GAINN PROJECT & MORE: LNG FOR MARITIME APPLICATIONS IN THE MEDITERRANEAN AREA

Eva Pérez
Director of Innovation Promotion and Sustainability
CONTENTS:

1. Overview of international regulation
2. GAINN projects
3. Deployment continuation of GAINN
OVERVIEW OF INTERNATIONAL REGULATION
INTERNATIONAL CONVENTION TO PREVENT MARINE POLLUTION FROM SHIPS (MARPOL 73/78) ANNEX VI

Adopted in 1997, in force since 2005

It regulates on fuel emissions from combustion regarding SOx, NOx, PM and Volatile organic compounds

It control emissions affecting the ozone layer

It rules on burning waste onboard

The 2008 revisión came into in 2010
INTERNATIONAL REGULATION ON SULPHUR CAP

IMO’s Marine Environment Protection Committee (MEPC 70) in October 2016 established the new limit
MARPOL Annex VI - Regulation 14
Sulphur Oxides (SOx) and Particulate Matter

0.5% Shulphur limit 2020

Evolution of the global sulphur limits for the shipping sector
INTERNATIONAL REGULATION ON SULPHUR CAP

- 0.5% global limit (MARPOL, 2020)
- 0.5% EU Sulphur Directive limit (2020)
- 0.1% Emission Control Area limit (MARPOL)
- 0.5% local limit (Hong Kong, China) *

*Note that China and Hong Kong may go down to 0.1% before 2020

<table>
<thead>
<tr>
<th>Area</th>
<th>Sulphur limit</th>
<th>Scrubbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global</td>
<td>0.5% (2020)</td>
<td>Yes</td>
</tr>
<tr>
<td>Sulphur ECA</td>
<td>0.1%</td>
<td>Yes</td>
</tr>
<tr>
<td>EU</td>
<td>0.1% in all ports</td>
<td>Open-loop restricted in some countries</td>
</tr>
<tr>
<td>China</td>
<td>0.5% in selected areas</td>
<td>Yes</td>
</tr>
<tr>
<td>California</td>
<td>0.1% within 24 nm</td>
<td>No, only through research exemption</td>
</tr>
</tbody>
</table>
INTERNATIONAL REGULATION ON GHG EMISSIONS FROM SHIPPING

IMO adoption of the Initial IMO Strategy on reduction of GHG emissions from ships (April 2018)

50% Reduction in GHG emissions 2050 vs 2008
OVERVIEW OF EUROPEAN REGULATION
LOW-SULPHUR MARINE FUELS
WITHIN THE EU
DIRECTIVE 2012/33/EU – DIRECTIVE 2016/802/EU

0.5% Shulphur limit 2020

LNG BUNKERING STATIONS
AT CORE PORTS in 2025
DIRECTIVE 2014/94/EU
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1. Overview of international regulation
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RETROFITTING OF PORT EQUIPMENT & SHIPS

STUDIES

STUDIES & PILOTS

ROLL-OUT

& more work in progress

& more upcoming on H₂ and other clean energies

GaInn 4MoS

GaInn 4Ship Innovation

H₂ Ports

GaInn

Hive2

Hive2

Green Cranes

SeaTerminals

Core LNGas

EfiCon

Costa

BunkerLogix

Green & Smart Links
SHIPS COMPLIANCE SOLUTIONS ON SULPHUR: ULSFO, SCRUBBERS OR LNG?

Low Sulphur challenges:
- Availability
- Refining capacity
- Uncertainty on future price
- Cold flow operability issues
- Regulation uncertainty on long-term compliance

LNG challenges:
- Space on ships
- Large investment
- Uncertainty on fuel price gap
- Availability of fuel depending on route
- Regulation uncertainty on long-term compliance

LNG

LOW SULPHUR FUELS 0.5%S, 0.1% S, MDO

HFO + Scrubbers

Scrubbers challenges:
- Space on ships
- Med / large investment
- Waste disposal facilities in ports?
- Cost of waste disposal
- Regulation uncertainty on open-loop operations in short-term and on long-term compliance

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EUROPEAN STRATEGY
FOSTERING LNG AS MARINE FUEL

& more:

- 2014-EU-TM-0732-S
  CORE LNGas hive - Core Network Corridors and Liquiﬁed Natural Gas
- 2014-EU-TM-0729-S
  Boosting Energy Sustainable fuels for freight Transport in European motorWays (BESTWay)
- 2014-EU-TM-0673-S
  Poseidon Med II
- 2014-EU-TM-0630-S
  Connect2LNG

Connecting Europe Facility
GAINN 4MoS
GAINN IT
POSEIDON MED II LNG BUNKERING PROJECT
4Ship Innovation
RETROFITTING OF SHIPS & LNG PORT PROJECTS

