POSEIDON MED II LNG BUNKERING PROJECT

LNG for bunkering

Prospects in Greece and Southeast Europe

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WHAT'S NEXT: a glance into the future of Shipping

Athens, May 2018

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Co-financed by the European Union
Connecting Europe Facility

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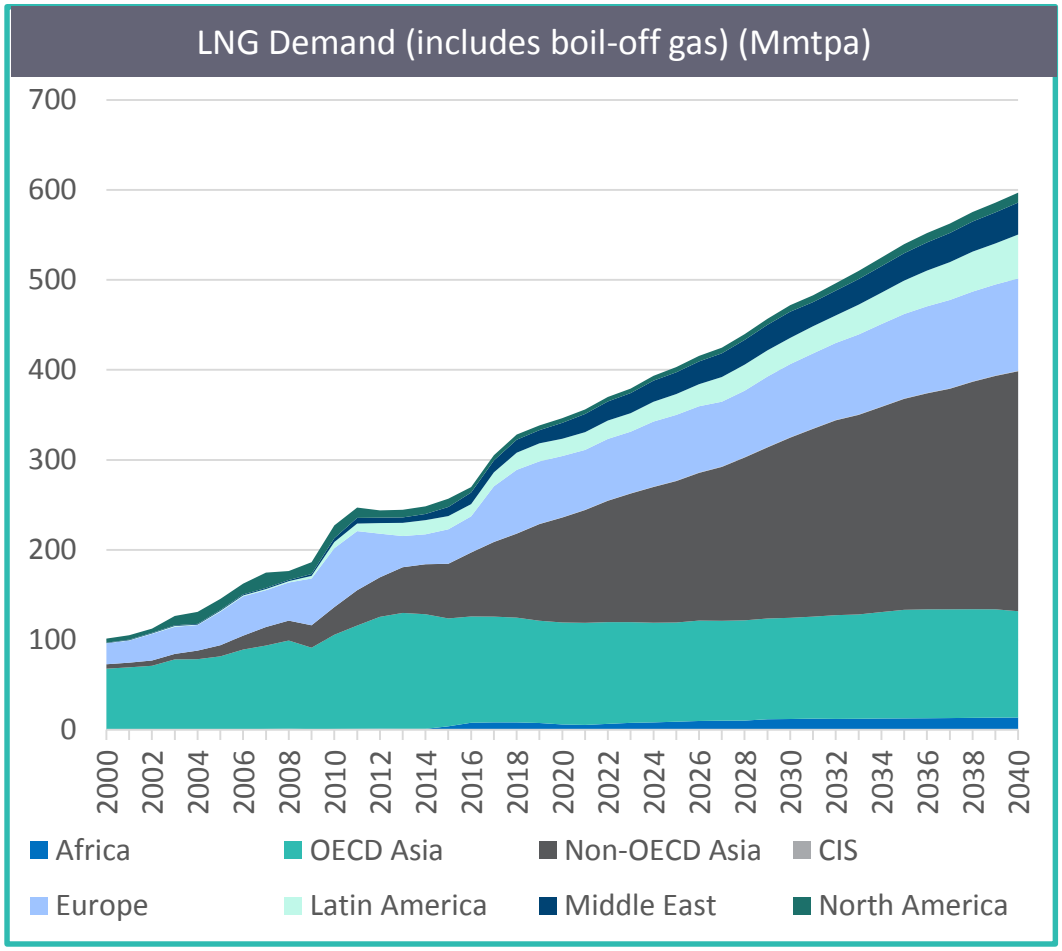
II. SSLNG Potentials in Greece and Southeast Europe
III. What's Next?

I. **Current LNG Market Conditions**

II. SSLNG Potentials in Greece and Southeast Europe

III. What's Next?

Global LNG Demand



LNG Demand growth under all scenarios

Non-OECD Asia is the main growth market

Europe remains the residual market

LNG demand as transportation fuel grows in importance

Source: IHS Markit

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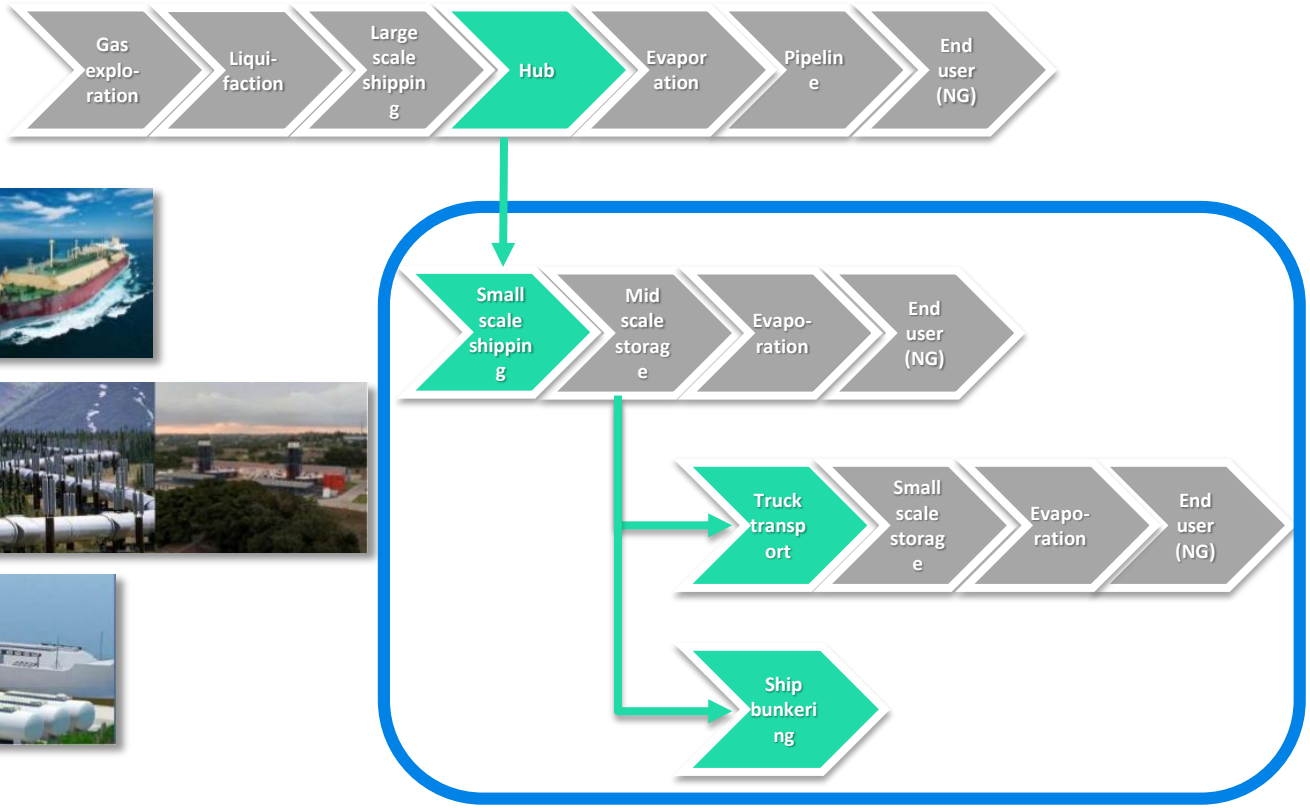
LNG for shipping needs smaller scale LNG Infrastructure



