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Feasibility of **LNG** as a Fuel for the Mediterranean SSS Fleet: Profitability, Facts and Figures

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ACKNOWLEDGEMENTS

Co-financed by the European Union
Trans-European Transport Network (TEN-T)

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ISBN: 978-84-940351-5-9

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FOREWORD

Rafael Aznar Garrigues
CHAIRMAN OF THE PORT AUTHORITY OF VALENCIA

As Chairman of the Port Authority of Valencia and Fundación Valenciaport, it has been an honour to participate in the European Union (EU) co-funded project "CO2 and ship transport emission abatement by LNG" (the COSTA Action). I would like to thank the Italian Ministry of Infrastructure and Transport for coordinating this eye-opening project, the EU's Trans-European Network for Transport (TEN-T) Programme for their co-financing of this Action and, extensively, for all their efforts in the improvement of the efficiency and sustainability of the European Transport System.

So far, most projects and activity on liquefied natural gas (LNG) as an alternative marine fuel have been focused in Northern Europe, particularly in the Baltic countries, with many of these projects having been boosted by a strong government and EU support. However, it has been highlighted in the COSTA Action that there is a huge potential for this sector in the Mediterranean and us, transport infrastructure managers, sea carriers and policy-makers should start to define the best strategy to comply with environmental regulation and then taking the necessary steps to develop the designed course of action.

Changes in international environmental regulations pose several challenges for the shipping and port sectors and we simply cannot afford the cost of inaction as not doing anything would have serious repercussions on the European transport sustainability and would affect significantly the competitiveness of the shipping industry. The time to deal with existing problems and uncertainty and start planning strategically is now.

In the Port of Valencia, we are following the developments in this field with great interest and our port cluster is initiating actions to prepare for the future. Terminal operators, LNG suppliers, engineering companies and sea carriers are beginning to work together. There have been some promising results that have already been obtained in the field of energy efficiency at container terminals using LNG for port equipment and we hope to continue with more successful pilots and projects in the coming months.

Timeliness and relevance of the results published in this report present a notable contribution to the state-of-the-art knowledge in this field in the Mediterranean and I hope this publication will help to shorten the initial learning curve for many members of our shipping and port communities.

Finally, I would like to thank the team of analysts in Fundación Valenciaport who have dedicated their time and effort to produce this work. We hope this report will contribute to stimulate discussion and ultimately help to advance the competitiveness of the European shipping and shipbuilding industries. Last but not least, I hope that you will find this publication both interesting and helpful.

PROLOGUE

Enrico Maria Pujia
**DIRECTOR GENERAL
DG FOR THE SUPERVISION OF
PORT AUTHORITIES,
PORT INFRASTRUCTURES
AND FOR MARITIME TRANSPORT
AND INLAND NAVIGATION
ITALIAN MINISTRY
OF INFRASTRUCTURES AND
TRANSPORT**

Within the next few years, stricter sulphur, nitrogen and carbon dioxide emission limits from ships will be enforced both locally (already in SECA zones and from 2020 in the rest of the EU) and worldwide (from 2025). Simultaneously, the European Commission is stimulating the use of alternative fuels in the transport sector. Directive 2014/94/EU requires the development in each Member State of the Union, in the period 2017-2025, of a network of infrastructures allowing the use of natural gas, hydrogen, electricity and other sources of power for transport.

We, the Transport Administrations of EU and non EU Countries, have a common challenge ahead of us: Making maritime transport more environmentally friendly without compromising its economic competitiveness. In order to comply with the incumbent regulatory regime, three solutions are available:

- To use low sulphur content fuels such as Marine Gas Oil (MGO) in combination with Selective Catalytic Reducers (SCR) (for new vessels) to limit NOx emissions. However, this solution involves a significant increase in the operational cost of maritime transport. **In the period 2020-2025, such costs will only apply to a limited part of the Mediterranean (the EU one) and Atlantic Seas, hence a significant risk exists of distorting competition in these areas until 2025.**
- To use traditional heavy fuel oil (HFO) in combination with Exhaust Gas Cleaning Systems – EGCS (e.g. Scrubbers) to limit SOx emissions and Selective Catalytic Reducers – SCR to limit NOx emissions. **This solution requires a greater amount of fuel consumption and requires a network of "reception facilities" for scrubbers' residues (dangerous wastes). However, no such facility is currently available.**
- To use alternative fuels such as Liquefied Natural Gas (LNG). This is, from an economic point of view, the most appealing solution (this is already used in the Baltic area). However, **it requires a network of LNG refueling stations in the area. It is also noted that this type of network is one of the aims of the previously mentioned Directive 2014/94/UE.**

The current situation requires the preparation of solutions to prevent damage in the EU's shipping economy due to the double regime in the Mediterranean in 2020-2025. However, **too many factors are still unknown, preventing an immediate deployment of these solutions.**

As part of a comprehensive green shipping pre-deployment strategy, in my capacity of Director General for Maritime Transport and Ports, I wholeheartedly supported the establishment of the COSTA Action as a think tank to provide me and my colleagues in other countries with the elements to shape our strategy for the years 2015-2030.

