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Autorità Portuale
di Livorno

# "Port infrastructure for alternative fuels and maritime transport: the Livorno case"


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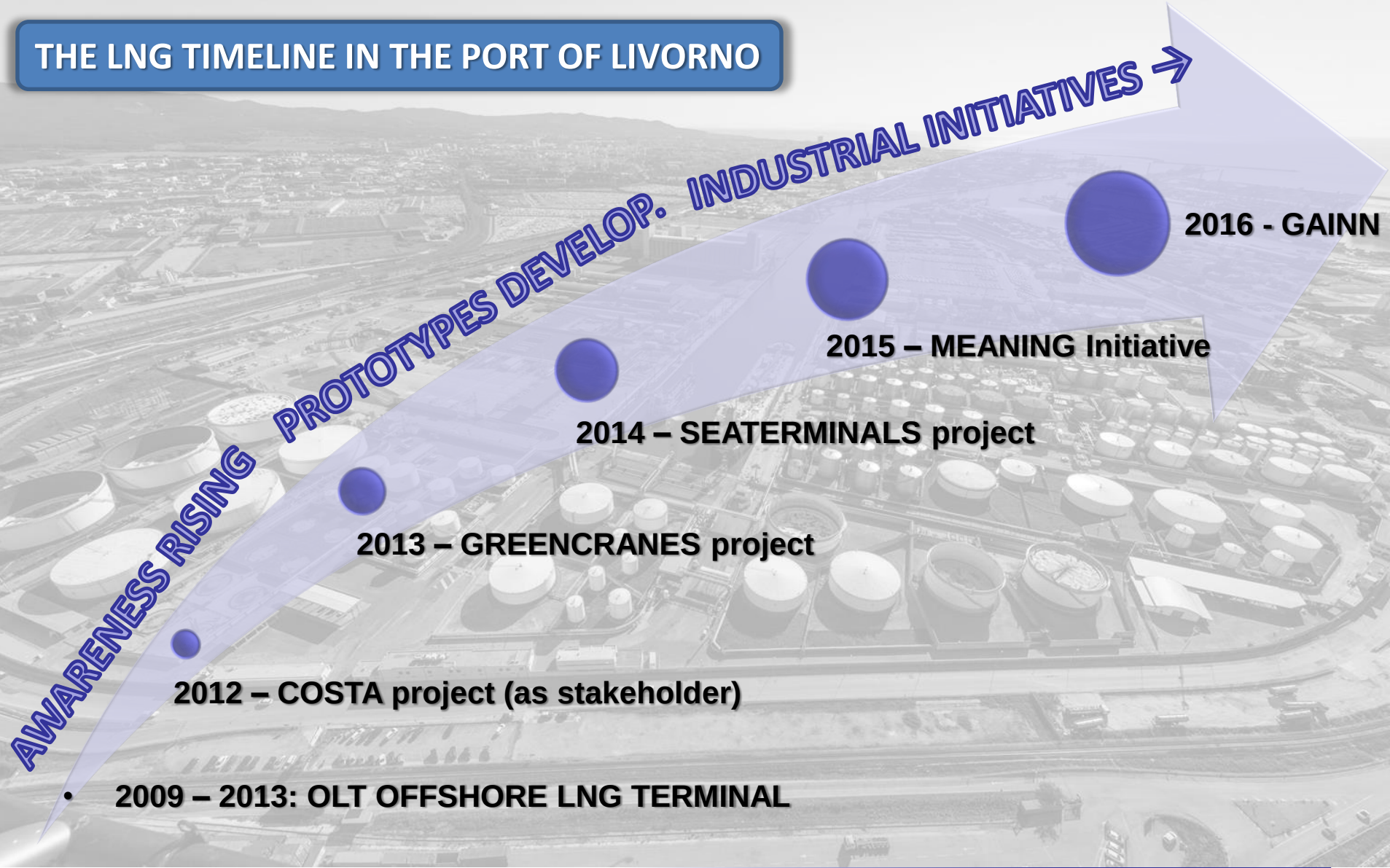
***Livorno Port Authority***