Source: Wartsila

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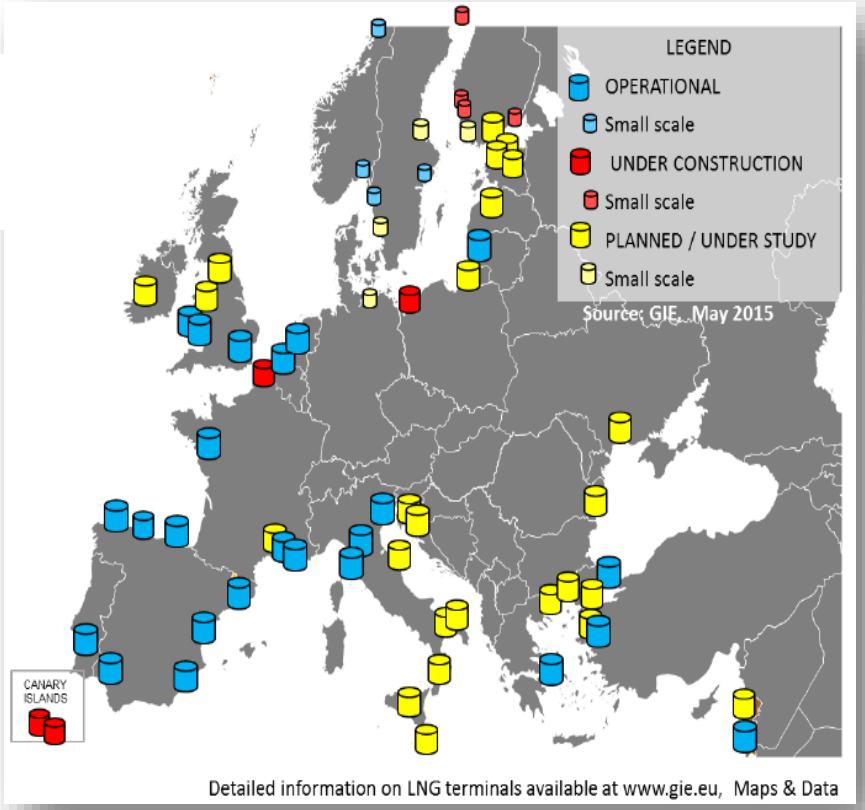
European LNG Infrastructure



	operational	under construction	planned
Large-scale	23	4	22
FSRUs and others	2	0	7
Small-scale	4	4	4
Total	**27**	**8**	**26**

Installations per type	Status		
	operational	under construction	planned
LNG terminals (large + small):			
Reloading large scale LNG	19	6	12
Transhipment	7	-	4
Reloading small scale LNG	15	10	12
Truck loading	25	7	7
Rail loading	-	-	5
Liquefaction plants	21	n.a.	4
Bunkering facilities for vessels	39	12	12
Bunker ships	11	1	6
Refuelling stations for trucks	167	8	63
Satellite Storages	>1000	n.a.	n.a.

Most European LNG Terminals provide already loading LNG Truck Stations while in the same time, premises with the capability of LNG bunkering are increasing significantly.

