Chapter 4

Selection of LNG Receiving Ports

January 2021

This chapter should be cited as

ERIA (2021), 'Selection of LNG Receiving Ports', in Kimura, S., et al. (eds.), *Feasible Solutions to Deliver LNG to Midsized and Large Islands in Indonesia.* ERIA Research Project Report FY2020 no.18, Jakarta: ERIA, pp.22-30.

Chapter 4
Selection of LNG Receiving Ports

In this chapter, we proposed the locations of LNG receiving ports by using a methodology that considers several factors. First, we looked at the forecasted LNG demand in Eastern Indonesia as estimated in chapter 3. Second, in each region we gathered all seaports that are geographically close to the existing or planned-to-be-developed natural gas–fired or dual-engine power plants. Third, we gathered information on the profile of those seaports. Finally, considering the specifications of the model LNG carrier vessels, we selected several seaports as LNG receiving ports based on the accessibility of those seaports.

In section 4.1, we presented the initial candidates for LNG receiving terminals (ports) based on the location of the existing seaports, the forecasted LNG demand and the existing and planned GPPs. In section 4.2, we selected LNG carrier vessels and presented their characteristics. Finally, in section 4.3, we presented the selected receiving ports based on their accessibility for the model ships.

1. Regions and the Potential LNG Receiving Ports

Chapter 3 identified 21 regions that include cities and small islands where potential LNG demand for power generation would likely be generated in the future, i.e. in the 2040 horizon. Table 4.1 summarises the results of demand forecasting, the potential seaports, the existing and planned gas-fired and dual-engine power plants, and the installed or planned-to-be-installed power generation capacity.

The existing seaports were selected as potential LNG receiving ports or terminals since they are currently serving the corresponding city or island as maritime ports. We also identified the existence of gas-fired and/or dual-engine power plants and/or plans to build and operate them in the near future. Several regions – South Halmahera, Flores Island, and North Sulawesi – have more than one potential seaport to serve as LNG receivers.

Table 4.1: Regions, Forecasted LNG Demand, Potential Seaports, and Natural Gas–Fired Power Plants

Location	Estimated LNG Demand		Seaports	Existing and Planned Gas-Fired and Dual-Engine Power Plants	Installed or To-Be-Installed Capacity
	2030	2040			Megawatt (MW)
Center Sulawesi	1.87	2.27	Palu - Pantoloan	PLTG Palu (KEK - Special Economic Region/*Kawasan Ekonomi Khusus*)	200
South Sulawesi	4.22	8.44	Makassar New Port	PLTG Makassar Peaker – Tamalanrea	450
North Sulawesi			Bitung		
			Manado		
Bali	0.91	2.75	Benoa	PLTDG Pesanggaran	200
Lombok, West Nusa Tenggara	0.58	0.82	Lembar - Mataram, West Lombok	PLTG MPP Jeranjang Lombok	50
Sumbawa, West Nusa Tenggara	0.31	0.41	Badas - Sumbawa	PLTMG Sumbawa - Labuan Badas	50
Flores, East Nusa Tenggara	0.15	0.28	Labuhan Bajo	MPP Flores - Manggarai Barat	20
			Maumere	PLTMG Maumere - Sikka	40
Kupang, East Nusa Tenggara	0.09	0.21	Tenau - Kupang	PLTMG Kupang Peaker - Lifuleo (2018)	40
Buru Island, Maluku	0.08	0.10	Namlea	PLTMG Namlea (2020)	10
Ambon, Maluku	0.09	0.12	Ambon	PLTMG Ambon Peaker - Waai (2020)	30+70
Halmahera (South), North Maluku	1.48	1.55	Tobelo	PLTMG Mamuya Galela	30

			Tapaleo	PLTG Halmahera Timur	80
Ternate, North Maluku	0.44	0.47	Ternate Kota Baru	PLTMG Ternate Kastela	30
Yapen Island (Serui), Papua	0.02	0.05	Serui	PLTMG Serui	10
Biak, Papua	0.04	0.07	Biak	PLTMG Biak (2018)	35
				PLTMG Biak 2 (2019)	20
Merauke, Papua	0.05	0.11	Merauke	PLTMG Merauke Karang Indah	20
Jayapura, Papua	0.02	0.09	Jayapura	MPP Jayapura (2017)	50
				PLTMG Jayapura Peaker (2019)	40
				PLTMG Jayapura (2020)	50
Manokwari, West Papua	0.15	0.19	Manokwari	MPP Manokwari (2018)	20
				PLTMG Manokwari (2019)	20
				PLTMG Manokwari (2019)	20
Sorong, West Papua	0.25	0.30	Sorong	PLTG Sorong (2018)	30
				PLTG Sorong (2019)	20
				PLTMG Sorong (2025)	50

PLTG = gas-fired power plant, PLTMG = gas engine power plant, PLTDG = diesel and gas power plant, MPP = mobile power plant.
Source: Authors' estimation and calculation.

