

STUDY ON LNG SUPPLY LOGISTIC CHAIN

WP4. IMPACT ON EUROPEAN LNG BUNKERING MARKETS

Activity 2 – WP2.1 – ET3 – WP1

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1 INTRODUCTION

The purpose of WP4 report is to compare the impact on the LNG supply chain to be developed in the Iberian Peninsula based on existing infrastructure and developments of competitor ports in the same markets. This study is part of the CORE LNGas HIVE project that addresses the future logistic supply chain design in Spain and Portuguese ports to address future LNG demand as shipping fuel. This study is framed under Activities ET2, ET3 and ET4 of the referred project and was co-finance with EU CEF funds.

This is the last deliverable of the project, the reader is recommended to read previous project deliverables, specially D2-3 deliverable for Activity 2 and Activity 3 where feasible and optimal LNG logistics supply chain for Spanish and Portuguese ports were studied in the 2020-2050-time frame. Also is helpful to review the LNG as bunkering fuel demand analysis, delivered in a previous study of CORE LNGas HIVE project.

Considering the the Iberian Peninsula location and the European maritime traffic, the key competitor's ports that shared traffic with the Iberian Peninsula in the same market will be studied.

The markets that shall be defined, analysed and evaluated are:

- West Mediterranean Market/ Southwest European Motorway
- Atlantic Market/ West European Motorway
- Gibraltar Strait/ Southwest European Motorway



Figure 1 EU MOS Markets

1.1-European Maritime Traffic

The most important ports within each defined market will be selected after evaluating the importance of key indicators such as: bunkering services, container traffic, port calls, volume of passengers, volume of freight... etc

For each candidate port included in this analysis, the following aspects will be studied:

- Existing LNG infrastructure
- LNG bunkering strategy, improvements, progress, or modifications foreseen.
- TPA (Third-party access) and impact of import terminal fees in the bunkering service.

Once the above information was gathered, an estimated competitiveness analysis was performed among the ports within each market. Competitive factors have been evaluated qualitatively through a scoring system, where it is evaluated:

- Fees for LNG ship loading service and truck loading service.
 - Current gas system fees supporting small scale maritime and truck operations.
 - Plans to update them to accommodate small scale operations
- LNG Potential.
 - Based on current vessel mix at the port and the expected speed LNG adoption rates
 - As ferries and cruise ships are among the early adopters of LNG passenger traffic will be considered as potential indicator.
- Technical capacity to serve small scale vessels and tank trucks.
 - Infrastructure availability such as storage, jetties, loading arms, truck loading stations, etc.
- Distance to nearest LNG Import Terminal
 - Both maritime and road distances from the target ports to the closest LNG storage location
- Conventional bunkering situation.
 - Current bunker means and activity with conventional fuels.

The used scoring system and the factors to be evaluated within each market are defined in Annex A.

The report also in chapter 6 highlights the response to maritime LNG in the respective National Action Plans after Directive 2014/94/EU on the deployment of alternative fuels infrastructure.

Finally, in chapter 7 key conclusions are summarized.

2 WEST MEDITERRANEAN MARKET

The Mediterranean Sea is among the world's busiest waterways accounting for 15% of global shipping activity by number of calls and 10% by vessel deadweight tons. Overall vessel activity within the Mediterranean has been rising steadily over the past several years and is projected to increase even further over the next few years. Transits across the Mediterranean are expected to rise.

2.1 SELECTION OF PORTS

To select the main ports that could be competitors of the Spanish ports, the following criteria has been analysed:

- The geographical location of the port.
- Freight volume handled
- Passenger in regular lines
- Passenger in cruise lines
- Bunkering volume served

The peninsular ports that have been studied based on the above criteria are: **Barcelona, Valencia-Sagunto and Cartagena**. The non-peninsular ports located in the French and Italian Mediterranean market, considered the most important are Marseilles-Fos, Genoa, and Civitavecchia.

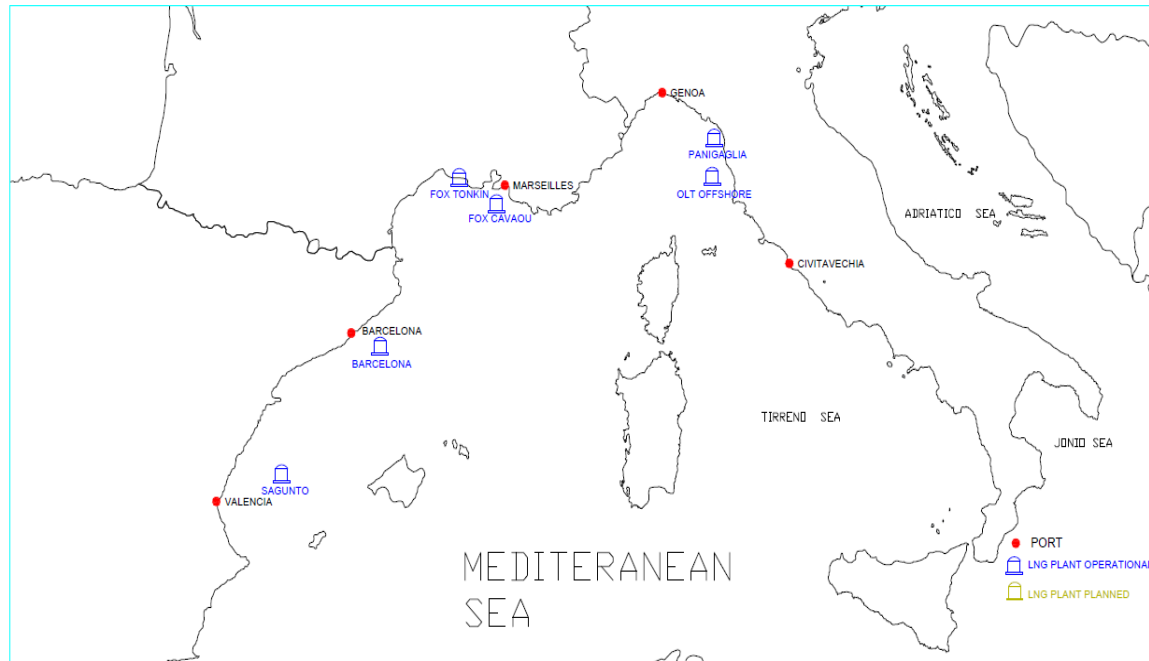
The non-peninsular ports have been selected based on those that have shared traffic with the peninsular ports and therefore, would compete in the LNG Bunkering market in the future.

Once the data was analyzed, it was decided to not include the Port of Cartagena in the study due to the low volume of current fuel bunkering and lower volume of passengers compared to the rest of the ports.

Therefore, the main ports that have been considered in the Mediterranean Market are:

- **Peninsular Ports:**
 - Port of Barcelona
 - Port of Valencia-Sagunto
- **Non-Peninsular Ports:**
 - Port of Marseilles-Fos (France)
 - Port of Genoa (Italy)
 - Port of Civitavecchia (Italy)

Location of the ports around the Mediterranean market are shown in the next figure:



2-1. Ports of Mediterranean Market, Source: ICC Ingenieros

2.1.1 State of play and planned development at the ports

A brief overview of the main characteristics of the ports included in this market are described in this section. The information is based on the 2016 Annual Reports of each Port, as well as on the statistics database for Europe of Eurostat

General Cargo and passengers

The following table provides a summary of the main characteristics of the ports (database year 2016):

Port/Country	Volume freight millions of tons	Volume Pax in regular lines (1,000)	Volume Pax (regular lines and cruises) (1,000)	Port calls
Barcelona (ES)	48	1,275	3,959	8,728
Valencia (ES)	71	507	910	7,552
Marseilles-Fos (FR)	81	1,119	2,714	7,469
Genoa (IT)	47	2,093	3,110	6,629
Civitavecchia (IT)	9	1,458	3,600	3,200

2-2. Characteristics of the Ports of Mediterranean Market. Source: Eurostar and Annual Reports

Bunkering

The Conventional bunkering market of fuel gives an idea of the potential LNG bunkering market.

The table below presents the current amount of fuel bunkering volume, the LNG Infrastructure in place, and the plans for future development in each port.

Port/Country	Bunkering (t/year Oil)	LNG Infrastructure	Plans for future development
Genoa (IT)	883,970	No currently	Feasibility study underway to identify appropriate site for permanent bunkering operations site, expected by 2022.
Barcelona (ES)	832,787	Import terminal in location.	
Marseilles-Fos (FR)	>1,000,000	Two LNG import terminals in the port	If French legislation still considering LNG as a hazardous good, no LNG bunkering possible in the Eastern basin
Valencia (ES)	392,993	Import terminal in location very near	
Civitavecchia (IT)	114,986	No currently, but truck -to- ship bunkering could be available	Plans in place for 100 m ³ storage terminal planned

2-3. Volume of Bunkering of the Ports of Mediterranean Market. Source: Annual Reports

2.2 PORT DESCRIPTIONS

2.2.1 Spanish Ports

The Spanish ports within this study, Barcelona and Valencia-Sagunto, as well as the associated LNG Terminals are described and defined in Wp1.

The following table shows a summary of the import terminals.

Import Terminal	Barcelona	Valencia-Sagunto
Number of tanks	6	4
Storage Capacity	760,000	600,000
Emission Capacity (m ³ (n)/h)	1,950,000	1,000,000
Small scale ship loading	Available	Considered available in 2020

2-4. Summary Peninsular import terminals

2.2.2 French Ports

Port of Marseille-Fos

The Port of Marseilles (Marseille-Fos Port) is the main trade seaport of France in terms of cargo and second in terms of TEU. It is the second largest Mediterranean port and fifth largest in Europe. In 2016 total cargo throughput equalled 76 million tons. The port contains 4 multipurpose terminals (with 19 berths), 1 container terminal (with 1,000 m of berth length, an area of 32 hectares, and 4 cranes), 1 liquid bulk terminal (with 3 berths, quay lengths of 150-150-220 m, and 60,000 m² of storage capacity), and 10 docks for ship repairs (totalling more than 1,500 m in length). It also serves as one of the largest destinations for passengers in the Mediterranean, with 2.4 million in 2016.

To strengthen the network of Liquefied Natural Gas (LNG) bunker-ready ports and to bolster efforts towards enabling the uptake of LNG as marine fuel, Port of Marseille-Fos has joined the Port of Singapore and seven other organisations to participate in an international LNG bunkering port focus group¹.

The Port is made up of two harbours, the “Eastern harbour”, located in the city of Marseille and covering 400 hectares, and the “Western harbour”, located in Fos (70 km from Marseille).

Current fuel bunkering is done mainly through 5 bunkering barges and in a complementary way via “expipe.”

Since there are two LNG Terminal in the port, the LNG Bunkering could be easily feasible and available only if some important actions take place, such as the require changes in French regulation, the existence of truck loading station, the jetty adaptation to LNG bunkering... etc.

Both Import Terminals are described below:

2.2.2.1 Fox Tonkin LNG Terminal



Fox Tonkin LNG Terminal

¹ The focus group was first formed in 2014 by Maritime and Port Authority of Singapore (MPA), Antwerp Port Authority, Port of Rotterdam and Port of Zeebrugge. In 2016, Asian representation in the LNG bunkering focus group increased with the joining of Ministry of Land, Infrastructure, Transport and Tourism, Japan and Ulsan Port Authority, Republic of Korea. Through the signing of a Memorandum of Understanding (MoU) in Singapore on 5 October 2016, all members of the focus group committed to working together to deepen cooperation and information sharing in relation to LNG bunkering, to develop a network of LNG bunker-ready ports across the East and West and Trans-Pacific trade. The first meeting was held in April 2017 in Yokohama, Japan, where the focus group agreed to focus collaborative efforts on enabling the uptake of LNG as bunkers globally.

FOX TONKIN	
Company	ELENGY
Port	MARSEILLES-FOS
LNG Terminal	YES
Number of tanks	1
Storage capacity	80,000 m ³ LNG
Emission capacity	620,000 m ³ (n)/h
Number of jetties	1
Small scale	YES
Minimum ship size	7,500 m ³

Future implementations planned:

Small Scale ship loading: Currently, the availability of this service is for ships from 7,500 m³ to 75,000 m³. The availability for ships below 5,000 m³ is under study.

Truck loading: Since 2014 the terminal offers 4 bays to LNG truck loading services, and in July 2016 Elengy -Terminal Operator-announced that it had doubled the capacity of the LNG truck loading facility at the terminal to accommodate eight trucks per day (up to 2,200 trucks a year).