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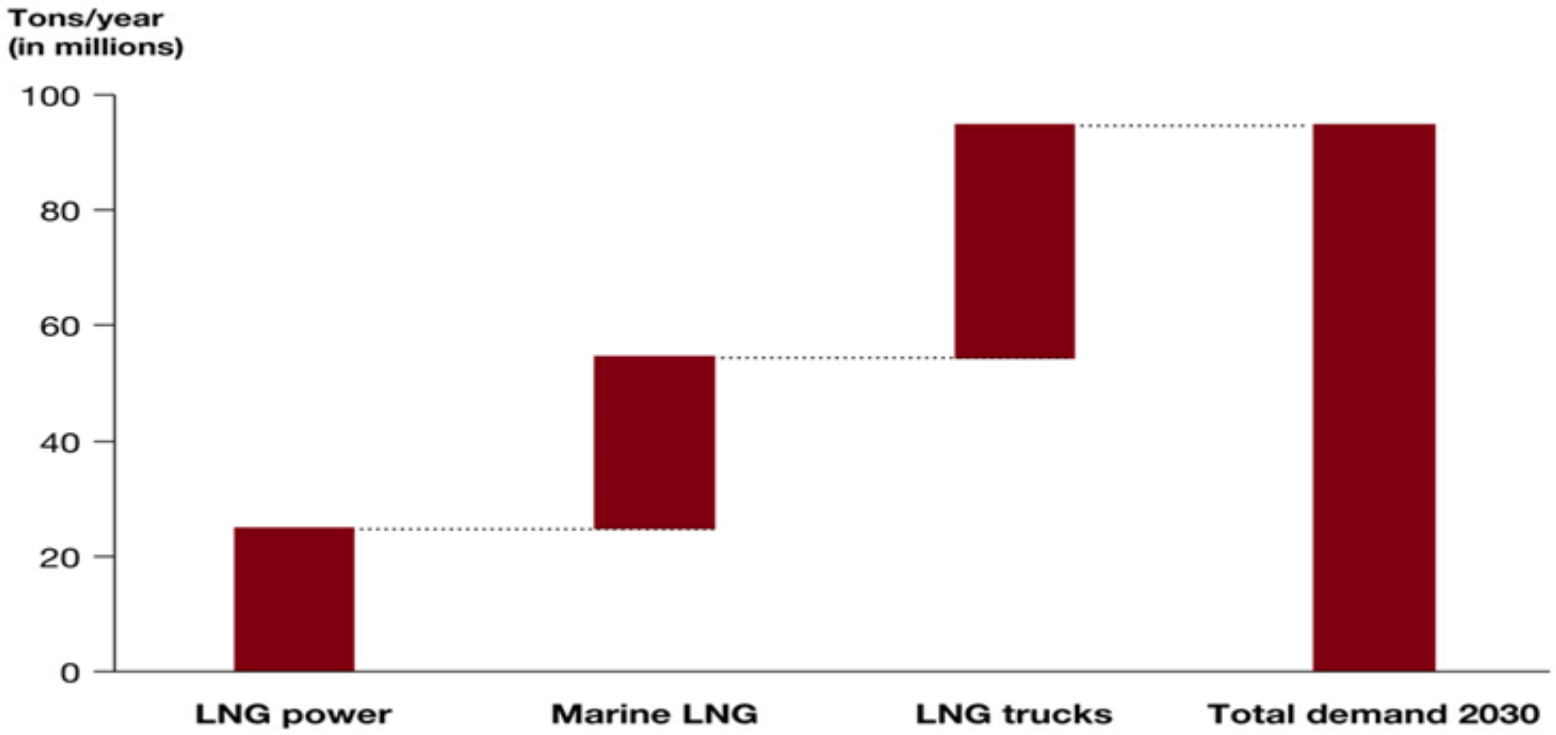
Forecast demand for ssLNG by segment, 2030



Source: Engie; Strategy& research

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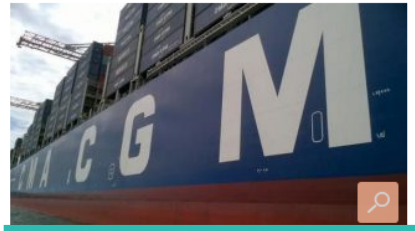
In the Press

CMA CGM to Power Its 22,000 TEU Giants with LNG



French shipping major CMA CGM Group has unveiled the decision to equip its nine future ships of 22,000 TEUs with engines using liquefied natural gas.

"We have ma... future 22,00... firmly focus... environmen...

MSC and Moby order LNG-ready ro-pax newbuild vessels from GSI

MSC and Moby have ordered four LNG-ready ro-pax ferry/cruise vessels, plus options for up four for more, from GSI Shipyard in China.

The four newbuilds will have 3,765 m of linear capacity and be able to accommodate 2,500 passengers. Two of the vessels are

MOL orders LNG-fueled tugboat

Image courtesy of MOL

Japan's Mitsui O.S... ordered a liquefie... fueled tugboat at ... Dockyard.

According to the MOL... of the vessel is set to ... expected to be compl...

The launching of the ... 2019, MOL said, notin... first tugboat with engines running on L... engines will be manufactured by Yan...

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China Boasts a Gas-Fuelled Fleet of 275 as Bullish Outlook for LNG Bunkering Continues

Monday March 26, 2018

Share Share Tweet Follow 6,118 followers

2018's bullish outlook for liquefied natural gas (LNG) bunkering continues this week courtesy of several recent reports highlighting increased interest and and adoption for the emerging marine fuel.

Among those was a report by **Interfax** quoting **Ji Yongbo**, a researcher at the **China Waterborne Transport Institute**, who last week spoke at ...

World's first LNG-fuelled bulk carrier delivered.

Rotterdam: Less fuel oil and more LNG bunkered in 2017

in Port News 20/02/2018

Port of Rotterdam

In 2017, the sale of bunker oil – fuel for shipping – in the Rotter... bunker port diminished from 10.1 million m3 to 9.9 million m3. ... bunkers contain fuel oil, in 2017, 8.3 million m3. The throughput ... bunkered liquefied natural gas (LNG) – liquefied natural gas – ... from less than 100 tonnes to 1500 tonnes.

EMSA – New guidance on the use of LNG as a ship fuel

Maritime Cyprus admin / February 13, 2018

Carnival Orders Third LNG-Fuelled Ship for Its AIDA Brand

Image Courtesy: Carnival Corp

Carnival Corporation & plc has signed a shipbuilding contract for a third next-generation cruise ship for its Germany-based AIDA Cruises brand.

Scheduled for delivery in 2023, the new 180,000-ton ship, being built by German shipbuilder Meye... Werft GmbH at its shipyard in Papenburg, will feature Carnival's "green cruising" design. The shi... will also be fully powered at sea and in port by liquefied natural gas (LNG).

