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

Francescalberto DE BARI

Livorno Port Authority
PRESENTATION CONTENTS

THE LNG TIMELINE IN THE PORT OF LIVORNO

2012 – COSTA project (as stakeholder)

2013 – GREENCranES project

2014 – SEATERMINALS project

2015 – MEANING Initiative

2016 - GAINN

• 2009 – 2013: OLT OFFSHORE LNG TERMINAL

- 2012 – COSTA project (as stakeholder)
- 2013 – GREENCranES project
- 2014 – SEATERMINALS project
- 2015 – MEANING Initiative
- 2016 - GAINN
- 2012 – COSTA project (as stakeholder)
- 2013 – GREENCranES project
- 2014 – SEATERMINALS project
- 2015 – MEANING Initiative
- 2016 - GAINN
Livorno Port Authority presentation

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

- 2) Costiero Gas Livorno (LPG)
- 5) Laviosa Chemical Mining (Plant 1)
- 9) Solvay Rhodia
- 14) Eni Ugione Dock
- 8) Enel Power Plant

- 4) Costieri D'Alesio
- 7) Styron Italia
- 13) Labromare (Plant 2)
- 6) Oil Products Dock Piers 10-11-12-13

- 10) Costieri del Tirreno Storage
- 3) Costieri Neri Storage
- 11) Toscopetrol Neri

- 11) Toscopetrol

- Chimiicals & DG Traffic:
  - ~ 600 Ships
  - ~ 3.500.000 tons (import)
  - ~ 200,000 Atb
  - ~ 10,000 c/c
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 MASTERPLAN
- ITALIAN LNG MASTERPLAN

STUDIES:
- LNG BUNKERING IN THE LIVORNO PORT
- LNG LOGISTICS
- LNG SAFETY IMPACT

PROTOTYPES:
- LNG DUAL FUELED REACHSTACKER
- LNG MOBILE REFUELING STATION

PORT OF LIVORNO

THE «MEANING» INITIATIVE

GAINN PROJECT
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

Development of new products that can lead to market innovations

EUROPEAN PROJECTS’ PARTNERS & ACTIVITIES

Can be considered as components of the same progressive integration strategy between:
**PRODUCTS & PROTOTYPES DEVELOPMENT**

- **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

- **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**, 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.
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

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.

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.)

PREVIOUS ACTIVITIES OUTCOMES (2)
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
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: OLT Offshore LNG Toscana
Livorno, Italy
Feasibility study for LNG transfer Technical Report from FARRU Toscana on Mini LNG Carriers
21 JANUARY 2013: Mou Innovation, ICT, Alternative fuels
• 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
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 Tuscany 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

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)

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

Source:

Livorno Port Authority presentation
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

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

Livorno Port Authority presentation
- 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
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
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

**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

Autorità Portuale di Livorno

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