It is under study the implementation of more bays, in order to provide a higher capacity to their customers.

2.2.2.2 Fox Cavaou LNG Terminal



Fox Cavaou LNG Terminal

FOX CAVAOU	
Company	ELENGY-FOSMAX
PORT	MARSEILLES-FOS
LNG Terminal	YES
Number of tanks	3
Storage capacity	330,000 m ³ LNG
Emission capacity	1,160,000 m ³ (n)/h
Number of jetties	1
Small scale	YES
Minimum ship size	15,000 m ³

Future implementations planned:

LNG Terminal: By 2021 the terminal has planned to increase its emission capacity to 1,550,000 m³(N)/h, and by 2023 to 2,320,000 m³(N)/h.

Small Scale ship loading: The terminal is looking to offer this service to ships below 15,000 m³.

The two parties, Elengy and Fosmax, have started works on adapting the Fos Cavaou LNG terminal for LNG bunkering service. The service will enable the terminal to accommodate smaller vessels with capacity below 20,000 m³ which, after loading their LNG tanks at Fos Cavaou, will be able to supply ships in the port of Marseille-Fos and other sites in the Mediterranean Sea.

This new service primarily calls for work to modify the wharf at the Fos Cavaou LNG terminal, which will be completed in June 2019. It enriches the offer of the Fos-sur-Mer LNG terminals, which already accommodate the unloading of LNG carriers ranging from 15,000 m³ to 265,000 m³ (Q-Max type extra large LNG tankers).

Truck loading: With the decision to build a loading station for LNG tankers at the Fos Cavaou terminal, the two companies are once again illustrating their desire to offer a real LNG hub in Fos, the privileged entry gate for LNG in the great European gas market.

The main constraint currently for LNG bunkering here is that the LNG development is dependent upon clarifications in French legislation. If LNG used for fuel bunkering continues to be treated as a hazardous good, it will not be possible to install any LNG bunkering infrastructure (barge or truck) in the Eastern harbour of the port because it is located too close to the city centre. However, the two LNG terminals are in the Western harbour, and it could be possible perform bunkering there.

2.2.3 Italian Ports

Port of Genoa

The Port of Genoa is a major Italian seaport and it's in competition with the ports of Marseille and Barcelona to be the biggest of the Mediterranean Sea. With a trade volume of 47 million tons in 2016, it is one of the busiest ports of Italy. The harbour has an area of 5,588,300 m² with 24 km of total dock length and 3 container terminals with 1,609,355 m² of handling area. Cargoes handled in the Port of Genoa include containers, general cargo, liquid and solid bulk, metals, forestry products, perishable goods, petroleum products, and passengers. Several companies in the Port of Genoa also provide maritime services like vessel repair and environmental management.

It is expected to build the required infrastructure for a permanent bunkering operation by 2022.

Port of Civitavecchia

The port of Civitavecchia is the seaport of Civitavecchia, serving the Metropolitan City of Rome, Italy and is an important hub for the maritime transport in Italy for goods but especially passengers – serving 3.6 million passengers in 2016, the most in Italy. The Port of Civitavecchia contains 28 berths which total 5,600 meters in length. Port properties include five warehouses containing 36,000 m² for handling and storing cargo and an intermodal terminal with 7,000 m² of storage space and 12,500 m² for loading/unloading rail cars and parking. In 2016, the port handled 4.7 million tons of cargo.

On May 2014 Port of Civitavecchia became the first port to perform Truck to Ship bunkering of LNG to a seagoing vessel, bunkered by LNGEurope, within an Italian coastal port or any port in Italy and this part of the Mediterranean. This operation proved that the port had all permits in place to execute an LNG Bunkering operation.

In the port of Civitavecchia a pilot project for a 100 m³ (45 tons) LNG Storage terminal is been developed. But, as long as Panigaglia terminal (the closest) does not count with a truck filling station, the LNG would have to be procured from the terminals of Marseille or Barcelona. The FSRU located in Tirrenian sea, is only to supply the national gas grid.

2.2.3.1 Panigaglia LNG Terminal



Panigaglia LNG Terminal

PANIGAGLIA	
Company	GNL ITALIA
PORT	LA SPEZIA
LNG Terminal	YES
Number of tanks	2
Storage capacity	100,000 m ³ LNG
Emission capacity	427,000 m ³ (n)/h
Number of jetties	1
Small scale	NO

*** Reloading not available**

Future implementations planned:

LNG Terminal: Reloading is not available, however, the pertinent viability study to introduce this service has been completed. The final investment decision is expected by the end of 2018.

Small Scale ship loading: Likewise, the viability study has been completed. The final investment decision is expected by the end of 2018.

Truck loading: There isn't any truck loading station in the terminal. Nevertheless, it is expected by the end of 2018.

2.2.4 Summary of non-peninsular import terminals

	FRANCE		ITALY
Terminal	Fox Tonkin	Fox Cavaou	Panigaglia
Number of tanks	1	3	2
Storage Capacity	80,000	330,000	100,000
Jetties	2	1	1
Emission Capacity	620,000	1,160,000	427,000
Small scale ready for ship loading	Available	Available	Not Available

2-5. Summary Non-Peninsular import terminals

2.2.5 Distance to LNG Terminal

The market for LNG Bunkering will depend significantly on how far the LNG is to the port. Therefore, the distance to the nearest LNG import terminal will be especially relevant and have a large impact on the feasibility and availability.

Trucks loading service

This service is the loading of LNG from terminal tanks into mobile/truck tanks, to be further transported to satellite plants or direct bunkering (to supply isolated networks or to final customers). There are some terminals which offer the truck loading service only in an unbundled way, while others do it in both a bundled and unbundled way.

Offer this service in an unbundled way widens the possibility to use these facilities, as there is no need to unload an LNG ship into the terminal to access the service. Users can directly buy gas at the LNG terminal, swap or liquefy natural gas from the transmission grid, and then load it in trucks by contracting this unbundled service.

Considering the ports and the import terminals in their vicinity, the following table shows the distance to the LNG Import via road and via sea. Also, the table gives the capacities of the truck stations in each LNG Terminal.

Port	Country	Nearest LNG Terminal Name	Road distance to Nearest LNG Plant (km)	Terminal Truck Loading Capacity(m³/h)	Comments	Sea distance to Nearest LNG Plant (milles)
Barcelona	Spain	Barcelona	0	3 bays x 91 m³/h		0
Civitavecchia	Italy	Panigaglia LNG Terminal	344			188
Genoa	Italy	Panigaglia LNG Terminal	120	0	(FID expected by 2018)	51
Marseilles	France	Fos Cavou Fos Tonkin	50 55	0 1 bay x 100 m³/h	(1 bay FID expected) (3 bays x100 under study)	9 12
Valencia	Spain	Sagunto	34	2 bays x 70 m³/h		13

2-6. Distance from LNG terminal. Source: GIE

2.2.6 Current tariffs and fees

Current tariffs and fees for the different LNG Terminals of the Mediterranean Market are as follows:

SHIP LOADING SERVICE					TRUCK LOADING	
Size	>9,000 m ³		<9,000 m ³		any	
Term	Fix €	Variable c€/kWh	Fix €	Variable c€/kWh	Fix c€/kWh/day/month	Variable c€/kWh
Barcelona	176,841	0.1563	87,978	0.0521	2.88	0.0171
Sagunto	176,841	0.1563	87,978	0.0521	2.88	0.0171

2-7. Spain. Ship reloading and truck loading fees. Source: Orden IET/2446/2013

SHIP LOADING SERVICE							TRUCK LOADING
LARGE SCALE				SMALL SCALE			
	Fix Term TNA €/berthing	Commodity TQR €/MWh	Fix Reload €	Fix rate €	Variable rate €/MWh	Comments	Fix Reload €
Fox Cavaou	100,000	0.32	120,000	50,000	0.5	50,000€/operation or 1.5 €/MWh	596.43
Fos Tonkin	75,000	0.32	40,000	50,000	0.5		Not available

2-8. France. Ship reloading and truck loading fees. Source: Elengy and Fosmax tariffs

THERE IS NO INFORMATION AVAILAIBLE ABOUT FEE COSTS FOR PANIGAGLIA LNG TERMINAL

Ship reloading tariffs

A comparison between the tariffs for the ship reloading service has been made for ships size of 3,000 m³, 7,500 m³ and 30,000 m³.

In WP2, the Spanish demand in the coming years was studied. According to those results, new tariffs have been estimated to remain competitive and are the ones that should be considered in his report.

A comparison between the official tariffs and the wp2 estimated tariffs is shown in the table below:

Vessel	Spain fees (Today) Barcelona/ Sagunto		Spain fees (WP2) Barcelona/ Sagunto		France fees Fox Tonkin		France fees Fox Cavaou	
	€	€/MWh	€	€/MWh	€	€/MWh	€	€/MWh
3,000 m³	99,049	4.66	19,874	0.94	60,625	2.85	50,000	2.35
7,500 m³	115,655	2.18	57,186	1.08	76,561	1.44	79,684	1.50
30,000 m³	508.963	2.4	238,743	1.12	182,997	1.72	287,997	1.36

2-10. Ship reloading tariffs comparison

Truck Loading tariffs

Similarly, the comparison was made with the price for the truck loading service estimated in wp1.

TRUCK LOADING SERVICE		
Barcelona-Sagunto (WP1)	1.13	€/Mwh
Fos Cavaou	596.43	€/operation
Fox Tonkin	Not available	
Panigaglia	Not available	






















2-11. Truck loading tariffs comparison

2.3 COMPARATIVE ANALYSIS

A qualitative comparative analysis between the different ports included in the Mediterranean Market has been done

Project estimated Spanish port's fees from WP2 have been considered for both loading service, ship and truck.

The categories analysed and scores values to every situation are showed in Annex A.

	Marseille	Genoa	Civitavecchia
Fee for Ship loading service			
Fee for Truck loading service			
Small scale vessel service			
Truck loading service			
Distance to terminal			
Conventional bunkering situation			
GNL Potential			
Weighted Number	46/55	21/55	15/55
Score with HIVE WP2 fees:	Barcelona Score (47/55)		Valencia Score (34/55)
Score with ACTUAL fees:	Barcelona Score (45/55)		Valencia Score (32/55)

2-12. Qualitative analysis of Mediterranean ports

2.3.1 Port of Barcelona vs Port of Marseille-Fos, Genoa and Civitavecchia

Regarding current fuel bunkering, the Port of Barcelona, the Port of Genoa have similar t/year while and the Port of Marseille operates higher volumes although no data is available in the Port Annual Report, the fact that 5 barges are used today indicates higher volumes than Barcelona.

LNG potential considers the passengers volume as a measure of the possibility of LNG bunkering. This indicator value is similar in all three ports.

Even though Italy is planning d to build a truck station in Panigaglia Terminal (the FID for its construction is expected by 2018), currently it does not exist. In addition, the distance from Panigaglia to Port of Genoa and Port of Civitavecchia is long due to the fact the terminal is not located in any of the ports.

However, Port of Barcelona has an LNG Terminal in its location and Port of Marseille-Fos has two LNG Terminals. Thus, LNG Bunkering infrastructure will be more readily feasible and available in Barcelona and Marseille-Fos than in Genoa and Civitavecchia.

Port of Marseille-Fos and Port of Barcelona will be real competitors. The advantages of Port of Barcelona are that the LNG Terminal is nearest the Port than in Port of Marseille-Fos, counts with a dedicated small scale vessels terminal and the fee for truck load service is lower than in Port of Marseille-Fos.

At Port of Marseille, LNG Terminals are further away, and, only truck loading service is available in Fos Tonkin.

2.3.2 Port of Valencia vs Port of Marseille-Fos, Genoa and Civitavecchia

Current fuel bunkering of the Port of Valencia is lower than in the Port of Marseille-Fos and in the Port of Genoa. This value is only higher than the Port of Civitavecchia.

On one hand, currently, the LNG bunkering could be more competitive in the Port of Valencia than the Italian's Ports, due to the fact it is only 14 nautical miles (34 km by road) away from Sagunto terminal, and the truck loading service is available. Italian's ports are not currently offering the truck loading service required for the LNG Bunkering. It is important to highlight the high LNG potential of the Italian's ports and the administration interests on future development of LNG Infrastructure in each case, although today falling way behind Marseilles-Fos and Valencia.