TOTE Completes First Phase of Vessel Conversion to LNG-Fuelled Propulsion

Tuesday February 27, 2018

Share Share Tweet Follow 6,118 followers

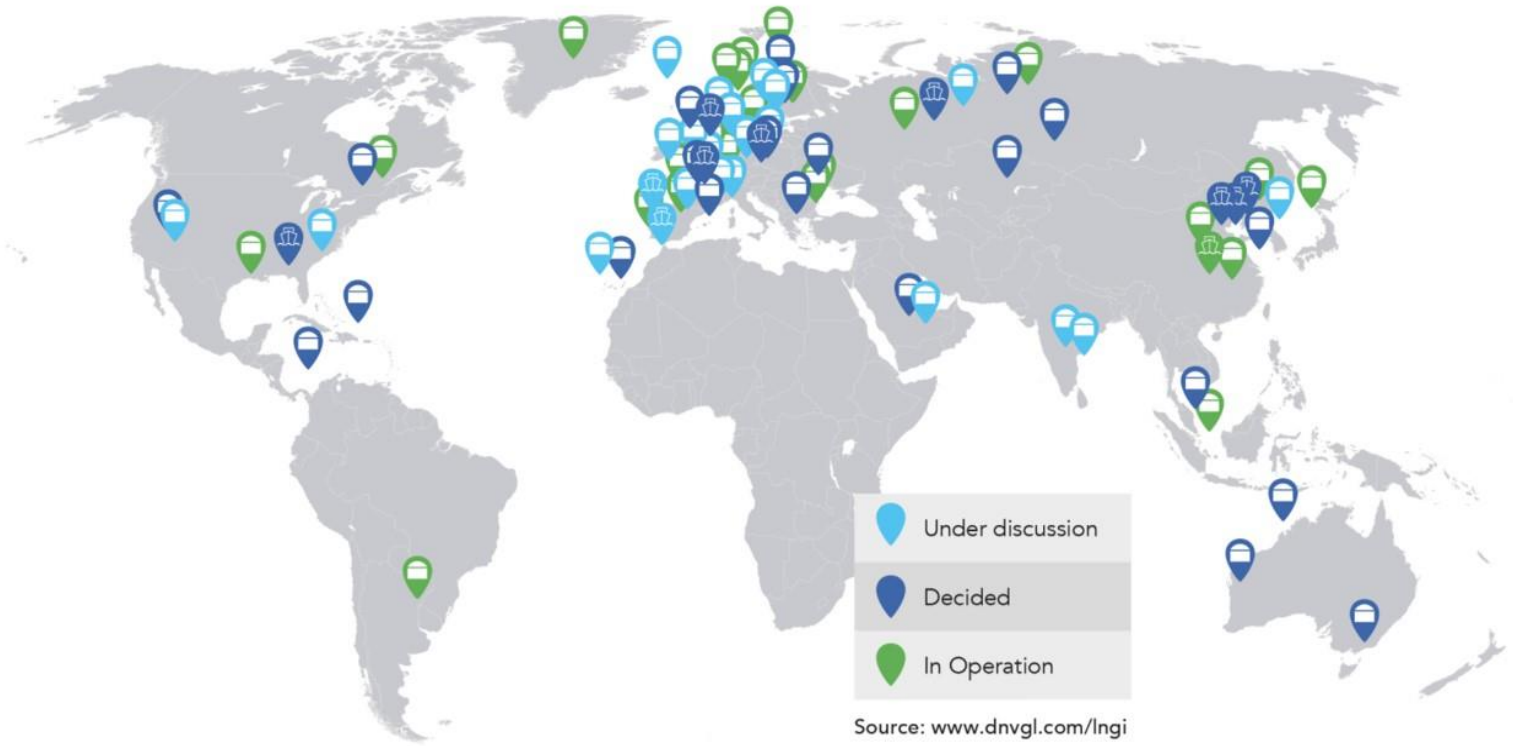
TOTE Maritime Alaska (TOTE) says it has completed the first of four conversion periods for its Orca class vessels, which will enable the ships to use liquefied natural gas (LNG) as fuel.

The company explains LNG tanks and critical engine updates necessary to utilise LNG as a fuel were completed during the initial phase of the planned four year process.

TOTE Maritime's vessel *North Star* arrived in **Anchorage** on Sunday after completing its first voyage with two LNG tanks fitted behind the ship's bridge.

TOTE Maritime's *North Star* has been fitted with two LNG tanks behind the ship's bridge. Image Credit: TOTE

Global Infrastructure for LNG Bunkering



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I. Current LNG Market Conditions

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III. What's Next?

Importance of SSLNG Market in Greece

Tradition - Greece is a world leader in shipping

Strategic geographical position

Important internal short sea activity (53 Islands with population >1.000 - 111 ports)

Need for LNG for other uses (potential for gasification of remote areas)

Availability of LNG supply / infrastructure (LNG Terminal – Revithoussa)

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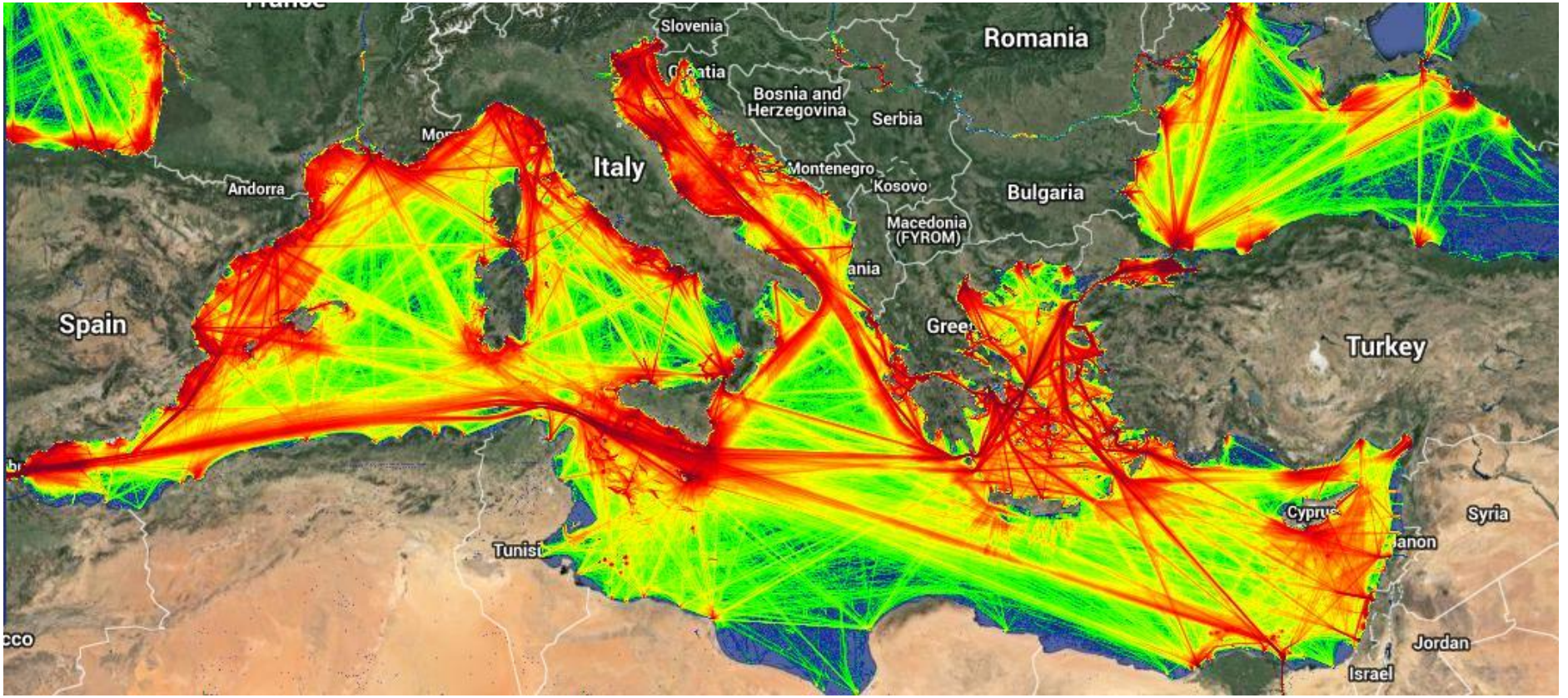
East Mediterranean: Shipping Traffic



