

POSEIDON MED LNG Bunkering Project

Port of Koper Preliminary assessment Local report

LNG Storage
Chemical Gas Storage
Liquefaction Plants
Gas Processing
Package Plants



Requirements (Poseidon Med): Assessment of LNG implementation potential

- An assessment of the future LNG demand for:
 - shipping companies (bunkering for maritime transportation)
 - road haulers (refilling for heavy duty road transportation)
 - port reloading equipment (refilling for port operations machinery)
 - other potential users
- Verification of possibilities to:
 - install the necessary LNG infrastructure
 - implement LNG supply logistics
- Assessment period: 2020 - 2040

Strategic shift toward (L)NG in mobility

Mandatory international agreements

- **EU Parliament Directive 2014/94/EU**
 - ... the necessary average distance between refuelling points should be:
 - CNG approximately 150 km.
 - LNG approximately 400 km.
 - ... LNG at maritime and inland ports should be available at least by the end of 2025 and 2030 ...
 - An appropriate number of LNG and CNG refuelling points accessible to the public should be put in place by 31 December 2025, at least along the TEN-T Core Network existing at that date
- **Slovenia has 2 Core Network Corridors crossing its Country**
 - The Baltic-Adriatic Corridor
 - The Mediterranean Corridor
- **Slovenia participates in „Blue Corridor“ initiative**

Strategic shift toward (L)NG in mobility

Mandatory international agreements

- **Emission Controlled Areas (ECAs) of the IMO Marpol VI Protocol**
 - Sulphur Emission Control Areas (SECAs)
 - Nitrogen Oxide Emission Control Areas (NECAs)
- areas in which stricter controls were established to minimize airborne emissions (SO_x, NO_x, ODS, VOC) from ships

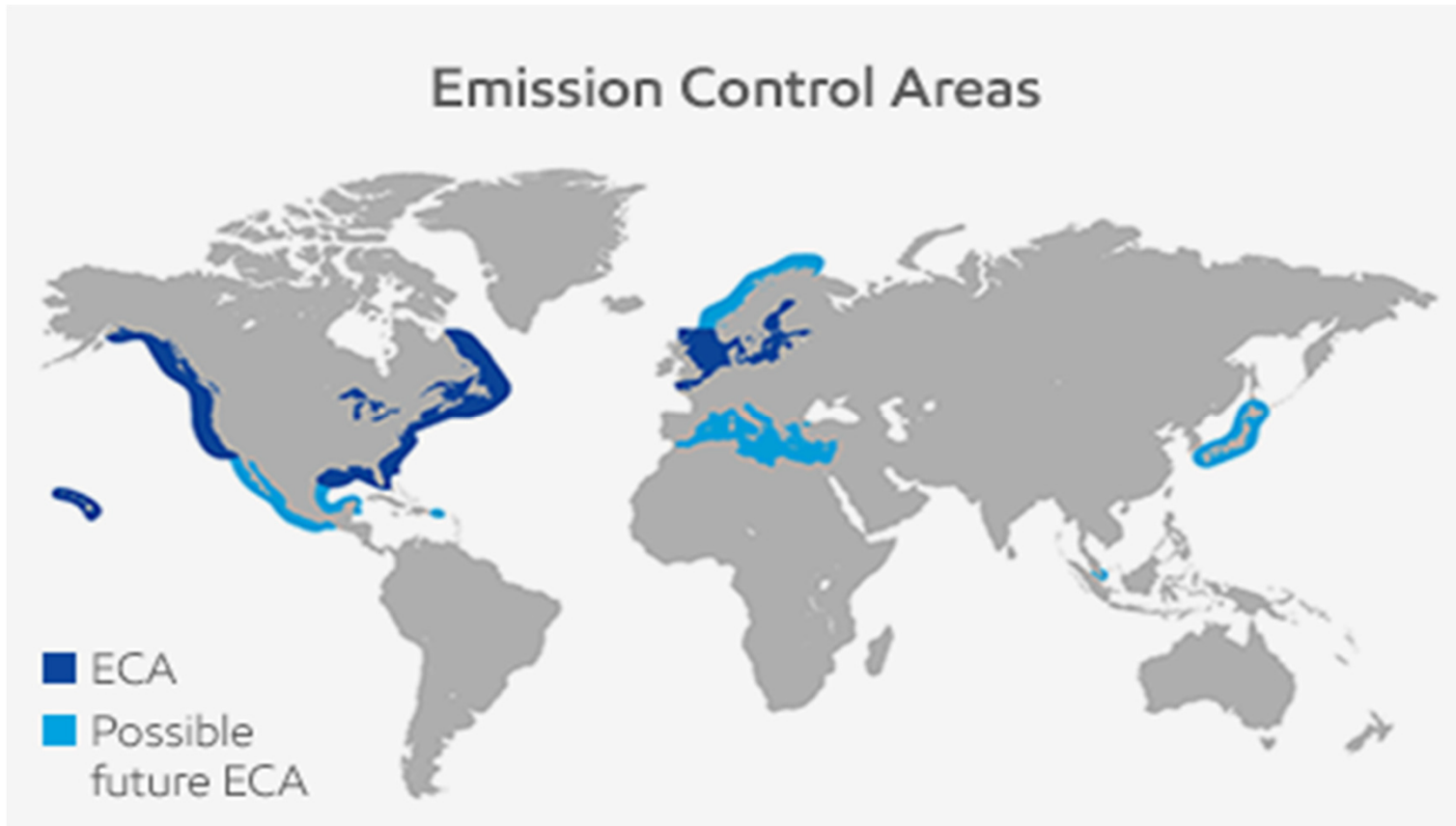
Sulphur limits for fuel in SECA	
before 1 July 2010	1.50% m/m
between 1 July 2010 and 1 January 2015	1.00% m/m
after 1 January 2015	0.10% m/m