On the other hand, Port of Marseille-Fos has two LNG Terminals in its location, although only Fos Tonkin is currently offering truck loading service, the LNG infrastructure for LNG Bunkering is similar than the one in the Port of Valencia. Fees in France are lower for ship loading but not for truck loading.

3 ATLANTIC MARKET

The Atlantic Sea Market is home to some of the most important ports in Europe such as Port of Rotterdam, Port of Antwerp, and the Port of Le Havre. This market is part of the Motorway of the Sea West Europe, and the countries that share traffic with Spain are The Netherlands, Belgium, France and United Kingdom.

3.1 SELECTION OF PORTS

To select the main ports that could be competitors of the Spanish ports, the following criteria has been analysed:

- The geographical location of the scenario.
- Freight volume handled
- Passenger volume in regular lines
- Passenger volume in cruise and regular lines
- Bunkering volume

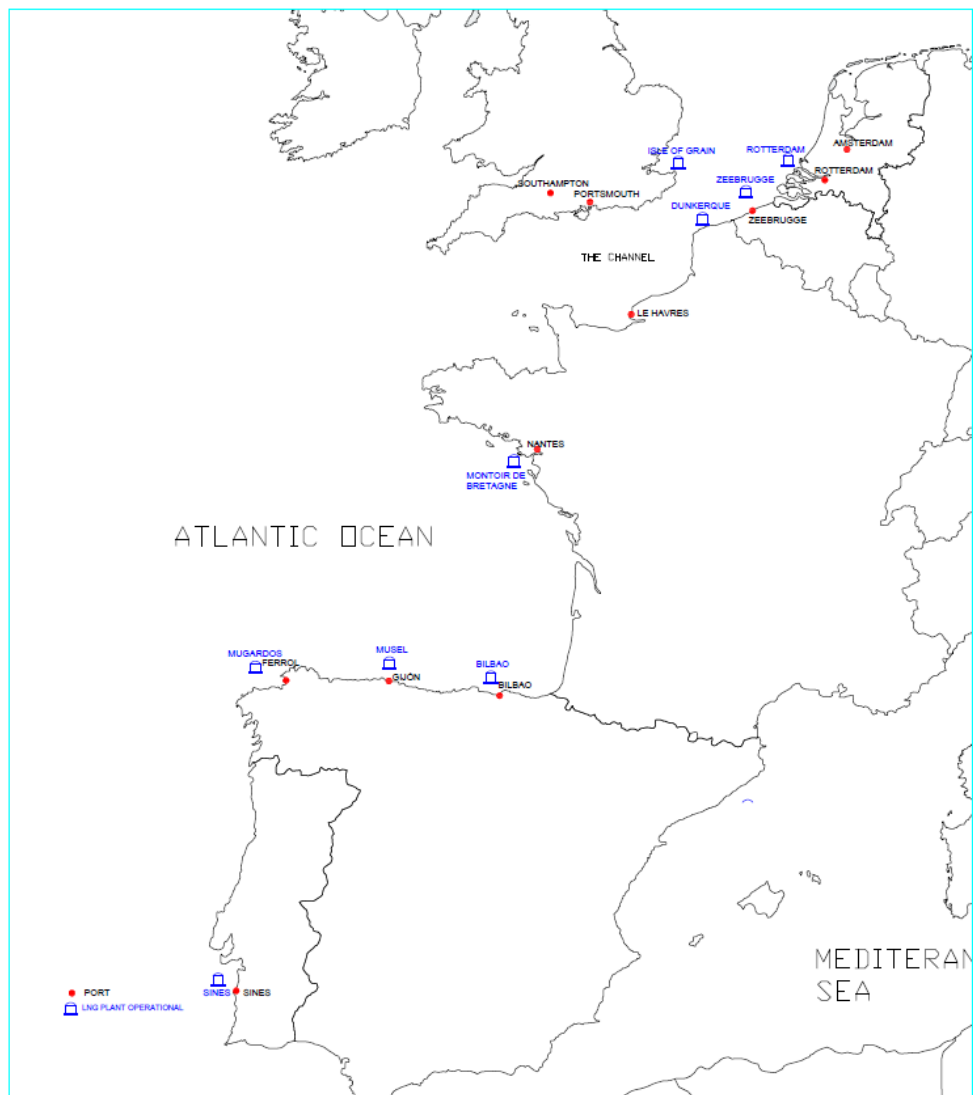
The peninsular ports that have been studied based on the above criteria are: Gijón, Bilbao, Ferrol, and Sines. The non-peninsular ports considered the most important are in the French, English, Belgian, and Dutch Atlantic markets and include the ports of Amsterdam, Rotterdam, Antwerp, Zeebrugge, Le Havre, Nantes, Southampton, and Portsmouth.

The non-peninsular ports have been selected based on those that have shared traffic with the peninsular ports and therefore, would compete in the LNG Bunkering market in the future.

Therefore, the main ports that have been considered in the Atlantic Market are:

- Peninsular Ports:
 - Port of Sines (Portugal)
 - Port of Ferrol
 - Port of Gijón
 - Port of Bilbao
- No-Peninsular Ports:
 - Port of Amsterdam (The Netherlands)
 - Port of Rotterdam (The Netherlands)
 - Port of Zeebrugge (Belgium)
 - Port of Antwerp (Belgium)
 - Port of Le Havre (France)
 - Port of Nantes (France)
 - Port of Southampton (UK)
 - Port of Portsmouth (UK)

The locations of these ports around the Atlantic market are shown in the next figure:



3-1. Ports of Atlantic Market, Source: ICC Ingenieros

3.1.1 State of play and planned development at the ports

A brief overview of the main characteristics of the ports included in this market are described in this section. The information is based on the 2016 Annual Reports of each Port, as well as on the statistics database for Europe of Eurostat.

General Cargo and passengers

The following table provides a summary of the main characteristics of the ports (data base year 2016):

Port/Country	Volume freight millions tons	Volume Pax in regular lines (1,000)	Volume Pax (regular lines and cruises) (1,000)	Port calls
Amsterdam (NL)	97	467	769	4,748
Antwerp (BE)	214	-	-	14,473
Bilbao (ES)	32	104	190	2,815
Ferrol (ES)	12	-	30	1,054
Gijón (ES)	18	-	35	1,156
Le Havres (FR)	66	158	333	-
Nantes (FR)	25	-	11	2,402
Portsmouth (UK)	4	1,986	4,985	-
Rotterdam (NL)	461	1,299		29,022
Sines (PL)	51	-	-	2,422
Southampton (UK)	36	2	-	10,016
Zeebrugge (BE)	38	330	1,073	1,335

3-2. Characteristics of the Ports of Mediterranean Market. Source: Eurostar and Annual Reports

Bunkering

The Conventional bunkering market of fuel gives an idea of the potential LNG bunkering market.

The table below presents the current amount of bunkering volume of fuel, the LNG Infrastructure in place, and the plans for future development in each port.

Port/Country	Bunkering (t/year of Oil)	LNG Infrastructure in place	Plans for future development of LNG Infrastructure
Rotterdam (NL)	8,624,418	Import terminal in location.	
Antwerp (BE)	6,500,000	Truck to ship from Zeebrugge	The infrastructure needed for barges and seagoing ships to fill up with LNG at permanent facility will be built.
Southampton (UK)	Unkonwn	None	
Amsterdam (NL)	4,000,000	None	
Civitavechia (IT)	114,986	No currently, but truck -to-ship bunkering could be available	Plans in place for 100 m³ storage terminal planned
Bilbao (ES)	61,500	Import terminal in location.	
Sines (PL)	373,255	Import terminal in location.	
Nantes (FR)	*260,000	Import terminal in location.	
Zeebrugge (BE)	*350,000	Import terminal in location.	
Gijón (ES)	47,135		Import terminal in location built but no operated yet.
Ferrol (ES)	3,914	Import terminal in location.	
Le Havres (FR)	900	None	
Portsmouth (UK)	Unkonwn	None	

3-3. Volume of Bunkering of the Ports of Atlantic Market. Source: Annual Reports

3.2 PORT DESCRIPTIONS

3.2.1 Spanish Ports

The Spanish ports and Portuguese port within this study, Sines, Ferrol, Bilbao, and Gijón, as well as the associated LNG Terminals are described and defined in Wp1.

The following table shows a summary of the import terminals.

Import Terminal	Sines	Mugardos	BBG	El Musel
Number of tanks	3	2	3	2
Storage Capacity	390,000	300,000	450,000	300,000
Emission Capacity (m ³ (n)/h)	1,350,000	800,000	800,000	800,000
Small scale ship loading	Considered available in 2020	Available	Available	Considered available in 2020

3-1. Summary import terminals

3.2.2 Dutch Ports

Port of Amsterdam

The Port of Amsterdam is the fourth largest port in Europe by cargo tonnage and the second largest port in the Netherlands after Rotterdam. It consists of the ports of Amsterdam, Zaanstad, Beverwijk, and Velsen/IJmuiden. In 2016 it handled 97 million tons of cargo, with the majority handled at Amsterdam and IJmuiden; 79.2 million and 16.8 million respectively. There are 31 quays in the Amsterdam Harbour that total over 25 kilometres in length and have depths varying from 4 to 15 meters. The 5 quays at the Port of Amsterdam's Beverwijk harbour total almost 2,400 meters and have depths from 7 to 11 meters. The nine Zaandam harbour quays in the Port of Amsterdam contain a total of over 2,600 meters of quays with depths from 2.5 to 10 meters. The North Sea Canal facilities at IJmuiden contain a total 7,200 meters of quays and depths from 6.5 to 16.5 meters.

Although, the nearest LNG Terminal is Gate Terminal in Rotterdam is 40 nm away (140 km by road) the port of Amsterdam has designed the 'Groene kade' (Green Quay) in Amerikahaven to enable safe bunkering from a tanker truck into an inland navigation vessel or small ocean-going vessel.

Moreover, Port of Amsterdam and Titan LNG have signed a long-term contract for the "home" location of Titan's bunkering pontoon: the FlexFueler001. This pontoon will be the first of its kind in Europe providing easy, affordable, and safe LNG bunkering services of this cleaner marine fuel. It is expected to start LNG bunkering in 2019.

The nearest LNG Terminal is Gate terminal LNG Terminal.

Port of Rotterdam

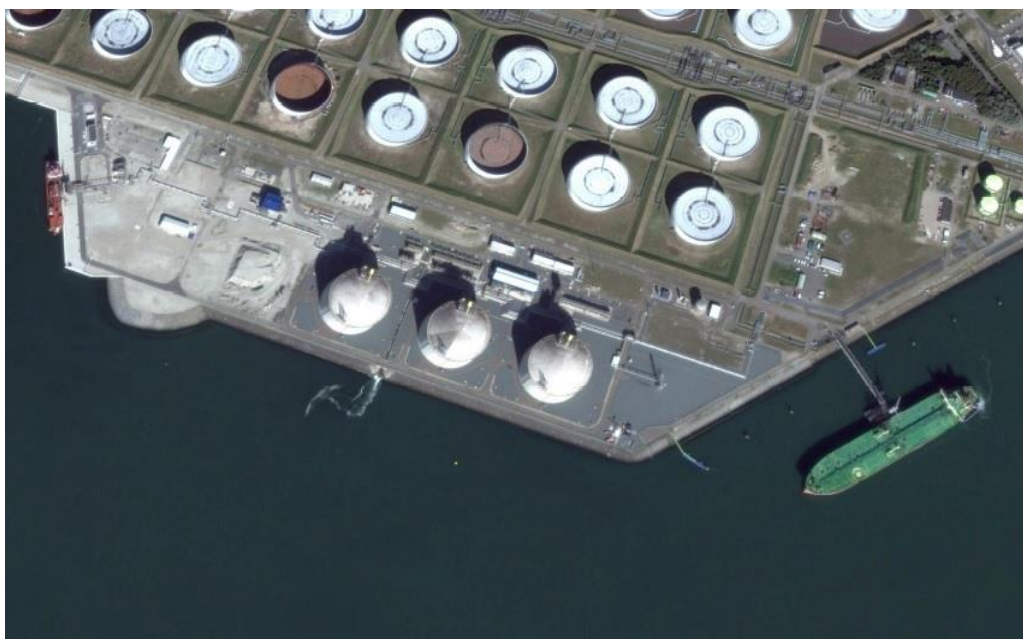
The Port of Rotterdam is the largest port in Europe and, as of 2017, is the eleventh busiest container port in the world with a container throughput of 13,734,334 TEU and the sixth largest port by cargo tonnage at 467.4 million tons of cargo handled. The total area of the port covers 12,713 hectares along 42 kilometres including 5,100 hectares of industrial sites and 5,500 hectares of infrastructure and water surface. Moreover, there are 123 jetties for sea and inland shipping and 77 kilometres of quay walls. The Port of Rotterdam also contains tank storage for 30 million m³ of liquids, including refinery storage for crude oil (12 million m³), refinery storage for mineral oil products (6.7 million m³), independent storage for mineral oil products (5.5 million m³), independent storage for chemical products (2.3 million m³), independent storage for vegetable oils and fats (1.1 million m³), and independent storage for crude oil (800 thousand m³).

