Plan for the Exploitation and the Dissemination of Results

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Type of Deliverable		
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DEM	Demonstrator, pilot, prototype	
DEC	Web sites, patent fillings, videos, etc.	
OTHER		
ETHICS	Ethics requirements	
ORDP	Open Research Data Pilot	

Dissemination Level		
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CO	Confidential, only for Members of the Consortium (including the EU Commission Services)	

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Author(s)		Luk Aerts, Niels Bersma, Alessia Di Loreto, Valentina Schmid
Reviewed by		
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Financial/Administrative Coordinator	
Project Coordinator Name	Mr. Loris COK
Project Coordinator Organization Name	NAVALPROGETTI Srl
Address	Via dei Papaveri, 21 34151 TRIESTE (Italy)
Phone Numbers	0039 040 212918,
Email	loris.cok@navalprogetti.net; gasvessel@navalprogetti.net;
Project web-sites & other Access Points	www.gassvessel.eu

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Table of Contents

Table of Figures

Table of Tables

List of abbreviations

ABS	American Bureau of Shipping (Hellenic) – Athens – Greece – Partner – Lead Beneficiary WP8
BMP	BM Plus Srl – Buttrio – Italy – Partner – Lead Beneficiary WP4

CA	Consortium Agreement
CBA	Cost benefit analysis
CEN	CENERGY Srl – Trieste – Italy - Partner
CHC	Cyprus Hydrocarbon Company – Nicosia – Cyprus – Partner – Lead Beneficiary of WP2
CNG	Compressed Natural Gas
CNGV	CNGV d.o.o. – Izola – Slovenia – Partner – Lead Beneficiary WP3
D	Deliverable
DC	Document Control
DOW	Dow Deutschland Anlaghengesellschaft mbH - Partner
DOWA	DowAksa Deutschland GMBH - Partner
EC	European Commission
EST	ESTECO S.p.A. – Trieste – Italy - Partner
EU	The European Commission or in general Europe
GA	Grant Agreement
HLL	Hanseatic Lloyd Schiffahrt GMBH & Co – Bremen – Germany - Partner
HSEQ	Health, Safety, Environment and Quality controls and assurance
INEA	Innovation and Networks Executive Agency of European Commission
IPR	Intellectual property rights
LNG	Liquefied natural gas
MM	Materials Management
MS	Mile stone
NP	Navalprogetti Srl – Trieste – Italy – The Coordinator – Partner -Lead Beneficiary of WP1 and WP5
O&G	Oil and Gas
P&C	Planning and Controls
PA	Project Administration

Partner	Company member of the GASVESSEL Project Consortium
PM	Project Management
PMS	Project Management System
PNO	PNO INNOVATION – Belgium – Partner – Lead Beneficiary WP9
PO	Project Officer assigned by INEA to GASVESSEL Project
PR	Project Reporting
PRM	Procurement Management
Project	The GASVESSEL no. 723030 Project
PV	Pressure vessel
QA	Quality Assurance
QC	Quality Control
SINTEF	SINTEF OCEAN AS – Trondheim – Norway – Partner – Lead Beneficiary WP7
TM	Team Management
VTG	VNIPITTRANSGAZ – Kyiv – Ukraine – Partner – Lead Beneficiary WP6
WBS	Work Breakdown Structure
Work Plan	Planning of Activities in Attachment 1 of Project Management Plan D1.2
WP	Work Package
WP1	Project Management
WP2	Scenario analyses
WP3	Prototyping activities, design of pressure cylinders and prototyping pilot line
WP4	Prototyping of pressure cylinders. Procurement/construction/arrangement of prototyping pilot line
WP5	Ship Design
WP6	Offshore & Onshore gas loading/unloading systems
WP7	Costs and Benefits Analysis
WP8	Class Design Review – Safety Assessments
WP9	Dissemination and Exploitation
TRL	Technology readiness level

CF	Carbon Fiber

Executive summary

Dissemination is intrinsically linked to exploitation, in the sense that efficient publicity is a facilitator of the exploitation of these results beyond the project lifetime. Moreover, dissemination allows to measure acceptance of the proposed concepts and reuse of them in other projects. While the Dissemination Plan defines the strategy and the planned activities, the Exploitation Plan presents in detail the actual activities and how they support exploitation.

The present document - ***Plan for the Exploitation and Dissemination of Results*** – it contains partners' intentions towards exploiting the project results to support their own business or activities, as already explained in the project proposal. It also includes the dissemination channels foreseen to date as well as the plans for other possible exploitation and dissemination routes to be identified during the course of the project.

This document is structured in five different sections. **Section 1** introduces the purpose of the document and the GASVESSEL project itself. This is followed by a detailed description of the methodology and the audiences foreseen for dissemination and exploitation actions. **Section 2** examines the innovations that will be developed during the implementation of the project and which stage of the overall value chain they will affect. Furthermore, an analysis of each partners' value chain will be conducted, to identify the groups of stakeholders, the benefits they will obtain from the implementation of the project and the message that should be conveyed to them. **Section 3** specifies the expected innovation potential of the project, how this can be extended in various ways and it examines the overall routes for exploitation. Moreover, a preliminary analysis of possible markets, the competitors and the potential hurdles that could limit the deployment of the project results will be provided. In **Section 4** the methods and the materials for the dissemination are described. Events, such as conferences and meetings are mentioned and the importance of attendance by the GASSVESSEL partners is stressed. The role of partners will be further investigated in **Section 5,** which specifies the regulatory framework and the IPR management strategy that should be implemented by each member of the consortium. This section also includes the way the main beneficiaries of WP9 and responsible for dissemination and exploitation intends to stimulate broad participation, raise awareness and engage potential stakeholders.

The present document – Plan for the dissemination and exploitation of results – *is considered as a living document. It evolves and becomes more precise during the lifespan of the project, reflecting the steps undertaken to exploit, disseminate and communicate the generated results*.

For this reason, the GASVESSEL consortium will include confirmations or updates to the following information, explaining how the achieved outcomes have been actually exploited and disseminated.

1. Introduction

1.1 The GASVESSEL project

Key to securing Europe's energy supply is diversifying supply routes. This includes identifying and building new routes that unlock resources and decrease Europe's dependence on a single supplier of natural gas and other energy resources. The GASVESSEL project **opens new possibilities to exploit stranded, associated and flared gas where this is currently economically unviable** and creates new cost-efficient gas-transport solutions. This will be achieved with a novel offshore and onshore compressed natural gas (CNG) transportation system.

New in the CNG transportation concept is the innovative, patented solution for the manufacturing of Pressure Vessels that are 70% lighter than current state-of-the-art alternatives. This enables new ship designs with much higher payloads and consequently dramatically lower transportation costs per cubic metre of gas.

The GASVESSEL project fills a market niche in transporting smaller gas volumes, where it is not justified to use LNG concepts or pipelines. For CNG no expensive liquefying and re-gasification plants are necessary, which drive up the costs of LNG. CNG is much more flexible than point-to-point pipelines and is also not associated with environmental and political difficulties during construction. These reasons make CNG the most efficient transport method for natural gas up to 2500 km.

GASVESSEL will open energy routes in Europe to three different oil and gas fields:

- **East Mediterranean gas fields** – the CNG concept will enable supply of remote areas such as the Greek and Italian islands and Cyprus.
- **Black Sea region** – CNG transport offers a flexible solution for early start-up of gas exploitation, before the planned pipeline will be finished.
- **Barents Sea offshore oil field** – the CNG concept will exploit gas associated to oil winning, which is currently reinjected in the oil fields.

1.2 Objectives

The main objective is to prove the techno-economic feasibility of the new CNG transportation concept. Three geo-logistic gas exploitation scenarios will be analysed to establish where and how the GASVESSEL concept provides added value. Research and development efforts will concern the functional design of the Pressure Vessel, the prototype facilities and the ship design including gas-compression and decompression systems. This new concept will finally be validated with a cost-benefit analysis and a class design review and safety assessment.

1.3 Impact

The GASVESSEL concept contributes to ensuring secure and affordable supplies of energy to Europe by diversifying supply routes. It allows identifying and building new routes that decrease the dependency of EU countries on a single supplier of natural gas and other energy sources. More efficient and economically viable off-shore CNG transport make waterborne supply of currently unexploited gas resources that dramatically exceed current annual gas consumption in Europe, commercially interesting.

On top of that, the GASVESSEL concept is expected to open important additional business opportunities for European industries from shipbuilding, shipping, Pressure Vessel manufacturers, epoxy resin and carbon fibre manufacturers to oil and gas and energy production companies.

1.4 General methodology for the exploitation and the dissemination of results

This section describes the strategy taken by the project partners to ensure successful dissemination, communication and exploitation of the GASVESSEL project. It describes the objectives of the foreseen actions, the aims that the partners want to reach from the implementation of the project

activities, which audience is addressed and with which message, the responsibilities of each GASVESSEL consortium partner, the dissemination and exploitation channels that will be used throughout the project.

GASSVESSEL partners have recognised that the fully maximisation of the project's outcomes has two major dimensions:

- Exploitation
- Dissemination and Communication.

A general methodology has been developed to maximise the exploitation of the project results and consequently, their dissemination and communication. The adopted methodology is meant to monitor the emergence of any innovation at early stage a on a regular basis and aims at establishing a smooth and continuous flow of information related to the generated knowledge during the project lifetime. The route towards the exploitation opportunities follows the next approach:

- Description of any potential innovation that could be valorised during and after the project duration;
- Benchmark the innovation against state-of-the-art ideas or products;
- Identification of relevant value chains, markets, potential users and possible stakeholders;
- Identification of the exploitation potential of the project and its exploitable benefits in the targeted markets;
- Preliminary analysis of the targeted markets, potential competitors and possible hurdles to the deployment of GASVESSEL project results;
- Definition and implementation of different dissemination methods and materials appropriate for each target group;
- Description of the existing regulatory framework, the background IPR ownership of each partner and a preliminary freedom to operate analysis to evaluate the exploitation potential of the project's results among the targeted markets;
  Protection of the innovations through the filing of patents and arranging the formalities in case of joint ownership.

It is clear that the effective dissemination and communication is a fundamental activity in any innovation process, since the success of these activities contributes decisively to the short and long-term success of the project – as measured by knowledge usage by external entities and its degree of adoption. For this reason, the main objective of dissemination of the GASVESSEL project is to ensure broad market take-up of the GASVESSEL concept and the results and knowledge obtained during the project.

This entails:

- *Raising awareness* of the GASVESSEL project to create wide-spread acceptance;
- *Spreading information* on technological breakthroughs and results for teaching and to stimulate further research;
- *Spreading information* on industrial applicability and exploitability of the results.

Information will only be shared with a wider audience after appropriate measurements have been taken to protect the IPR of the GASVESSEL consortium members.

1.5 Exploitation Questionnaire

An *exploitation questionnaire* has been drafted to be addressed to each partner involved in the implementation of the GASVESSEL project. The main objectives of the questionnaire are:

- To assess the state-of-the-art of the innovative features and the targeted TRL within the GASVESSEL project in order to settle and update assumptions made in the previous analyses (project proposal);
- To validate the IPR management strategy of the consortium members and the to investigate the possibility of future agreements to further exploit the project's results;
- To better shape the business needs and the opportunities;
- To validate and improve the analyses and the exploitation strategies.

The questionnaire is divided in three distinct sections.

- *The first section* aims at gathering information to better understand which exact role they have in their own value chain and to assess what is the TRL of their technologies within the GASVESSEL project;
- *The second section* wants to explore the strategy of the partners and their expectations on the project;
- *The third section* aims at investigating the sustainability of the project, beyond its duration.

PNO is the partner of the consortium responsible for the exploitation and dissemination activities. IPNO distributed in January 2018 the questionnaire to all GASVESSEL partners regarding the exploitation potential of the different innovations. The partners have returned the *questionnaire* and some pieces of information provided have already been included in the present document.

As the project is still on-going, is still too early for the partners to make some estimations about possible hurdles for the GASVESSEL market uptake, the sustainability of the project; for this reason, the same questionnaire will be delivered to the partners in the next consortium meetings. This will support the GASVESSEL partners to better address the exploitation strategy, once the project has achieved a more advanced level of development.

1.6 Intended audience of this document

The Plan for the Exploitation and Dissemination of Results is aimed at the following audience and respectively at the fulfilment of the following objectives:

Exploitation	**Dissemination**	**Key Players** *(industrial players directly involved – oil & gas and energy sectors, petrochemical industry, ship design companies, logistic industries and shipyards…)* • Close engagement and collaboration
		Subjects/Defenders *(industrial players not directly involved – construction, manufacturing and automotive sectors).* • Keep informed; • Capacity building (potential supporters and ambassadors of the project results)
		Context setters *(institutions, NGOs)* • Meet their needs; • Mitigate possible negative influence; • Raise awareness;
		Crowd/ bystenders *(Civil society)* • Monitor their needs • Raise awareness

2. Exploitable knowledge

2.1 Innovations

The **key enabling business case** for introducing the new CNG transport concept is related to the introduction of the Pressure Vessel Manufacturing capacity.
The key issues where R&D is needed to realise the novel concept are: 1) **Pressure Vessel Manufacturing, 2)** elements of **the Ship Design** and **3)** the Gas **Loading / Unloading System.** The following R&D activities will need to be carried out (for details see table 1 below) to go from current state-of-the-art to needed level of development. For the **Pressure Vessel manufacturing** the project will investigate basic Pressure Vessel production, liner production, impregnation, composite wrapping, curing and auto-frettage. The concept has an Approval in Principle by project partner American Bureau of Shipping (ABS)[1]. The full preliminary outline of the **conceptual ship design** including relevant engineering simulations, has been developed in 2014, but R&D will need to be carried for the gas loading / unloading system; calculations and drawings of piping system, hull and propulsion; and gas transport calculations. Finally, **onshore and offshore gas loading system** designs will be developed to fit the GASVESSEL solution.