Piraeus on Global Map

Piraeus is a key port in Global Bunkering

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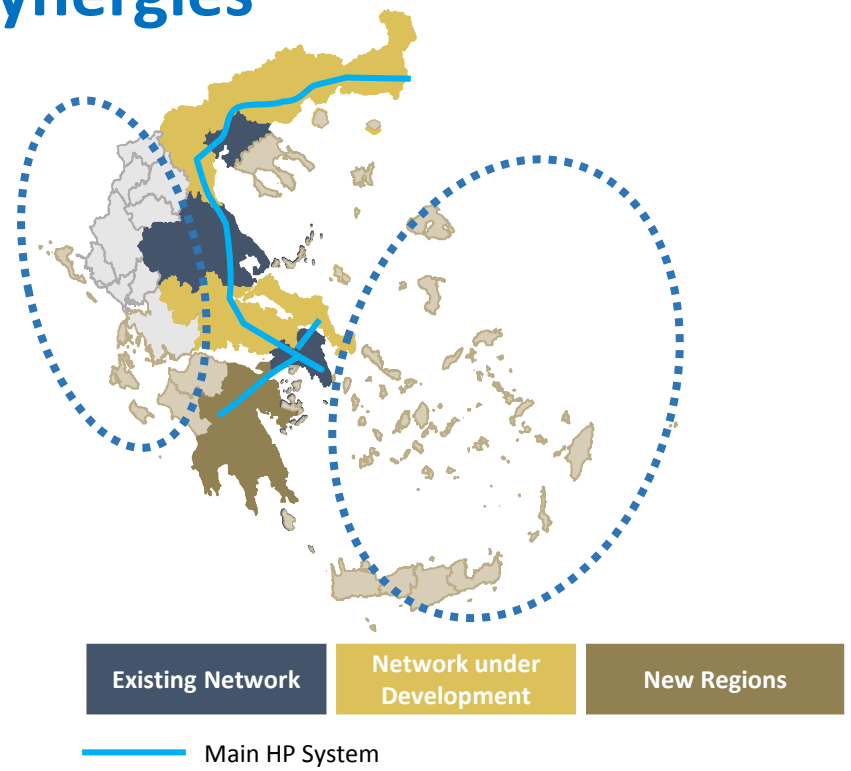
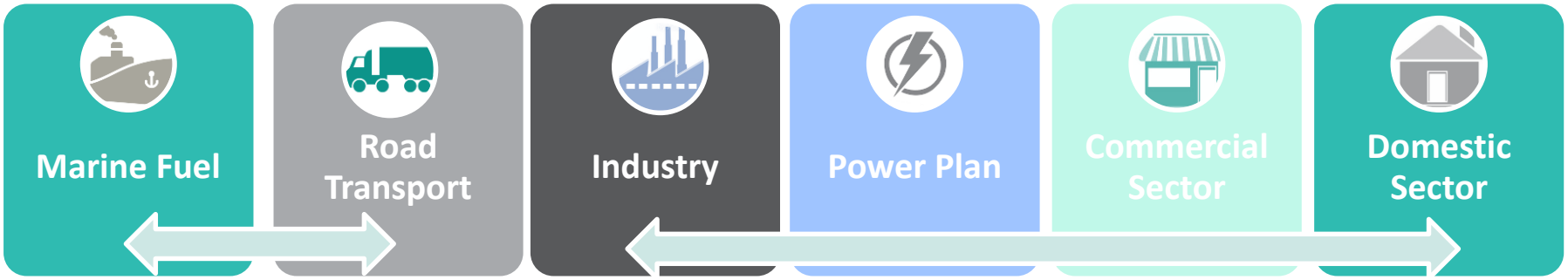
SSLNG Infrastructure - Synergies

LNG Distribution in small scale to serve:

- New Markets for transport(bunkering, road transport)
- High density residential areas & large industrial & commercial customers in Western Greece & the Islands without access to Natural Gas
- Non interconnected power generation plans





Poseidon Med II

Poseidon Med II is a key European project
aiming to take all the necessary steps towards adoption of LNG as marine fuel in the Eastern Mediterranean Sea, while making Greece an international marine bunkering and distribution hub for LNG in South Eastern Europe.