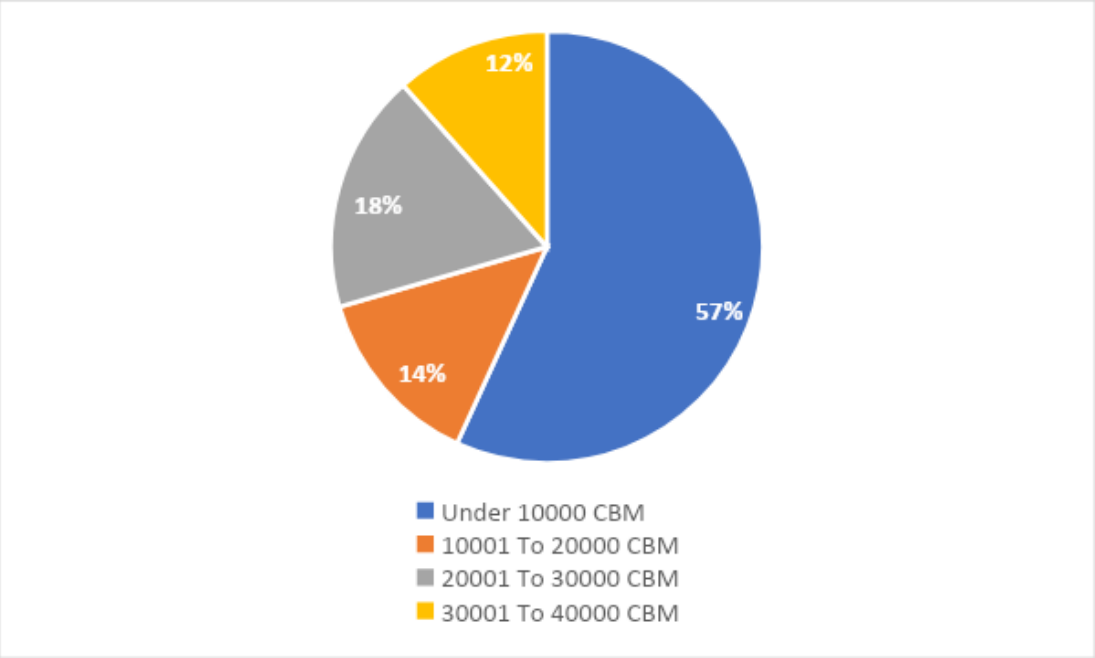
2. Small-Scale LNG Carrier Vessels

DNV-GL (2019) listed 96 small-scale LNG carrier vessels. From the different vessel information database available on the Internet[2], we collected information on the tanker size of 67 ships amongst the active ships. The maximum tanker size of the 67 ships is 36,000 cubic metres (CBM). We grouped the ships into four classes according to tanker size:

- Under 10,000 CBM
- 10,001–20,000 CBM
- 20,001–30,000 CBM
- 30,001–40,000 CBM

It appears that vessels with tanker size under 10,000 CBM make more than half of the total small-scale LNG fleet in the world and the percentage seems to decrease with tanker size (Figure 4.1).

Figure 4.1: Share of Small-Scale LNG Carrier Vessels According to Tanker Size



Source: Authors' calculation.

For each tanker size class, we selected one model vessel and assumed that their characteristics represent those of ships in the class.

Table 4.2 presents the five vessel–models based on four real LNG carrier ships.

[2] Most of the information were gathered from www.marinetraffic.com and www.vesselfinder.com.

Table 4.2: Selected LNG Carrier Model Vessels and their Characteristics

LNG Carrier Name	LNG Storage Cap	Length Overall (LOA)	Breadth	Gross Tonnage	(Summer) DWT	Draught	Average Speed	Maximum Speed	Minimum Depth in Wharf
	CBM	Metre (m)	Metre (m)	Tonne	Tonne	Metre (m)	Knots	Knots	Metre (m)
Engie Zeebrugge	5,000	107.60	18.4	7,403	3,121	4.80	9.66	11.52	5.28
Aman Hakata	18,000	130.00	25.7	16,336	10,951	5.50	9.96	11.57	6.05
JS Ineos Independence	27,500	180.30	26.6	22,887	20,916	8.00	13.23	15.29	8.80
Navigator Nova	35,000	179.89	29.6	27,546	27,014	9.17	13.40	14.57	10.08

CBM = cubic metre, DWT = deadweight tonnage.
Source: Authors' elaboration from data available at www.marinetraffic.com and www.vesselfinder.com.

