane and propane. These types of gas have uses in addition to power generation and are more valuable when separated and sold.

27 Data Source: EGAT, Ft Tariff Calculation of power purchase costs, https://www.egat.co.th/ft/index3.html

The other IPP that uses Myanmar gas, RATCH, has a capacity of 3,481 MW and a utilization rate of 37%. Its output could be met by underutilized IPPs, as well as underutilized power plants owned by EGAT. The cost difference would be in energy costs between RATCH and the plants selected to replace it. These plants would likely cost no more than an extra 10% per kWh,[28] and Myanmar gas, in turn, provides only around 8% of Thailand's kWh.[29]

For the second cost, LNG on the Asian spot market has seen several years of low prices, sometimes dropping below the price paid for Myanmar gas. However, there has been a large spike in LNG prices on the Asian spot market in 2021.[30] So while the cost of Myanmar gas is now also beginning to rise, switching to LNG could result in price increases for Thai electricity consumers of around 12% in the short term.[31] Other options may include increasing deliveries under long-term LNG contracts[32] or utilizing Thailand's fuel-switching capacity by using fuel oil.[33] Another option is using domestic gas that is currently refined and sold for industrial use rather than power generation. These may all be less costly than procuring LNG on the Asian spot market. In the longer term Thailand is already planning on switching from Myanmar gas to LNG as the Yadana field depletes.

28 Calculated based on the next cheapest power plants using historical data of power purchase costs of EGAT used in calculation of Ft tariffs. Data source: https://www.egat.co.th/ft/index3.html

29 60% of Thai electricity generation mix is gas, of which Myanmar gas is now 13.4%.

30 "Asia, Mideast utilities turn to dirtier fuel as LNG prices bite, " Reuters, 3 September 2021. Available at: https://www.reuters.com/world/middle-east/asia-mideast-utilities-turn-dirtier-fuel-lng-prices-bite-2021-09-03/

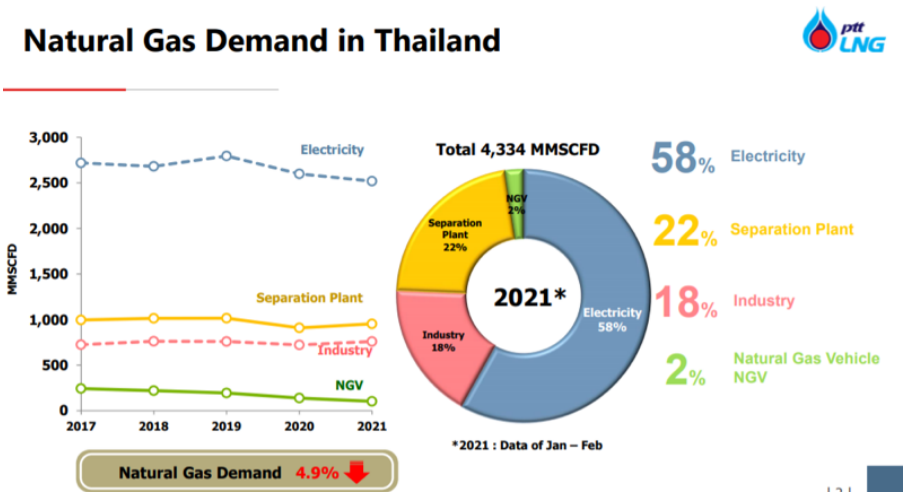
31 This is based on Myanmar gas prices being roughly 50% of current prices of LNG on the Asian spot market and assumes that 60% of Thai electricity generation mix is gas, of which Myanmar gas is now 13.4%.

32 "Buyers of long-term LNG ask sellers for extra cargoes" " Reuters, 3 September 2021.

33 "Asia, Mideast utilities turn to dirtier fuel as LNG prices bite, " Reuters, 3 September 2021.

ANNEX 1: ADDITIONAL DIAGRAMS

Diagram 3: Natural Gas Demand in Thailand



Source: https://erranet.org/wp-content/uploads/2021/03/9.-A.Detwarasiti_TH-case-study-PTTLNG_finalV2.pdf

Diagram 4: Utilization rates of Independent Power Producers (IPPs)

IPPs	Installed Capacity (MW)	Utilization Rate or Plant Factor (%)											
		May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21
KEGCO	930	79%	79%	78%	78%	87%	86%	85%	84%	65%	53%	98%	98%
GPSC	700	21%	21%	21%	21%	21%	18%	14%	0%	0%	0%	0%	0%
RATCH	3,481	38%	51%	50%	48%	41%	39%	40%	12%	31%	32%	53%	37%
GLOW IPP	713	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
EPEC	350	65%	70%	0%	0%	0%	0%	0%	0%	0%	0%	57%	58%
BLCP	1,347	99%	99%	99%	99%	99%	99%	63%	64%	92%	99%	99%	99%
Gulf-GPG	1,468	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RPCL	1,400	46%	39%	40%	0%	0%	23%	0%	0%	30%	43%	3%	1%
GHECO-1	660	97%	97%	97%	97%	97%	97%	97%	97%	0%	76%	97%	97%
Gulf JP NS	1,600	82%	53%	40%	21%	0%	0%	0%	0%	0%	0%	0%	0%
Gulf JP UT	1,600	20%	13%	18%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Gulf SRC	663						7%	17%	40%	3%	5%	14%	0%

Source: EGAT, Ft charge calculations, https://www.egat.co.th/ft/Web/Purchase%20may64_aug64.htm

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