The Gate Terminal LNG Terminal is located in the port, meaning LNG is easily accessible for bunkering operations. The port has been a first-mover in LNG bunkering initiatives and many small-scale LNG developments are underway that will build upon the infrastructure already in place. Because of this, Port of Rotterdam is the leader in Europe for the introduction of LNG as a fuel. The port takes a leading role in adapting the regulations and creating the necessary infrastructure and in doing so also serves as an example for other ports. Since 2014, the Port Management By-Laws of the port of Rotterdam have changed, making Rotterdam the first port where ship-to-ship LNG bunkering of seagoing vessels is officially allowed. Truck-to-ship bunkering of inland vessels was already possible before that.

LNG bunkering increased from 100 tons in 2016 to 1,500 tons in 2017, and in the first quarter of 2018, 729 tons LNG were bunkered. There is currently a 6,500 m³ bunker-supply ship, the Cardissa from Shell, that uses the Gate breakbulk jetty as its home berth, and a 3,000 m³ bunker barge that will be used to bunker gas-powered, inland waterway vessels is expected to operate by 2019. Routine bunkering operations are expected in the port by 2020.

Port of Rotterdam has got in its location the Rotterdam Gate Terminal LNG Terminal.

3.2.2.1 Rotterdam Gate Terminal



Rotterdam Gate Terminal LNG

ROTTERDAM GATE TERMINAL	
Company	GATE TERMINAL
PORT	Rotterdam
LNG Terminal	YES
Number of tanks	3
Storage capacity	540,000 m ³ LNG
Emission capacity	1,650,000 m ³ (n)/h
Number of jetties	3
Small scale	
Minimum ship size	500 m ³

Future implementations planned:

LNG Terminal: Due to market request and demand, the terminal is expected to increase the number of tanks to 4, the storage capacity to 720,000 m³, and the emission capacity to 2,200,00 m³(n)/h, when required.

3.2.3 Belgian Ports

Port of Antwerp

The Port of Antwerp has been an indispensable link in world trade since the Middle Ages. It is the biggest port area in the world with 12,068 hectares. The Port infrastructure and location, close to the centre of Europe, make transport to consumer easier, more sustainable, more efficient and therefore cheaper.

During the year 2016, the port of Antwerp not only did it manage to handle a freight volume of more than 214 million tons for the first time, but it also passed the 10 million TEU, 117,909,607 tons of containers being handled. Furthermore, the main sources of growth in the port were container freight and liquid bulk, 69,242,417 tons.

Fluxys has taken over the concession in the port of Antwerp at quay 526-528 to make liquefied natural gas (LNG) available as an alternative fuel for ships and barges, in one of the Port Authority's key initiatives to make the port's activities more sustainable. Truck-to-ship bunkering is now possible in the port of Antwerp, and the port authority wishes to further augment the availability of LNG by setting up a permanent station to complement the existing mobile (truck-to-ship) bunkering service. It therefore requested the market for proposals to build and operate an LNG bunkering & filling facility. The aim is to have the facility up and running by 2019.

The nearest LNG Terminal is Isle of Zeebrugge LNG Terminal.

Port of Zeebrugge

The Port of Bruges-Zeebrugge is a large container, bulk cargo, new vehicles and passenger ferry terminal port in the municipality of Bruges, Flanders, Belgium. It is a major European port, as it is the leading European RoRo port, contains one of the largest LNG terminals in Europe, and is situated in an advantageous, central position on the coast of the North Sea. In 2016, its cargo tonnage equalled 37,813,064 tons and it had a container throughput of 1,399,309 TEU. The port is divided into three major areas: the outer port, the inner port, and the Baudouin Canal. The outer port contains most of the terminals that handle high-speed traffic. Behind the locks in the inner port are distribution centres and the terminals for new cars, heavy-lift cargo, and conventional loads. At the Baudouin Canal there are terminals for building materials and agribulk. There are three deep-sea container terminals in the outer port, over a space of more than 100 hectares with thousands of meters of quays and the capacity to handle several million TEUs a year.

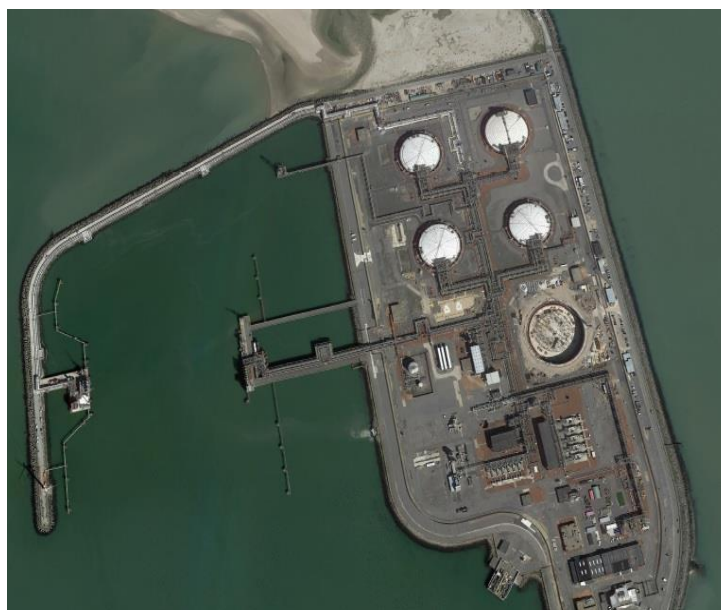
The Port of Zeebrugge has had infrastructure for the storage and transfer of LNG since 1987, and it is one of the main access points for LNG supplies in North-Western Europe. The Zeebrugge LNG terminal (Fluxys) was built for loading and unloading LNG to and from ships. LNG is distributed via the distribution network, and loaded into LNG ships or LNG trucks

Five LNG-powered inland navigation vessels are currently supplied via tanker trucks that take on LNG at the LNG terminal in Zeebrugge (truck-to-ship bunkering). It is expected that tanker trucks from Zeebrugge will, in the near future, bunker a total of 13 inland navigation vessels.

The second jetty at the LNG terminal in Zeebrugge was commissioned in 2016 and has been specially designed to accommodate LNG bunkering vessels, small LNG ships that load LNG and supply it to LNG-powered ships (ship-to-ship bunkering) or deliver it to small LNG bunker terminals in other ports.

The port of Zeebrugge locates an LNG Terminal in its location.

3.2.3.1 Zeebrugge Terminal



Zeebrugge LNG Terminal

ZEEBRUGGE TERMINAL	
Company	FLUXYS
PORT	Zeebrugge
LNG Terminal	YES
Number of tanks	4
Storage capacity	386,000 m ³ LNG
Emission capacity	1,700,000 m ³ (n)/h
Number of jetties	2
Small scale	YES
Minimum ship size	2,000 m ³

Future implementations planned:

LNG Terminal: It is planned that by 2019 the terminal will have 5 tanks, increasing the storage capacity to 566,000 m³. It is also planned the construction of a third dock in the terminal.

3.2.4 French Ports

Port of Le Havre

Strategically located at the entrance to the English Channel/North Sea route, Port of Le Havre is a major seaport in North-Western Europe. The Port of Le Havre is the second-largest commercial port in France in terms of overall tonnage, and the largest container port, with three sets of terminals, dedicated to container, bulk, breakbulk, oil/liquid, and cruise traffic. The Port of Le Havre covers an area that extends 27 kilometers from east to west and, at its widest, 5 kilometers from north to south. The Port of Le Havre covers more than 10,000 hectares and includes zones dedicated to sea traffic and to industry-related port activities. There is storage area available for millions of tons of cargo, and access to the rest of France through rail and intermodal connections. In 2016 the Port of Le Havre handled 66 million tons in total.

On May 2016 a cruise ship was supplied for the first time to be operated with LNG in the Port of Le Havres. It took place there because the port of Le Havre was able to get the best conditions and to proceed with LNG truck supply.

No infrastructure currently in place. It is part of the Drageges Ports and the Samuel LNG Consortium, as other ports included in this report, a dredger vessel is being retrofitted with two 153 m³ LNG tanks for bunkering purposes, expected to be completed by the beginning of 2019.

The nearest LNG Terminal is Dunkerque LNG Terminal.

3.2.4.1 Dunkerque Terminal



Dunkerque LNG Terminal

DUNKERQUE TERMINAL	
Company	DUNKERQUE LNG/FLUXYS/TOTAL
PORT	Dunkerque
LNG Terminal	YES
Number of tanks	3
Storage capacity	600,000 m ³ LNG
Emission capacity	1,900,000 m ³ (n)/h
Number of jetties	1
Small scale	YES
Minimum ship size	5,000 m ³

Future implementations planned:

Small Scale ship loading: By 2019 the capacity of the small scale loading will be increased to 9,000 m³/h.

Truck loading station: It is expected to be built the first truck loading station 1 x90 at the end of 2018. Likewise, two more truck loading station ,2x100, are under study

Port of Nantes

The Port of Nantes-Saint Nazaire is a large port on the western coast of France that ranks fourth among Metropolitan France's major seaport authorities and is the leading port on France's Atlantic Seaboard. The port facilities are located on the 65 km long Loire Estuary, between Nantes and Saint Nazaire. Up to 2,600 calls, 1,200 merchant trains, and about 240 transfers by river barges are made each year at the Nantes – Saint Nazaire Port Authority's facilities. 7 terminals are available with a variety of uses and more than 10 berths between them. In 2016 the port handled more than 25 million of tons of cargo.

Apart from truck-to ship bunkering being feasible, Elengy is also studying the possibilities for supplying bunker barges which could then carry out ship-to-ship bunkering. The objective of these two services is to set up the necessary logistics chain to supply feeder ships, road carriers and ferries, as well as service vessels. Nantes Saint-Nazaire Port and Elengy's Montoir terminal are working together. It is also part of the Drageges Ports and the Samuel LNG Consortium.

Montoir of Bretagne LNG terminal is located in the Port of Nantes Saint-Nazaire.

3.2.4.2 Montoir de Bretagne Terminal



Montoir de Bretagne LNG Terminal

MONTAIR DE BRETAGNE TERMINAL	
Company	ELENGY
PORT	Montair
LNG Terminal	YES
Number of tanks	3
Storage capacity	360,000 m ³ LNG
Emission capacity	1,600,000 m ³ (n)/h
Number of jetties	2
Small scale	NO

Future implementations planned:

LNG Terminal: By 2023, according to the terminal plan the emission capacity will be 2,000,000 m³(n)/h.

Small Scale ship loading: The availability of this service for ship sizes up to 5,000 m³ is under study.

Truck loading station: It is expected to be built the first truck loading station 1 x100 at the end of 2018. Likewise, two more truck loading station are under study

3.2.5 UK's Ports

Port of Southampton

The Port of Southampton is the second largest container port in the United Kingdom and is the busiest export port in the country. In 2016, the port handled 36 million tons of cargo. The Port of Southampton covers almost 294 hectares across three main areas. The Eastern Docks occupy almost 69 hectares and the Western Docks occupy 237 hectares. It also has a reserve of almost 324 hectares at Dibden that has been set aside for future port expansion. The Eastern Docks have total quay length of 882 meters along 6 berths, the Ocean Dock has a total quay length of 1150 meters in 5 berths, the Empress Dock has a total quay length of 988 meters across 9 berths, and the Itchen Quays have a total quay length of 743 meters in 6 berths.

No bunkering operations currently planned; port is expected to wait for newly built LNG cruise ships before developing infrastructure (between 2020-2025). It is considered that LNG developments will be market led.

The nearest LNG Terminal is Isle of Grain LNG Terminal.

