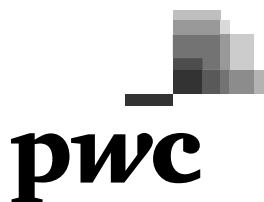
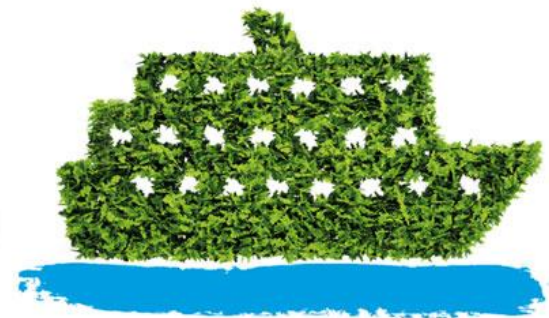


***GNL: un'opportunità (ecologica) per il  
bunkeraggio e nuove infrastrutture***



**SHIOWNERS &  
SHIPBUILDING**

**2°FORUM 5 GIUGNO 2017**  
STAZIONE MARITTIMA DI GENOVA



**Navi passeggeri, porti e ambiente.** La svolta verde dello shipping: investimenti e opportunità

# ***Who we are: Strategy& (formerly Booz & Company) is now part of PwC network***

Booz | Allen | Hamilton



**booz&co.**



**strategy&**  
Formerly Booz & Company

- Booz & Company launched the management consulting profession 100 years ago (Booz Allen Hamilton)
- It has the capabilities, track record, talent and thought leadership to support C-suite executives on their most important challenges
- The merger agreement with PwC was announced on October 2013, and completed on April 2014
- Booz & Company, with the new brand **Strategy&**, becomes the strategy house within the Global PwC Network



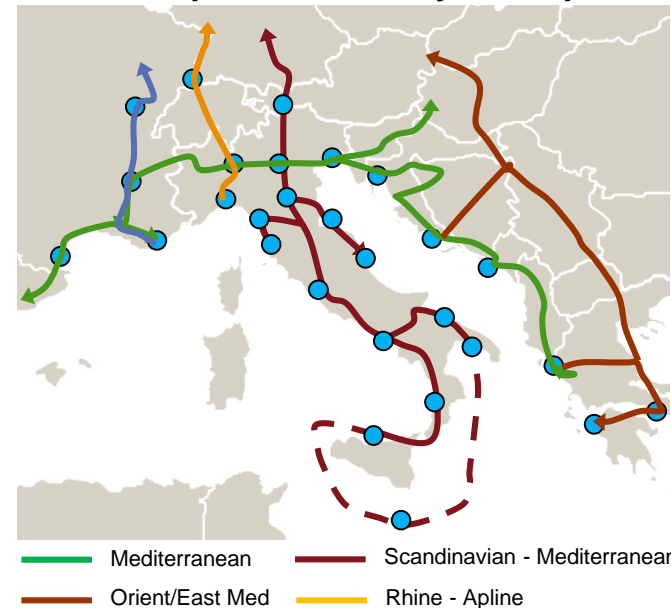
# *Regulation is a pre-requisite for LNG for bunkering uptake: Mediterranean Sea will become an ECA zone in 2020*

## ECA – Demand Side

- Revised annex VI of MARPOL entered into force in 1<sup>st</sup> July 2010 imposes a sulphur cap on fuel oil to control SOx emission
  - 0.1% in ECA
  - Plan to gradually reduce limit from 3.5% to 0.5% outside ECA in 2020
- Current ECA zones around the world are within 200 nautical miles from coast
- Directive 2012/33/EU requires member states to determine effective and dissuasive penalties for non-compliance with the provisions
- Complying with the low sulphur marine fuel limits can result in significant increase of the fuels and modal shift from sea to land-based transport

## TEN-T Core Ports – Supply Side

### TEN-t core ports of country in scope



- Directive For Alternative Fuels Infrastructure requires TEN-T Core ports to develop LNG refuelling points by the end of 2025

# Only at that time, regulation will call for the adoption of three main technologies...

## Overview of alternative technologies

### Conventional Fuel (HFO) +Scrubber

- Continue to use conventional fuel, which today is used as the main fuel...
- ... with the addition of an exhaust scrubber (specific regulations to be detailed)
- **Requires sizable modifications to the ship and presents waste management issues**