	Current state of maturity basic or comparable technologies	**Innovation based on the basic technologies**
Pressure Vessel Manufacturing		
Basic PV production	Currently, PVs used for CNG transportation are *composite cylinders*. In type 4 PVs technology (internal plastic liner), the state of the art allows to produce PVs of small dimensions. This technology has a criticality in the junctions between the metal part and the plastic part (HDPE) as both materials (subjected to high pressures and temperature changes) show different thermal expansion coefficients. The poor reliability of the welding can cause gas leaks and this problem is amplified when the surface increases (major size of the PVs).	The new process implies a new type of high pressure cylinder type 3 stainless steel welded liner. This technology makes possible to produce very large liner with a very small wall thickness, reduces weights and the cost of the liner and its transport will be cheaper. The new composite PVs will be produced by using austenitic steels, conferring a major reliability of the welded parts.
Liner production	Existing process engineered and patented for but never applied for Pressure Vessels.	The new process combines the filament winding technology with hydroforming to create a liner of great dimensions, with minimum weight, made of stainless steel and perfectly impermeable to gases. This technology is applicable to austenitic steels and it allows to obtain the following benefits: increase of elastic range and ultimate tensil strength; appropriate reduction of deformation parameters into acceptable values and achievement of a perfectly smooth surface of the liner.
Impregnation	Traditional impregnation process.	Tailored Drum/Dip type resin impregnation bath specifically designed CF composite system based on novel more formulated epoxy resins. To be tailored

[1] Official maritime certifying organization

		for specific very large-scale vessels based on novel highly tunable resins. Opportunity to facilitate impregnation process and curing, towards higher speed and single curing step.
Composite wrapping	Automated single multi-axe robot filament winding for smaller scale vessels. Existing pilot process for multiple multi-axe filament winding robots for aeronautics industry	Automated multiple -multi-axe robot filament winding for very large vessels. Opportunity to be adapted for application to large scale Pressure Vessels.
Curing	Multiple curing steps in smaller scale ovens. Existing (autoclave) based curing	One step curing of very large-scale vessels. Possibility of using the metal liner as an oven, blowing hot air through the nozzles of the Pressure Vessel and allowing a better polymerization reaction of the resin from the inner layers to the outer one and a better alignment of the fibers.
Auto-frettage	High pressure liquid based auto-frettage for standard type 3 Pressure Vessels.	Autofrettage is a metal fabrication technique in which a pressure vessel is subjected to enormous pressure, causing internal portions of the part to yield plastically, resulting in internal compressive residual stresses once the pressure is released. High pressure liquid based auto-frettage for ultra-thin and very large vessels. Existing process to be adapted to large scale and ultra-thin walls Tuning auto-frettage to steel type, wall thickness (elasticity, plasticity etc.) and outer composite layer.
Key Elements of Ship Design		
Gas Loading / Unloading	Gas compression by standard gas compressors	The compression/decompression system has to be specifically designed for the GASVESSEL project application, which means that the capacity of compressors, the inlet/outlet pressures and the power needed to perform this operation will all be designed specifically for the ship and the operational conditions. The novelty of the design consists in the high pressures and in the large quantities. The 250-300 bar gas pressure that are needed are not the usual pressure parameters needed in standard ships. Moreover, the capacity of the gas that has to be compressed is larger and the operation has to be carried out with high speed in order to be efficient. Currently, such compressors might be already used onshore but for their use in marine environment, additional items have to be taken into account. Decompression will be carried out thanks to specific equipment installed on the shore unloading terminal. Moreover, on the shore loading/unloading terminals blocks for cooling and heating the gas will be installed. The optimal choice of the loading / unloading facilities will allow keeping the cargo transfer time and energy for the process low. Study, simulations and mathematical tools will be used. This will increase yearly export rates of gas from a specified field and reduce the number of ships needed in the fleet.
Pipe connection	Pipe connection system for gas and fluid transport	The systems of supplying gas Interconnectors will be built to connect the existing infrastructure of gas

design		transmission systems with onshore loading/unloading terminals. In some places (for example, islands in Greece or Italy), where there is no gas transmission system, but gas distribution local networks have been built, it will be necessary to build the appropriate interconnectors. The necessary technical calculations for the projects of such infrastructure should take into account the loading and unloading parameters of GASVESSEL.
Hull (structural design and stability)	Hull for standard LNG gas transport	Currently there are no internationally accepted specific requirements for such a ship. This is mainly because such a ship does not exist at the moment. The existing IMO (International Maritime Organisation) code is applicable to LNG transportation, where the maximum expected pressures for tanks is around 15 bars. In the frame of GASVESSEL project and in CNG transportation, we have to consider a pressure around 250 bars; for this reason, these rules are not applicable. Currently, also thanks to the implementation of the project, ABS is preparing a guide for building and classing CNG ships. The guide will be based mainly on IMO-IGC code requirements, but there are special items that need to be considered together with Risk Assessment studies. In order to make a ship fully operational, a well organised documentation package has to be prepared, in order to justify the design aspects and all the safety measures considered in this task.
Gas transport	LNG ship standard	Longitudinal and local strength calculations needed to certify the ship for carrying CNG and the connections between the gas Pressure Vessels and manifolds, as unlike in LNG tankers there will be a large amount of pipework that forms part of the hydrocarbon containment system. In terms of Class Rules, the same applies to this element as for the Hull development. Special attention will be given to hull structural strength for collision and grounding. Also in the construction of LNG loading, unloading and storage systems, it will be necessary to use shut-off, control valves and connections of the Zero Leakage class to prevent gas leakage from the system. Similar principles will be applied to the construction of the GASVESSEL coupling with underwater manifold and pipeline since after unloading the GASVESSEL, the underwater pipeline and the SAL system will be exposed to high pressure.
Propulsion	Standard propulsion design	New environmentally friendly propulsion system using transported gas and residual gas after unloading for return voyage. Propulsion system will grant 30% reduction of CO2 emissions and 85% of NOX emissions compared to fuel oil. In addition, a superior grade of redundancy in the installations will be studied in order to avoid disasters due to the loss of propulsion and manoeuvrability in case of blackout or malfunction of some equipment.

		Currently there are IMO regulations for this kind of propulsion (IGF code) in LNG fuelled ships, but a new designed propulsion system has to be designed within the GASVESSEL project.
Gas Loading / unloading System		
Offshore loading system	Submerged low pressure Turret Loading system (TRL9)	Existing STL or SAL concept needs to be upgraded. innovation will result in adapting the systems to operate at 300 bars. Calculations, simulations and adapting of design will be carried out (TRL5)
Onshore loading and unloading system	Pipe connection and harbour storage in gas containers (TRL9)	The receiving system will need to be designed to fit the CNG conditions. The novel Pressure Vessels will be the standard containing system. The innovative study is referred to design onshore receiving stations, safe and reliable, in condition to handle the 300 bar CNG, reduce the pressure to the operative level of the domestic distribution net (70-120 bar according the country) delivering the gas directly to the users. (TRL5)

2.2 Value Chain analysis

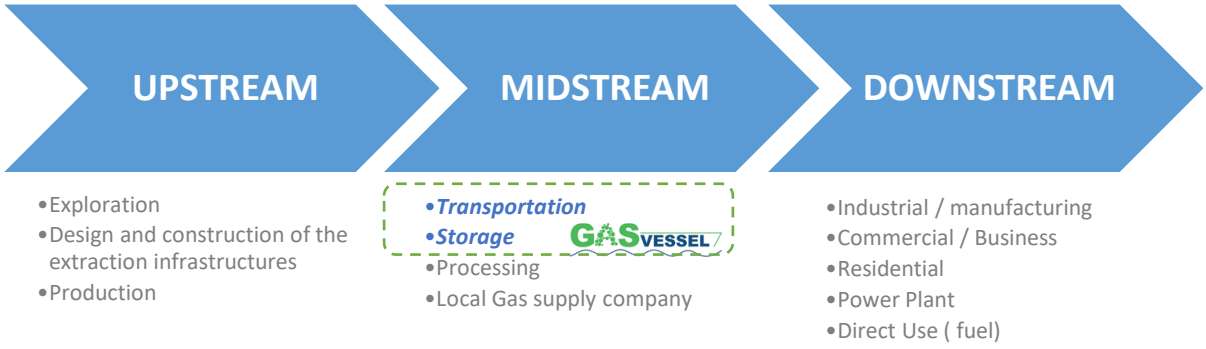


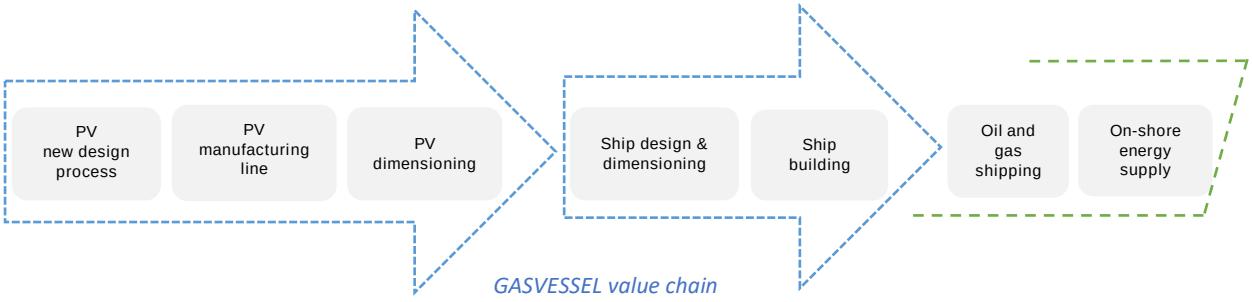
Figure 1. Phases of the gas industry value chain that are mainly affected by the GASVESSEL project.

GASVESSEL project aims at developing a novel and financially viable offshore and onshore CNG transportation system to collect, transport and unload natural gas from oil and gas fields into the distribution network. The innovations included in the concept (both technical and cost-effective) will contribute to improve the proficiency of the currently available gas fields; above all, **the project will open new routes for the exploitation of stranded, associated and flared gas** where currently this appears as not as a feasible option, due to the high costs of operations, transports and logistics.

The gas industry encompasses a wide range of different activities and processes, which jointly contribute to the transformation of the raw resource into useable end-products valued by industrial and private customers. These different activities are inherently linked with each other (conceptually, contractually or physically) and these linkages might occur across many different individual firms and can go through national boundaries. In this framework, **the development of an alternative transport system of CNG will dramatically affect all the steps of the gas industry value chain**. Firstly, *GASVESSEL will completely revolutionise the midstream phase* (transportation and storage modes); moreover, transformations will have an impact both on the *upstream* (new exploitable resources available) and *downstream phase* (reduction of operational costs). For this reason, ***a value chain analysis*** is needed to better investigate which impacts the project will have on the different

economic sectors (and related players) involved in the gas industry value chain, the specific GASVESSEL project value chain and the partners' value chain. More in detail, the value chain analysis will pursue:

- Which stage(s) of the gas industry value chain will be mostly affected by the innovations introduced during the implementation of the project;
- How the innovative solutions created during the implementation of the project will allow the partners to improve their performance in their own sector of activity.
- How the innovations will have an impact on the project partners' ***sphere of influence*** (customers and buyers identified within the own partners' value chain).



GASVESSEL value chain

In the following pages, the analysis of each partner's value chain is reported.

NAVALPROGETTI

Sector	Ship design and engineering
Gas Industry value chain	*Midstream* (transport)
GASVESSEL value chain	Ship design
Core service	Consulting, design and engineering. Structural and hydrodynamic calculations, seakeeping, mooring and DP analysis, inclining experiments and ship surveys, on-site measurements for vessels operating in iced water, etc.
Sphere of influence	• *Offshore industries:* drilling companies; • *Marine:* merchant vessels (tankers, fishing vessels, mega yachts, car carriers, etc.).

Dow Chemical

Sector	Petrochemical industry
Gas Industry value chain	*Upstream/ Midstream* (industrial/ manufacturing)
GASVESSEL value chain	PV manufacturing – raw materials supplier

Core service	Chemical corporation, which manufactures basic plastic and performance chemicals. Fuels and oil-based raw materials.
Sphere of influence	• *Oil and gas Industry.* Exploration, production and drilling; pipeline insulation; gas processing and midstream. • *Mining Industry.*

Dow AKSA

Sector	Chemical industry
Gas Industry value chain	Transportation
GASVESSEL value chain	PV manufacturing
Core service	Joint venture between Dow and AKSA for the manufacturing of high-quality carbon fiber.
Sphere of influence	• *Transport.* Aerospace, automotive and marine; • *Energy.* Wind energy and energy storage; • *Infrastructure.* Infrastructure repair, construction industry.

PNO

Sector	Innovation consultancy -
Gas Industry value chain	/
GASVESSEL value chain	/
Core service	Maximise the impact of the project results through proper management, exploitation and dissemination
Sphere of influence	• *Industry* (Chemical, manufacturing, ICT, energy, food…) • *Agriculture* • *Education and Research* (Universities, research clusters…)

Vnipitransgaz

Sector	Oil and gas transport, gas storage and gas treatment
Gas Industry value chain	*Midstream/ Downstream*
GASVESSEL value chain	Gas shipping / on shore energy supply
Core service	Design and engineering of gas and oil pipelines, refineries, processing plants, gas supply systems for residential areas, industrial buildings, refuelling stations for vehicles., underground gas storages.

Sphere of influence	• *Public sector.* National entities for gas supply; • Offshore gas and oil producers, distributors.

Sintef Ocean

Sector	R&D institute
Gas Industry value chain	*Midstream* - Transportation
GASVESSEL value chain	Ship building / gas shipping
Core service	R&D, technical consulting to verify solution for the shipping and maritime equipment industries and in the maritime sector for industry and for offshore petroleum production.
Sphere of influence	• *Transport and energy.* Gas industry, shipping industry; • *Public sector.* Research institutes, universities, navy.