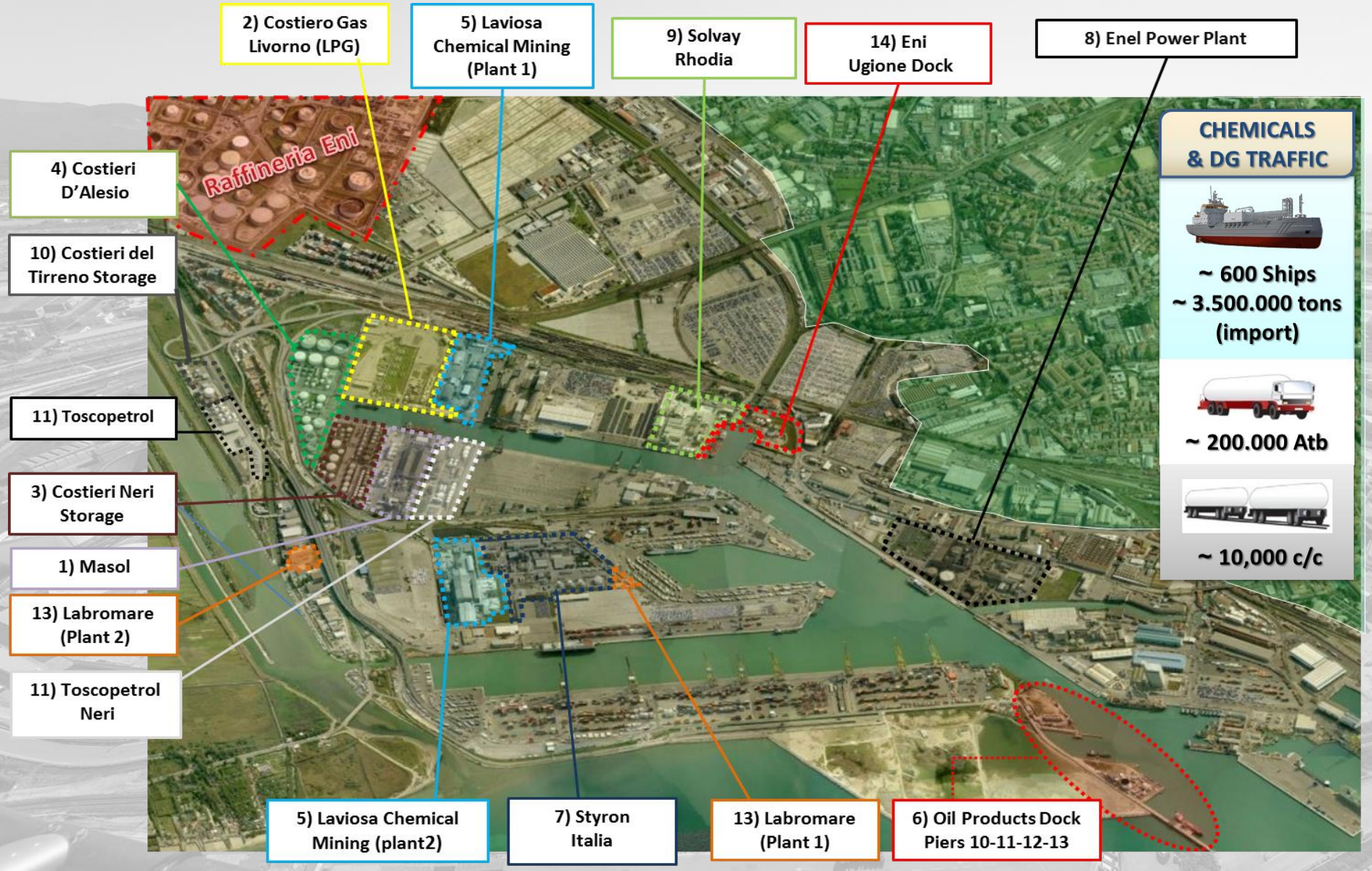

**DEVELOPMENT AND INNOVATION DEPARTMENT**

# PRESENTATION CONTENTS

## THE LNG TIMELINE IN THE PORT OF LIVORNO



# LIVORNO PORT: A LONG-TERM TRADITION IN THE CHEMICAL AND "GAS & OIL" SECTORS



# THE O.L.T. OFFSHORE "LNG TOSCANA" STORAGE AND REGASIFICATION TERMINAL



- Operations based on ship-to-ship transfer of LNG in open sea. Ship-to-Ship manoeuvres approved for wave Hs up to 1.5 m while LNG transfer designed for wave Hs up to 2.5 m.
- Regasification unit on board for send-out with nominal capacity of **3.75 bm³/a** and a storage capacity of **137,500 m³** in 4 spherical Moss-type tanks more suitable for partially-filled terminal in offshore environment (anti-sloshing).
- The terminal is completely **self-sufficient** and has the same operational features as typical onshore regasification terminals.
- LNG loading occurs by direct transfer from LNG carriers moored side-by-side to the terminal via traditional (Jetty) loading arms.
- **Wobbe Index Corrector** installed to produce Nitrogen can allow to receive most of the LNGs types.
- Terminal is allowed to receive LNG carriers size in the range between **65,000 and 155,000 m³** (about 80% of the current worldwide LNGc fleet).
- High **flexibility in send out** flow rate (maximum capacity of 15 MSm3/d with a very low minimum send out) allows high trading value to the users.

# OVERVIEW OF A RECENT HISTORY

MARPOL ANNEX VI