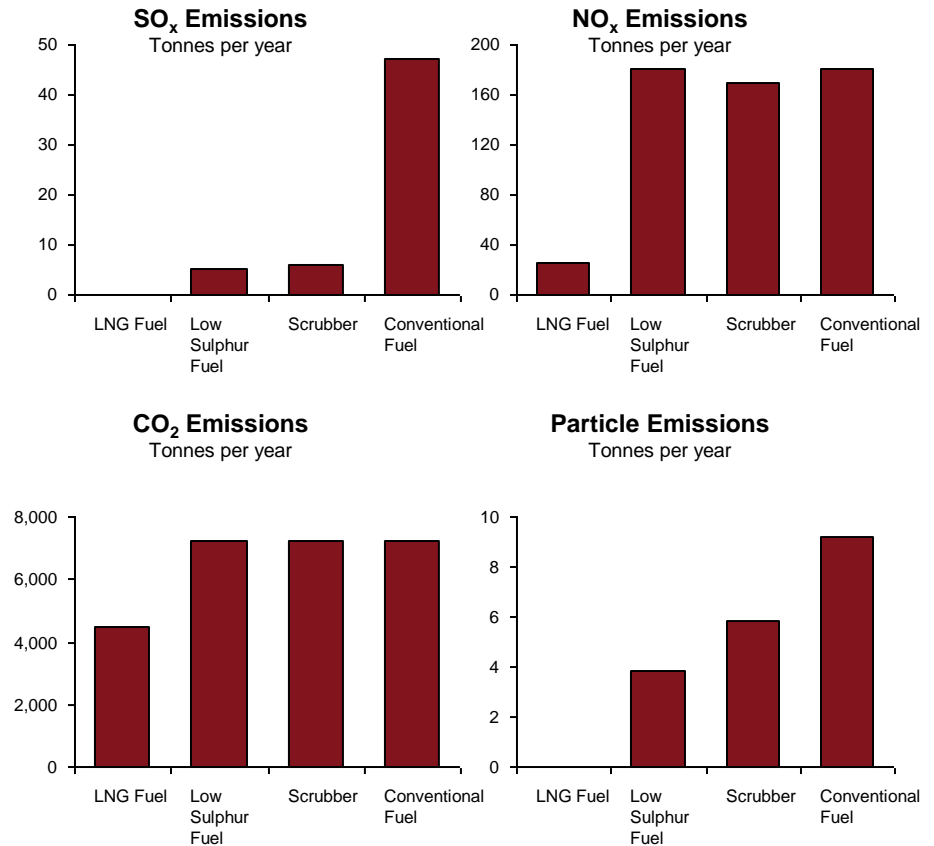
### Low Sulphur Fuel (e.g. MGO)

- Often referred to Marine Gas Oil (MGO) and includes transport fuels such as gasoline and diesel
- This is where refiners make their margins
- If price gap between fuel oil and MGO increases (higher oil demand), scrubbing becomes economic
- **It is the simplest to implement**

### Liquefied Natural Gas (LNG)

- LNG could be an alternative to conventional fuel (**potentially dual fuel**)
- Today LNG is used in selected ECAs (Norway/ Baltic, USA, Japan) - Global acceptance requires infrastructure in relevant harbours
- LNG is gaining momentum with vessel and OEMs
- **Mainly applicable to new ships** (some conversion trials in Canada)

## Environmental emissions



Sources: Public searches, Strategy& analysis

# ...ship owners will investigate on pros and cons of available alternatives

## Choice of Fuel/ Technology in ECA zones

	CAPEX	Fuel Cost	Fuel Availability	Operating costs	Emissions	Comments
<b>Conventional Fuel (HFO) + Scrubber</b>	-	+++	+++	-	?	<ul style="list-style-type: none"> <li>Significant alterations on-board: tanks, pipes, pumps and water treatment system</li> <li>Slight increase of power consumption</li> </ul>
<b>Low Sulphur Fuel (e.g. MGO)</b>	+++	--	-	+++	+	<ul style="list-style-type: none"> <li>Limited availability of MGO at adequate specs</li> <li>No treatment on board</li> <li>Minor modifications to existing fuel system on board</li> </ul>
<b>Liquefied Natural Gas (LNG)</b>	--	?	?	+	+++	<ul style="list-style-type: none"> <li>Difficult logistics</li> <li>Significant alterations required, such as reduced cargo capacity – New hull integrated tanks are expected to simplify this issue</li> <li>Longer / more complex bunkering operations (HSE issues, especially for passenger ships)</li> <li>Mainly applicable to new ships – difficult retrofitting</li> <li>Well proven technology in selected ECA zones</li> </ul>