BM Plus

Sector	Mechanical Sector
Gas Industry value chain	*Upstream/ Midstream* – Industry transportation
GASVESSEL value chain	PV new design process/ PV manufacturing
Core service	Design and construction of machines and gears for the industry
Sphere of influence	*Industry* (steel and iron, textile, mold…)

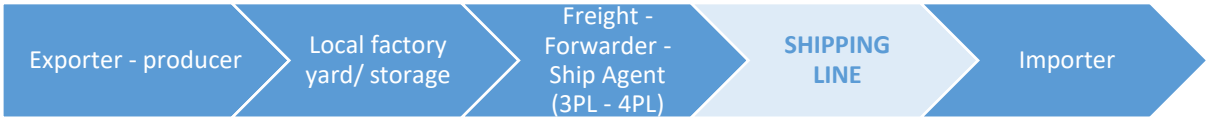
CNGV

Sector	Manufacturing of high-resistance composite vessels
Gas Industry value chain	*Midstream* - Transportation
GASVESSEL value chain	PV new design process/PV manufacturing/PV dimensioning
Core service	Design, development and testing of prototypes and process simulation for energy generation and conversion system
Sphere of influence	Energy industries, partnership with research institutes and universities.

cEnergy

Sector	Advanced technologies in energy conversion and storage provider
Gas Industry value chain	*Midstream* - Storage
GASVESSEL value chain	Gas shipping / on shore energy supply
Core service	Design and production of high-resistance composite vessels with inner metal liner and vessels made by said method. ?? Thermal and Thermodynamics studies and analyses
Sphere of influence	Gas and oil industry

Hanseatic Lloyd



Sector	Shipping operation
Gas Industry value chain	*Midstream* - Transportation
GASVESSEL value chain	Gas shipping
Core service	Provide and operate vessels (which implies ownership of vessels and operation).
Sphere of influence	Logistic companies, carriers.

Cyprus Hydrocarbons company

Sector	Exploration, production and monetization of Oil and Gas reserves from the Exclusive Economic Zone (EEZ) of Cyprus.
Gas Industry value chain	*Upstream*
GASVESSEL value chain	Gas shipping / on shore energy supply
Core service	Provide and operate vessels (which implies ownership of vessels and operation). CHC to better specify
Sphere of influence	Logistic companies, carriers.

ESTECO

Commissioning	**Design**	Implementation	Operation

Sector	Technology provider
Gas Industry value chain	*Midstream-upstream*
GASVESSEL value chain	Gas shipping / on shore energy supply
Core service	Software provider and developer.
Sphere of influence	• *Transport*. Aerospace, automotive, marine and offshore; • *Infrastructure*. Architecture, engineering and construction industry; • *Energy and environment*. • *Health.* Biotech and pharma.

American Bureau of Shipping

Commissioning	**Control and quality check**	Operation

Sector	Shipping industry
Gas Industry value chain	*Midstream*-transport
GASVESSEL value chain	PV design and manufacturing / Ship design
Core service	Traditional classification services, as well as on-the-ground technical services, auch as assessment of performance and life cycle management.
Sphere of influence	Marine, offshore oil and gas industries. Partners from: • *Industry stakeholders.* Industry owners and operators, shipyards and manufacturers; • *Public sector.* Govermental bodies and classification organisation. • *Academic stakeholders.* Universities and research institutes.

2.3 Stakeholders analysis

During the implementation of the GASVESSEL project, the consortium is going to define a methodology for extending the project results both at national and EU level. While doing this, it will be relevant to interact with several **stakeholders** outside the GASVESSEL project – *located via personal contacts of the partners involved*. These will mainly be potential users of the project tangible (products – such as pressure vessels, improved materials and transport modes) and intangible (technologies, know-how, processes, etc.…) results, as such, should be important in

pointing the uses of such results and how they should be implemented to be better exploited in the market.

In this preliminary PEDR, the consortium has already identified the main target groups that will be addressed during the GASVESSEL project:

- Industrial clusters
- Oil & Gas companies
- Shipping industry
- Ports
- Interest & Networking organisations
- Scientific & Research community
- Policy makers
- Regulators
- Media
- General public

So far 176 stakeholders have been identified. All identified stakeholders are listed with the target group they belong to, legal name, country and website in **Table 9**.

3. Possible routes for future exploitation

3.1 Alignment of the project with the policy framework

International level

Recent studies predict a bright futures for the expansion of global natural gas supplies for the next decade, as a result of new technology used to extract gas in unconventional settings. Over a long-term, natural gas can be substituted for oil in some transportation uses. If natural gas prices decline and carbon emissions are constrained, gas-fired electrical power generation plants will likely replace coal-and-oil-fired facilities. **Growth in natural gas demand could be accelerated if governments provide economic incentives to reduce carbon dioxide emissions or if governments reduce the number of nuclear powerplants[2].**

At international level, the **United Nation Framework Convention on Climate Change – UNFCCC,** adopted during the Rio Earth Summit in 1992 represents the main agreement on climate action. To date it has been ratified a by 195 countries and it started as a **way to work together to limit global temperature increases and climate change**, and to cope with their impacts. Other agreements have been signed internationally in the past decades (Kyoto protocol and further amendments, Paris agreement)[3]. In this framework, although the current level of global action is not yet on track to meet the below 2 degrees (relative to pre-industrial level) global goal(Paris Agreement), there is a significant and accelerating trend to global action to reduce greenhouse gas emissions. All the major emitting economies, including China and the United States, have 2020 emissions reduction goals backed by domestic policies and measures.

Climate change and public health challenges, such as air quality, mean that action has to be taken to reduce the carbon footprint, reduce all polluting emissions and move towards a world of more sustainable energy. The transition to renewable sources will take some time yet to achieve, because energy storage technologies, and especially those made possible by gas, must be improved to offer

[2] Attanasi E.D., Freeman P.A., Role of stranded gas in increasing global gas supplies, Open-file Report 2013-14, US Dept. of Interior, US Geological Survey

[3] http://www.consilium.europa.eu/en/policies/climate-change/international-agreements-climate-action/

more reliable and more competitively priced energy. Expert scenarios, and particularly those of the International Energy Agency (IEA), see gas as playing a dominant role during this period of transition: it releases less greenhouse gas than any other fossil fuel, and its consumption will increase.

European level

The European Union has always represented a global leader in climate action and in developing policies for the supply of energy . The EU aims at setting policies to ensure secure, affordable and climate-friendly energy for all citizens. Besides the focus on climate action (decarbonising the economy) the state of the Energy Union points also at diversifying Europe's energy sources through cooperation between Members States. In this framework, to secure gas supply and avoid crises, the Commissions plans to improve the coordination between EU countries and regions. Gas currently covers one quarter of the EU's energy consumption and **the EU represents the biggest gas importer in the world**. Besides, gas is also seen to play a determinant role in accompanying the EU's transition to a low carbon energy system since it is a back-up fuel for renewables when weather conditions hamper renewable energy production. The Commission has also published a proposal to regulate the intergovernmental energy agreements between an EU country and a non-EU country. The new rules will allow the Commission to take action before such agreements are signed if it assesses that such an agreement could affect the security of gas supplies in another EU country or hamper the functioning of the energy market in Europe[4].
The CNG transport solution opens opportunities for the energy supply chain in Europe. The GASVESSEL project addresses the high dependency of Europe from gas import by opening new routes for the exploitation of the unused, associated or flared gas disseminated all along the EU borders, as well as ensuring the utilisation of recently found sites that will benefit from the cost-effective and flexible transportation modes introduced by the project. In this framework, the **project will support the EU member states** (both citizens than governments) **to pursue their goals of energy independence, security of supply, diversification of sources and the transition into a low-carbon economy**.

3.2 Potential impacts of the project

ENVIRONMENTAL IMPACTS		
Reduce flaring		*Reduce CO_2 emissions*
PRODUCERS	**MARKET**	**END USERS**
- *Monetise stranded/ underdeveloped fields*		- *Reduction of the reliance on oil*
- *Produce and sell more gas*		- *Reduction of OPEX*
- *Technology advancements*		- *Fuel cost savings*
ECONOMICS IMPACTS		

The GASVESSEL project is targeted at introducing a novel energy and waterborne transport solution based on innovative CNG transport, first in Europe and later towards other world regions. The project will bring important benefits to *environment, economy and society*.

Environment

In areas where natural gas is produced at oil ores, but it is not economically feasible to transport for sale, usually it is burned *(flared)* in the sites. Natural gas flaring produces CO_2, Sulphur dioxide, nitrogen oxides and many other dreadful compounds depending on the chemical composition of the natural gas and on how the natural gas burns in the flare. However, until recently, flaring has been

[4] https://ec.europa.eu/energy/en/news/commission-proposes-new-rules-gas-and-heating-and-cooling-strategy

considered a safer solution than releasing gas into air as it results in lower overall greenhouse gas emissions. In this framework, the GASVESSEL project will bring **technology advancements to reduce flared gas**, hence **waste of energy sources and emissions of harmful compounds** into the environment.

Economy- market

The GASVESSEL project opens new market at each stage of its duration.

- ***Inside the Consortium***
  - *Short-term benefits*. The partners involved in the **development of innovative processes** have the chance to enlarge their IP portfolio and provide their industrial partners with real-time demonstrations of their technology. Even at this early stage, the partners could exploit the work done under the GASVESSEL project to attract further investments and potential clients in their own sector of expertise.
  - *Mid-term benefits*. Once the project reaches a good-stage of development, the partners will be able to provide their partners with a reliable and a credible technology to better access the stranded and associated gas market and to open new routes to flared gas.
  - *Long-term benefits.* Once the project will be completed, the partners of the consortium will benefit from the long-lasting relationships (both inside than outside the consortium) established during the implementation of the project. Partners will achieve the right know-how on how to deploy the GASVESSEL technology at a large-scale and how to reach new potential investors.

Moreover, the partners will carry out commercial simulations to better define the market introduction strategies, showing potential returns on investments, the impact of the project in their companies' financial forecasts and their growth in terms of industrial capacity and employment. Already in the Exploitation Questionnaire has been demanded to the partners to **quantify the exploitable potential of their outcomes**. Further updates of this document are expected at the end of the project.

- ***Outside the consortium***
  - *Short-term benefits.* Actors from the oil & gas value chain and other groups of stakeholders will have the chance to see in action the technologies developed during the project, evaluate their costs and understand how they can integrate these technologies with their business operations.
  - *Mid-term benefits.* Once the project has reached a significant level of maturity, other industries can be involved in the project, providing active partners with valuable feedback and suggestion on how to adapt the technologies developed inside the project in other applications.
  - *Long-term benefits.* Above all, the long-term benefits that all the targeted groups of GASVESSEL stakeholders consist of: **the possibility to exploit and monetise gas sources from underdeveloped** (stranded) **fields** or from oil sites where otherwise gas sources would be burned or wasted; **an increase in terms of production and sales**. Moreover, stakeholders located at the downstream phase of the gas value chain (energy suppliers, end-users) can benefit from the **reduction of OPEX** generated thanks to GASVESSEL.

3.3 General Approach of the consortium to the exploitation plan

The GASVESSEL partners have different background and core businesses. Thus, **the exploitation interests of each partner are different and complementary**.

Industrial partners

Ship design, engineering and maritime transport logistics

Petrochemical industries

Offshore and onshore service providers for oil and gas industries

Manufacturing industry

Service providers

Technology providers

R&D-performing SMEs and institutes

Classification Organisation

Innovation management consultancy

The GASVESSEL partners have different background and core businesses. Thus, **the exploitation interests of each partner are different and complementary**.

Industrial partners

Industrial partners use ***their significant presence in relevant markets and networks to give weight and exposure to the project results*** relevant to exploitation activities, both to generate new customers, collaborations or networks and to reinforce existing links and commercial collaborations.

The industrial partners involved in the GASVESSEL project are engaged in different sectors: ship design and maritime transport (HLL) materials processing and product manufacturing (DOW, DOWAKSA), energy and service providers to the energy industry or energy suppliers (CNGV, CHC, VPG, GSP), etc.; for this reason, their involvement in the project can stimulate the introduction of innovative solutions in different domains. An overview of their exploitation potential is described below:

NAVALPROGETTI

NAVALPROGETTI is fully engaged in the ship design phase of the GASSVESSEL project; the company is mainly in charge of the analysis of naval architecture (calculations for stability, strength and to ensure the lightest ship weight and experimental tests for manoeuvrability and resistance).
The results of GASVESSEL and its implementation phase could represent for NAVALPROGETTI the opportunity to set up new technologies and new calculation models to provide its clients with new solutions that can be applied in the ship design and more in general in the maritime and offshore industries worldwide.
The innovations developed during the project implementation are perfectly in line with the overall strategy of the company, which since its establishment has placed a strong focus on research activities. For this reason, the GASVESSEL project represents a good opportunity for the company to acquire further experience and abilities that will allow NAVALPROGETTI to enhance its competitiveness among other European firms and to grow its network of clients and business partners.

Dow Chemical

Dow represents a global firm, which drives innovations on chemical, physical and biological sciences to address the most challenging problems of the current society: the need of clean water, clean energy generation and conservation, increasing the agricultural productivity. As the company owns experience and competences in many different domains of science, it represents one of the best players to experience the innovations introduced by GASVESSEL in other fields.

- Science and technology of materials /Industry;
- Infrastructures / construction;
- Energy
- Safety standards

DOWAKSA

DOWAKSA is an international Joint Venture focused on manufacturing of carbon fibers and its derivates with a focus on the energy, infrastructures and transportation markets. The company makes use of the GASVESSEL outcomes to promote and extend the domain of use of carbon fiber in its targeted markets, thanks to the activities related to the optimisation of impregnation techniques based on new higher viscosity epoxy resin system and tailored design and fine-tuned carbon technology for pressure vessel manufacturing process. The achievement of high level technologies in science of materials will give the company the chance to play an active role in setting-up the value-chain partnership.

DOWAKSA represents the only carbon-fiber composites industry's large-scale provider. It is uniquely positioned to supply large quantities of affordable, high-quality carbon fiber to the market, which is foreseen to grow rapidly in the next future. For this reason, the GASVESSEL project represents an opportunity for the company to investigate private and public finance opportunities to support large scale investments.