EU ALT. FUEL DIRECTIVE

COSTA

COSTA MASTERPLAN

ITALIAN LNG MASTERPLAN

Green Cranes

SEAterminals

THE «MEANING» INITIATIVE

| STUDIES | PROTOTYPES |
|---|---|
| LNG BUNKERING IN THE LIVORNO PORT | LNG DUAL FUELED REACHSTACKER |
| LNG LOGISTICS | LNG DUAL FUELED R.T.G. |
| LNG SAFETY IMPACT | |
| OFFSHORE TERMINAL REFITTING | LNG MOBILE REFUELING STATION |

PORT OF LIVORNO

**GAINN PROJECT**

# AN EXAMPLE OF SUCCESSFUL INTEGRATION

COSTA | Green Cranes | SEAterminals

**Can be considered as components of the same progressive integration strategy between:**

**European Commission – Trans-European Network Transport Policies - INEA**

Favouring stakeholders awareness about eco-efficiency in port operations

Supporting the start-up phase of innovative actions in early stage markets

**Italian National Transport Authorities (MIT & MISE)**

Definition of the Italian national policies

Italian LNG Masterplan

**Livorno Port Authority**

MEANING Initiative:

definition of a global strategy for the Port of Livorno as a LNG hub for the Northern Thyrrenian sea

**Local Industrial PS**

Setting up of new industrial partnerships

Develoment of new products that can lead to market innovations

**EUROPEAN PROJECTS' PARTNERS & ACTIVITIES**

# PREVIOUS ACTIVITIES OUTCOMES (1)

## PRODUCTS & PROTOTYPES DEVELOPMENT

### LNG dual fuel Reachstacker

Retrofit conversion of a diesel unit to a dual fueled (Diesel – LNG) Reachstacker .