I am therefore proud to introduce this technical report, which summarises a major piece of work carried out within the COSTA Action. Thanks to this work, we have been able to identify the major factors influencing the costs (hence the likelihood of success) of using LNG as a marine fuel and to estimate them as opposed to the costs of the other possible solutions.
This work is so important and useful that I totally supported the idea of Fundación Valenciaport to make this report publicly available. It will be instrumental to the decisions that, in less than 18 months, I and other Directors General for Maritime Transport in Europe will have to take concerning, as requested by Directive 2014/94/EU:

- Which, where and by when alternative fuel infrastructures will be located in each EU Country
- Who and how (e.g. national law and/or guidelines) will be in charge of giving authorisations (so called "permitting") to operate alternative fuel infrastructures.

No matter how many other pre-deployment studies and pilot refueling infrastructures will be developed in the next few years, this book will be a "bestseller" within my General Directorate and I believe, in many other Public Administrations across Europe.

While acknowledging the whole COSTA Action team for 30 months of excellent work, I would like to specially thank the authors of this publication for their dedication.

Roma
March 2015

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INTRODUCTION

Forthcoming implementation of international and European environmental regulations, namely Marpol Annex VI and Directive 2012/33/EU, will force ship owners to assess technologies that can allow them to comply with regulation whilst helping them to improve their position in an increasingly competitive market.

Given the European economy's fragile condition, prevailing uncertainty about its future and about the future evolution of key factors affecting the outcome of the ship owners' decisions, making the right choice among the multiple feasible technologies available becomes a considerable challenge.

For the past two years, the undersigned team of analysts have worked together in a study leading towards the publication of this report. This analysis has been the Fundación Valenciaport's contribution to the European Union (EU) co-funded project "CO2 and ship transport emission abatement by LNG" (the COSTA Action). The COSTA project has been coordinated by the Italian Ministry of Infrastructure and Transport and co-financed by the EU's Trans-European Network for Transport (TEN-T) Programme under the Motorways of the Sea Call 2011.

Our objective has been to analyse which technology would give the best results for the ship owner to comply with environmental regulations concerning emissions from a financial point of view. This has been done for those vessels that are particularly affected by this regulation, that is, each of the 658 vessels deployed in short-sea shipping (SSS) lines calling at core ports in the Mediterranean and Black Sea EU countries and Portugal. Additionally, a cost-benefit analysis including externalities has been conducted.

As a result of this study, different scenarios on technology uptake towards 2030 for the Southern European SSS fleet have been defined. Needless to say, there is no certainty of how many of the driving factors will behave in the next 15 years. The results published in this report are not definitive predictions of the Mediterranean shipping sector in 2030. Instead, our main findings are intended to stimulate discussions about available options for the industry. By examining the entire SSS fleet operating in the Mediterranean, Black Sea and Portuguese core ports, we hope to portray a general picture of the most convenient technological options for different kinds of vessels. In addition, we hope to draw attention to the factors explaining most of the uncertainty over future results and provide useful information for both ship owners and policy-makers who may be evaluating policies to foster the adoption of the technologies that are most environmentally friendly and contribute the most to the competitiveness of the shipping and shipbuilding sectors in Europe.

Financial feasibility and cost-benefit analyses for the conversion of each vessel deployed in short-sea services in the studied area have been validated with the collaboration of prominent industrial companies. We would like to thank experts working for MAN Diesel & Turbo, Caterpillar, Wärtsilä, Ros Roca Indox Cryo Energy, S.L., Boluda Corporación Marítima, RINA and Bureau Veritas for the information provided and for their help validating the results on the investment required for each ship in the SSS fleet to install scrubbers, be retrofitted to LNG dual fuel or be substituted by a newly built vessel of similar characteristics and operating with LNG dual fuel engines, tanks and all the necessary installations for this newbuilding to be LNG-compatible. Their support has also been crucial to check the operational costs of the ship for each pair of alternative options (the options compared have been: installing scrubbers, retrofitting to LNG dual fuel, newbuilding with HFO engines plus scrubbers, newbuilding with MGO engines (no scrubbers) and newbuilding with LNG engines and other LNG-related installations).

We share this report openly and free of charge to enhance the understanding of some of the challenges the shipping sector is facing, to encourage comprehension of the driving factors that affect the future competitiveness of short-sea shipping in the South of Europe and grasp the potential consequences that a "do nothing" scenario would bring in terms of modal backshift and increase in the use of road transport for intra-European trade flows. We hope you find this report useful and informative; and that it helps to stimulate discussion and thinking of the challenges, solutions and potential incentives to be put in place to favour the adoption of the technological options that will foster the competitiveness of the European shipping and shipbuilding industries. We sincerely hope you will enjoy reading the following pages.