VTG

VTG is a pioneer company in the development of engineering and technical solutions for the construction of facilities in the Oil and Gas infrastructures. In the Gasvessel project VTG is developing main technical solutions for:

- the installation of process modules for the implementation of the processes of Gas loading and unloading to the GASVESSEL ships;
- Measurement of the quantity of gas, the relative parameters, life support, terminals operations and connection of gas pipelines.

VTG is also monitoring the feasibility study (assessment of the economic impact of the Project and technical indicators for optimizing the Gas loading/unloading systems).

By participating to the GASVESSEL Project, VTG will obtain a better understanding of the future services that the company has to deliver to be aligned with the market requirements; also the project represents a great opportunity to investigate what will be the main direction of development of gas transmission systems in the next future. This project will directly contribute to the expansion of engineering and design services offered in the Gas transportation modes.

More in detail, the results of the GASVESSEL Project will support the company in improving the services related to *intermodal transport systems*. The project will have a positive professional and operational impact on the services provided by VTG to all its customers around the world.

After the completion of the Project GASVESSEL, VTG plans to participate in the popularization of the principle of Natural Gas supplies, using the philosophy of the benefits of supplies without being tied to a specific Gas source, as in the case of main Gas pipelines tied to a particular source.

In addition, the application of this principle VTG will support the creation of a universal Gas loading/unloading grid structure with a reference only to the national Gas transportation networks.

BM Plus

BM Plus SRL was born in 2016 thanks to 45 years of a previous experience in the mechanical industry. It is specialized in the manufacturing of industrial machines and in the revamping of machines for several sectors. The strategy for the next years is to extend the market in new sectors, to implement the knowledge in new technologies, improving the expertise and number of the proper human resources too.

By participating in the Gasvessel project BM Plus will have the chance to improve its knowledge in the manufacturing of new types of machines and to get important experiences in the manufacturing of the new type of vessels. The Gasvessel project represents also the opportunity for the company to get in touch with important public and private entities and start new collaborations.

CNGV

CNGV has been established for the exploitation of the new patent (No. B14-038Wo) which covers the design and the production of high-resistance composite vessels with inner metal liner, reinforced by external winding of high strength fibers, suitable to safely withstand to an operating pressure of 300 bar.

CNGV is fully engaged to develop the pressure vessel and its manufacturing process design. Thanks to the results achieved during the GASVESSEL project, the company has the chance to exploit its technology advancements, through three means:

- By improving the industrial production equipment of pressure vessels and their adaptation to ships. The feedback of knowledge and experience with materials and production technologies will represent an opportunity to update the production equipment to enhance the core business of the company;
- By performing the experimental validation of the patent to guarantee its future applications in other projects lead by the company;
- By developing further R&D activities aimed at developing new business lines.

Hanseatic Lloyd

Hanseatic Lloyd is a logistic company that manages the international maritime container shipping. The company provides the consortium with the right skills to ensure a smooth operation of the ships and their compliance with International safety regulations. As a global player in logistics (the company is a member of the Bremer Reeder Cooperation), Hanseatic Lloyd makes every effort to prepare its business and customers for the challenges of the future. *With challenges becoming more and more complex, the GASVESSEL project represent a chance to achieve a more efficient and sustainable logistic industry in the next years*:

- *Climate and environment:* companies collaborate with each other in order to develop solutions to decrease the fuel consumption and to reduce the environmental impact (e.g. low GHG emissions). In this framework, the technological advancements foreseen in the GASVESSEL project – especially within the ship design phase - could provide a valid support to enhance the environmental sustainability not just of the oil and gas transport mode; the results can be applied not only to the domain of oil and gas transport but more in general to the maritime container transport chain.
- *Flexible and cost-effective transport mode:* logistical and transport systems will have to adjust for new markets and products in ever shorter time frames. For this reason, the GASVESSEL project represents the opportunity for Hanseatic Lloyd to analyse the real needs and requirements of its clients (ship agents, freight forwarders, export companies) and to use new solutions based on the technologies developed and tested during the implementation of the project.

CHC

CHC is the national Oil and Gas Company of Cyprus and it has the mandate to act as the technical and commercial arm – on behalf of the government- on matters related to the exploration, production and commercialisation of oil and gas reserves of Cyprus.

Service providers

PNO

The GASVESSEL project represents a very valuable twofold opportunity for PNO:
- On one side the project will allow the company and its technicians to gain important and further expertise on CNG transport concept and more in general, on technologies to explore new energy supply routes.
- On the other side, the project will provide the opportunity for PNO – during the dissemination activities and networking – to get in touch with interesting organizations to offer them its *know-how*

and services and stimulate and support innovation all over Europe. Among such services, PNO comprises also support to access to EU public and systematic innovation starting from companies' technological needs in order to identify possible "solutions" that will increase industries' competitive advantages on innovation.

Sintef - Ocean

The main result from the point of view of Sintef - Ocean is the application of the knowledge acquired during the performance of qualitative and quantitative assessment of the GASVESSEL solution. Considering that Sintef - Ocean is a research institution, this result will be marketed through different means:

- Scientific publications in specialised journals and platforms (as an important component of the production of a research centre) will be generated;
- The GASVESSEL project will represent as success case to be shown to potential clients and partners in the industrial environment.
- Further exploitation routes can be explored among other departments of the institute (renewable energy, infrastructures, climate change and environment, society, ICT…)

ESTECO

ESTECO is a supplier of integration, simulation and optimisation technology and consulting services for many sectors of industry (automotive, aerospace, manufacturing, pharmaceutical, petrochemicals

…). ESTECO's main product is modeFRONTIER, a software environment that allows product engineers and designers to integrate their CAE tools (CAD, Finite Element Structural Analysis, etc.) into a multi-disciplinary and automatic process flow. The development of a platform in modelFRONTIER in order to perform the scenario cost analysis and safety analysis of the new designed Pressure Vessels represents the main task of ESTECO in the GASVESSEL project.
ESTECO is committed to lead the development of this software-based integrated tool to realise an efficient and intermodal gas transport service. Its participation to the GASVESSEL project will allow ESTECO to participate with a large scope of the European industry on the development of a new gas transportation technology that will open new routes and draw new scenarios for the exploitation of energy resources (flared/ associated gas). The results of the project will allow the company to improve existing products, identify new services thus ensuring that ESTEC continues creating software-based integrated tools to improve the performance of already existing industrial partners and to generate the cooperation with emerging actors.

cEnergy

The R&D based SME partner - cENERGY will focus on network building, raising their profile and seeking opportunities for commercial linking and co-exploitation of project results or provision of innovative services in their current area of operation. They will be able to exploit the project activities to leverage company growth through an improved high-tech reputation for the company, new opportunities for collaboration and new service offers that can open new markets.

ABS

ABS regularly partners with industry stakeholders -owners and operators, shipyards and manufacturers, governmental entities and other classification organisations – to research and develop solutions to evolving technical, regulatory and performance challenges in the marine and offshore industries. For this reason, within the project *ABS uses its strong reputation among the industry sector targeted by the GASVESSEL project to bring to light the results achieved during the implementation of the project*. Moreover, ABS is involved in many other innovation projects, which

could open new routes for the exploitation of the innovations introduced within the GASVESSEL project.

3.4 Extensions to other domains

Although the novel gas transport concept - and consequently, all the technological challenges included in the project - are focused on unlocking currently not exploited gas sources (stranded-associated sites or flared gas) through CNG, **the innovations could also have relevant application possibilities**.

CNG storage cylinders for alternative Natural Gas Vehicles - NGVs

The biggest advantage of NGV vehicles is that they can drastically reduce environmentally harmful emissions. NGVs can achieve up to 93% reduction in carbon monoxide emissions, 33% reduction in emissions of various NO_x and they can also reduce PM10 emissions. Moreover NGVs are cheaper because natural gas is a convenient and abundant resource and maintenance costs of the engine are lower than the other fossil fuel-based cars. On the other hand the biggest compliant about NGV is their fuel storage system. Storage cylinders can be expensive to design and to build. Innovations introduced within the GASVESSEL project **- *mainly in the sector of the pressure vessel manufacturing*** **-** can increase the advantages of the NGVs.

In particular, it has been showed that the **hydroforming technology** is easily scalable and applicable with maximum benefits to produce vessels and CNG storage cylinders of different sizes. Fatigue tests performed on austenitic steels (mainly AISI 304 and 301) with a thickness of 1.2 mm have showed that the material goes beyond the same number of test-cycles than steels 6 mm thick, reaching the expected standards. For this reason, the innovative process developed for manufacturing the pressure vessels for the maritime CNG transportation, could be applied also in Natural Gas Vehicles, for the production of low-cost, lighter and safer CNG storage cylinders.

Pressure vessels produced in the framework of the GASVESSEL project are expected to be located in an *inert environment* in the carriers compartments; in order to be deployed in further applications, their resistance to the atmospheric agents should be increased. For this reason, the innovative **impregnation process** will be based on the use of resins that are expected to have a longer lifespan and have an increased resistance to UV rays.

Hydrogen transport

Hydrogen is an energy carrier with great potential for clean and efficient power; it is envisaged as a significant element of the future fuel for transport, enhancing energy security, reducing oil dependency, GHG emissions and air pollution. In order to realise a future hydrogen-based economy, key economic determinants will be cost and safety of the fuel distribution system from the production site to the point of end-use. This represents a challenge for any fuel, but hydrogen is unique due to its high diffusivity, its extremely low density as a gas and liquid and its broad flammability; these properties present special cost and safety obstacles at every step of the value chain. **Hydrogen can be transported in several ways**, including **as a compressed gas**.

For this reason, innovations introduced during the GASVESSEL project will offer a flexible and cost-effective solution not only for the exploitation of gas, which is clearly a non-renewable energy source, but also for the deployment of renewable energy resource, to boost the European transition into a clean energy based economy.

Ship design

Some actions taken within the GASVESSEL project are focused on the adaptation of the carriers to the mew dimensions of the pressure vessels. For instance, the project foresees the development of a new environmentally friendly propulsion system, using residual gas after unloading for return voyage. Thanks to this system emissions of CO_2 and other harmful compounds will be drastically reduced. This system, which will improve the energy efficiency of the fleet, could meet the demand of the transport industry in general (oil & gas industry, renewable sources, freights and other goods).

3.5 Preliminary market analysis (trends, market size and competitors)

An important activity that needs to take place in the next few months and which will contribute towards the production of the PEDR is to start to assess the extent to which the GASVESSEL results can be commercialised and which are the next steps for the market's uptake. For this reason, a market analysis is required. This document will introduce the market segments, the trends, the expected growth and it will set the basis for a competitors' analysis. The complete market analysis will be further investigated during the project implementation by PNO in the deliverable D9.5, titled *"Business Plan for the project results and 6 Business Cases"*. Moreover, an in-depth analysis will be also developed within the *WP7 "Cost-benefit analysis"* and it will include:

- Estimation of the commercial strengths for **a financial viable CNG technology**;
- Identification of the **markets that could be suitable for the proposed CNG technology**;
- Evaluation of the CNG technology with respect of the environmental and **economic flows** in a life cycle inventory (LCI).

Moreover, a deeper investigation of possible obstacles that the consortium could face during the implementation and exploitation of project outcomes and related mitigation measures is needed; for this reason, a question on which risks the partners foresee for market uptake of the project results has been included in the *Exploitation Questionnaire*. When the partners will return the filled Questionnaire, the present document will be updated, according to their viewpoints.

General overview of the CNG market size

The shift in trend towards adoption of unconventional transportation fuels to reduce carbon footprints is expected to remain a key driving factor for global compressed natural gas (CNG) market. The emergence of CNG as low-cost fuel coupled with growing energy demands is expected to have a positive influence on global CNG market growth. It costs lower than traditional fuels such as gasoline and diesel and produce energy equivalent on combustion.

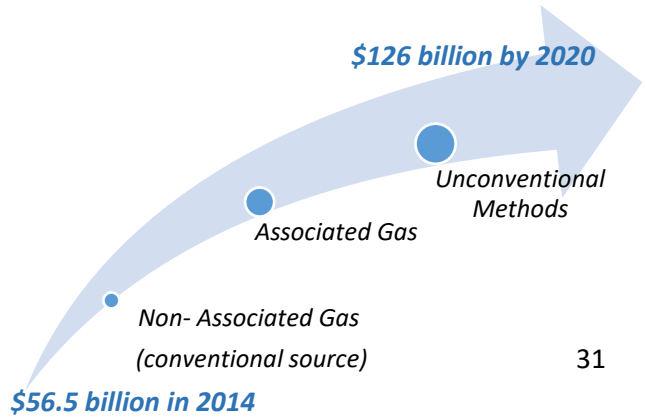


Figure 2. Global CNG Market forecast (2014-2020).
Source: Market Research Store, 2016

Exploration of shale gas and other non-conventional sources of energy, increasing government regulations on account of environmental concern i**s expected to have a significant impact on global CNG market over the next future**. The global CNG

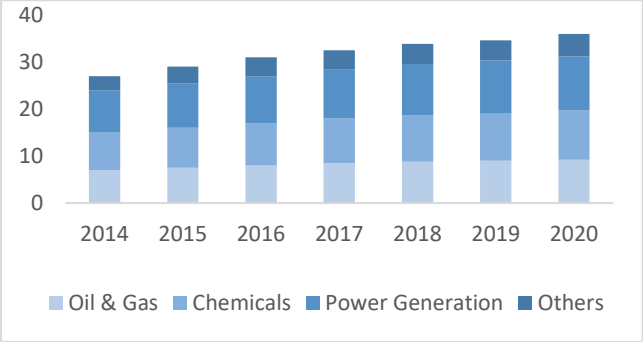
market is expected to reach USD 126 billion by 2020 (from USD 56.5 billion in 2014); this growth is foreseen in all its segments (see *Figure 2*). As the GASVESSEL project mainly has effects on the maritime *transportation* (CNG carriers) and *storage* (pressure vessels) phases of the CNG value chain, further investigations in these segments are needed.

CHC has carried out a preliminary market analysis in the framework of the GASVESSEL project, which specified the **targeted market niche** and **the most relevant geographical areas** for the market uptake of the project outcomes.