**Legend**    +++ Strongly Favourable    + Favourable    -- Strongly Unfavourable    - Unfavourable    ? Unclear

Sources: Interviews, Strategy & analysis



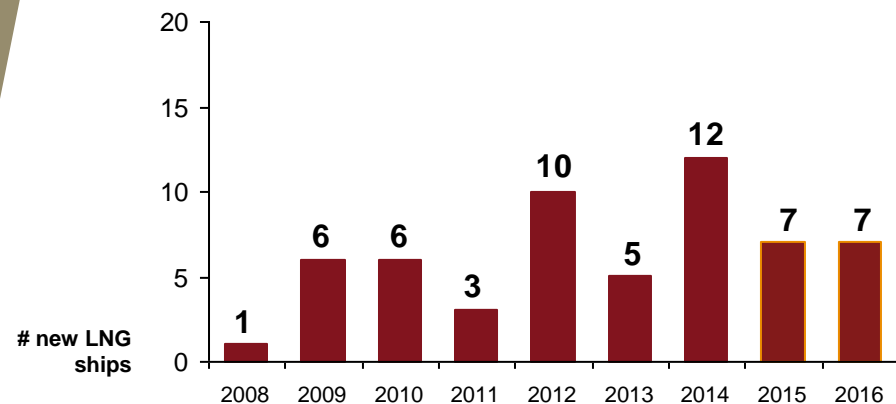
# An LNG bunkering market has first emerged in Norway, also supported by incentives

## Norway's NOx Fund Background

- An LNG bunkering market has emerged in the last year in Nordics, after the **Baltic and North Sea became an ECA**
- **The Norwegian NOx Fund was established in 2008** with the objective of reducing Norwegian NOx emissions by financing concrete measures for ships, offshore installations and land-based industry
- **The fund is financed by its members**
  - Ferries and cargo vessels pay on the one hand **0.5 € per kilo NOx<sup>(1)</sup>** to the fund, and ...
  - ... in return, they can receive support for investments aimed to **reduce NOx**
- **LNG-fuelled ships are eligible** for 19€ per kg NOx yearly emission reductions, limited to 75% of the additional cost (e.g. CAPEX) of LNG propulsion

