



Autorità Portuale
di Livorno

“Port infrastructure for alternative fuels and maritime transport: the Livorno case”

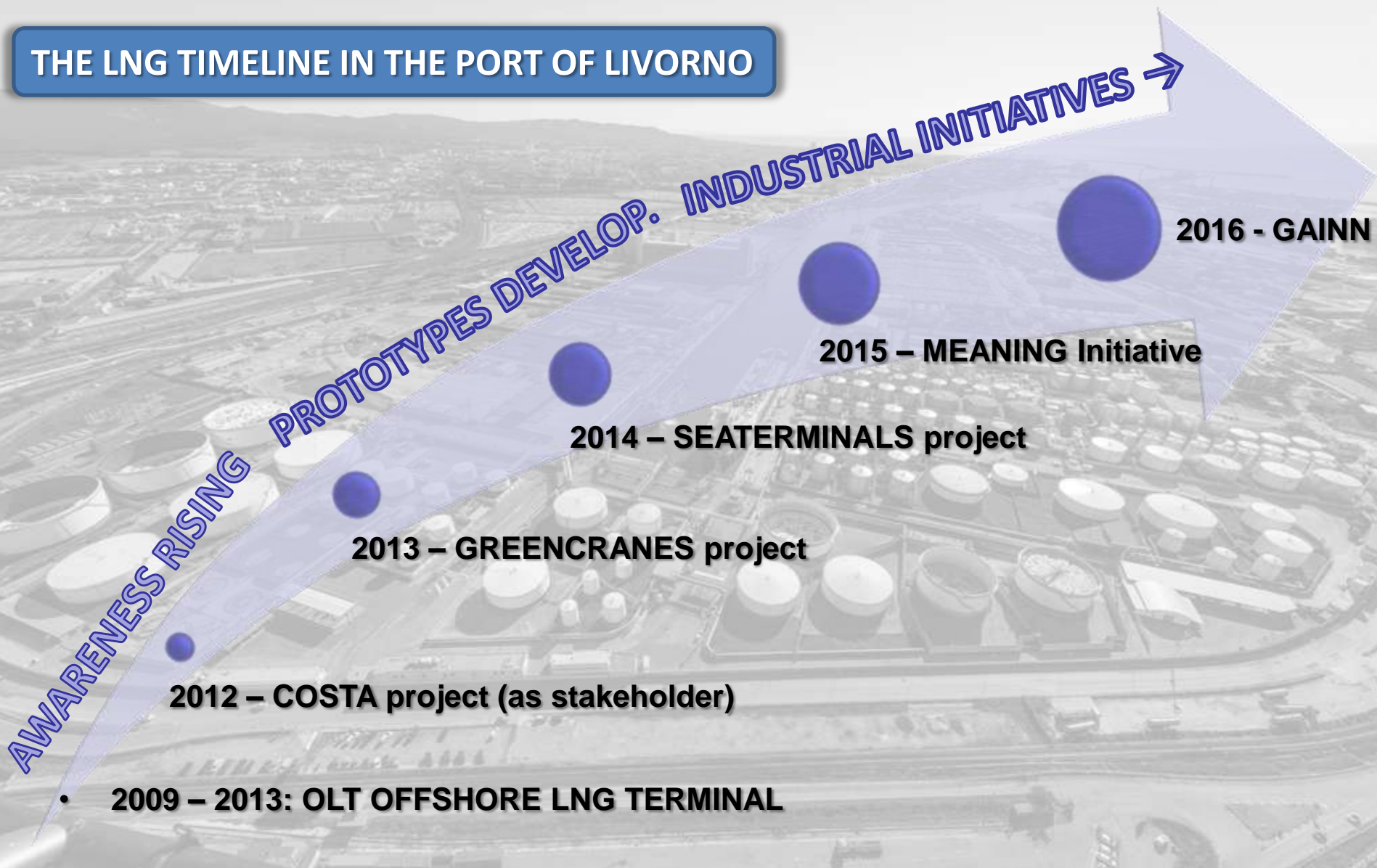