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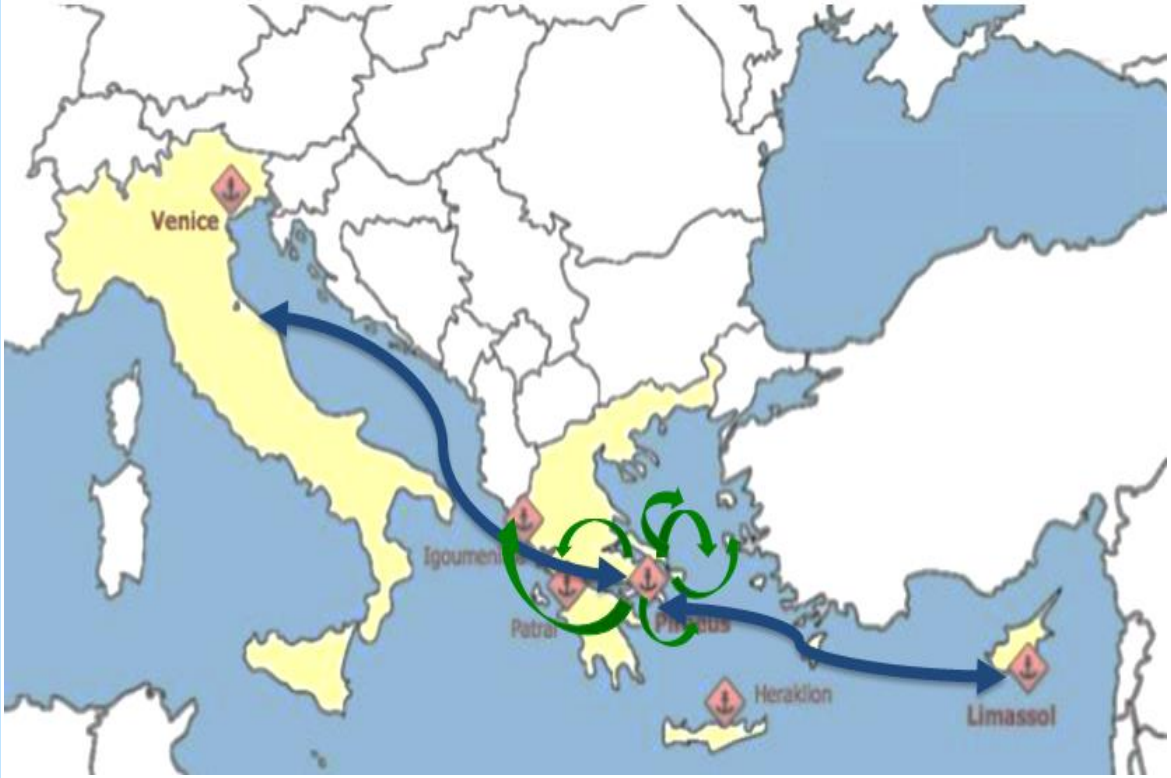
Poseidon Med II – Region of Action

3 Countries

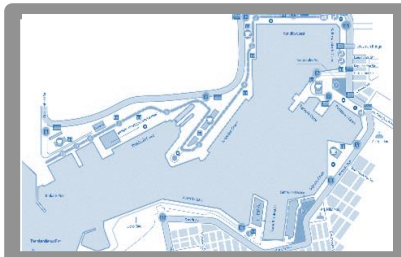
- Greece
- Cyprus
- Italy

6 Ports

- Piraeus
- Patra
- Heraklion
- Igoumenitsa
- Limassol
- Venice



Activities



01
Studies for Ports

Infrastructure at Revithoussa LNG terminal -
LNG infrastructure at 5 ports -

02
Designs of Vessels

- LNG fuelled vessels (newbuilds & retrofit)
- LNG bunkering and feeder

Synergies

Adaptation of regulatory framework -
Environmental impact assessment -

03
Regulation

- Financial assessment
- Financial tools for investments

04
Financial

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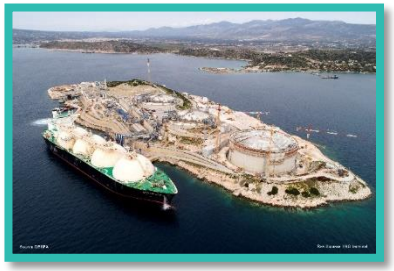
Progress on ports & LNG Terminal Infrastructure

- Hazard Identification (HAZID) & Risk assessment studies at ports
- Preliminary Engineering Design for the Pilot Truck Loading Station
- Supporting Studies for ports; Bathymetric, Wave, Navigation
- Technical Feasibility and Cost Estimate Study for Revithoussa
- Site planning for LNG bunkering infrastructures in ports





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Progress on Vessels Designs

- Designs of 10 vessels for retrofit to LNG powered
- Visits and assessments of Greek Shipyards
- LNG bunkering vessel and LNG feeder Design
- Detailed design of an innovative RoPax dual-fuelled vessel

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Key conditions for LNG adoption as a bunker fuel

LNG availability

LNG main infrastructure

LNG competitiveness (full cost)

ssLNG supply chain

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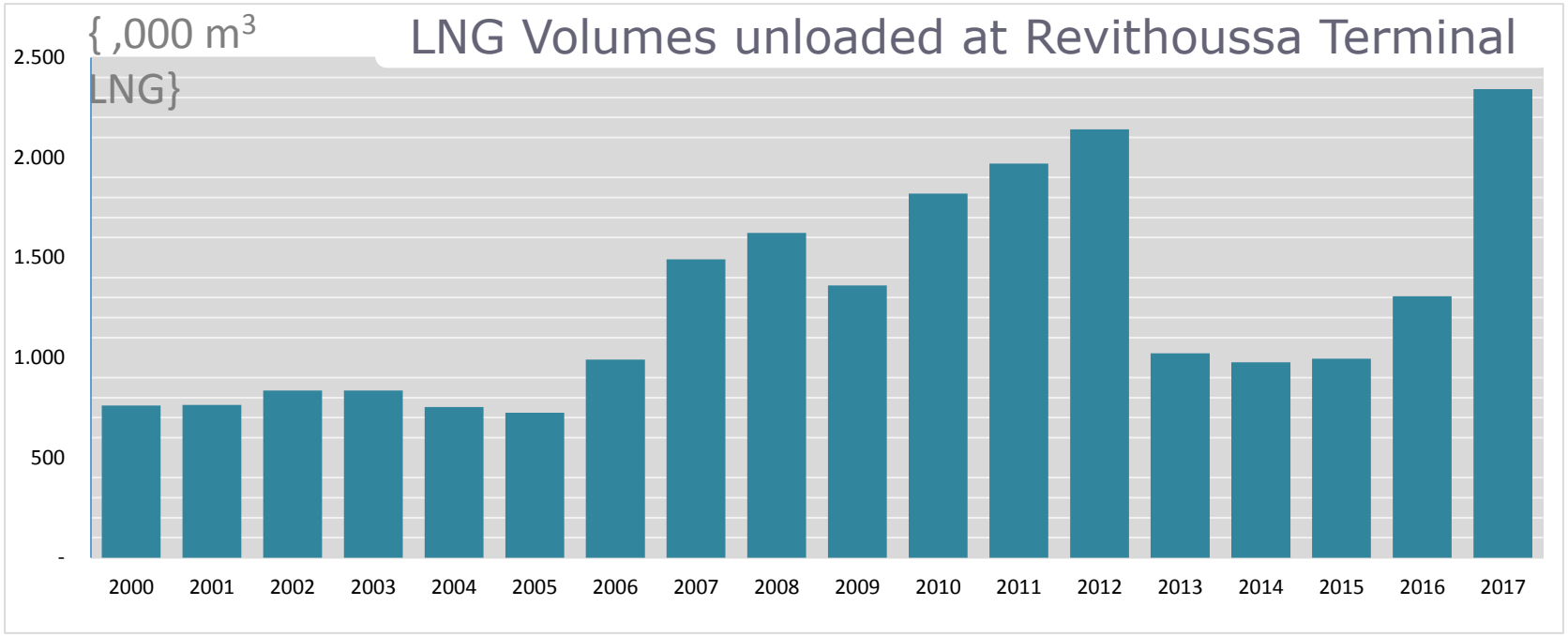
LNG Available in Greece since 2000