## Results

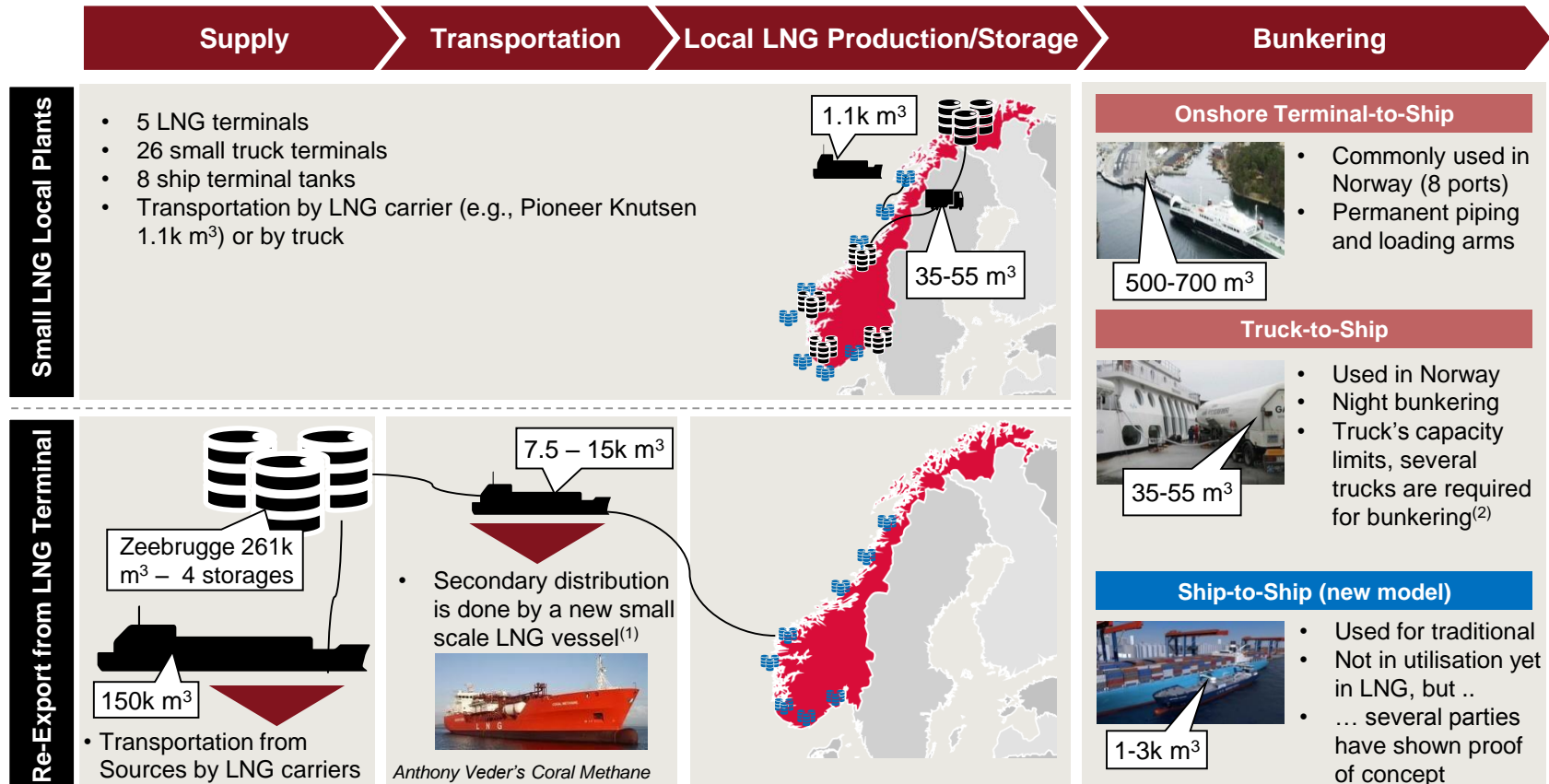
- One of the most effective NOx-reduction measures for ships is **switching to LNG fuel**, which reduces the NOx emissions by 85-90%
- There are **65 ships operating on LNG fuel in Norway**
- The NOx Fund has granted support to **over 60 ships** converted to LNG or new ships (in operation and on order)
- The total funding to LNG projects **amounts to more than 110M€** in the last three years



1) 57 gr NOx per kg HFO

Sources: Internet research, LNG as a ship fuel report (DNV-GL), Norwegian NOx Fund as a driving force for LNG use (Viking Line Seminar), Strategy& analysis

# Two business models emerged in Norway bunkering



1) Currently 1 LNG vessel for transportation from Zeebrugge (7.5k m<sup>3</sup>) – 1 additional LNG carrier already ordered (15k m<sup>3</sup>) – 2 additional LNG vessels planned (10k m<sup>3</sup>)

2) Four truck loads are required for each bunkering operation if the LNG storage on the ferry (125m<sup>3</sup>) is empty – 1.5 hours each