GAIN4MOS GENERAL OVERVIEW

Action Number: 2014-EU-TM-0698-M

January/2015 – September/2019

European Union, Connecting Europe Facility Transport Call for Proposals, 2014

Co-financed by the European Union
Connecting Europe Facility
RETROFITTING OF SHIPS & LNG PORT PROJECTS

- 6 EU COUNTRIES
- 16 PORTS
- 6 SEA CARRIERS
- 19 PARTNERS
GAINN4MoS Partners:

MIT Implementing Bodies in GAINN4MoS Action:
LNG Bunkering Stations at Core Ports

Engineering Study of LNG Infrastructures at Port
LNG Pilot Bunkering Stations at Core Ports
Construction of LNG Break-bulkling Stations

Other Actions linked to GAIGN4MoS are GAIGN4CORE, GAIGN4SHIP INNOVATION and CORE LNGas hive where additional LNG Bunkering Stations will be piloted & built in Spain & Italy and more ship prototypes will be piloted.
Ship Prototype

ROPAX PROTOTYPE (Italy)
Type of vessel: Ropax Ship
Total Cargo Capacity aprox.: + 1,000 passengers + 600 linear meters

Challenge: Lack of LNG bunkering services in Southern Italy and Sicily.

Engineering Studies

Engineering study of ropax MV LOBO MARINHO (Madeira)

SPABUNKER CUARENTA (Valencia)
Type of Vessel: Bunkering Barge
Overall Length: 73.79 m
DWT: 4,200 Tn
Total Capacity of Tanks: 12,623.7 m³

Challenge: Maintaining capacity to supply conventional fuels whilst ensuring safety of operations with different fuels.

Engineering study of the containership MV FUNCHALENSE 5 (Madeira)

MV CORVO (Açores)
Type of vessel: General Cargo Ship
Overall Length: 119.80 m
DWT: 8,893 Tn
Total Cargo Capacity: 610 TEUs

Challenge: Maintaining the ship’s autonomy. Several LNG storage alternatives will be explored, including ISO tanks on board.

Three engineering studies of pax or ropax vessels (Italy)

TUGBOAT (Leixões)
Type of vessel: Tractor
Propulsion: Azimuthal

Challenge: Finding space to position the LNG tanks and complying with safe ventilation distances.
FIRST LNG-FUELLED ROPAX SHIP OPERATING IN THE MEDITERRANEAN

Characteristics:

- 7 decks
- Capacity for 1500 passengers, 290 cars and 35 trucks
- 133.6 x 21.5 x 4.5 m
- 6L34DF Wärtsilä 9,000 kW dual fuel engines
- 150 m3 of LNG tank capacity
- Service speed: 12.5 knots
- Maximum speed: 15 knots
- Italian flag, classified by RINA – IGF notation
FIRST LNG-FUELED ROPAX SHIP OPERATING IN THE MEDITERRANEAN

Ship Pilot: First LNG-fueled Ropax vessel in the Mediterranean

Launch of "Caronte & Tourist's ELIO" at Sefine Shipyard
Nantes Saint Nazaire
- Upgrading truck / Iso-Containers loading facility
- Studying jetty adaptation and loading arms adaptation to load LNG bunker barges

Fos Marseille
- Upgrading truck / Iso-Containers loading facility
- Adapting the jetty and loading arms (or new jetty) to load LNG bunker barges
LNG dual-fuel
retrofitted ropax high-speed craft

FRED. OLSEN Express

1st in the world

GaInn 4Ship Innovation
Co-financed by the European Union
Connecting Europe Facility

Canary Islands
GAINN4SHIP INNOVATION

LNG technologies and innovation for maritime transport for the promotion of sustainability, multimodality and efficiency of the network


Co-financed by the European Union
Connecting Europe Facility


January/2015 – December/2018

50% EU co-financed
€ 7,512,782 EU Grant
Bencomo Express: An LNG dual-fuel retrofitted ropax HSC

Year of construction: 1999
Speed: 38 Knots
Capacity
871 passengers 330 line metres

Main engines: 4 x CAT 3618
(4 x 7200 kW)

Auxiliary engines: 4 x CAT 3406

Waterjets: 4 x Wartsila LIPS LJ 150D

Distance: 36 nm
Transit time: 1 hour
Round trips: 3/day
Bencomo Express: An LNG dual-fuel retrofitted ropax HSC

Retrofitting ropax HSC

**STEP 1**
To adapt an external engine to run on LNG

**STEP 2**
To convert the four engines and vessel's systems

**STEP 3**
Real life trials
Step 1. Adapting a second-hand sister engine

- Engine overhaul
- Designing and building the dual-fuel conversion kit
- Selecting a test bench
- Adapting the test bench to dual-fuel operations
- Acceptance Test
- Acceptance Certificate
- External second-hand sister engine