Francescalberto DE BARI

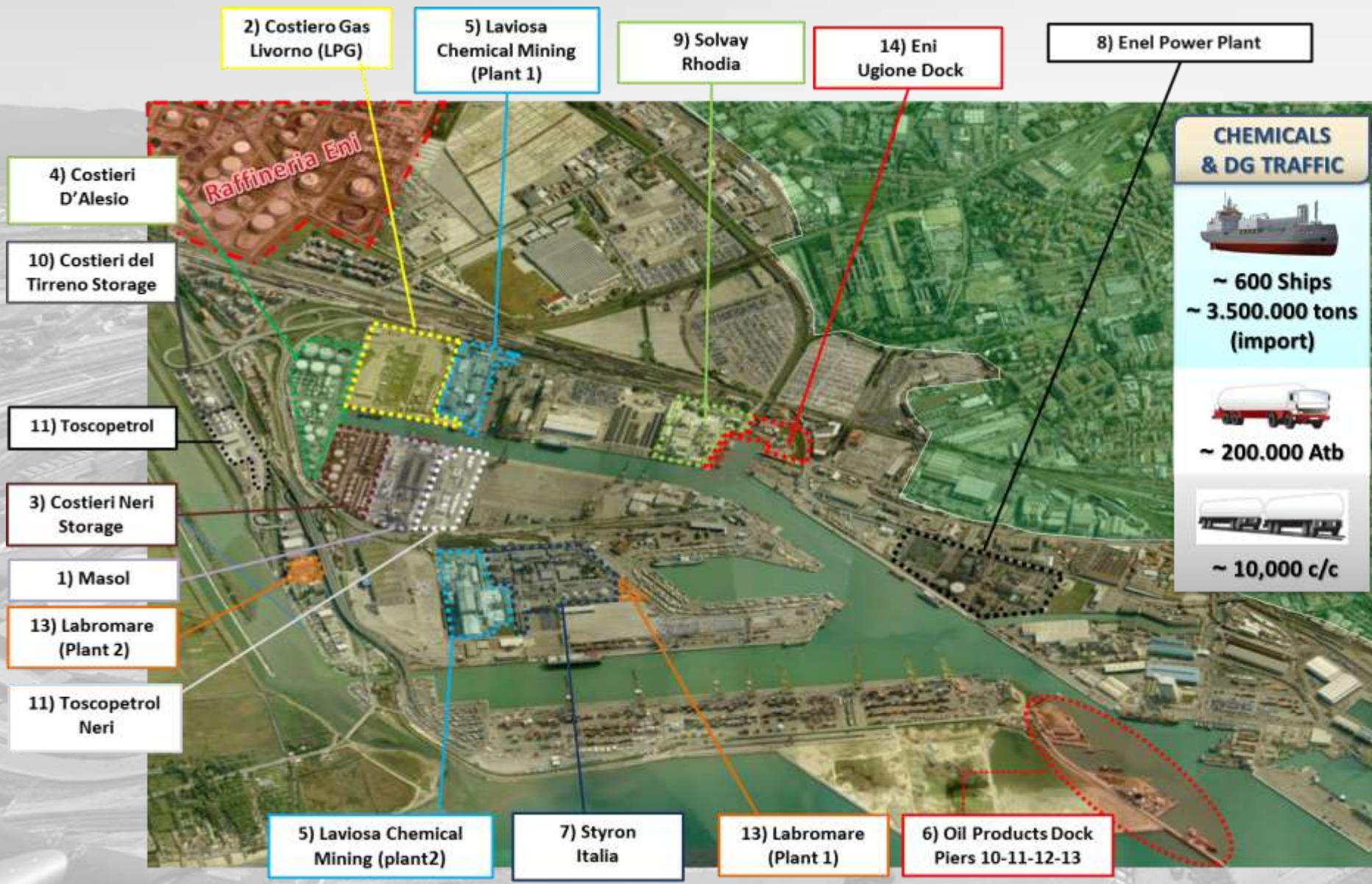
Livorno Port Authority

DEVELOPMENT AND INNOVATION DEPARTMENT