- Integration and realisation of a prototype according to the design
- Prototype functional testing
- Prototype pilot and performance analysis in a real Port Container Terminal

### LNG dual fuel RTG

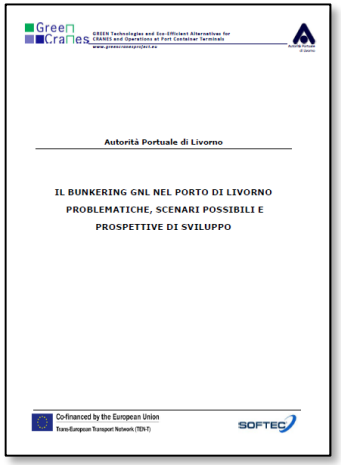
Retrofit conversion of a diesel unit to a dual fueled (Diesel – LNG) Rubber Tyred Gantry (RTG).
The retrofit conversion of a R.T.G. engine is an absolute innovation since it does not exist in the market any models of RTG powered by dual fuel, neither OEM, nor retrofit.

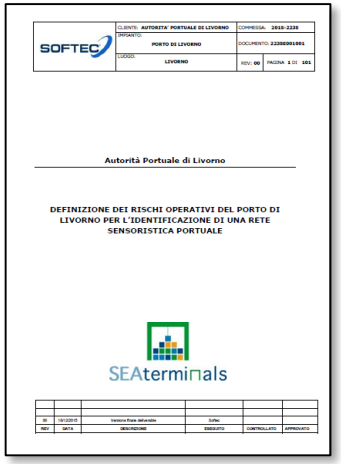
### LNG Mobile Refueling Station

LNG Mobile Refueling Station, able to refuel LNG tanks placed both at elevated and normal heights. Modular, Flexible, the station can be arranged on different types of platforms/trailers and it can be easily handled by a normal terminal fork-lifts.
Autonomy: it has a built-in power generator that makes the unit completely autonomous.

# PREVIOUS ACTIVITIES OUTCOMES (2)

## STUDIES & ANALYSIS


Green Cranes
Autorità Portuale di Livorno
IL BUNKERING GNL NEL PORTO DI LIVORNO
PROBLEMATICHE, SCENARI POSSIBILI E
PROSPETTIVE DI SVILUPPO
Co-financed by the European Union
SOFTEC


SOFTEC
Autorità Portuale di Livorno
DEFINIZIONE DEI RISCHI OPERATIVI DEL PORTO DI
LIVORNO PER L'IDENTIFICAZIONE DI UNA RETE
SENSORISTICA PORTUALE
SEAterminals

## LNG BUNKERING IN THE PORT OF LIVORNO

Setting up of an LNG terminal/storage facility with a capacity of 1,500 $m^3$, scalable up to 9,000 $m^3$.

Enabled for filling operations of small LNG bunker barges/vessels and tanks mounted on trucks, trailers, semi-trailers or rail wagons

The main data of terminal size and capacity are the following:

- LNG Storage Capacity: up to 9,000 $m^3$ (6x1500 $m^3$)
- Maximum transfer capacity for filling SSLNG vessels: 250 $m^3$/hr
- Max LNG transfer capacity for filling truck/rail-tanks: 60 $m^3$/hr
- Number of LNG loading bays for truck-mounted tanks: 3
- Number of LNG loading bays of rail-mounted tanks: 2

➢ **Definition of a port sensing network (IoT) for risks mitigation: the resulting specifications have been already implemented in the Port of Livorno Monitoring and Control Application (MONI.C.A.)**

MONI.C.A.

# PREVIOUS ACTIVITIES OUTCOMES (3)

## STUDIES & ANALYSIS

SEAterminals

**LNG LOGISTICS DEVELOPMENT IN THE PORT OF LIVORNO – NORTHERN TYRRHENIAN AREA BASED ON CRYOGENIC ISO TANK CONTAINERS UTILIZATION**

ISTITUTO INTERNAZIONALE DELLE COMUNICAZIONI

## LNG ISO Cryo-Container based onshore storing and distribution facility in the port of Livorno

1. Quay-to-Ship LNG bunkering
2. Feeding of storage facilities in other ports
3. Feeding of refueling stations (road & rail)
4. Use as tank onboard ships
5. Feeding of territorial methane distribution networks (e.g. Sardegna)