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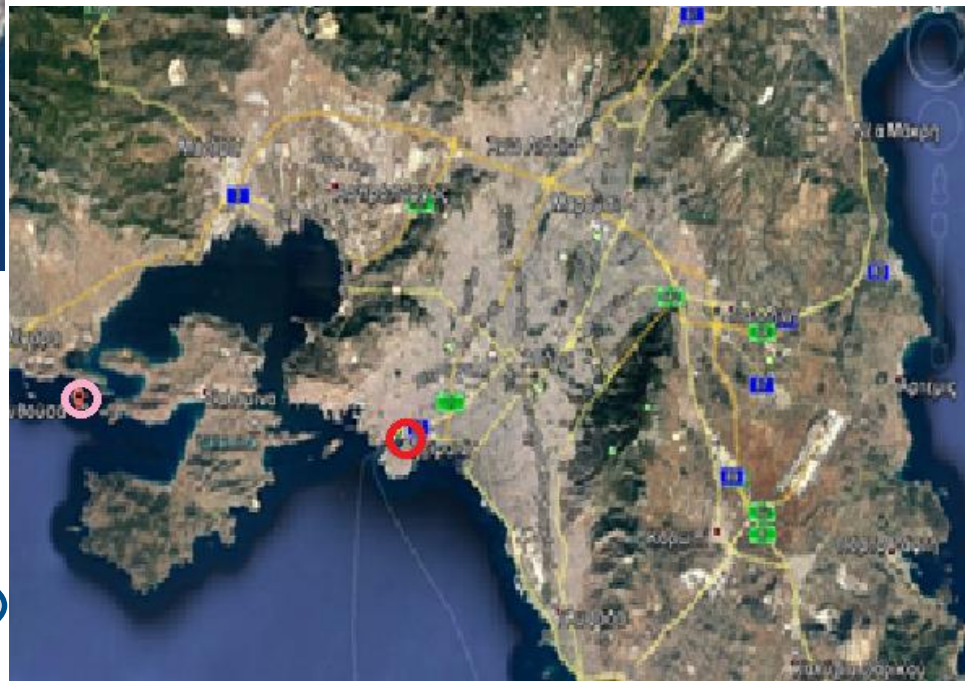
Role of Revithoussa Terminal

Revythoussa is a small island located in the Saronic Gulf approx. 15miles away from Piraeus Port. Since 1999 it has been operating the main LNG Terminal which is one of the most important infrastructures in Greece.



New Infrastructure

(Under Development)