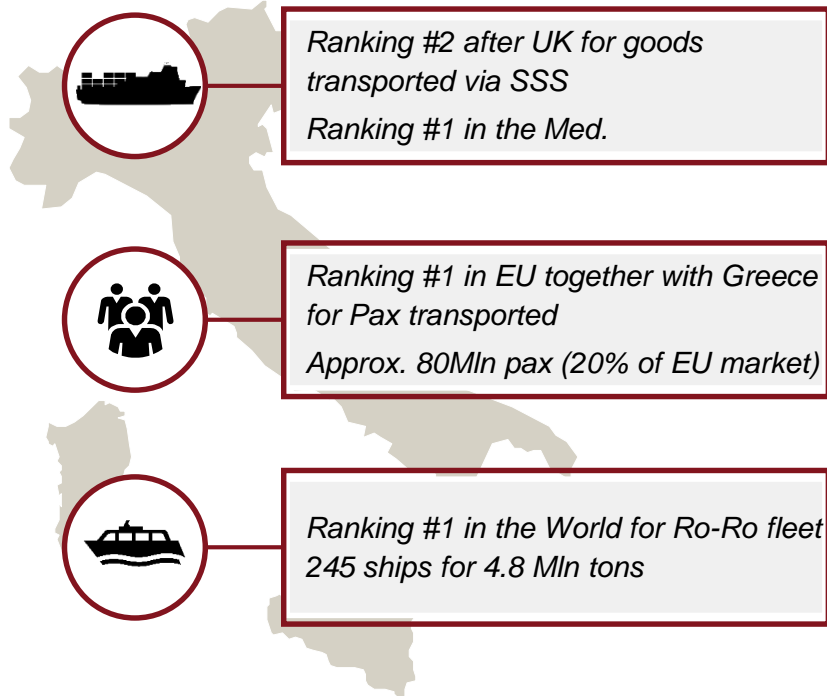
Sources: Internet research, Strategy& analysis



# Italy has a good LNG for bunkering potential, especially for point-to-point, Ro-Ro and Pax transfers from/to islands

## Key Facts & Figures – Italy

## Ro-Pax and Ro-Ro from IT Ports – Annual and seasonal transfers



-- # of transfers

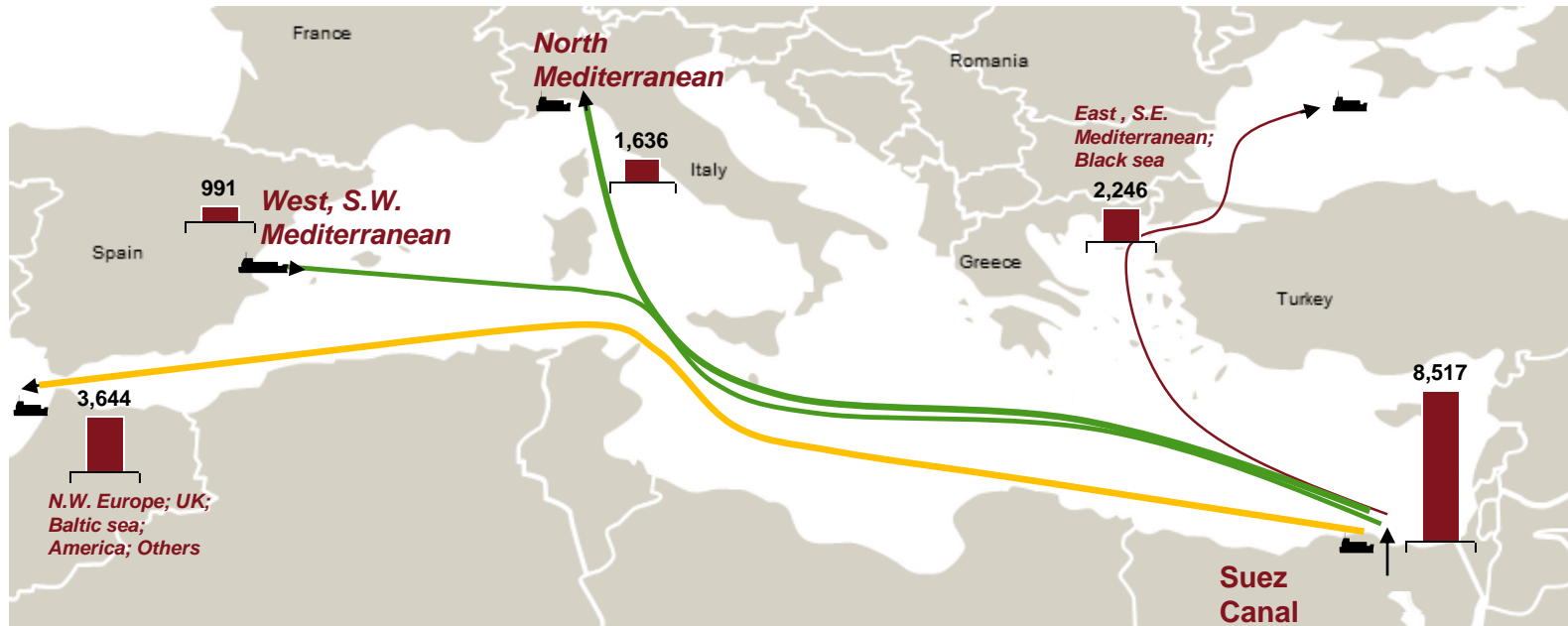
Sources: Confitarma, Interviews, Strategy & Analysis