Port of Portsmouth

The Port of Portsmouth is a port and ferry terminal located in the city of Portsmouth on the South Coast of England. The majority of the ports business derives from its range of local ferry services and cruise facilities, but it handles commercial traffic as well in its commercial port. The port covers about 17.6 hectares.

A major bunkering spill in 2017 put bunkering at anchor on hold until a full investigation has been completed and recommendations made.

The nearest LNG Terminal is Isle of Grain LNG Terminal.

3.2.5.1 Isle of Grain Terminal



Isle of Grain LNG Terminal

ISLE OF GRAIN TERMINAL	
Company	NATIONALGRID
PORT	Isle of Grain
LNG Terminal	YES
Number of tanks	8
Storage capacity	1,000,000 m ³ LNG
Emission capacity	2,650,000 m ³ (n)/h
Number of jetties	2
Small scale	NO

Future implementations planned:

LNG Terminal: According to the terminal aim to be the foremost LNG Import Terminal of the world, they will increase the storage capacity to 1,200,000 m³ and 9 tanks.

Small Scale ship loading: The terminal is looking to offer this service.

3.2.6 Summary of no-peninsular import terminals

	FRANCE		BELGIUM	NETHERLANDS	UK
Terminal	Montoir (Nantes)	Dunkerque	Zeebrugge	Gate Terminal	Isle of Grain
Number of tanks	3	3	4	3	8
Storage Capacity	360,000	600,000	386,000	540,000	1,000,000
Jetties	2	1	2	3	2
Emission Capacity	1,600,000	1,900,000	1,700,000	1,650,000	2,650,000
Small scale ready for ship loading	Considered available in the future	Available	Available	Available	Considered available in the future

3-5. Summary Non-Peninsular import terminals

3.2.7 Distance to LNG Terminal

The LNG bunkering will depend significantly on the distance to the nearest LNG import terminal will be especially relevant and it will also impact on the feasibility and availability.

Port	Country	Nearest LNG Terminal	Road distance Plant (km)	Terminal Truck Loading Capacity(m ³ /h)	Comments	Sea distance (n miles)
Amsterdam	Netherlands	Gate Terminal	125	3 bays x100		40
Antwerp	Belgium	Gate Terminal	144	3 bays x100		90
		Zeebrugge LNG	95	2bay x100		60
Bilbao (ES)	Spain	Bilbao	0	2 bays x27		0
Ferrol (ES)	Spain	Mugar dos	0	3 bays x75		0
Gijón (ES)	Spain	El Musel	0	3 bays x91		0
Le Havre	France	Dunkirk LNG Terminal	315		(1 x90 at the end of 2018) (3 x100 under study)	146
Nantes	France	Montoir-de-Bretagne	0	1 bay x100	(3 bays x100 under study)	0
Portsmouth	United Kingdom	Grain LNG Terminal	185	2 bays x80		172
Rotterdam	Netherlands	Gate Terminal	0	3 bays x100		0
Sines (PL)	Portugal	Sines LNG Terminal	0	3 baysx 65		0
Southampton	United Kingdom	Grain LNG Terminal	200	2 bays x80		185
Zeebrugge	Belgium	Zeebrugge LNG Terminal	0	2 bay x100		0

3-6. Distance from LNG terminal. Source: GIE

3.2.1 Current tariffs and fees

Current tariffs and fees for the different LNG Terminals of the Atlantic Market are as follows:

SHIP LOADING SERVICE					TRUCK LOADING	
Size	>9,000 m³		<9,000 m³		any	
Term	Fix €	Variable c€/kWh	Fix €	Variable c€/kWh	Fix c€/kWh/day/month	Variable c€/kWh
Bilbao	176,841	0.001563	87,978	0.0521	2.88	0.0171
Mugardos	176,841	0.1563	87,978	0.0521	2.88	0.0171
Sines	Not available yet				172,92 €	0

3-7. Spain. Ship reloading and truck loading fees. Source: Orden IET/2446/2013

SHIP LOADING SERVICE						TRUCK LOADING		
LARGE SCALE			SMALL SCALE			any		
Fix Term	Variable	Approval	Fix	Variable €/MWh	Fix €	Truck approval	Comments	
Zeebrugge	81,449.74	0.2	7,997.28	28,177	1.10 *	596.43	3,264	Under study reduction to 914,56 €

* Proposed tariffs for April 2018 and more than 25,561 MWh are loaded

3-9. Belgium. Ship reloading and truck loading fees. Source: Zeebrugge tariffs

SHIP LOADING SERVICE							TRUCK LOADING
LARGE SCALE				SMALL SCALE			
	Fix Term TNA €/berthing	Commodity TQR €/MWh	Fix Reload €	Fix rate €	Variable rate €/MWh	Comments	Fix Reload €
Montoir de Bretagne	90,000	0.32	60,000	Not available			596.43
Dunkerque	NO TPA						

3-10. France. Ship reloading and truck loading fees. Source: Elengy and Dunkerque tariffs

THERE IS NOT INFORMATION AVAILABLE FOR GATE AND ISLE OF GRAIN TERMINAL FEES

Ship reloading tariffs

A comparison between the tariffs for the ship reloading service has been made for ships size of 3,000 m³, 7,500 m³ and 30,000 m³.

As seen before, LNG Import Terminal such as Gate Terminal, Isle of Grain and Dunkerque are exempted of publishing their fees, thus, tariffs are based on commercial negotiations.

In wp2 has been studied the Spanish demand in the coming years. According to those results, new tariffs have been estimated as the ones that should be taken into account to be competitive.

Hence, a comparison between the official tariffs and the wp2 estimated tariffs is shown in the table:

Vessel	Spain fees Bilbao/Mugardos		Spain fees wp2 Bilbao/Mugardo		France fees Montoir de Bretagne		Belgium fees Zeebrugge	
	€	€/MWh	€	€/MWh	€	€/MWh	€	€/MWh
3,000 m ³	99,049	4.66	19,874	0.94	not available	not available	51,492	2.42
7,500 m ³	115,655	2.18	57,186	1.08	not available	not available	86,552	1.63
30,000 m ³	508.963	2.4	238,743	1.12	217,997	2.05	131,945	0.62

3-12. Ship reloading tariffs comparison

Truck Loading tariffs

Same as before, the comparison has been made with the price for the truck loading service estimated in wp1.

TRUCK LOADING SERVICE		
Bilbao-Mugardos wp1	1.13	€/MWh
Montoir de Bretagne	596.43	€/operation
Zeebrugge	531.27	€/operation



3-13. Truck loading tariffs comparison

3.3 COMPARATIVE ANALYSIS

A Qualitative comparative analysis between the different ports included in the Mediterranean Market have been done. Data of the different variable have been analysed with a numeric number in order to give a weighted ranking.

Estimated Spanish port's fees for in WP2 have been considered for both loading service, ship and truck.

The categories analysed and scores values to every situation are showed in Annex A.

	AMSTERDAM	ROTTERDAM	ZEEBRUGGE	ANTWERP	LE HAVRE	NANTES	SOUTHAMPTON	PORTSMOUTH
Fee for Ship loading service								
Fee for Truck loading service								
Small Scale service								
Truck loading service								
Distance to terminal								
Conventional bunkering situation								
LNG potential								
Weighted Number	36	45	41	34	24	26	17	25
Maximum score available	45	45	55	47	37	42	28	36

As not every information is available in this case, a ratio between weighted number obtained and maximum score available has been calculated and compared with the equivalent Spanish ports score.

Port	Score WP2	Score Actual fees	Maximum Score	AMSTERDAM	ROTTERDAM	ZEEBRUGGE	ANTWERP	LE HAVRE	NANTES	SOUTHAMPTON	PORTSMOUTH
SINES	28	28	42	Not competitive	Not competitive	Not competitive	Not competitive	Competitive	Competitive	Competitive	Competitive
FERROL	36	34	55	Not competitive	Not competitive	Not competitive	Not competitive	Competitive	Competitive	Competitive	Competitive
MUSEL	30	28	55	Not competitive	Not competitive	Not competitive	Not competitive	Competitive	Competitive	Competitive	Competitive
BILBAO	36	34	55	Not competitive	Not competitive	Not competitive	Not competitive	Competitive	Competitive	Competitive	Competitive

3.3.1 Port of Sines (Score 32/50) vs Non-Peninsular Ports

There are so many unknown data that it makes really daunting the realization of a complete qualitative analysis. Although small scale service is currently available in ports such as Amsterdam, Rotterdam, Zeebrugge, Antwerp and Le Havres, fees are only regulated in Zeebrugge LNG Terminal. Even though this service is available in a few years, it is not yet available in Port of Nantes, Port of Southampton and Port of Portsmouth.

Every port, except Port of Le Havres (nearest LNG Terminal Dunkerque LNG Terminal), have the truck loading service available in their corresponding LNG Terminal. Only those ports that does not have an LNG Terminal in its location have a longer distance to it than Port of Sines.

In the case that concerns us, three of the non-peninsular ports include the LNG Terminal.

Gate Terminal, Dunkerque Terminal and Isle of Grain Terminal are exempted to publish their fees, therefore, fees are also difficult to compare. Assuming fees in Port of Sines as the fees estimated in wp2, are lower than fees for truck loading service than Montoir de Bretagne terminal and Zeebrugge terminal. In addition, ship loading service fee is also lower than in Zeebrugge.

Regarding to bunkering situation, we do not have data of the UK's ports. It seems that only Port of Zeebrugge and Port of Nantes have a worst Conventional bunkering situation than Port of Sines. However, it is necessary to highlight that data for bunkering in Port of Zeebrugge and Port of Nantes have been estimated. Moreover, data are not unlike.

The future LNG potential is not possible to compare due to the fact the volume of passengers in Port of Sines are not available.

3.3.2 Port of Ferrol (Score 36/55) vs Non-Peninsular Ports

Current fuel bunkering of the Port of Ferrol is lower than the tons per year bunkering in the other ports. The bunkering in the port of Ferrol is very low, only 3,914 tons/year bunkered in 2016.

Because of the low number of passengers, only 30,000, the GNL Potential is higher in the other non-peninsular ports.

As said before, in the Atlantic market most of the ports have the truck loading service, except Dunkerque terminal, ie, Port of Le Havres. Those ports with the terminal in its locations have a lower distance to travel by truck.

The small scale service is available in every port excluding Port of Nantes and Port of Isle of Grain.

Gate Terminal, Dunkerque Terminal and Isle of Grain Terminal are exempted to publish their fees, therefore, fees are also difficult to compare. Assuming fees in Port of Ferrol as the fees estimated in wp2, are lower than fees for truck loading service than Montoir de Bretagne terminal and Zeebrugge terminal. In addition, ship loading service fee is also lower than in Zeebrugge.

3.3.3 Port of Gijón (Score 30/55) vs Non-Peninsular Ports

Firstly, the Musel LNG terminal is already built waiting to be operated as soon as demand requires it.

Secondly, the analysis has been made assuming the operation of the Terminal.

Conventional bunkering service is very low indeed as it is the number of passengers especially compared to the rest of the ports. Thus, the GNL Potential is lower.

One of the advantages over ports like Le Havres, Amsterdam, Antwerp, Southampton or Portsmouth, is that the truck loading service will be not only available, but also in the same location.

Although it does not have small scale service a priori, the service will be available by 2020.

Due to the fact, Gate Terminal, Dunkerque Terminal and Isle of Grain Terminal are exempted to publish their fees, the comparison of fees is a daunting issue. Assuming fees in Port of Ferrol as the fees estimated in wp2, are lower than fees for truck loading service than Montoir de Bretagne terminal and Zeebrugge terminal. In addition, ship loading service fee is also lower than in Zeebrugge.

3.3.4 Port of Bilbao (Score 36/55) vs Non-Peninsular Ports

The scenery of comparison is similar to the port of Ferrol despite the fact that the number of passengers and the current tons bunkered are much higher than in Ferrol, however, are numbers much lower than the non-peninsular ports, consequently the GNL Potential and the future LNG bunkering will be probably low in comparison to ports such as Antwerp, Amsterdam, Le Havres... etc.

It seems that non-peninsular ports, excepting the English ports, will be more suitable for LNG bunkering.

4 STRAIT OF GIBRALTAR MARKET

Strait of Gibraltar is located at the crossing of two major maritime routes, between Mediterranean and Atlantic shipping markets. Strait of Gibraltar is a passageway for international lines joining Europe, America and the Far East, that is why bunkering is particularly relevant in this area, occupying the first position on the Mediterranean Sea and second in Europe.