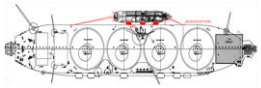
➢ **Expected benefits**

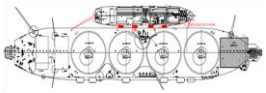
- Modularity and Adaptability
- Short development time
- Existing handling facilities
- Container trailers service
- Container ships service
- Full intermodal approach
- Storing efficiency maximization (stacking)
- Simpified logistics for final users
- LNG transportation towards remote targets

# PREVIOUS ACTIVITIES OUTCOMES (4)

## STUDIES & ANALYSIS




**Preliminary feasibility study**

**Identification of the terminal's capability to performing LNG transfer into mini LNG carriers and the consequent modifications needed.**

**The terminal will be able to receive Small LNG carriers with the following characteristic:**

- **Mini LNGC with a cargo capacity in the range of 1,000 $m^3$ to 7,500 $m^3$**
- **Mini LNGC Length: between 60 m to 110 m**
- **Loading rate between 250 $m^3$ and 900 $m^3$ (the timing is the same requested for bigger LNG carriers)**
- **Manifold in accordance to OCIMF recommendation**
- **ESD in accordance to SIGTTO recommendation**
- **Minor modifications will allow to perform the transfer of LNG from port side**
- **Purchase of new cryogenic hoses, reducers, fenders etc…**