# Italy could also become an LNG hub for vessels operating long routes (entering in Mediterranean sea from Suez)

Traffic from Suez Canal - # of ships



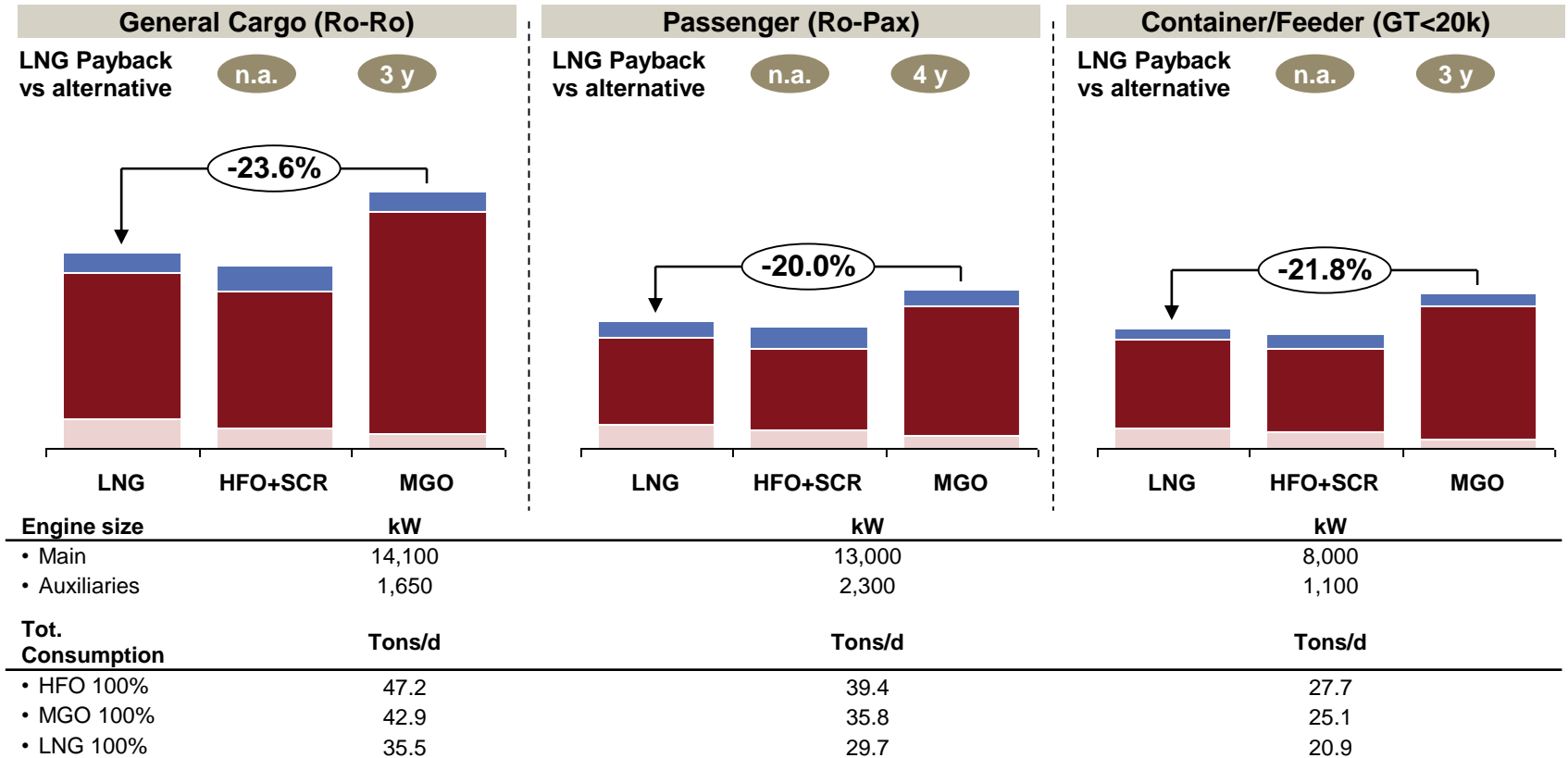
Sources: [www.suezcanal.gov.eg](http://www.suezcanal.gov.eg), Strategy & Analysis