4.1 SELECTION OF PORTS

To select the main ports that could be competitors of the Spanish ports, the following criteria has been analyzed:

- The geographical location of the scenario.
- Freight volume handled
- Passenger volume in regular lines
- Passenger volume in cruise and regular lines
- Bunkering volume

The peninsular ports that have been studied based on the above criteria are Huelva and Algeciras (Spain) and Gibraltar (UK). The non-peninsular ports, in addition of Port of Gibraltar, are in Morocco (Port of Casablanca and Port of Tanger-med), Malta (Port of Marsaxlokk) and Italy (Port of Gioia Tauro).

The non-peninsular ports have been selected based on those that common markets (transshipment) with the peninsular ports and therefore, would compete in the LNG Bunkering market in the future.

Therefore, the main ports that have been considered in the Gibraltar Strait Market are:

- Peninsular Ports:
 - Port of Huelva
 - Port of Algeciras
 - Port of Gibraltar (UK)
- Non-Peninsular Ports:
 - Port of Tanger Med (Morocco)
 - Port of Casablanca (Morocco)
 - Port of Gioia Tauro (Italy)
 - Port of Marsaxlokk (Malta)

Location of the ports around the Gibraltar Strait market are shown in the next figure:



4-1. Ports of Gibraltar Strait Market, Source: ICC Ingenieros

4.1.1 State of Play and planned development at the ports

A brief overview of the main characteristics of the ports included in this market are described in this section. The information is based on the 2016 Annual Reports of each Port, as well as on the statistics database for Europe of Eurostat.

General Cargo and passengers

The following table provides a summary of the main characteristics of the ports (database year 2016):

Port/Country	Volume freight millions tons	Volume Pax in regular lines (1,000)	Volume Pax (regular lines and cruises) (1,000)	Port calls
Algeciras (ES)	97	4,221	-	25,192
Tanger-med (MR)	45	2,763	2,763	13,990
Gibraltar (UK)	-	-	*348	*9,581
Huelva (ES)	30	37	57	2,120
Marsaxlokk (MA)	2	5,133	-	2,257
Casablanca (MR)	28	29	200	-
Gioia Tauro (IT)	28	1,278	1,292	-

4-2. Characteristics of the Ports of Strait of Gibraltar Market. Source: Eurostat and Annual Reports

Bunkering

The Conventional bunkering market of fuel gives an idea of the potential LNG bunkering market.

The table below presents the current amount of fuel bunkering volume, the LNG Infrastructure in place, and the plans for future development in each port.

Port/Country	Bunkering (t/year Oil)	LNG Infrastructure in place	Plans for future development of LNG Infrastructure
Gibraltar (UK)	5,000,000	None	Shell is planning the construction of a Small Scale LNG Terminal, with a start-up date expected to be in 2018. Its main purpose is to supply the Gibraltar's power plant
Algeciras (ES)	3,118,245	None	
Marsaxlokk (MA)	1,301,899	Import terminal location.	FSRU with 180,000 m3 storage capacity planned to be completed in 2021. LNG bunkering expected to begin upon completion of FSRU unit, with a max ship size of 135,000 m3.
Tanger-med (MR)	1,000,000 ¹	None	Feasibility study currently underway to assess LNG options.
Huelva (ES)	124,420	Import terminal location.	
Gioia Tauro (IT)	1 bunker ship. Not normally available	No currently	Plans in place to build an LNG terminal
Casablanca (MR)	0	None	It is planned the construction of a LNG Terminal in Jorf Lasfar

¹ <http://www.tmpa.ma/en/activites-services/services-aux-navires/>

4.2 PORT DESCRIPTIONS

4.2.1 Spanish Ports

The Spanish ports within this study, Huelva and Algeciras, as well as the associated LNG Terminals are described and defined in Wp1.

The following table shows a summary of the import terminals.

Import Terminal	Huelva
Number of tanks	5
Storage Capacity	619,500
Emission Capacity (m ³ (n)/h)	1,350,000
Small scale ship loading	Available

4-4. Summary Peninsular import terminals

4.2.2 United Kingdom's Ports

Port of Gibraltar

The Port of Gibraltar is a seaport located on the peninsula of Gibraltar and is in one of the most strategically placed locations in the Mediterranean region due to being located at the maritime centre point connecting the Atlantic Ocean to the Mediterranean Sea. However, most of its business comes from the bunkering industry, with an estimated 4.5-5 million tons of bunkering products delivered each year.

The nearby ports of Tanger-Med in Morocco and Algeciras in Spain compete with Gibraltar and have taken the majority of container traffic.

However, Gibraltar is the largest bunkering port in the Mediterranean and bunkering continues to be the main activity within the Port of Gibraltar. The Port of Gibraltar's advantages include:

- Competitive market because of high turnover
- Low costs because of unique tax-free status within European Union
- Competitive port dues
- Located near main shipping lanes
- Market is continuously monitored by the Government of Gibraltar to ensure competitiveness

Nowadays, Shell is building a small scale LNG terminal in this port, this terminal with a start-up date expected to be in 2018, is aimed to supply fuel for the new natural gas power plant but, overcapacity in storage and Gibraltar bunkering position will make imminent the supply of LNG.

Currently, the nearest LNG Terminal is Huelva, and it is likely that after start up, Gibraltar terminal would be supplied from Huelva too, although Shell could choose another European terminal as Sines, Gate or Fox Tonkin, this probably would rise up the final cost of the product, making less competitive this port.

4.2.2.1 Gibraltar LNG Terminal

- The future characteristics will be:



GIBRALTAR LNG TERMINAL	
Company	SHELL
PORT	-
LNG Terminal	YES
Number of tanks	5
Storage capacity	1,000 m ³ LNG
Emission capacity	
Number of jetties	1
Small scale	YES

4.2.3 Morocco's Ports

Port of Tanger-Med

The Port of Tanger-Med began operations in 2007 and is the largest port in Africa. It was a project began by the Moroccan government for the economic and social development of the northern Moroccan region and was envisioned as a multi-port endeavour; Tanger-Med port 1 is complete and fully operational and Tanger-Med port 2 is expected to begin operations in January, 2019. It is already handling large amounts of traffic in the Mediterranean region, and with the completion of the second port it is expected to be the busiest port in the entire region. Tanger-Med port 1 has 2 terminals with a total capacity of 3 million TEU and includes 1.6 km of container docks and 140 hectares of total land. The completion of Tanger-Med port 2 is expected to add 2 terminals with 6 million TEU capacity, 2.8 km of container docks, and 160 hectares of total land.

Tangiers Mediterranean Special Agency (TMSA) has started feasibility analysis for the construction of an import terminal, storage and distribution of liquefied natural gas in Tangier Med II. The Tangier Med port intends to be considered as a hub for LNG supply and vessel bunkering. The project, which will be installed at Tangier Med II (TM2), is intended for import and LNG storage for refuelling vessels frequenting the entire Tangier Med port complex. It also intends to supply other LNG markets, mainly the industrial sector of the northwest region of Morocco.

Currently, the nearest LNG Terminal is Huelva.

Port of Casablanca

The Port of Casablanca is one of the largest ports in Morocco, handling around a third of the country's port traffic every year. In 2016, it handled 26 million of tons of cargo. The port spans over 450 ha, including 256 ha of platforms and features more than 8 km of quays. It can accommodate up to 40 ships at a time and features a commercial port with three terminals including 14,000 m² of storage space. It has lost some traffic since the construction of the Tanger-Med port on the north coast of Morocco.

Nevertheless, there is no bunkering service available.

Morocco plans to build a liquefied natural gas (LNG) terminal at Jorf Lasfar, Casablanca. However, as of today there is not a Planning Project underway, the nearest LNG Terminal is Huelva

4.2.4 Italian's Ports

Port of Gioia Tauro

The Port of Gioia Tauro is the largest port in Italy for container throughput, the 9th in Europe and the 6th Mediterranean and, due to its location along the East-West route stretching from the Strait of Gibraltar to the Suez Canal, serves mainly as a transshipment hub, connecting the global and regional networks that cross the Mediterranean. The port benefits from the natural depth of its water (up to 18 m) and offers one of the longest linear quays available in the Mediterranean (3.4 km). These characteristics, together with the availability of dedicated equipment (22 Ship-to-shore cranes, reaching up to 23 rows of containers), enable the port to serve four Ultra Large Container Carriers simultaneously, a unique feature among Mediterranean ports. The port district has a total area of 6,090,000 m² and 5,125 meters of docks. In 2017 the port handled 2.449 million TEU (which was lower than other years due to an extended strike in April) but has the capacity to handle up to 4.2 million TEUs per year.

In the ports under study, it has the seventh position in bunkering, the sixth in freight volume and the fifth in volume of passengers.

The current nearest LNG Terminal is Panigaglia Terminal.

It is planned to build an LNG import terminal (LNG MedGas Terminal) with a capacity large enough to regasify 1,458,000 m³/hr, and with up to four tanks that could also support trucking and other small-scale deliveries. Estimated start up in 2019.

4.2.4.1 Panigaglia LNG Terminal



Panigaglia LNG Terminal

PANIGAGLIA	
Company	GNL ITALIA
PORT	LA SPEZIA
LNG Terminal	YES
Number of tanks	2
Storage capacity	100,000 m ³ LNG
Emission capacity	427,000 m ³ (n)/h
Number of jetties	1
Small scale	NO

*** Reloading not available**

Future implementations planned:

LNG Terminal: Reloading is not available, however, the pertinent viability study to introduce this service has been completed. The final investment decision is expected by the end of 2018.

Small Scale ship loading: Likewise, the viability study has been completed. The final investment decision is expected by the end of 2018.

Truck loading: There isn't any truck loading station in the terminal. Nevertheless, it is expected by the end of 2018.

4.2.5 Malta's Ports

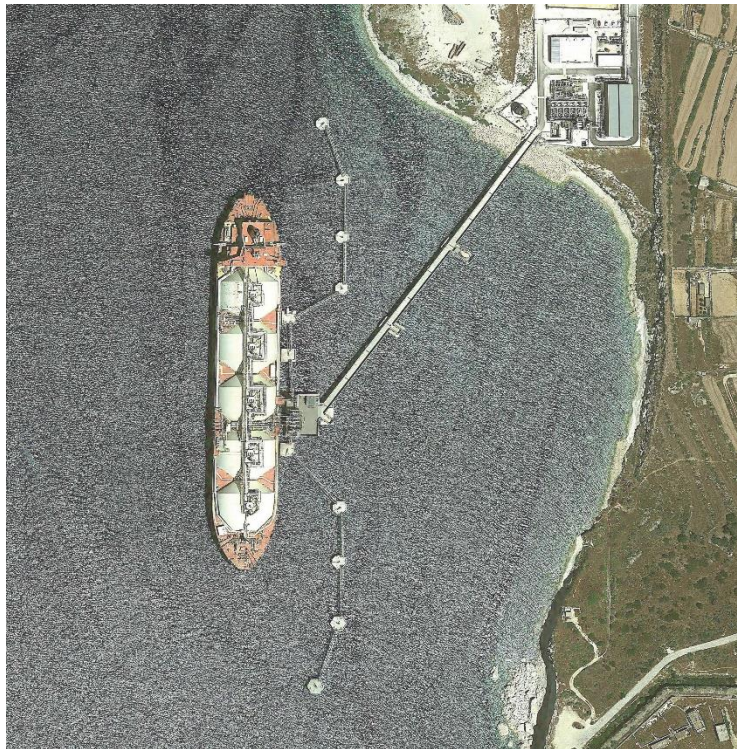
Port of Marsaxlokk

Malta Freeport (Marsaxlokk Harbour) is one of the Mediterranean's key transshipment ports being located at the crossroads of some of the world's busiest shipping routes and in the heart of the Europe/Maghreb/Middle East triangle. Around 96 per cent of Malta Freeport's container traffic is transshipment business. It is the one of the top three largest transshipment ports in the Mediterranean region, and in 2017 had a total throughput of 3,150,000 TEU. Its facilities include a total operational deep-water quay of 2,463 metres, a total area of 771,000 square metres, 15,290 container ground slots, and a total number of 1,175 reefer points. 20,000 TEU containerships and larger can be handled in both terminals, and Malta Freeport is taking other investment initiatives to further increase its current capacity to 4.5 million TEUs in the coming years.