Source: OLT

# THE PARTNERS NETWORK

## INSTITUTIONS

**21 JANUARY 2013: Mou**

**Innovation, ICT, Alternative fuels**

Ministero dello Sviluppo Economico

MIT

## RESEARCH

Scuola Superiore Sant'Anna
di Studi Universitari e di Perfezionamento

cnit

LOGIT
UNIVERSITA' DI PISA
POLO SISTEMI LOGISTICI - LIVORNO

CSI

Polo Universitario Sistemi Logistici

## INDUSTRY

SOFTEC

GAS and HEAT

CONFINDUSTRIA LIVORNO

eni
Costiero Gas

HIGAS

RINA 1861

KALMAR

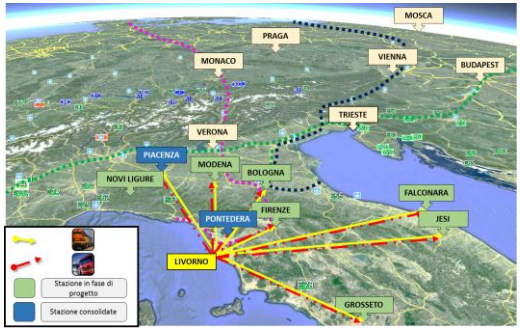
HVM
High Vacuum Maintenance

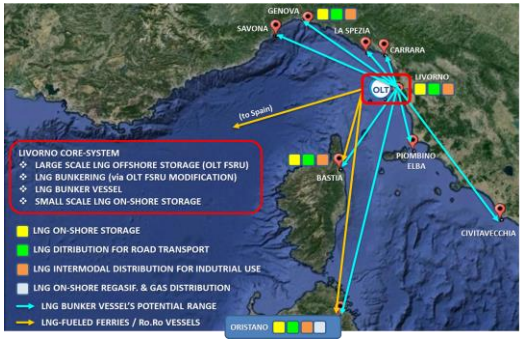
OLT

ecomotive solutions

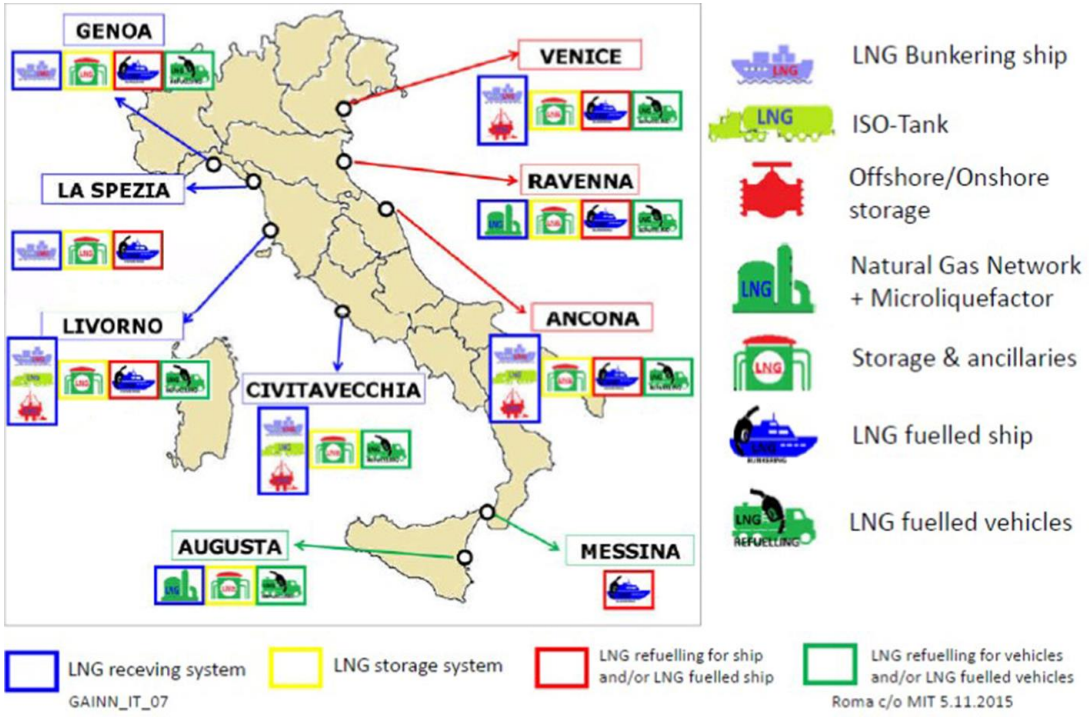
# COORDINATION WITH NATIONAL-LEVEL POLICIES

## THE PORT OF LIVORNO «MEANING» INITIATIVE


- The **Port of Livorno «MEANING» Initiative**: studies and development actions in the Tuscan Port cluster for the setting up of a full LNG chain serving the Northern Tyrrhenian sea;
- During the MIT and MISE stakeholders consultation phase, it has been absorbed and **integrated in the Italian LNG Masterplan** and, consequently, in the **GAINN-IT Initiative**




Ministero dello Sviluppo Economico

MIT

# A NEW ENTRY: THE PORT SYSTEM ENERGY PLAN

THE NEW ITALIAN PORT REFORM LAW SET UP A NEW ORGANIZATIONAL MODEL: THE «PORT SYSTEM AUTHORITY»

LIVORNO AND PIOMBINO ARE THE TWO NODES OF THE NORTHERN TYRRHENINAN PORT CLUSTER

THE NEW ARTICLE «4-BIS»

- ENFORCES THE PRINCIPLE OF «ENERGY SUSTAINABILITY»
- A PORT SYSTEM «ENERGY PLAN» IS MANDATORY

FROM ENERGY CONSUMER → TO → ENERGY PRODUCER

**Lowering the energetic dependency, making the use of energy more efficient and reducing the emission levels, will play a crucial role for the Livorno port future development.**

- ❑ Creation and/or integration of small-scale renewable energy power plants ("Energy Districts" and "Smart Grids"), with particular focus on LNG power;
- ❑ Solutions for increasing eco-save/eco-efficiency and real time monitoring of port energy consumptions;
- ❑ Fossil fuels needs analysis and studies/actions for their gradual substitution, with periodic updates of energy audits in the port operating companies;
- ❑ Integration of energy decisions within the Port of Livorno Energy Plan, with particular focus on energy and production networks safety, due to their proximity with urban areas.