# In terms of costs for the ship owner, LNG seems attractive vs MGO and comparable to HFO + scrubber

## TCO (LNG vs. alternative fuels, in M€)

### Genoa (IT) – case example



Capex Fuel cost Maintenance

Note: Maintenance for LNG and MGO assumed equal

Sources: Bloomberg, interviews, Strategy& TCO model and analysis



# However, there is still the “chicken-egg dilemma”

## Key drivers

### Environmental benefit

- Reduction of emissions of gaseous pollutants (NO<sub>x</sub>, SO<sub>x</sub>), green house gases (CO<sub>2</sub>) and particulate
- Compliancy with MARPOL Annex VI limitations for sulphur in ECAs and global deep sea
- Availability of fuel as renewable source (Bio-LNG)

### Economic advantage

- Lower fuel cost of LNG compared to alternative fuels
- Potential reduction of Total Cost of Ownership for ship owners (*if lower fuel cost outpaces higher investment and O&M cost*)

### Diversification strategy

- Reduce dependence from oil/ oil products
- Flexibility in fuel choice (*especially in case of dual fuel engine*)

## Key enablers



### Infrastructure development

- Development of bunkering infrastructure and ssLNG terminals and storages (*if needed*)
- Initial coverage of key ports to sustain LNG uptake and required investments -- several ssLNG opportunities become only feasible with an integrated supply chain, from source to end-users



### Technology

- Competitive and comprehensive OEMs offering
- Increased standardization and modularization to reduce initial Capex and increase competition
- Reliable, consolidated and efficient technology to foster LNG uptake and ship owners confidence



### Regulatory environment

- Solid and stable regulatory and standards framework
- Stimulating policies and regulations, such as environmental standards on emissions (e.g. ECA zones)
- Favourable fiscal regime and subsidies
- Financing and infrastructure co-funding

## ***New infrastructures (regasification terminals and costal storages) are currently under development***



### **Regasification terminals**

<b>Company</b>	<b>Location</b>	<b>State of play</b>	<b>Predisposition to ssLNG services</b>
LNG MED GAS Terminal	Gioia Tauro	Authorized	✓
API – Nova Energia	Falconara Marittima	Authorized	
Nuove Energie	Porto Empedocle	Authorized	
Edison	Rosignano	Authorization procedure ongoing	✓
Smart Gas	Monfalcone	Authorization procedure ongoing	✓



### **Costal storages**

<b>Company</b>	<b>Location</b>	<b>State of play</b>	<b>Storage capacity [m<sup>3</sup>]</b>
Higas	Oristano	Authorized	9.000
Edison	Oristano	Authorization procedure in advanced phase	10.000
Edison (in partnership with PIR)	Ravenna	Authorization procedure in advanced phase	20.000
IVI Petrolifera	Oristano	Authorization procedure ongoing	9.000
Costiero Gas Livorno	Livorno	Authorization procedure ongoing	9.000
Consorzio Industriale Provincia Sassari	Porto Torres	Authorization procedure ongoing	10.000

Source: Ref-e Study, «La filiera degli usi finali del GNL in Italia, Strategy& analysis

# Key challenges is the financing: GAINN4DEP could be an option



- We are supporting the European Commission within the GAINN4DEP project
- Our key activities are:
  - Facilitating the relationship with the EIB and the other investments funds and banks
  - Preparing the required documents to be submitted for the CEF blended call in order to obtain EU funds
- In addition, we support consortium members in the:
  - Scouting for additional incentives specific for each projects
  - Possibility to create common investment platforms
  - Presentation of the project to the EIB /CDP and to other financial institutions or investors

## Example of potential investors

*European Investment Bank -- EIB*



*Cassa Depositi e Prestiti - CDP*



*Investment funds*



*Banks*

## Example of potential incentives

*CEF blended Call- deadline June 2017 (first window)*

*InnovFin Guarantee facility*

*Green shipping loan*

*Banks*

**€1 billion of funding available** for projects of common interest in the transport sector

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# *Strategy* & Impact

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