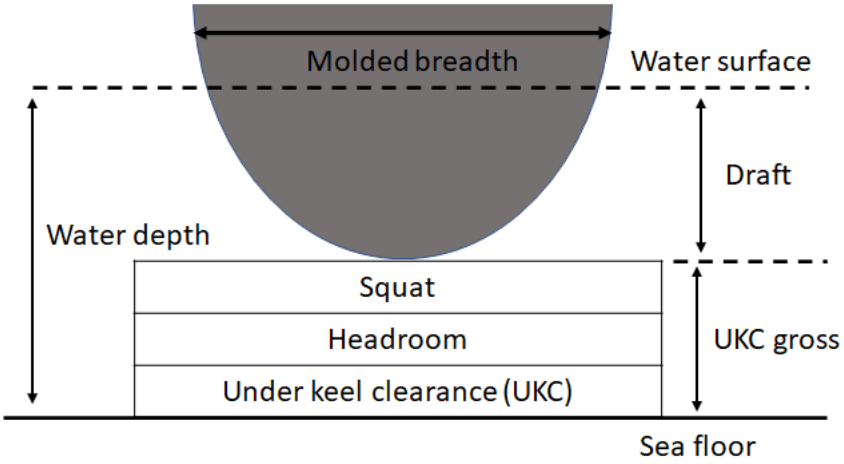
Figure 4.2: Selected Model Vessels

Source: www.marinetraffic.com.

The minimum (water) depth of the wharf in Table 4.2 is the minimum water depth that a seaport needs to have in one of its wharfs so that an LNG carrier vessel can enter the seaport.

Figure 4.*3* shows that the water depth at the wharf comprises the ship's maximum draft and under keel clearance (UKC) gross. The UKC gross is a necessary depth from the bottom of the sea that allows for the ship's squat movement whilst providing for headroom like semi-wave height and heeling and a clearance depth. The minimum UKC gross is set at 10% of the maximum ship's draft. The minimum water depth is then calculated as the maximum ship's draft multiplied by a factor of 1.1.

Figure 4.3: Under Keel Clearance Concept



Source: Authors' elaboration.

3. Proposed LNG Receivers or Seaports

Based on the UKC concept, LNG carrier model vessels' required minimum water depth at the wharf, and the information and data of minimum depth in channel/basin/wharf we received from the Directory General of Seaports of the Ministry of Transportation, we determined the accessibility of each seaport for each LNG vessel. A seaport is accessible by an LNG vessel when the minimum depth of one of its channels, basins, and wharf is bigger than the vessel's required minimum wharf. The results are given in Table 4.3 where we finally selected 20 seaports that should serve as LNG receiving terminals.

Table 4.3: Selected LNG Receiver Seaports and their Accessibility for LNG Carrier Model Vessels

LNG Carrier Vessel Models			Shinju Maru	Engie Zeebrugge	Aman Hakata	JS Ineos Independence	Navigator Nova
LNG Storage Cap (CBM)			**2,513**	**5,000**	**18,000**	**27,500**	**35,000**
Minimum Depth in Wharf (m)			**4.61**	**5.28**	**6.05**	**8.80**	**10.08**
Port Location	Port Name	Minimum depth-channel/basin/ wharf	Port Accessibility				
Center Sulawesi	Palu– Pantoloan	9	1	1	1	1	0
South Sulawesi	Makassar New Port	16	1	1	1	1	1
North Sulawesi	Bitung	12	1	1	1	1	1
Bali	Benoa	9	1	1	1	1	0
Lombok, West Nusa Tenggara	Lembar	7	1	1	1	0	0
Sumbawa, West Nusa Tenggara	Badas	7	1	1	1	0	0
Flores (West side), East Nusa Tenggara	Labuhan Bajo	10	1	1	1	1	0
Kupang, East Nusa Tenggara	Tenau	17	1	1	1	1	1
Buru Island, Maluku	Namlea	8	1	1	1	0	0
Ambon, Maluku	Ambon	25.9	1	1	1	1	1

Ternate, North Maluku	Ternate Kota Baru	12	1	1	1	1	1
Yapen Island (Serui), Papua	Serui	10	1	1	1	1	0
Biak, Papua	Biak	9	1	1	1	1	0
Merauke, Papua	Merauke	7	1	1	1	0	0
Jayapura, Papua	Jayapura	9	1	1	1	1	0
Manokwari, West Papua	Manokwari	12	1	1	1	1	1
Sorong City, West Papua	Sorong	15	1	1	1	1	1

Accessible:	1
Not Accessible:	0

Source: Authors' elaboration.