The existing LNG Terminal in Malta is an FSU Offshore. The Maltese Ministry for Energy has planned the construction of a new facility, Malta LNG Terminal, by 2026. It will consist of a FSRU (Floated Storage Regasification Unit)

4.2.5.1 Malta Delimara

- The future characteristics will be:



Malta Delimara LNG Terminal

DELIMARA FSRU	
Company	MALTA DELIMARA (FSRU)
PORT	MARSAXLOKK
LNG Terminal	YES
Number of tanks	5
Storage capacity	125,000 m ³ LNG
Emission capacity	3,910,000 m ³ (n)/h
Number of jetties	1
Small scale	NO

* Reloading not available

4.2.6 Summary of non-peninsular import terminals

	ITALY	MALTA	UK
Terminal	Panigaglia	Malta Delimara	Gibraltar
Number of tanks	2	5	5
Storage Capacity	100,000	125,000	1,000
Jetties	1	1	1
Emission Capacity (m ³ (n)/h)	427,000	3,910,000	
Small scale ready for ship loading	Not Available	Not Available	Will be Available

4-5. Summary Non-Peninsular import terminals

4.2.8 Distance to LNG Terminal

The market for LNG Bunkering will depend significantly on how far the LNG is to the port. Therefore, the distance to the nearest LNG import terminal will be especially relevant and have a large impact on the feasibility and availability.

Trucks loading service

This service is the loading of LNG from terminal tanks into mobile/truck tanks, to be further transported to satellite plants or direct bunkering (to supply isolated networks or to final customers). There are some terminals which offer the truck loading service only in an unbundled way, while others do it in both a bundled and unbundled way

Offer of this service in an unbundled way widens the possibility to use these facilities, as there is no need to unload an LNG ship into the terminal to access the service. Users can directly buy gas at the LNG terminal, swap or liquefy natural gas from the transmission grid, and then load it in trucks by contracting this unbundled service.

Considering the ports and the import terminals in their vicinity, the following table shows the distance to the LNG Import via road and via sea. Also, the table gives the capacities of the truck stations in each LNG Terminal.

Port	Country	Nearest LNG Terminal	Road distance (km)	Truck Loading Capacity (m³/h)	Comments	Sea distance (n miles)
Algeciras	Spain	Huelva	281	3 bays x 91		120
Casablanca	Morocco	Huelva	/	3 bays x 91	Josrf Lasfar/El Jadida LNG Terminal planned	210
Gibraltar	UK	Huelva	288	3 bays x 91	Small Scale Gibraltar LNG Terminal projected	120
Gioia Tauro	Italy	Panigaglia LNG Terminal	1,044	0	Gioia Tauro LNG Terminal (projected)	463
Huelva	Spain	Huelva	0	3 bays x 91		0
Marsaxlokk	Malta	Malta Delimara	7	0	It's planned the construction of a new facility in by 2026. It will consist of a FSRU	1
Tanger Med	Morocco	Huelva	/	3 bays x 91	Tanger Med LNG Terminal planned	120

4-6. Distance from LNG terminal. Source: GIE

4.2.9 Current tariffs and fees

Current tariffs and fees for the different LNG Terminals of the Strait of Gibraltar Market are as follows:

SHIP LOADING SERVICE					TRUCK LOADING	
Size	>9,000 m ³		<9,000 m ³		any	
Term	Fix €	Variable c€/kWh	Fix €	Variable c€/kWh	Fix c€/kWh/day/month	Variable c€/kWh
Huelva	176,841	0.001563	87,978	0.0521	2.88	0.0171

4-7. Spain. Ship reloading and truck loading fees. Source: Orden IET/2446/2013


































It is not possible to make a comparison of the tariffs for the ship reloading and truck loading between LNG Terminals due to the fact Malta Delimara is an FSU without ship reloading and truck loading service, Panigaglia does not have both service either.

4.3 COMPARATIVE ANALYSIS

A qualitative comparative analysis between the different ports included in the Gibraltar strait market have been done. Data of the different variable have been analyzed with a numeric number to give a weighted ranking.

Estimated Spanish port's fees for WP2 have been considered for both loading service, ship and truck.

The categories analyzed and scores values to every situation are showed in Annex A.

	TANGER MED	GIBRALTAR	MARSAXLOKK	CASABLANCA	GIOIA TAURO
Fee for Ship loading service					
Fee for Truck loading service					
Small Scale service					
Truck loading service					
Distance to terminal					
Conventional bunkering					
GNL Potential					
Weighted Number	39/55	41/55	25/45	13/45	18/45

Port	Score	Score Actual fees	TANGER MED	GIBRALTAR	MARSAXLOKK	CASABLANCA	GIOIA TAURO
HUELVA	38	36	No	No	Competitive	Competitive	Competitive
ALGECIRAS	48	46	Competitive	Competitive	Competitive	Competitive	Competitive

4.3.1 Port of Algeciras vs Non-Peninsular Ports

It makes no sense to compare some factors such as the small scale and truck loading service and the pertinent fees due to the fact every port will use the Huelva Import Terminal service and fees, except for Port of Marsaxlokk and Port of Gioia Tauro, but, both nearest terminals do not have those service available. For this reason, in the table it can be seen the same qualitative value for the services and fees in the Port of Tanger Med, Gibraltar, and Casablanca.

Considering only the distance by road to the nearest LNG Import Terminal, the port of Marsaxlokk is nearest to the terminal, but is important to highlight the lack of the truck service in the LNG Malta Terminal.

The distance from the Import Terminal of Huelva to Port of Algeciras and Port of Gibraltar is similar. The other distances are worst comparing to the Port of Algeciras because of an obvious fact, it is not possible to go by road to Tanger-med or Casablanca.

GNL Potential considers the passengers volume as a measure of the possibility of LNG bunkering. The value is similar in Port of Tanger Med, Port of Marsalokk and Port of Gioia Tauro.

Although there are some LNG terminals planned such as in Tanger Med, Josrf Lasfar, Gioia Tauro and Gibraltar, as of today, only the small scale terminal in Gibraltar seems to have been really scheduled. Therefore, it seems Gibraltar could be a real Port of Algeciras competitor, both have a good bunkering position, a good location for the shared traffic through the Strait of Gibraltar and probably will receive the product from the same import terminal (Huelva).

4.3.2 Port of Huelva vs Non-Peninsular Ports

As it has been said in the previous point, the first four factors are daunting to compare.

In the case that concern us now, comparing Port of Huelva vs the non-peninsular ports, it has the great advantage that it has an LNG Import Terminal in the same location. Port of Marsaxlokk does as well but it has as a great disadvantage, the lack of the truck loading service.

GNL Potential considers the passengers volume as a measure of the possibility of LNG bunkering. As we could see in the previous point the value is similar in Port of Tanger Med, Port of Marsalokk and Port of Gioia Tauro. But, in this case, even though Port of Gibraltar has a lower number of passengers, the value is better than in Port of Huelva.

Although Port of Huelva counts with an import terminal, the current traffic is not as high as in the rest of ports and has a limited anchorage area.

5 ANALYSIS OF EUROPEAN LNG PRICING

Bunkering competitiveness will not fall only on logistics costs, but also in LNG wholesale prices. Spain is the main importer of GNL in the European Union, as it can be seen in the figure below.

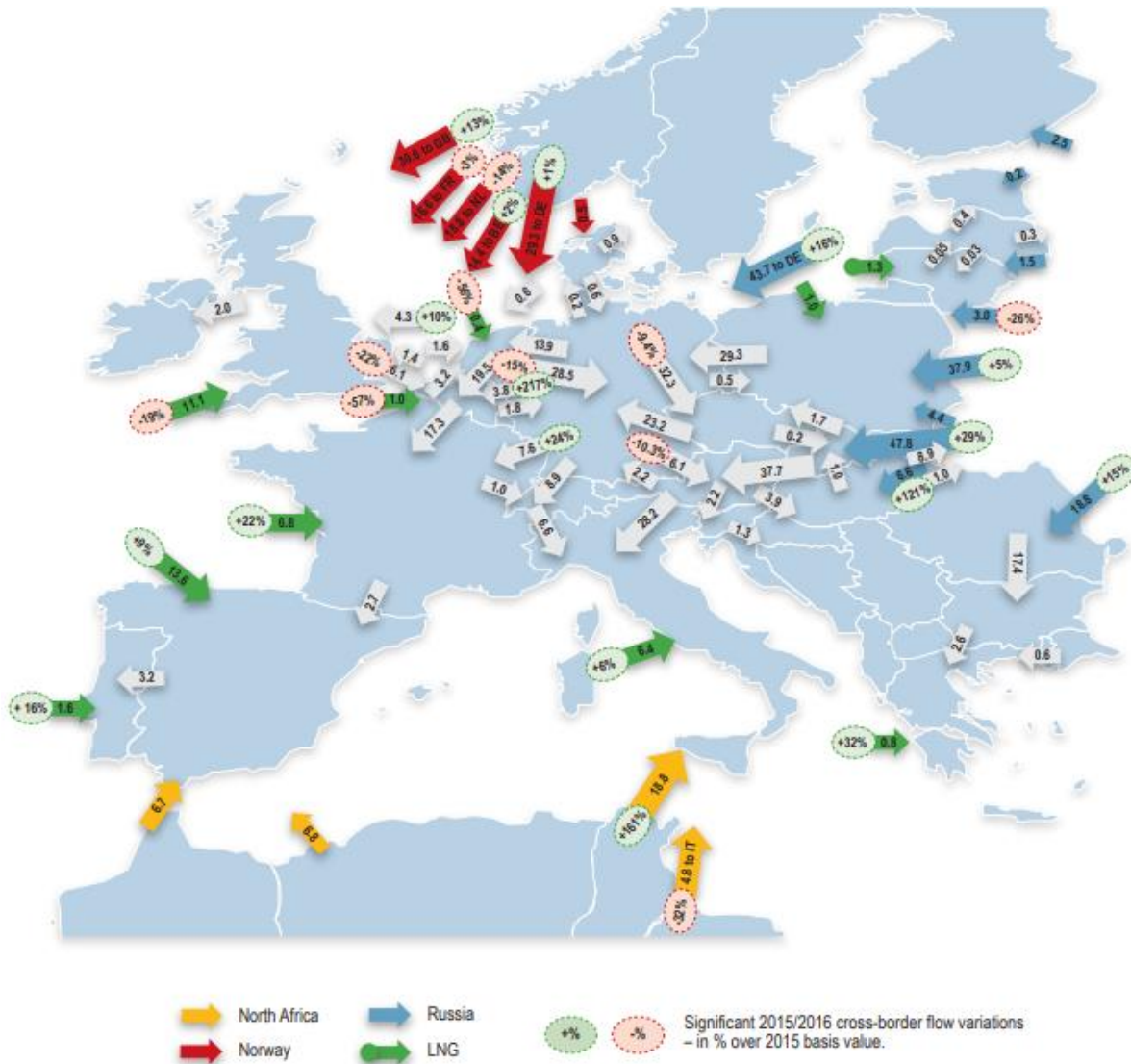


Figura 5.1 European traded gas volumes. Source: ACER

This high LNG demand gives Spain a strong position within the LNG market and, along with a regulated and non-discriminatory TPA it creates a good situation for the entry of new players. Although Spain is the leader of LNG imports, as this is the main source for natural gas supply, prices are greater than in France, Belgium and UK, where it has been deployed a extensive pipeline grid, interconnected with other countries that allows to import gas from Norway and Russia downplaying the importance of LNG for conventional supply.

The figure below gives an idea of the differences between pipeline gas prices and LNG prices in every European Union country.