# THE TUSCAN PORT SYSTEM AS A "SERVICE" FOR THE LNG CHAIN


## OFF-SHORE

Strengthening the position of the Tuscan Port System in the future

LNG oriented Motorways of the Sea market

## IN-PORT

Reinforcing Livorno as a «Oil & Gas» port

LNG energy production

Widespread adoption of LNG powered vehicles

The port as a knowledge provider in the LNG sector

## ON-SHORE

LNG Intermodal services (road/rail)

Becoming a LNG hub for the land transport modes, through the adoption of ISO-Tank container

**LNG NATIONAL TRAINING CENTRE**

Industrial Partners

# TOWARDS THE FIRST LNG CHAIN FOR THE NORTHERN TYRRHENIAN SEA

## SUPPLYING FACILITIES

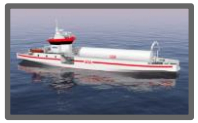
Source: OLT

New functions for the OLT storing & regasification terminal: SSLNG operations


## STORAGE & DISTRIBUTION FACILITIES


Small-scale facilities network for the Northern Tyrrhenian sea: Livorno as a hub port

## TRANSPORT



Mini LNG carriers (1000-3000 $m^3$)
Bunker barges (400-1000 $m^3$ )

Trucks/Trains/ISO containers (50-80 $m^3$)

## FINAL USERS


Rail & Road Transport

Industrial Facilities

Maritime Transport

## Advantages of the Tuscan Port system LNG hub:

- **Strategic positioning both for the maritime and the land transport sectors**
- **Offshore LNG storage, regasification AND bunkering facility**
- **Onshore small scale LNG storage and distribution facility**
- **LNG as energy source: a new cold ironing approach + energy surplus for terminals needs**
- **Intermodal LNG distribution via Iso-tank containers**