As a main segment to target, CHC has identified the *isolated sites,* represented by all the offshore locations positioned between 100-200 km of distance from the already existing grid. Another important market segment is represented by all the coal/oil-fired power plants that soon will switch into natural gas.

From a geographical point of view, CHC has considered mainly located in the South Mediterranean area such as Cyprus, Greece, Italy, Lebanon and Egypt; these countries represent a huge market opportunity both as CNG importers than exporters. Above all, Egypt is a different case compared to the others, mainly due to its larger dimensions. Egypt represents a huge market opportunity as in the next decades, the balance of demand-supply is expected to grow significantly. Moreover, Egypt is a mature country in terms of gas infrastructure as it owns a well-structured grid of pipelines and related gas facilities. For this reason, Egypt together with the above-mentioned countries (further investigated in the next steps -and related deliverables of the project) represent the main geographical for the GASVESSEL market uptake, both in their home-markets than for their export markets.

Pressure vessel market overview



CNG pressure vessels are widely used for storage and transportation of liquids and gases at high pressure. As mentioned above, such changing energy patterns and environmental issues across the world are expected to drive the industry volumes in the near future. In the recent years, decreasing oil and gas projects have hindered the revenues; on the other hand, the chemical industry is expected to enhance its demand of pressure vessels.
Segmentation based on geographical area shows that Asia- Pacifica leads the global market (in 2015 Asian industry accounted for 35%. Developed renewable sectors, mainly in China, India, South-Korea and Australia is expected to drive the regional market. In addition, increasing government initiatives to expand power generation capacities is anticipated to significantly contribute towards regional market development.

Seaborne transportation market overview

As the backbone of international trade, seaborne transportation plays a major role in the world's industries and society, enabling the transport of large volumes of raw and processed material, as well as food, water and technological products. Growing cross border e-commerce, digitalisation and technology advancements in industry sectors have the potential to reshape maritime trade patterns and drive their global growth. In this framework, global oil seaborne trade is estimated to grow at

1.8% until 2035 (IEA), driven to large extent by increasing demand coming from emerging economies. Besides that, fossil fuels will remain the dominant energy source until 2035, with both gas and renewables though being set to grow rapidly in the coming years (thanks to the implementation of environmental policies).[5]

4. Dissemination Materials and tools

For dissemination and communication of the GASVESSEL project, we make use of different materials and tools. Different tools will be used for different levels of communication and for different purposes and audiences. We show examples and screenshots of the materials and define a timeline and actions that still need to be taken.

4.1 H2020 acknowledgements

All dissemination materials should at all times acknowledge EU funding to the GASVESSEL project.

The following sentences should be use:

- For **publicity and promotional materials**:
  "The GASVESSEL project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement no. 723030."
- For **patents**:
  "The work leading to this invention has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement no. 723030."
- For **publication of results**:
  "The research leading to these results/this publications has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement no. 723030."
- **Disclaimer excluding EU Agency responsibility**:
  "This paper/presentation/article/publication reflects only the author's view and the Innovation and Networks Executive Agency (INEA) is not responsible for any use that may be made of the information it contains."

4.2 Logo

The project logo is designed to be easily recognisable to create immediate association with the GASVESSEL project. Different logos have been discussed among the partners.

[5] https://maritimetechnology.nl/media/2017-Market-Forecast-Report-finaal.pdf

Figure 3: Proposed GASVESSEL logos.

The logo will be prominently featured on all other project materials and tools, every document produced within the project context and all pieces of communication, such as email signatures and presentations. Its design and colour schemes will define the project identity. It is necessary that every newsletter, poster, presentation, event, brochure and deliverable make use of this image and be consistent with its style.

Figure 4: Final GASVESSEL logo.

The chosen GASVESSEL logo presents a 'green' marine transport of gas - represented by the bubbles.

4.3 GASVESSEL website

The purpose of a website is to gather all information and news about the project. All promotional materials should include a link to the website. It should be the portal, which external stakeholders can use to find out more about the GASVESSEL project and to connect to the project management and administration. The website is described in a separate deliverable (D9.3 Public and internal website).

The website can be accessed through the URL www.gasvessel.eu. The homepage (*Figure 5*) contains a short summary of the project, a form to subscribe to the GASVESSEL newsletter, the latest news and events and links to all GASVESSEL consortium partners. There are five subsites:

- **About**: Contains information about the GASVESSEL project – a summary, objectives and impact of the project.
- **Consortium**: Lists all project partners, including logos and links to their websites.
- **Downloads**: Contains all documents, reports and promotional material that is not restricted for the public.
- **News**: Contains items on news and events organised by the GASVESSEL and other events that are attended by the GASVESSEL partners.
- **Contact**: Contains contact information of the project coordinator and a contact form to leave a message.

All subsites list the latest news and event items and a form to subscribe to the GASVESSEL newsletter.

There is also a restricted area, which is accessible only to consortium members. On this subsite, consortium members can connect, exchange restricted reports and documentation. It contains a calendar, polls and doodles for organisational purposes.

The website will be presented in English and all information should be as accessible as possible to a broad audience. Since the URL of the website should be listed on all promotional materials and press releases, it is to be expected that members of the general public are as likely to visit the website as policy members and potential users of the GASVESSEL concept.

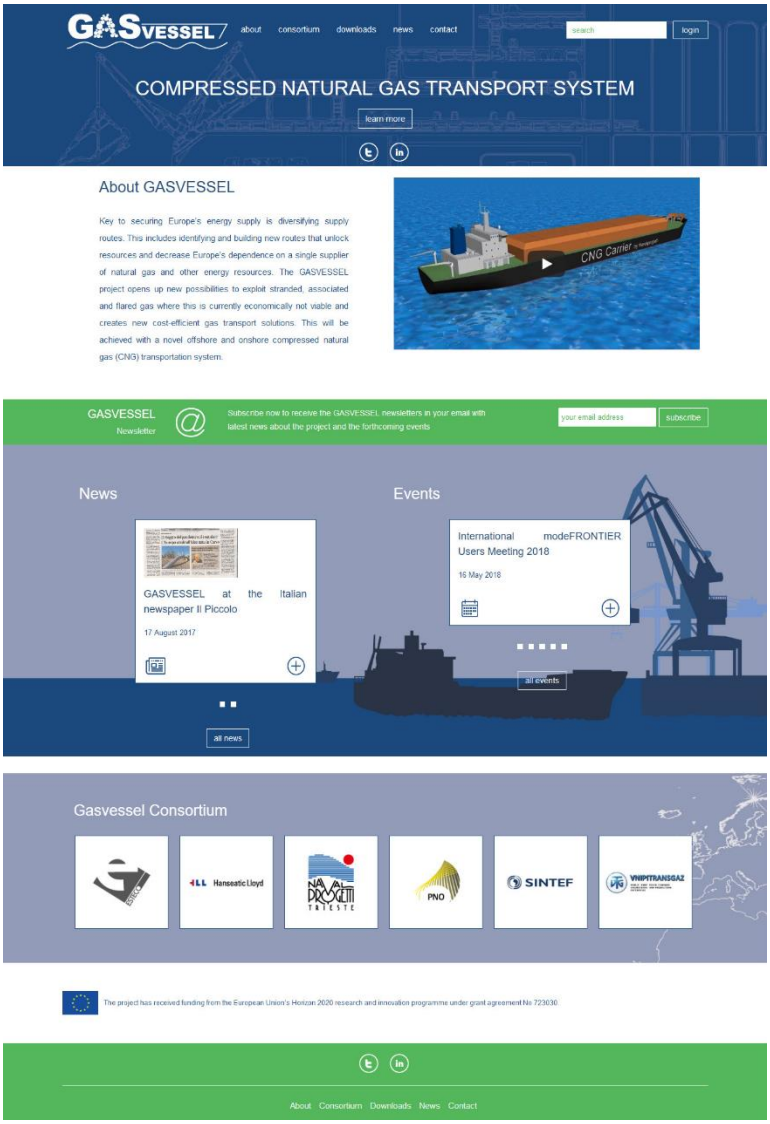


Figure 5: GASVESSEL homepage (as of 1/12/2017)

4.4 Newsletter

Important stakeholders from the industry and the scientific and research community will be reached with a bi-monthly newsletter. The newsletter contains relevant news and project updates and it informs stakeholders, whenever a key public deliverable is released, a milestone is reached, or partners attend an important event. The workshops that will be organised by the consortium, including relevant information regarding attendance, will also be announced via the newsletter. After each workshop a summary or report will be included as well. A list of all planned newsletters,

including their main topic, can be found in *Table 1*. The first newsletter was published in December 2017 (month 6) and introduced the project and the website. Furthermore, it contained information about the next consortium meeting, an article about the first phase of the scenario analysis and relevant Oil & Gas event. The newsletter was sent to 154 recipients (partners and stakeholders from *Table 9*) and can be found at this link.

Everyone can sign up for the newsletter through the project website, but it is mainly aimed at Key players and Subjects/Defenders.

Table 1: List of newsletters

Month	Title/topic	Deliverable/ Milestone
6	Introduction of project and first peak into the scenario analysis	
8	Scenarios description and decision support model defined	MS1
10	Announcement of first workshop	
12	Scenarios analysis performed with the decision support model	MS2, D3.2
14	Report/summary of first workshop	D9.4
16	Project updates, events, etc.	
18	MFD Platform	MS3
20	Announcement of second workshop	
22	Report/summary of second workshop	D9.4
24	Pilot line Pressure Vessels ready	MS4
26	Project updates, events, etc.	
28	Project updates, events, etc.	
30	Technical proposals for the construction and equipment of the loading and unloading modules	D6.1
32	Results of PV pilot productions and Tailored Ship design and (on/off) loading systems available; Basic ship design	MS5, D5.1
34	Report on the offshore loading/unloading operation analyses; announcement of third workshop	D6.3
36	Functional Ship Design Ready	MS6
38	Report/summary of third workshop	D9.4
40	Project updates, events, etc.	
42	Project updates, events, etc.	
44	Announcement of final conference	
46	Proof of Concept, CBA and safety assessment ready	MS7
48	End of project report; summary of final conference	

4.5 Brochure

A first draft of the brochure is depicted in **Error! Reference source not found.** and *Figure 6*. It contains a short description of the GASVESSEL project, its objectives and impacts and a list of the GASVESSEL partners. The brochure should be made available for interested stakeholders from the scientific

community and the industry at events and conferences. It is described in a separate deliverable D9.2 Promotion material.

Figure 6: GASVESSEL brochure

4.6 Presentation and Poster

A poster and a short introductory presentation were created about the GASVESSEL project, its objectives and results. *Figure 7* shows the poster draft. All partners are encouraged to use the poster or the presentation to present the project at events and conferences. They can add more details about their contribution in the presentation after the introduction. If partners wish to create their own presentation or poster about their role in the GASVESSEL project, they should use the GASVESSEL templates, which are designed according to the project identity and contain the logo. The templates will be provided for download at the GASVESSEL website. Poster and presentation are also part of deliverable D9.2 Promotion material.

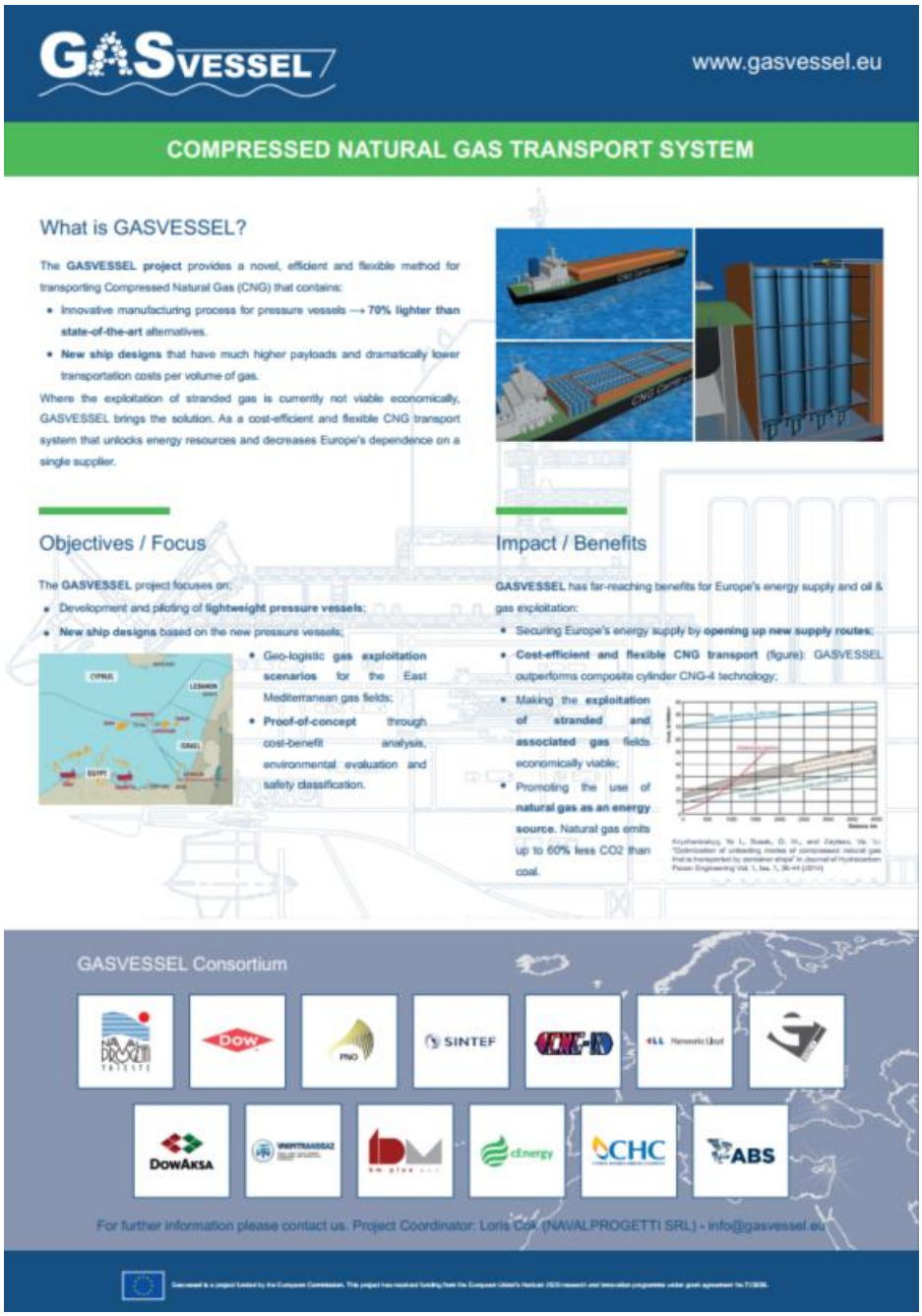


Figure 7: GASVESSEL poster

4.7 Publications

For the entire duration of the project all partners will create several publications, among which press releases and publications in relevant international journals and industrial magazines. There should always be a clear link to the GASVESSEL project, by using the logo or, where this is not possible, a reference in the acknowledgements.