- To load bunkering/feeder Vessels
- Truck Loading

Regional role in SE Europe

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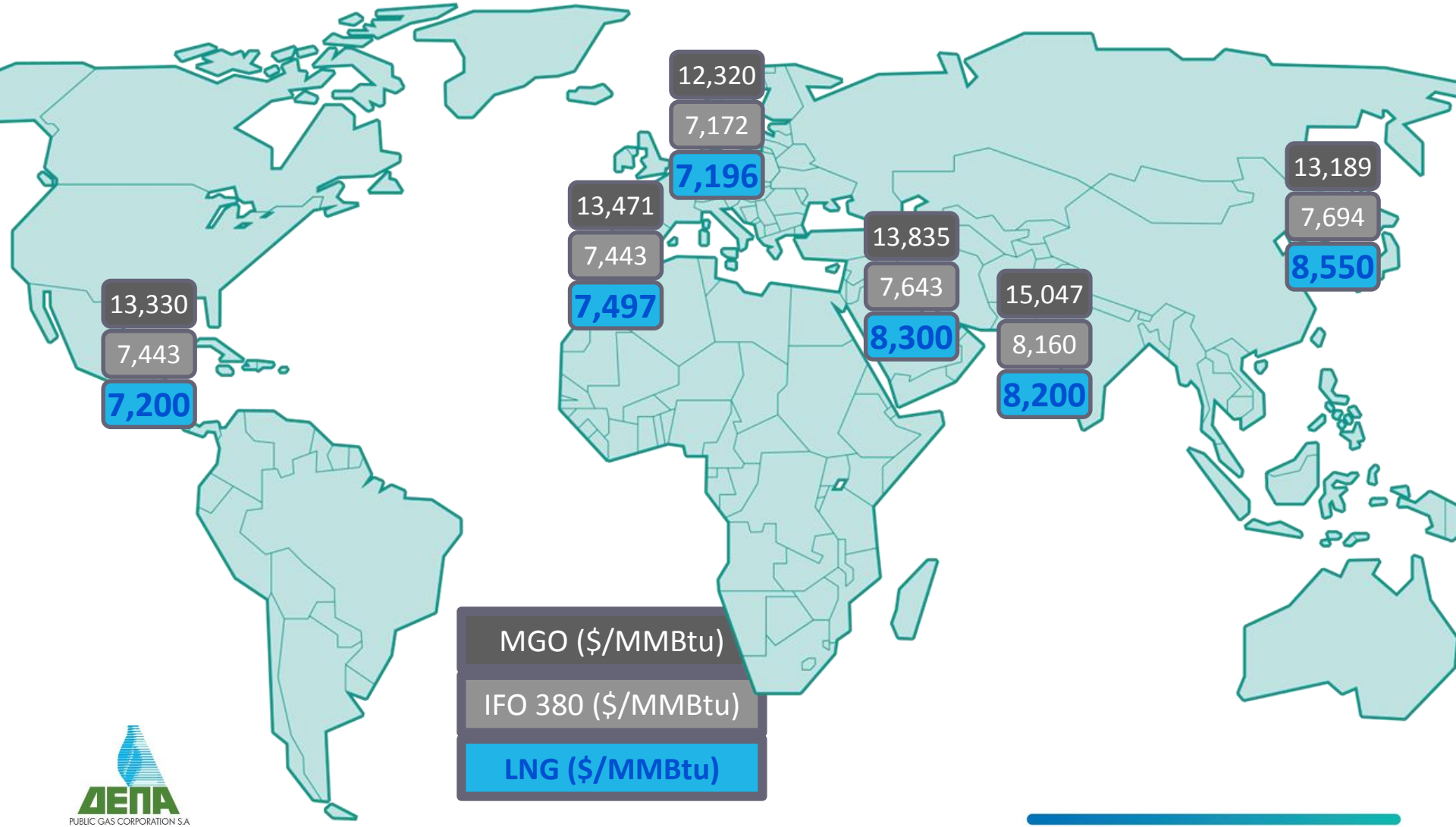
Current Marine Fuel prices vs LNG prices



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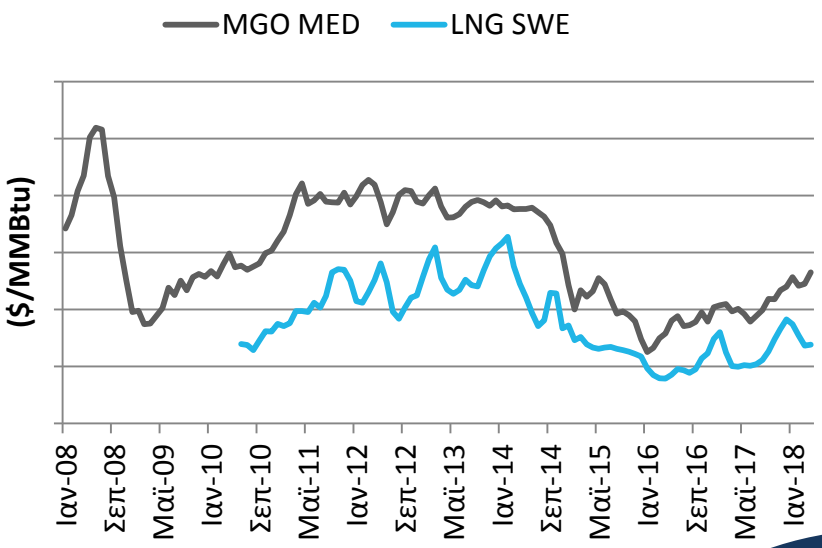
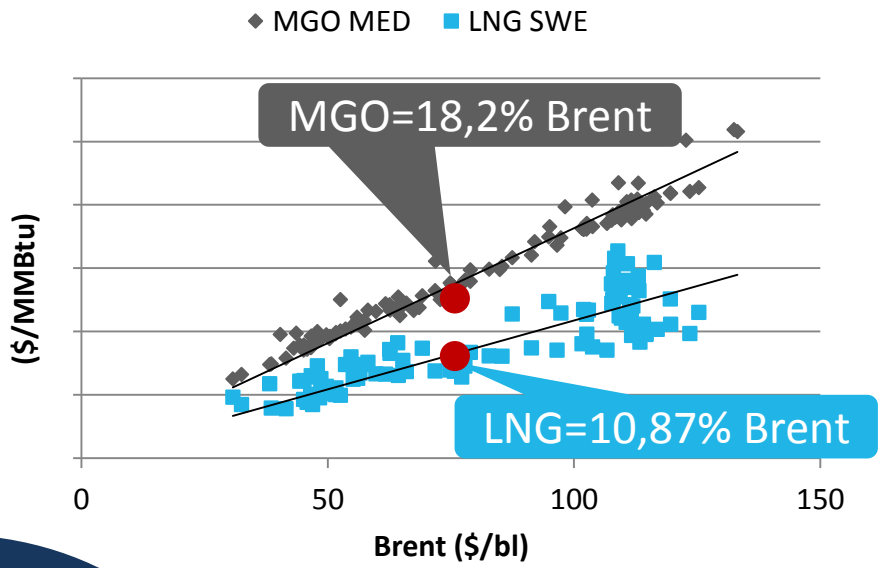
Source: S&P Global - Platts

Long Term Price Comparison

Last Decade





Today

MGO = 18,76 Brent

LNG = 10,45 Brent

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DEPA's Strategic Goals

- Maintain a leading role in the liberalized competitive domestic market.
- ***Increase the natural gas penetration in the Greek energy market by developing infrastructure projects and by supplying natural gas to regional markets (mainland, Aegean islands).***
- Become a key player in the broader region – expand trading activities through participation in international infrastructure projects.
- Maintain and continuously improve the competitive and sufficiently diversified natural gas supply portfolio.

DEPA's Strategic Planning

DEPA aims to develop SSLNG projects, in cooperation with private investors, to supply new users/markets with NG

- LNG as marine fuel
- LNG/CNG in road transport sector
- LNG for Power Generation Plants on Greek Aegean islands
- LNG for off grid areas mainly in Western Greece (individual/remote consumers, potential distribution companies),

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