**NODE 1**
The OLT Platform

**NODE 2**
The Port LNG Terminal

**NODE 3**
The LNG/CNG filling station


# LNG AS A SOURCE FOR POWER GENERATION

**A NEW APPROACH TOWARDS THE «COLD IRONING» PROCESS**

**FROM «QUAY ELECTRIFICATION»**

**TO «MOBILE AND MODULAR» LNG FUELED POWER UNITS**

**LAND SIDE**

- LNG SUPPLY FROM
- ONSHORE STORAGE FACILITY
- ISOTANK CONTAINERS LOGISTICS

**LAND SIDE**

- MOBILE
- MODULAR
- LNG FUELED
- POWER GENERATOR

**BOTH SIDES**

- MOBILE
- SEA-TO-LAND
- LAND-TO-LAND
- INTERFACE OR ADAPTER

1

2

**SEA SIDE**

- COLD IRONING:
- CRUISERS
- FERRIES
- NEW SHIPS

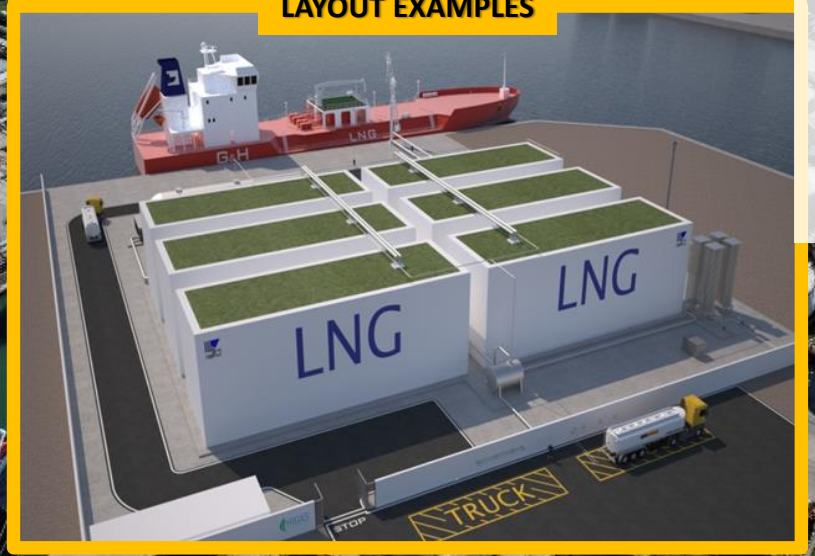
**LAND SIDE**

- TERMINALS:
- LIGHTNING
- REEFER AREAS
- ELECTRIC RTG AND VEHICLES

- **Clean, versatile and low-cost energy for addressing port energy needs**

# SMALL SCALE ONSHORE LNG STORING & REFUELING


**LAYOUT EXAMPLES**




- Initial Storage volume: 1500 $m^3$ corresponding to 675 tons
- Upwards scalability: up to 9000 $m^3$
- Annual number of supplies: 20 (during the startup phase)
- Annual number of bunkering operations: 25 during the initial phase, assuming a standard quantity of 1200 $m^3$ for each operation

# LNG INTERMODAL DISTRIBUTION FACILITY

## FEATURES

- ISO-compliant containers, worldwide std.
- Shorter handling time, versatility
- Low-level investments for starting up
- No need of refrigeration plants

## APPLICATIONS

- LNG supplying for port/yard activities
- LNG supplying for power generation
- Possible use as tank for LNG ships
- LNG supplying for refuelling stations (road)
- LNG feeding for gas distribution networks


# STC$^{LEG}$ – SIMULATION AND TRAINING CENTRE

PLANTS & EQUIPMENTS

INTERMODALITY & LOGISTICS


PORTS OPERATIONS

NAVIGATION & OFFSHORE

- **Sea**: crew members on LNG ships and personnel on offshore LNG platforms;
- **Land/Sea interface**: LNG loading, unloading, bunkering and other related operations:
- **Industrial installations**: LNG handling in industrial sites, facility maintenance (plants, tanks, pumps), cryogenic pipelines related operations;
- **Landside**: LNG tank-containers filling operations and loading/unloading on trucks and trains.


A comprehensive, distributed, facility network for the training in the LNG sector, as required also in the Italian forthcoming law (at present, a decree-scheme) implementing Directive 2014/94/EU

Livorno – Piombino – Interporto «Vespucci»: each subject will contribute with its own

- ❑ Facilities
- ❑ Equipment
- ❑ Logistical resources
- ❑ Logistics spaces
- ❑ Livorno "test bench" for the LNG chain simulation

# FINANCIAL RESOURCES FOR LNG DEVELOPMENT

fesr Fondo Europeo di Sviluppo Regionale

MARITTIMO - IT FR - MARITIME
TOSCANA - LIGURIA - SARDEGNA - CORSE

THE FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION
HORIZON 2020

Regione Toscana
POR FSE
2014-2020
FONDO SOCIALE EUROPEO

CEF programme

## LNG «NEIGHBORHOOD»
- STUDIES
- NETWORK BUILDING
- SMALL PILOTS

## LNG «RESEARCH»
- APPLIED RESEARCH
- PROTOTIYPES
- TECH. STUDIES

## LNG «SOCIETY»
- TRAINING
- HR DEVELOPMENT

## LNG «DEVELOPMENT»
- TECH. STUDIES
- PROTOTYPES, PILOTS
- SMALL SCALE INFRASCTRUCTURES

Autorità Portuale di Livorno

European Investment Bank

PORT OF LIVORNO

# LIVORNO PORT AUTHORITY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**DEVELOPMENT AND INNOVATION DEPARTMENT**
**INNOVATION, TECHNOLOGIES & RESEARCH AREA**
**f.debari@porto.livorno.it**