4.7.1 Press releases

Press releases will be used to announce relevant project updates, intermediate and final results. They will be spread through the channels listed in *Table 3* to reach the press and inform policy makers, the general public and other relevant stakeholders.

4.7.2 Factsheets

During the course of the project, six factsheets will be released. Each factsheet will describe one project outcome in detail. They are written for a broad audience in English and possibly in other EU languages. The factsheets will be provided for download on the website in the Downloads section. A list of factsheets can be found in *Table 2*.

Table 2: List of factsheets

№	Title/Topic
1	Scenario description and analysis
2	Decision support model and Design optimization platform
3	Pressure Vessel pilot and production line
4	Ship design and loading/unloading tool
5	Proof of Concept, CBA and safety assessment
6	Exploitation and business cases

4.7.3 Publications in international journals and industrial magazines

The work-package leaders will publish relevant results in international (peer-reviewed) journals and industrial magazines to spread the knowledge and information among the scientific and research communities and the industry. Other partners, who do not lead a work package, are also encouraged to publish their project-related results.

4.8 Dissemination channels

4.8.1 Social media

In recent years, social media has become ubiquitous and essential for communication, networking and content sharing purposes. Therefore, by being present on social media GASVESSEL would get a step closer to realizing the dissemination and communication goals. Social media presence will allow the project to:

- reach the relevant stakeholders;
- establish (online) presence;
- increase GASVESSEL's brand awareness.

Thus, GASVESSEL will be present on social media, in particular on the LinkedIn and Twitter platform to reach the business and research world. Communication will be held in English. These platforms will be used as additional channels to promote news about the GASVESSEL project and to direct the

audience to the GASVESSEL website. Figure 8 shows a screenshot of the LinkedIn page for GASVESSEL.

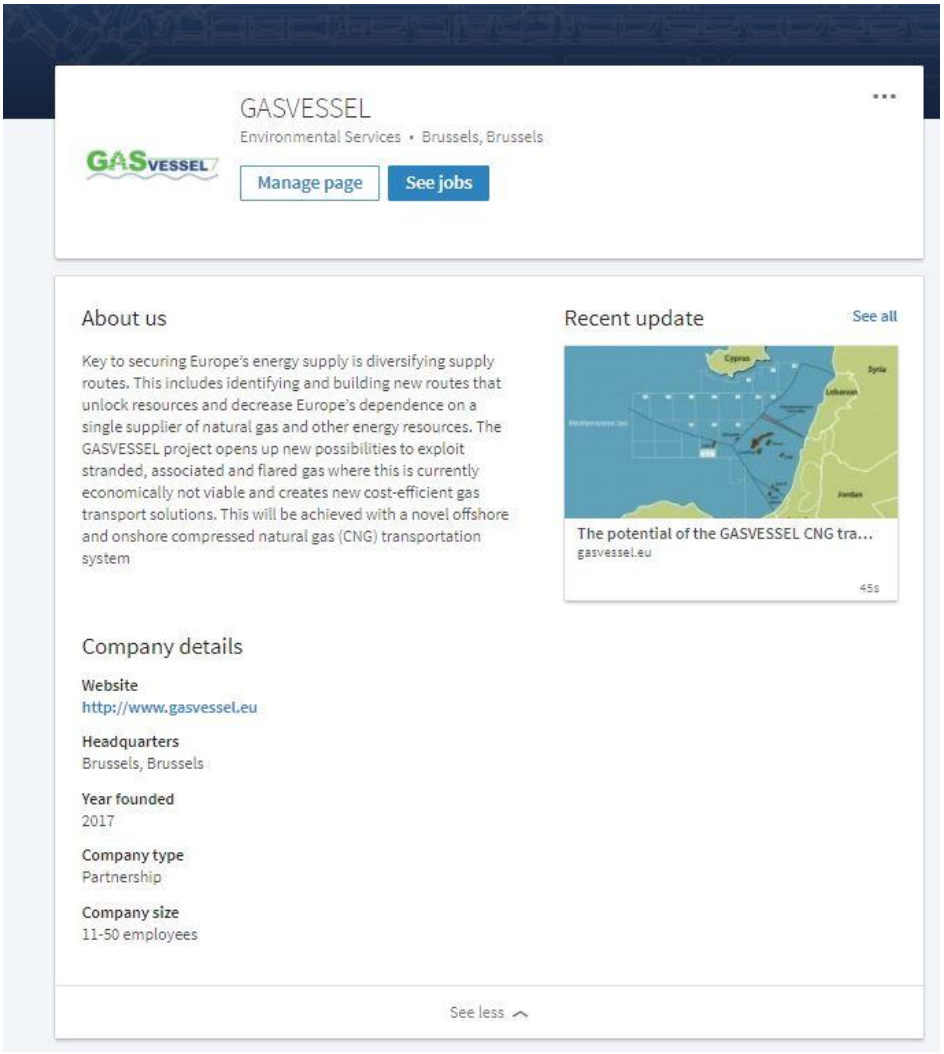


Figure 8: GASVESSEL LinkedIn page

All relevant dissemination channels that will be used to spread information about the GASVESSEL project, are listed in *Table 3*. The audience intended to be reached by each dissemination channel is listed in *Table 4*.

Table 3: Dissemination channels

Channel	Link
GASVESSEL website	www.gasvessel.eu
Innovation Place: CTECH/PNO-I web portal	www.innovationplace.eu
Partners' websites	www.navalprogetti.net de.dow.com www.dowaksa.com www.pnoconsultants.com www.vtg.com www.sintef.no www.bmplus.it

	www.cenergy.it www.hanseatic-lloyd.de chc.com.cy www.esteco.com ww2.eagle.org
LinkedIn	www.linkedin.com/company/18191206/
Twitter	@gasvessel

Table 4: Dissemination methods used per stakeholder category

Stakeholder category	Interest	Targeted communication channel
Crowd/bystanders General public	Lower priority	Social media, press releases
Subjects/defenders Industry, potential users of the GASVESSEL	Show consideration	Same as crowd/bystanders + GASVESSEL website, LinkedIn, Twitter, newsletter, brochures, presentations, work shops
Context setters Policy makers	Monitor closely	Same as crowd/bystanders + GASVESSEL website, LinkedIn, Twitter, brochures, events
Key players Partners and EC	Engage and collaborate closely	Same as subjects/defenders and context setters + GASVESSEL platform

4.9 Workshops

PNO will organise three workshops on core themes of the GASVESSEL project to engage relevant stakeholders from the oil & gas, shipping and ports industry and from the scientific and research community. All consortium partners will attend these workshops and interact with the stakeholders.

The topics of the workshops will be:

- The development, implementation and validation of the tools “Decision Support Tool” and “Design optimisation platform”
- IPR management and its commercial/industrial potential
- Thoughts on benchmarking and roadmaps towards exploitation

All results will be communicated to policy makers at a final conference and through policy reports. These reports will be designed to be effective in illustrating the potential of the novel gas transportation concept to policy makers and to grasp the importance of policy transfers to support the continuation of the initiative in the future. Each report is part of the deliverable D9.4 Reports of the 3 workshops.

4.10 Dissemination events

Partners are requested to maintain active participation within the dissemination strategy and throughout the project.

Proactive and balanced levels of participation will have profound effects throughout the whole project and will guarantee that the dissemination techniques are fully applied. Dissemination Tables will be distributed to each partner to collect and monitor dissemination progress. Each table summarises the dissemination activities that will be attended or foreseen by each partner within the coming months.

Past and upcoming events, where the GASVESSEL was or can be presented are listed in *Table 5*. A comprehensive list can be found on the GASVESSEL website https://www.gasvessel.eu/events/.

Table 5: List of relevant Oil & Gas events

Title	Date	Location	Website	Partner pesent
Meeting IEA - HIA Task 39	26-27 September 2017	Delft, NL	http://ieahydrogen.org/About-IEA-HIA/Calendar/Calendar/Task-39-Expert-meeting-on-hydrogen-in-maritime-tr.aspx	Cenergy
Maritime spatial Planning for Blue Growth	11-12 October 2017	Brussels, BE	http://msp-platform.eu/sites/default/files/20170809_msp4bg_draft_programme.pdf	PNO Innovation
European Gas Conference	29-31 January 2018	Vienna, AT	http://www.europeangas-conference.com/	
Easter Mediterranean Gas Conference	21-22 March 2018	Nicosia, Cyrpus	EMGasConference.com	
Midstream Oil and Gas Congress 2018	26-27 March 2018	Copenhagen, DK	http://mogc.eu/	
TRA 2018	16-19 April 2018	Vienna, AT	http://www.traconference.eu/	Navalprogetti
Mediterranean Offshore Conference 2018	17-19 April 2018	Alexandria, Egypt	http://www.moc-egypt.com/	
The Port and Maritime Sector: Key Developments and Challenges	3-4 May 2018	Antwerp, BE	https://www.uantwerpen.be/en/conferences/siga2-2018-conference/	
ESTECO International Users' Meeting 2018	23-24 May 2018	Trieste, Italy	um18.esteco.com	ESTECO
27th World Gas Conference	25-29 June 2018	Washington DC, USA	http://wgc2018.com/	
ECOS 2018 31st International Conference on Efficiency, Cost, Optimisation, Simulation and Environmental Impact of Energy Systems	17-22 June 2018	Portugal	ecos2018.org	
NAV 2018: 19th International Conference on ships and maritime research	20-22 June 2018	Trieste, Italy	https://www.waterborne.eu/events/view-events/nav-2018-19th-international-conference-on-ships-and-maritime-research/	Navalprogetti
27th World Gas	25-29 June	Washington	wgc2018.com	

Conference	2018	DC, USA		
Operational Excellence in Oil&Gas Summit	5-7 November 2018	Houston, TX, USA	http://www.opexinoilandgas.com/	
Offshore Mediterranean Conference 2019	27-29 March 2019	Ravenna, IT	http://www.omc2019.it/	
National conference of the Italian Thermotechnic Association (ATI) 2019	September 2019	Italy		

4.11 Responsibility of the GASVESSEL partners

Dissemination is an important part of the GASVESSEL project. Therefore, all partners are actively involved and encouraged to communicate on the progress and results of the project. PNO is the partner responsible for the dissemination work package and therefore, the coordination of all efforts for effective communication.

Responsibilities of PNO Innovation:

- Coordination of the WP
- Prepare the dissemination and exploitation plan, realise and follow up its implementation
- Identification of relevant stakeholders and networks
- Design and maintain the project website
- Design and prepare newsletters and a list of subscribers
- Design leaflets, brochures and presentations to facilitate the partners when attending events
- Collect relevant information from project partners for the website and newsletter
- Measure the outreach of the dissemination activities and methods
- Inform all partners at least 30 calendar days before publication. They have 2 calendar weeks to comment and request modifications. If there are no comments within this period, publication is allowed.

Responsibilities of other partners (Navalprogetti, Dow Deutschland, Dowaksa, Vnipitransgaz, Marintek, BM Plus, CNGV, CEnergy, Hanseatic Lloyd, Cyprus Hydrocarbons Company, ESTECO, and ABS Hellenic):

- Assist in preparing the dissemination and exploitation plan and in its implementation
- Assist in identifying stakeholders and networks; each partner will provide at least 25 stakeholders
- Actively attend events and conferences and represent the GASVESSEL project; each partner should attend at least 2 events during the project. Partners with a higher budget available should attend at least 2 events per year for the duration of the project.
- Actively share relevant information on the progress and outcomes of the project activities with PNO
- Inform both the Coordinator (Navalprogetti) and the WP9 Lead Beneficiary (PNO), if they wish to undertake any formal communication. The content and message of the communication activities should be agreed upon by the Navalprogetti and PNO.

- Inform all partners at least 30 calendar days before publication. They have 2 calendar weeks to comment and request modifications. If there are no comments within this period, publication is allowed.

4.12 Partners' dissemination tables

Table 7 and Table 8 are templates to report the dissemination activities by individual partners. All partners are requested to fill in their dissemination activities is these tables (in the separate Excel-sheet "Dissemination activities of project partners.xlsx"). These requests will be done on a monthly basis.

Table 6: Description of dissemination events

Title	Date	Location	Short description	Website	Type of audience	Name of partner attending	Short description role
[Insert title]	*[dd-dd month yyyy]*	*[Insert location]*	*[Insert short description]*	*[Insert event website]*	*[International, stakeholder category]*	*[Insert name of partner attending]*	*[Presentation, Poster, Booth]*

Table 7: Description of other dissemination activities - press releases, news, non-scientific publications, etc.