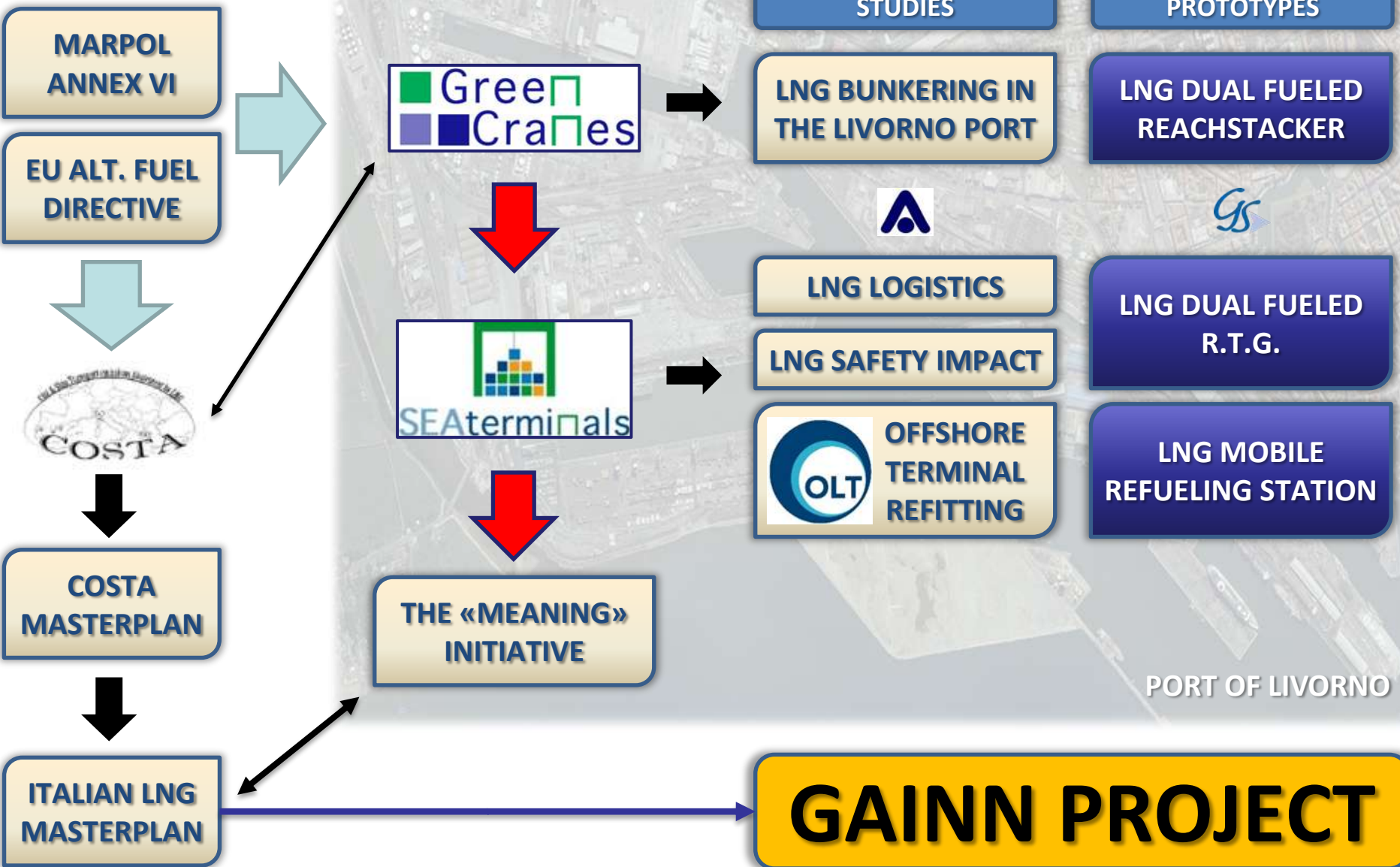
THE LNG TIMELINE IN THE PORT OF LIVORNO







- 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.