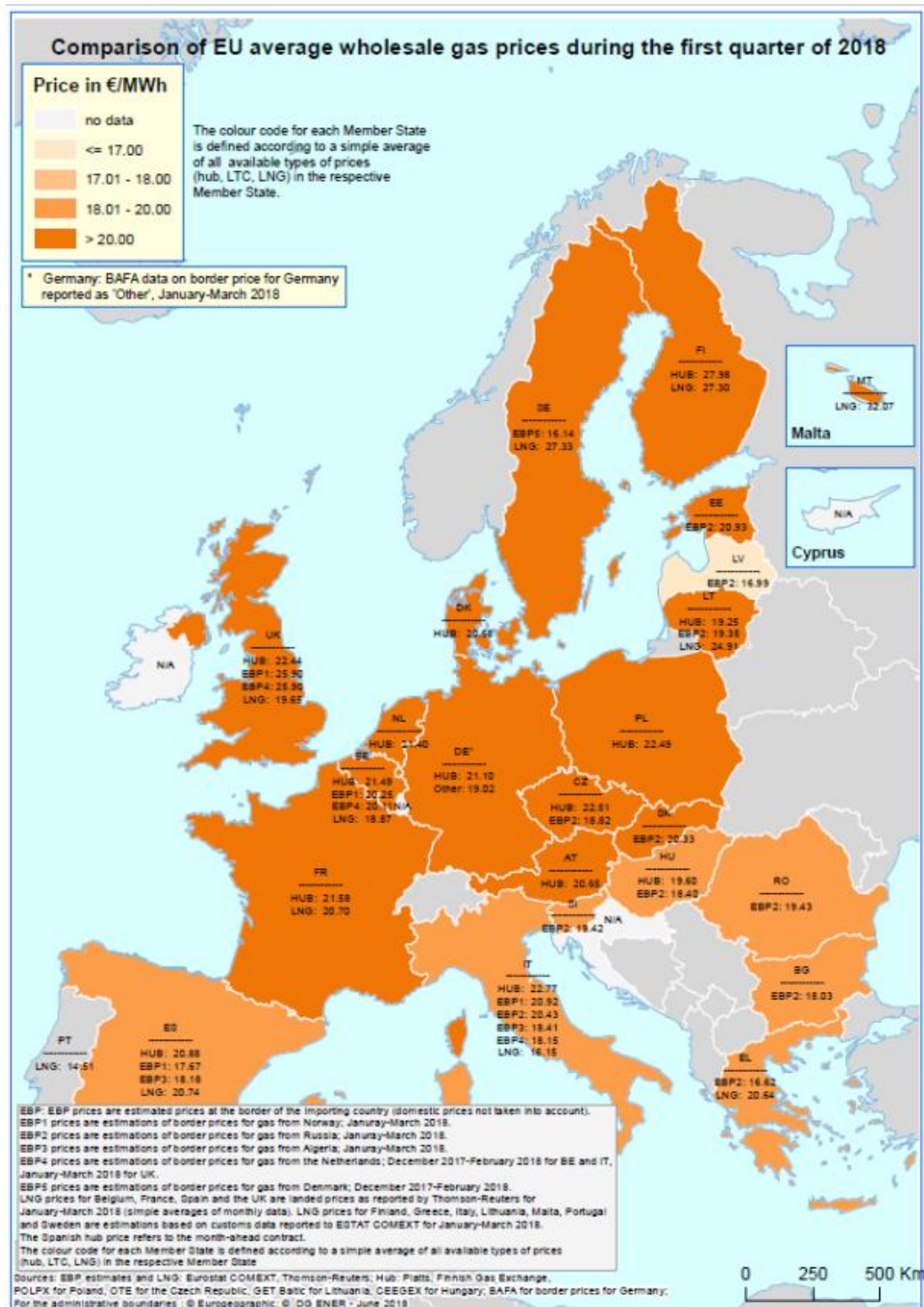


Figura 2 EU Average wholesale gas price Q1 2018. Source . DG ENERGY . Market Observatory

Notice that LNG prices for Spain, UK, Belgium and France are not estimations as it is for the rest of countries.

As it can be seen in the map above Spain LNG is the expensive of this 4 countries, but differences are not really high with a maximum spread of +9% with Belgium.

6 SUMMARY OF NATIONAL PLANS FOR LNG AS AN ALTERNATIVE MARITIME FUEL

In 2014 the European Parliament approved Directive 2014/94/EU on the deployment of alternative fuels infrastructure. In terms of LNG the directive requires a minimum coverage to ensure accessibility of LNG in main maritime and inland ports, therefore, an appropriate number of refueling points for LNG are to be deployed in maritime ports of the TEN-T Core Network by 31 December 2025 and in the inland waterways TEN-T Core Network ports by 31st December 2030.

It is important to highlight that the National Plans provided are from European Countries. Hence, the National Plans from Non-European countries such as Malta or Morocco are unknown.

6.1 France

The French National Policy Framework (NPF) commits to the provision of LNG bunkering by 2025, at least, on one maritime port of each coastal area of the country: Channel - North Sea, Atlantic and Mediterranean. France targets to equip at least three ports with LNG refuelling on its inland waterways.

Refuelling solutions will build upon the existing LNG Terminals at Marseille-Fos, Montoir-de-Bretagne, and Dunkirk ports, located on each France's coastlines.

For cruise ships and large deep-sea container vessels, refuelling can be done only with a LNG Bunker barge or ship due to the large amount of LNG required for each operation. The initial investment will therefore amount to tens of millions of euros while truck to ship refuelling is easier and quicker to implement, at lower cost, over a wide perimeter around LNG terminals, the issue is the limitation in volume by operation.

To be economically viable, the STS service could be justified in Marseille-Fos and in Dunkerque.

6.2 Italy

The Italian NPF considers the development of an LNG infrastructure for maritime applications as strategic and critical in the context of the implementation of the Directive. Plans for its development, including designing of storage quantities in all 14 maritime TEN-T Core Network ports and beyond, are part of the NPF.

It has been estimated, in the ports of our report, a potential LNG Bunkering demand by 2025 of:

Genoa	323,951 m ³ /year	Gioia Tauro	78,901 m ³ /year
-------	------------------------------	-------------	-----------------------------

It is only expected the existing regasification plants to be operative by 2020. By 2025 a new terminal in Sicily could be operating, and in 2030 another terminal could be operating or auxiliary plants along either coastal or internal

- Truck loading stations: The plan foresees each regasification terminal will be provided with at least one truck loading station, excepting offshore facilities.
- Ship loading points: Probably, every coastal facility will be provided with an LNG supply point for ships. It has been estimated 12 ports by 2025 and 20 ports by 2030 will be

6.3 Belgium

LNG refueling is planned for all maritime ports in the TEN-T Core Network and several inland ports. Furthermore, at least 2 LNG refueling points for heavy-duty vehicles are targeted in the ports of Antwerp and Oostende. Altogether, the planned LNG refueling points could guarantee that the maximum distance requirement for LNG refueling points along the TEN-T Core Network would be fulfilled on Belgian territory, with more than 4 refueling points.

6.4 The Netherlands

If the planned LNG bunkering points in the Dutch ports is accomplished, it would guarantee that the requirement for LNG refueling points on the maritime and inland ports of the TEN-T Core Network would be fulfilled in the Netherlands, with 6 points of seagoing vessel in 2025 and 13 points of inland waterway vessel in 2030.

6.5 United Kingdom

The UK currently offers LNG refueling in 2 (out of 15) maritime ports in the TEN-T Core Network and 2-3 additional facilities are considered before 2025 located close to the UK's existing LNG supply terminals at Milford Haven and the Isle of Grain, and the planned terminal off the coast of North-West England.

7 KEY CONCLUSIONS

Spain and Portugal are well positioned to become active players in the future LNG bunkering market. The annual LNG imports of Spain alone is the higher in annual volume in all countries in Europe.

From a macro perspective: high volume of imports, open TPA regulation and clear and competitive fees for small scale access to the national gas infrastructure will highly determine the competitiveness of a port in the yet to be developed LNG bunkering market.

Considering the **Mediterranean market**, Spain and France with Barcelona, Valencia-Sagunto and Marseille-Fos are today the clear leaders. Italian ports, with high potential for LNG lag behind due to a lack of existing accessible infrastructures. If Spain announces competitive access fees, Portugal follows this path, and both countries complete the development of service standards, access to services at the ports, safety regulations, etc, the competitiveness will be granted.

In the **Atlantic market**, the Iberian position would still fall behind the port in ARA zone, current leaders in the conventional bunker market, the ARA ports, will probably also lead the LNG bunker market in the market. Perhaps Iberian ports could compete closely with Portsmouth or Le Havre, both ports with distant access to the LNG infrastructure.

Finally, in the **Gibraltar strait** market, spanning from Suez Canal to open Atlantic waters, one of the world most intensive maritime market, the leadership of Algeciras seems highly feasible. Algeciras considered as a cluster of four ports: Algeciras, Gibraltar, Tanger Med and Ceuta, all potentially being supplied from the import plant of Huelva could offer high quality services at competitive price. Although main competitors ports such as Gibraltar (UK), Tanger Med (Morocco), Marshalock (Malta) and Gioa Tauro (Italy) all have announced plans or intentions to develop LNG infrastructure to support bunkering, as of today only Huelva accounts with real available capacity in the region.

If we analyze the far east Europe container traffic, the main operators and current routes, we find that Algeciras – Tanger Med would be competing with Rotterdam, but this time supported by a higher LNG activity in the national gas supply network.

Notice that this competitive analysis was based on non-approved yet terminal access fees for Spain and Portugal (as described in WP2) and fees can reach 30% of the total logistic cost in the highly competitive scenarios analyzed for Spanish and Portuguese ports. Public authorities therefore have a significant role in the impulse of the new LNG bunkering market and the competitiveness of their ports, by both attracting supply and demand initiatives.

7.1 LNG refueling points in Spanish and Portuguese Ports

According to WP2-3, a list of ports with available **TTS, STS and PTS for 2025** has been elaborated. From a market point of view only ports with a competitive logistic price will be able to supply LNG. Competitiveness is defined when the following parameters are met:

- TTS is available below 12€/MWh
- STS is available below 12€/MWh
- PTS is served from an import terminal or auxiliary terminal

Besides, refueling points has been classified by CORE, Comprehensive and Regular Ports

7.1.1 CORE PORTS

2025	TTS Supply	STS Supply	PTS Supply
Algeciras	✓	✓	
Barcelona	✓	✓	✓
Bilbao	✓		✓
Cartagena	✓		✓
Gijón	✓		✓
Huelva	✓	✓	✓
La Coruña	✓		
Las Palmas	✓	✓	✓
Leixoes	✓		
Lisboa	✓		
Palma de Mallorca			
Santa Cruz de Tenerife	✓	✓	
Sevilla	✓		
Sines	✓	✓	✓
Tarragona	✓	✓	
Valencia	✓	✓	
	15/16	8/16	7/16

7.1.2 COMPREHENSIVE PORTS

2025	TTS Supply	STS Supply	PTS Supply
Alicante	✓		
Almería	✓		
Arinaga	✓		
Arrecife	✓		
Aveiro	✓		
Avilés	✓		
Cádiz	✓		
Canical			
Castellón	✓		
Ceuta	✓	✓	
Ferrol	✓		✓
Funchal			
Granadilla	✓		✓
Ibiza			
Málaga	✓		
Melilla			
Motril	✓		
Pasaia	✓		
Portimao	✓		
Sagunto	✓	✓	✓
Santa Cruz de la Palma	✓		
Santander	✓		
Setubal	✓		
Vigo	✓		
	20/24	2/24	3/24

7.1.1 OTHER PORTS CONSIDERED

2025	TTS Supply	STS Supply	PTS Supply
Marín	✓		
Palamos	✓	✓	
Puerto Rosario	✓		
Ponta delgada			
Vilagarcía de Arousa	✓		
	4/5	1/5	0/5

8 SOURCES

<http://ec.europa.eu/eurostat/web/transport/>

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9 ANNEXES

9.1 Annex A: Scoring methodology used for comparative analysis

The factors that have been evaluated qualitatively through a scoring system are:

- Fees for LNG ship loading service:

Fee value	Score
Not available	0
0-1 €/MWh	5
1-1,25 €/MWh	3
1,25-1,5 €/MWh	2
1,5-2 €/MWh	1

- Fees for truck loading service:

Fee value	Score
Not available	0
0-1 €/MWh	5
1-1,25 €/MWh	3
1,25-1,5 €/MWh	2
1,5-2 €/MWh	1

- Technical capacity to serve small scale vessels.

Infrastructure	Score
Exclusive	10
Shared	8
In construction	6
Planned	4
No	0

- Technical capacity to serve tank trucks.

Infrastructure	Score
Yes	10
In construction	6
Planned	4
No	0

- Distance to nearest LNG Import Terminal

km	Score
0-20	8
20-60	6
60-150	3
more than 150	0

- Conventional bunkering situation

Bunkering (t/year)	Score
0-100.000	1
100.000-500.000	3
500.000-1M	6
+1M	9

- GNL Potential by passengers moved

Volume passenger	Score
more than 1,000,000	8
500,000 -1,000,000	4
less than 500,000	2