Name(s) of partner(s) involved	Type of activity	Title	Date	Countries addressed	Website where document is published
[Insert name of partner involved]	*[Press releases, news, non-scientific publications, etc.]*	*[Insert title of communication]*	*[dd-mm-yyyy]*	*[insert countries addressed]*	*[Insert website/communication channel]*

Table 8: Scientific publications - only peer-reviewed publications

Type of scientific publication	Title	DOI	ISSN or eSSN	Authors	Affiliations	Title of the journal or equivalent	Volume
[Article in journal] [Publication in conference proceeding/workshop] [Books/Monographs] [Chapters in books] [Thesis/dissertation]	*[Insert title of publication]*	*[insert DOI reference]*	*[insert ISSN or eSSN number]*	*[insert author names]*	*[insert affiliations of authors]*	*[insert title of the journal]*	*[insert volume of the journal]*
Number or Page(s)	**Date of publication**	**Publisher**	**Place of publication**	**Year of publication**	**Public and private participation**	**Open access is/will be provided**	
[insert article number] OR [insert first page]-[insert last page]	*[insert month]-[insert year]*	*[insert name of publisher]*	*[insert place of publication]*	*[insert year of publication]*	*[YES][NO]*	*[Yes - Green OA [insert length of embargo, if any]] [Yes - Gold OA [insert amount of processing charges in EUR, if any]] [NO]*	

4.13 Success and outreach of dissemination activities

The outreach of the dissemination activities and methods has to be measured continuously to ensure their efficiency and success. This allows the GASVESSEL partners to adapt their activities and the materials, in case an insufficient number of stakeholders is reached, or stakeholders show a decline in interest. The following measurements will be used to monitor the outreach:

- Number of visitors of the GASVESSEL website
- Number of subscriptions to the newsletter
- Number of clicks on newsletter items
- Number of followers on LinkedIn and Twitter
- Number of copies per printed material (brochures and poster)

These measurements will be carried out and recorded by PNO. They will come to action if one of the measurements requires a change in strategy. This could, for example, be a decline in the number of followers on LinkedIn or Twitter or in the number of newsletter subscriptions. In such a negative case, PNO will assess the activities and methods that influence the outreach and how it should they should be changed to improve the outreach. A positive case, which calls for action, could be the necessity to print new copies of brochures and posters.

4.13.1 Outreach targets

The outreach targets for dissemination, set by the GASVESSEL consortium are listed in *Table 9*.

	1st year	2nd year
Website (unique visitors)	1000	2000
Social media (followers)	50	100
Print (copies distributed per partner)	300	600

While the website is online and folders are available and used already by the partners, no social media channels have been used yet. This will be discussed among the partners next consortium meeting.

5. IPR Management

During the project, specific actions have been and will be undertaken for properly addressing the issues related to ownership, protection and guarantee of knowledge inside the GASVESSEL Consortium.

The management of Intellectual Property Rights has been regulated in detail by the following documents; the *Grant Agreement* (GA) and the *Consortium Agreement* (CA).

5.1 The Grant Agreement

Ownership, use, dissemination and access rights are ruled in the Chapter 4, Section 3 *"Rights and obligations related to background and results"* of the H2020 Model Grant Agreement.

Definitions

The GA defines the terms, which are relevant to perform exploitation and dissemination actions:

- ***Access rights*** means licenses and user rights to *foreground* and *background*;
- ***Background*** means information which is held by *beneficiaries* prior to their access to the GA, as well as copyrights or other intellectual property rights pertaining to such information, the application for which has been filed before their access to this agreement and which is needed for carrying out the project or for using *foreground*;
- ***Dissemination*** means the disclosure of *foreground* by any appropriate means other than that resulting from the formalities for protecting it, and including the publication of *foreground* in any communication channel;
- ***Fair and reasonable conditions*** mean appropriate conditions including possible financial terms taking into account the specific circumstances of the request for access, for example the actual or potential value of the *foreground* or *background* to which access is requested and/or the scope, duration or other characteristics of the use envisaged;
- ***Foreground*** means the results, including information whether or not they can be protected, which are generated under the *project*. Such results include rights related to copyright, design and patent rights or other forms of protection;
- ***Use*** means the direct or indirect utilisation of foreground in further research activities other than those covered by the project, or for developing, creating and marketing a product or process, or for creating and providing a service.

Contractual requirements

Beneficiaries are named in the GA (and consist of all the partners in the project) and all the beneficiaries together form the consortium. The GA requires that each beneficiary shall report on the expected use to be made of foreground in the plan for the use and dissemination of foreground. The information must be sufficiently detailed to permit the Commission to carry out any related audit. Any dissemination activity shall be reported in the plan for the use and dissemination of foreground, including sufficient details/references to enable the Commission to trace the activity. With regards to scientific publications relating to foreground published before or after the final report, such details/references and an abstract of the publication must be provided to the Commission along with an electronic copy of the published version or the final manuscript accepted for publication. Any dissemination action concerning foreground must include a statement acknowledging the financial support of the European Community, as well as a disclaimer specifying that it reflects only the author's view, exempting the Community from any liability. Any publicity concerning the project must also display the EU emblem.

5.2 The Consortium Agreement

More details on IPR issues are specified in Section 8 of the Consortium Agreement (CA), which focuses on the following main points:

- licensing of pre-existing know-how and knowledge – *Background*;
- Ownership of the knowledge gained within the project -*Foreground*;
- Confidentiality for *dissemination* of project results.

Section 9 of the CA specifies how the beneficiaries have agreed on the background for the project and, where relevant, they have also defined the terms to inform each other when Access to a specific background is subject to limits or restrictions.

5.3 Background

To enable a trustful and reliable cooperation (i.e avoid disputes on the property of a specific information) the partners of the GASVESSEL consortium defined their project background at the beginning of the project. Pre-existing know-how remains the property of the partner that brings it into the project but pre-existing know-how needed for carrying out the activities of IPAN project shall be granted on a "royalty-free" basis, unless it is agreed otherwise by the concerned partners before signature of the Contract (especially in the case where the "exchanges" are unbalanced). According to the Article 9.1.3 of the CA all Background not listed in Attachment 1 shall be explicitly excluded from Access Rights. This section provides an overview of the background ownership and access rights included and excluded defined in the GASVESSEL Consortium Agreement and updated by each partner.

BACKGROUND INCLUDED	
Partner short name	**Background included**
Navalprogetti	*No IPR included in ship design*
Dow Chemical	/
DOWAKSA	/
PNO	*Methodology for the Stakeholders analysis included in the background*
VTG	*In the GASVESSEL project, VTG doesn't plan to involve any patents, trademarks, copyrights, licenses.*

Sintef-Ocean	/
BM plus	*No IPR included*
CNGV	*Patent application for the technology which combines the filament winding technologies with hydroforming technology to create a liner with greater dimensions has been submitted in January 2014. The extension of this patent has been obtained for China, South-Africa.*
cEnergy	/
Hanseatic Lloyd	/
CHC	/
ESTECO	/
ABS	/

Please, note that the table above will be updated once the partners will return their questionnaire at the end of the project.

5.4 Foreground

In order to obtain a well organised IPR management during the whole duration of the project, a time slot dedicated to IP issues will be always arranged during the face-to-face meetings. The aim of this IP time-slot is to give the opportunity to *all the partners of the consortium to inform each other about any kind of innovation* that has been identified within their own activities and tasks belonging to the GASVESSEL project. This organisation will allow the GASVESSEL consortium *to explore appropriate protection measures, dissemination and exploitation venues and routes*.

More in detail, the knowledge arising from work carried out under the GASVESSEL project shall be the property of the participant carrying out the work leading to that. If, during the activities required by GASVESSEL project, two or more participants have jointly carried out work generating invention, design or knowledge, and if the features of their joint work are such that their respective share of the work cannot be ascertained, an agreement will need to be made, establishing joint ownership and the associated terms covering issues such as, for example, the allocation of and terms of exercising such joint ownership (although it is recognised that the joint owners may agree not to continue with joint ownership but decide on an alternative regime - for example, a single owner with access rights for the other beneficiaries that have transferred their ownership share).

These conditions also lay out what should happen if no such joint ownership agreement has been put in place. In this case, the following procedure applies:

- each of the joint owners shall be entitled to Use their jointly owned Foreground on a royalty-free basis, and without requiring the prior consent of the other joint owner(s), and
- each of the joint owners shall be entitled to grant non-exclusive licenses to third parties, without any right to sub-license, subject to the following conditions:
  - at least 45 days prior notice must be given to the other joint owner(s);
  - fair and Reasonable compensation must be provided to the other joint owner(s).

The following table provides an overview of the expected foreground to be generated in the project, the ownership and access rights.

FOREGROUND	
Partner short name	**Foreground**
Navalprogetti	*No expected foreground in ship design*
DOW Chemical	*Formulations testing for the production of new epoxy resins. Results obtained during the testing phase will not be disclosed.*
DOWAKSA	/
PNO	/
VTG	***Expected foreground*** *The technical solutions will be developed for the design of universal modules for carrying out the loading / unloading processes of GASVESSEL, accounting for the amount of transported gas, and a new gas storage for loading terminals.*
	Ownership *Technical solutions and process calculations of loading/unloading equipment relating to onshore GASVESSEL loading/unloading terminals.*
	Access Rights *Results obtained on innovative techniques in*

	the field of terminals design will be made available without royalties to the consortium only for use in the GASVESSEL project.
SINTEF-Ocean	/
BM Plus	*No IPR foreseen*
CNGV	*Patent application for combination of filament winding technologies with hydroforming technology is going to be extended in India, Russia, Singapore, Australia, Canada, USA, Emirates.*
cEnergy	/
Hanseatic Lloyd	/
CHC	/
ESTECO	/
ABS	/

Please, note that the table above will be updated once the partners will return their questionnaire at the end of the project.

5.5 Confidentiality for the dissemination of project results

This paragraph particularly concerns the dissemination phase: specific agreement guarantees on one hand the right scientific dissemination (and visibility acquisition), in particular for the partners involved in R&D activities; on the other hand, that sensitive information is maintained confidential within the consortium.

The rules and the conditions showed in the above paragraphs shall not apply for disclosure or use of Confidential information, if:

- The recipient part can show that the confidential information becomes publicly available by means other than a breach of the Recipient's confidentiality obligations;
- the Disclosing Party subsequently informs the Recipient that the Confidential Information is no longer confidential;
- the Confidential Information is communicated to the Recipient without any obligation of confidence by a third party who is in lawful possession thereof and under no obligation of confidence to the Disclosing Party;

- the disclosure or communication of the Confidential Information is foreseen by provisions of the EC-GA;
- the Confidential Information, at any time, was developed by the Recipient completely independently of any such disclosure by the Disclosing Party; or
  - the Confidential Information was already known to the Recipient prior to disclosure, or
  - the Recipient is required to disclose the Confidential Information in order to comply with applicable laws or regulations or with a court or administrative order.

5.6 Future agreements and further commercial exploitation of IPR

During the implementation of the GASVESSEL project the potential for further agreements between the partners (and potentially third parties) aimed at fully exploiting the project results will be explored, taking into account the outcomes and deliverables from the project .

The GASVESSEL R&D activities and future investments will be financed by a combination of in-house industrial investments (NP, CNGV, DOW, DowAksa, ESTECO, CENERGY) as well as public funding and finance. During the implementation of the GASVESSEL project the potential for further agreements between the partners (and potentially third parties) aimed at fully exploiting the project results will be explored, taking into account the outcomes and deliverables from the project. The commitment of the project partners is to exploit the main results of the project for the benefit of all the parties involved and to make the knowledge available for future research.

For this reason, further agreements and continuous communication between partners during the whole duration of the projects are needed to set up a viable exploitation plan. *The exploitation plan will constitute a flexible document, always updated during the project implementation*, which aims at investigating all the possible market opportunities and financing instruments (both at regional than at European level) to realise the best exploitation of the project results.

Appendix A List of identified stakeholders

Table 9: List of identified stakeholders sorted by target group

Target group	Name	Country	Website
General Public	Roland Berger	Europe	www.rolandberger.com
Industrial clusters	Brazilian Association of Research and Development in Petroleum and Gas (ABPG)	Brazil	www.portalabpg.org.br
Industrial clusters	Assomineraria	Italy	
Industrial clusters	Danieli & c Officine meccaniche	Italy	www.danieli.com
Industrial clusters	Gortani	Italy	www.gortani.com
Industrial clusters	INTERTANKO	International	www.intertanko.com
Industrial clusters	Maritime Technology Cluster FVG	Italy	www.marefvg.it
Industrial clusters	MARTECMA	Greece	www.martecma.com
Industrial clusters	Primetals Technologies GmbH	Austria	www.primetals.com
Industrial clusters	Riva acciaio	Italy	www.rivagroup.com
Industrial clusters	Sedigas	Spain	www.sedigas.es
Industrial clusters	SIGTTO	International	www.sigtto.org
Industrial clusters	SMS Concast Ag	Switzerland	www.sms-concast.ch
Interest & Networking organizations	Area Science Park	Italy	www.areasciencepark.it
Interest & Networking organizations	Associazione Italiana Pressure Equipment	Italy	www.aipe.it
Interest & Networking organizations	Confindustria Udine	Italy	www.confindustria.ud.it
Interest & Networking organizations	European Hydrogen and Fuel Cell Association	Europe	www.h2euro.org
Interest & Networking organizations	Waterborne – European Technology Platform	Europe	www.waterborne.eu
Interest & Networking organizations	Euroscience Open Forum		www.esof.eu/en
Interest & Networking	Federmeccanica	Italy	www.federmeccanica.it

Target group	Name	Country	Website
organizations			
Interest & Networking organizations	Marine Transport Technology Platform		
Interest & Networking organizations	Maritime Spatial Planning Platform		
Interest & Networking organizations	Maritime Technology Cluster	Italy	www.marefvg.it/en/
Interest & Networking organizations	Maritime Transport Coordination Platform		
Interest & Networking organizations	SEA Europe		
Interest & Networking organizations	SISSA	Italy	www.sissa.it
Interest & Networking organizations	Sustainable Transport Forum		
Interest & Networking organizations	Univ. Of Naples	Italy	www.unina.it
Interest & Networking organizations	University Of Genova	Italy	www.unige.it
Interest & Networking organizations	University of Strathclyde engineering		www.strah.ac.uk/naome
Interest & Networking organizations	University of Trieste	Italy	www.units.it
Interest & Networking organizations	University of Udine	Italy	www.uniud.it/en
Media	Ansa.it	Italy	www.ansa.it
Media	Corriere della Sera	Italy	www.corriere.it
Media	CWC LNG Hub	International	http://lnghub.biz
Media	Financial Times		www.ft.com
Media	Geoexpro	UK	www.geoexpro.com
Media	Global LNG Hub	International	www.globallnghub.com
Media	Gulf Editor Publications		www.gulfpub.com
Media	Hazardous Cargo Bulletin	International	www.hcblive.com
Media	IMarEST	UK	www.imarest.org
Media	LNG Industry	International	www.lngindustry.com
Media	LNG Journal	International	lngjournal.com
Media	LNG World Shipping	International	www.lngworldshipping.com