FO3618DF
CAT3618

Acceptance Test
External second hand sister engine
Engine overhaul
Designing and building the dual-fuel conversion kit
Adapting the test bench to dual-fuel operations

New safety measurements

New hardware: Gas Train Supply
Adapting the test bench to dual-fuel operation
Acceptance test successfully completed

- SAFE
- EFFICIENT
- POWERFUL
- ENVIRONMENTALLY FRIENDLY

- 32% CO₂
- 45% NOₓ
- 90% SOₓ
WORLD’S FIRST DUAL-FUEL ENGINE FOR HIGH-SPEED VESSELS
LNG plant in Granadilla: the never starting project

La Comisión Nacional de Competencia da un golpe de muerte a la política energética del Gobierno de Canarias

- El organismo sostiene en un informe que el proyecto de la regasificadora de Granadilla se debe paralizar hasta que haya garantías de uso sobre la planta y estudios que permitan su sostenibilidad económica.
- La introducción del gas en el Archipiélago ha sido motivo de disputa entre el Gobierno canario y el Cabildo de Gran Canaria, que apuesta por un modelo de energías sostenible.
- Antonio Morales había advertido recientemente de la inviabilidad de apostar por el gas en las Islas.

Canarias Ahora Follow @Canarias
Las Palmas de Gran Canaria
13/10/2017 - 17:10h

NO LNG PLANT IN GRANADILLA → LNG PRICE > MDO PRICE

(AND BOTH FUELS MEET ENVIRONMENTAL REGULATIONS REQUIREMENTS)

Polígono Industrial de Granadilla donde se prevé construir la regasificadora.
JOIN OUR SOCIAL NETWORKS!

www.gainnprojects.eu

GAINN: LNG Ship Retrofitting & Bunkering Station Pilots

@GAINNprojects
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SHIP RETROFITTING PROJECTS – ROLL OUT

RETROFITTING ROLL OUT PROJECTS
LNG hive 2: Ready for deployment

- LNGHIVE2 BAR: 45,98 M€ (13,73)
- LNGHIVE2 VESSEL DEMAND: 75,05 M€ (15,01)
- LNGHIVE2 INFRASTRUCTURE AND LOGISTICS SOLUTIONS: 23,69 M€ (4,74)

Projects submitted (2017 CEF blending call 2nd cut)

Adaptation of LNG plant in Huelva and MTTS

Adaptation of LNG plant in Sagunto

LNG in maritime-rail corridor

Retrofitting 5 LNG powered ferries

Multifuel barge

4 PARTNERS AND AN AFFILIATED COMPANY

TOTAL ELIGIBLE COSTS: 58,987,122 EUROS

ACTION = PROJECT SEEKING FINANCE

€ 82 M. OF ESTIMATED ECONOMIC NPV FOR THE IMPLEMENTATION OF THIS ACTION

6 TECHNICAL ACTIVITIES + COORDINATION

CEF CONTRIBUTION: 11,797,424 EUROS
CONSORTIUM

PARTNERSHIP:

BALEARIA

gasNatural

Puerto de Gijón

Autoridad Portuaria de Gijón

COORDINATOR:

BALEARIA

COORDINATING TEAM:

BALEARIA
TECHNICAL ACTIVITIES OF THE ACTION

LNG-powered

Retrofitting vessels to run on LNG (Activities 1-5)

Communication and coordination (Activity 7)

LNG port infrastructures (Activity 6)
WORKS TO BE CARRIED OUT

Main engines adaptation to run on LNG dual fuel: MAK 9M43C will be converted to MAK M46DF to meet and exceed the M43C reliability and life-time expectations, while maintaining its class leading position regarding operational efficiency and reliability.

Vacuum insulated cylindrical double shell LNG tanks with ellipse heads will be installed in each vessel.

The following vessel systems will be adapted: Inert system, ventilation system, gas/fire detection system, bilge system, electrical installations, automation system (to be upgraded to include the gas system, main engines, ventilation), safety and fire prevention system, control air system, monitoring and control of gas system (allowing local and remote reading of the essential parameters that control the gas system, vent mast; cryogenic piping, gas ventilated piping, cooling water system, diesel system.

ACTIVITY BUDGET

Total investments: EUR 9.7 million
Eligible costs: EUR 9.7 million
CEF co-funding rate: 20%

TIME PLAN

Start date: April 2018
End date: March 2020
NAPOLES: FIRST ROPAX RETROFITTED VESSEL TO BE LAUNCHED IN MARCH 2019
ABEL MATUTES: STARTING ITS RETROFITTING PROCESS IN VALENCIA IN MARCH 2019
CONCLUSIONS
Although we have accumulated some experience so far...

there are still many sustainable challenges to be addressed and a long path ahead of us...
and we hope we will walk part of the way in collaboration with you.
THANK YOU VERY MUCH FOR YOUR ATTENTION!

www.fundacion.valenciaport.com