PORT OF LIVORNO

GAINN PROJECT



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

European Commission – Trans-European Network Transport Policies - INEA

Italian National Transport Authorities (MIT & MISE)

Favouring stakeholders awareness about eco-efficiency in port operations

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

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 Tyrrhenian sea

Local Industrial PS

Setting up of new industrial partnerships
Development of new products that can lead to market innovations

EUROPEAN PROJECTS' PARTNERS & ACTIVITIES

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.

STUDIES & ANALYSIS



LNG BUNKERING IN THE PORT OF LIVORNO

Setting up of an LNG terminal/storage facility with a capacity of 1,500 m³, scalable up to 9,000 m³.

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 m³ (6x1500 m³)
- Maximum transfer capacity for filling SSLNG vessels: 250 m³/hr
- Max LNG transfer capacity for filling truck/rail-tanks: 60 m³/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.)**



STUDIES & ANALYSIS



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



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)
- Simplified logistics for final users
- LNG transportation towards remote targets

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 m³ to 7,500 m³
- Mini LNGC Length: between 60 m to 110 m
- Loading rate between 250 m³ and 900 m³ (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:

INSTITUTIONS

21 JANUARY 2013: Mou
Innovation, ICT, Alternative fuels



Ministero dello
SVILUPPO ECONOMICO



RESEARCH



POLO UNIVERSITARIO SISTEMI LOGISTICI

cnit

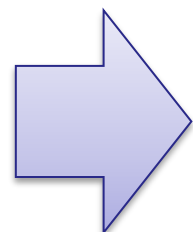
INDUSTRY



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**



- LNG Bunkering ship
- ISO-Tank
- Offshore/Onshore storage
- Natural Gas Network + Microliquefactor
- Storage & ancillaries
- LNG fuelled ship
- LNG fuelled vehicles

- LNG receiving system
- LNG storage system
- LNG refuelling for ship and/or LNG fuelled ship
- LNG refuelling for vehicles and/or LNG fuelled vehicles

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 TYRRHENIAN 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.



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



SUPPLYING FACILITIES

STORAGE & DISTRIBUTION FACILITIES

TRANSPORT

FINAL USERS

Source: OLT

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



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



Mini LNG carriers (1000-3000 m³)
Bunker barges (400-1000 m³)



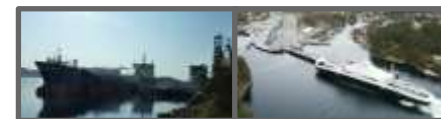
Trucks/Trains/ISO containers (50-80 m³)



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



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

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



LAYOUT EXAMPLES



- ❑ Initial Storage volume: 1500 m³ corresponding to 675 tons
- ❑ Upwards scalability: up to 9000 m³
- ❑ 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 m³ for each operation



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



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



LNG «NEIGHBORHOOD»

- STUDIES
- NETWORK BUILDING
- SMALL PILOTS

LNG «RESEARCH»

- APPLIED RESEARCH
- PROTOTYPES
- TECH. STUDIES

LNG «SOCIETY»

- TRAINING
- HR DEVELOPMENT

LNG «DEVELOPMENT»

- TECH. STUDIES
- PROTOTYPES, PILOTS
- SMALL SCALE INFRASTRUCTURES



PORT OF LIVORNO

THANK YOU FOR YOUR ATTENTION !

FOR INFORMATION AND CONTACTS:

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