Target group	Name	Country	Website
Media	Maritime reporter		www.marinelink.com/magazines
Media	Messaggero Veneto	Italy	www.messaggeroveneto.gelocal.it
Media	Motorship		www.motorship.com
Media	Offshore Engineer	US	www.oedigital.com
Media	Offshore magazine	US	www.offshore-mag.com
Media	Realtà industriale	Italy	www.realtaindustriale.it
Media	Repubblica	Italy	www.repubblica.it
Media	SNAME	US	www.sname.org
Media	Sole24ore	Italy	www.ilsole24ore.com
Media	Tecniche nuove	Italy	
Media	The Naval Architect	UK	www.rina.org.uk/tna.html
Media	Tradewinds	International	www.tradewindsnews.com
Media	Upstream online	International	www.upstreamonline.com
Media	World Maritime News	International	worldmaritimenews.com
Media	World Oil	US	www.worldoil.com
Oil & Gas Companies	Bluenergy		www.bluenergy.it
Oil & Gas Companies	BP	UK	www.bp.com
Oil & Gas Companies	British Gas	UK	www.britishgas.co.uk
Oil & Gas Companies	Cedigaz	France	www.cedigaz.org
Oil & Gas Companies	Centrica	International	www.centrica.com
Oil & Gas Companies	Chevron	International	www.chevron.com
Oil & Gas Companies	Conocco Phillips	International	www.conocophillips.com
Oil & Gas Companies	DEPA	Greece	www.depa.gr
Oil & Gas Companies	EDISON	Italy	www.edisonenergia.it
Oil & Gas Companies	Enagas	Spain	www.enagas.es
Oil & Gas Companies	Energean oil & gas	Greece	www.energean.com
Oil & Gas Companies	ENGIE	International	www.engie.com
Oil & Gas Companies	Eni	Italy	www.eni.com
Oil & Gas Companies	Eni Norge	Norway	www.eninorge.com
Oil & Gas Companies	Eni Tecnomare	Italy	
Oil & Gas Companies	Enna Energia Naturalis	Croatia	www.enaturalis-int.com
Oil & Gas Companies	Exxon Mobil	USA (HQ)	corporate.exxonmobil.com
Oil & Gas Companies	Fluxys	Belgium	www.fluxys.com
Oil & Gas Companies	Gasnor	Norway	http://gasnor.no/en/
Oil & Gas Companies	Gastrade	Greece	www.gastrade.gr
Oil & Gas Companies	GE OIL & GAS (General Electric)		www.geoilandgas.com

Target group	Name	Country	Website
Oil & Gas Companies	GNF	Spain	www.gasnaturalfenosa.com
Oil & Gas Companies	GRT Gaz	France	www.grtgaz.com/en/
Oil & Gas Companies	Hellenic Petroleum S.A.	Greece	www.helpe.gr/en/
Oil & Gas Companies	INFRASTRUTTURE TRASPORTO GAS spa		www.infrastrutturetg.it
Oil & Gas Companies	JX Nippon Oil & Energy Corporation	Japan	www.eneos.eu
Oil & Gas Companies	M&M Gas and Motor Oil	Greece	http://www.moh.gr/Default.aspx?a_id=10575
Oil & Gas Companies	MMI Engineering Inc.	US	www.mmiengineering.com
Oil & Gas Companies	Nidec ASI Spa	Italy	www.nidec-asi.com
Oil & Gas Companies	NordStream	Germany	www.nord-stream.com
Oil & Gas Companies	OMV	Austria	www.omv.com
Oil & Gas Companies	Petramina	Indonesia	www.pertamina.com/en/
Oil & Gas Companies	Petrobras	Brazil	www.petrobras.com.br/en/
Oil & Gas Companies	REPSOL	Spain	www.repsol.energy/en/
Oil & Gas Companies	S.I.O.T spa	Italy	www.tal-oil.com
Oil & Gas Companies	Saipem	Italy	www.saipem.com
Oil & Gas Companies	Shell	The Netherlands	www.shell.com
Oil & Gas Companies	Snam Rete Gas	Italy	www.snamretegas.it/en/
Oil & Gas Companies	Statoil	Norway	www.statoil.com
Oil & Gas Companies	Swissgas		www.swissgas.ch
Oil & Gas Companies	Total	France	www.total.com/en
Oil & Gas Companies	TransCanada	Canada & USA	www.transcanada.com
Oil & Gas Companies	Transalpine Olleitung in Ostereich Gmbh	Austria	www.tal-oil.com
Oil & Gas Companies	Uniper	Germany	www.uniper.energy
Policy makers	European Commission: DG for Mobility and Transport	Europe	http://ec.europe.eu/transport/
Policy makers	Italian Ministry of Economic Development	Italy	www.mise.gov.it
Ports	APA – ASEAN	South East Asia	www.apamalaysia.com

Target group	Name	Country	Website
Ports	ESPO	Belgium	www.espo.be
Ports	GIINGL	International	www.giignl.org
Ports	Hewett UK Bacton	UK	
Ports	IAPH	International	www.iaphworldports.org
Ports	Karsto	Norway	
Ports	Kollness	Norway	
Ports	Port Authority of Trieste	Italy	www.porto.trieste.it
Ports	Port Authority of Civitavecchia	Italy	www.portidiroma.it
Ports	Port Authority of Mantova	Italy	
Ports	Port Authority of Piombino	Italy	www.ap.piombinoelba.it
Ports	Port Authority of Savona	Italy	www.porto.sv.it
Ports	Port Authority of Venice	Italy	www.port.venice.it/en
Ports	Port Authority of Zeebrugge	Belgium	www.portofzeebrugge.be/en/zeebrugge
Ports	Port of Baku	Azerbaijan	
Ports	Port of Koper	Slovenia	https://luka-kp.si/eng/
Ports	Port Authority of Rijeka	Croatia	www.portauthority.hr/en/
Ports	Special Authority for the Port of Monfalcone	Italy	www.porto.monfalcone.gorizia.it/eng/
Regulators	AMSA	Australia	www.amsa.gov.au
Regulators	DNV - GL	Norway	www.dnvgl.com
Regulators	EMSA	Europe	www.emsa.europa.eu
Regulators	IACS	International	www.iacs.org.uk
Regulators	Lloyd's Register TID	UK	www.lr.org
Regulators	Norsok	Norway	www.standard.no
Regulators	RINA Sp.A.	Italy	www.rina.org
Regulators	US Coast Guard	USA	www.uscg.mil
Scientific & Research community	LabOceano	Brazil	www.laboceano.coppe.ufrj.br
Scientific & Research community	University of Strathclyde,	UK	www.strath.ac.uk/engineering/navalarchitectureoceanmarineengin

Target group	Name	Country	Website
	Department of Naval Architecture, Ocean and Marine Engineering		eering/
Scientific & Research community	Technological Educational Institute of Athens, Department of Naval Architecture	Greece	www.na.teiath.gr/index_en.html
Scientific & Research community	Gdansk University of Technology, Faculty of Ocean Engineering and Ship Technology	Poland	http://oio.pg.edu.pl/en
Scientific & Research community	Institut Français du Pétrole	France	www.ifpenergiesnouvelles.fr
Scientific & Research community	LAMCSO – Laboratorio de Metodos Computacionais e Sistemas Offshore	Brazil	www.lamcso.coppe.ufrj.br
Scientific & Research community	National Technical University of Athens, School of Naval Architecture & Marine Engineering	Greece	www.ntua.gr/en/schools/item/8-school-of-naval-architecture-and-maringe-engineering
Scientific & Research community	Sirehna	France	www.sirehna.com
Scientific & Research community	University of Genova, Naval Architecture and Marine Engineering Unit (DITEN)	Italy	www.dibe.unige.it
Shipping industry	AET (American Eagle Tankers)	Singapore (HQ)	www.aet-tankers.com
Shipping industry	CANSI	China	www.chinaexhibition.com/Official_Site/21-553-China_Association_of_the_Naional_Shipbuilding_Industry_(CANSI).html
Shipping industry	Caterpillar	USA	www.caterpillar.com
Shipping industry	CESA	Europe	www.cesa-shipbuilding.org
Shipping industry	Cetena Sp.A.	Italy	www.cetena.it
Shipping industry	Chemgas	Netherlands	www.chemgas.nl

Target group	Name	Country	Website
Shipping industry	China Shipping Tanker Co Ltd	China	www.cstanker.com/en/
Shipping industry	CIMC Raffles	China	www.cimc-raffles.com/en/enterprise/raffles
Shipping industry	Dunya Shipping	Turkey	www.dunyashipping.com
Shipping industry	Dynagas	Greece	www.dynagas.com
Shipping industry	ECSA	Europe	www.ecsa.eu
Shipping industry	European Ships and Maritime Equipment Association		www.seaeurope.eu
Shipping industry	Fincantieri SpA	Italy	www.fincantieri.com/en
Shipping industry	Gaslog	Greece	www.gaslogltd.com
Shipping industry	Gazpro	Greece	www.gazpro.gr
Shipping industry	Hantong	China	www.cnhtship.com/english/aboutus.asp
Shipping industry	Hellenic Chamber of Shipping	Greece	www.globalmaritimehub.com/directory/hellenic-chamber-of-shipping.html
Shipping industry	Hyundai Shipyard	South Korea	english.hhi.co.kr/biz/ship_over
Shipping industry	K&H Maritime Ltd	Israel	www.khmaritime.com
Shipping industry	Knutsen OAS Shipping	Norway	knutsenoas.com
Shipping industry	KOSHIPA	Korea	www.koshipa.or.kr/eng/koshipa/koshipa3/companies01_1.htm
Shipping industry	MainTank Schifffahrtsgesellschaft mbH	Germany	maintank.com
Shipping industry	Man	Germany	marine.man.eu
Shipping industry	MaranGas	Greece	www.marangas.com
Shipping industry	Mitsui Engineering & Shipbuilding Co Ltd	Japan	www.mes.co.jp
Shipping industry	Nanjing Tanker Corporation	China	www.njtc.com.cn
Shipping industry	Naval Group	France	www.naval-group.com
Shipping industry	Ocean Tankers Ship Management	Singapore (HQ)	www.oceantankers.com.sg
Shipping industry	Prime Marine	Greece	www.prime-marine.net
Shipping industry	Rolls royce	UK	www.rolls-royce.com/products-and-services/marine.aspx
Shipping industry	SAJ	Japan	www.sajn.or.jp/e/membership
Shipping industry	Samsung Shipyard	South Korea	www.samsungshi.com/eng/defau

Target group	Name	Country	Website
			lt.aspx
Shipping industry	SeaTrans	Norway	www.seatrans.no
Shipping industry	TMS Cardiff Gas	Greece	www.tms-cardiffgas.com
Shipping industry	VDR	Germany	www.reederverband.de/en.html
Shipping industry	Wärtsilä	Finland	www.wartsila.com

Appendix B Exploitation questionnaire

EXPLOITATION QUESTIONNAIRE

Please indicate in the below table the name(s) of the representative(s) of your organisation providing answers to this questionnaire. Several representatives from your organisation may usefully fill in this questionnaire in order to provide the consortium with a better understanding of the way your organisation foresees the exploitation and sustainability of the project.

	Contributor
Full name	
Organisation	
Position	
Email address	
Skype ID (to be provided only if you would kindly accept to be contacted should some of provided answers need a clarification)	

Section 1 -SOTA Assessment

Q.1. What is the main reason your organisation got involved in the GASVESSEL project?

What does your organisation expect to achieve in joining the GASVESSEL consortium?

(Increase of expertise/knowledge, network building, commercial opportunities, technological advancements…)

Q.2.In which of the following clusters of activities is your organisation involved?

1. Pressure vessels design and manufacturing	
2. Ship design	
3. Decision support model	
4. Analysis and assessment	

Q.3. According to the submitted GASVESSEL project proposal, your organisation is contributing to develop the following innovative feature:

Q.4. Which was the TRL of your feature *(technology, process or service)* at the beginning of the project?

Q.5. Which is the current TRL of your feature *(technology, process or service)*?

Please describe the current state of the art of your activity.

Q.6. Are there any Intellectual Property Rights that existed before the beginning of the project which are needed to carry out your own work, or the work of another partner, in the project?

	YES
	NO

If yes, please provide details.

Section 2 – Expectations

Q.7. Is your organisation currently using / exploiting any GASVESSEL project outcome(s)?

	YES
	NO

If yes, which one?

Q.8. Which benefits (in terms of revenues, employment, sales…) will your organisation obtain from the outcomes of the GASVESSEL project?

If possible, please quantify *(financial forecasts, increase of production, employment..)*.

Q.9. How does your organisation plan to exploit GASVESSEL outcomes and knowledge after the project?

Q.10. What is your strategy for knowledge management and protection?

Which measures (patents, licenses, trademark, copyright) is your organisation going to apply?

Q.11. What are your measures to ensure the commercial exploitation *(freedom to operate)* of the outcomes?

Section 3 – Towards the sustainability of the GASVESSEL project

Q.12. What are, in your opinion, the key GASVESSEL developments and measures necessary to reach the envisioned impact of the project?

Q.13. What are, in your opinion, the main obstacles faced by the GASVESSEL partnership towards the sustainability of the project?

Q.14. What, in your opinion, are the main risks for the GASVESSEL market uptake?

Q.15. Would you have any recommendations concerning other initiatives to benchmark against GASVESSEL development (in the oil & gas industry or in other domains), which could lead to more relevant business models?