	Entry into force	New diesel engines installed on ships	NO _x limit in g/kWh	Relative reduction compared to Tier I
Tier I	2005	from 1-01- 2000 to 1-01- 2011	9.8-17.0	-
Tier II	2011	After 1 January 2011	7.7-14.4	15-25%
Tier III	Flexible from, 2016-2020	Flexible, only when operating in NECAs	2.0-3.4	80%

Source: IMO Marpol VI Protocol

Strategic shift toward (L)NG in mobility

Mandatory international agreements



In the Commission Staff Working Document (**European Commission 2013**) it is stated that **LNG** (Liquefied Natural Gas) is the **most promising alternative shipping fuel in the short term**, at least for short sea transport.

LNG demand from maritime transportation

- Likelihood of LNG fuelled ship calling Port of Koper:
 - 2020: minimum one ship per month, more likely one ship per week
 - 2030: one to two ships per week
 - 2040: one ship every two days
- Average LNG fuelled ship size calling Port of Koper in near future
 - container carriers, automobile transportation ships (Ro-Ro), general and bulk cargo ships, will represent half of all traffic
 - Koper accepts big passenger/tourist ships
 - statistically taken: 10 MW propulsion engine => 5.000 t LNG / year

Structure of Port of Koper ship traffic is such that matches with ship classes, which are under fastest LNG fuel implementation process. Consequently the probability of LNG fuelled ship calling Port of Koper in near future is high.

LNG demand from maritime transportation

- From the current bunkering statistics, it seems that there is very little bunkering activity in the Port of Koper; only small ships take bunker oil!!
- Considering that most of ships traffic is from outside ECAs, it seems that small quantities of LNG will be bunkered in the Port of Koper
- We assume:
 - 2.5% of total bunkering shall be LNG by 2020 => 500 t/y of LNG
 - 5% of total bunkering shall be LNG by 2030 => 1,000t/y of LNG
- Should however one medium size ship (10 MW engine) regularly bunker in Koper with LNG every week, its total LNG consumption would be about 5,000 t/y.

LNG demand from road transportation

- Main drivers that will support use of LNG in heavy duty road transportation:
 - Dual-diesel fuel – DDF technologies are already available
 - New trucks using gas engines are entering into market (LNG, CNG)
 - Cost of NG is estimated to be more favourable compared to diesel
 - Gas engine using NG (LNG or CNG tank) is by default EURO 6
 - Stricter emission regulations in urban areas
 - Emergence of traffic corridors that support NG vehicles (like Blue Corridors)
- Estimation
 - Target number of 30 refuellings per day
 - Standard 450 lit LNG tank
 - Consumption => 1,000 t LNG /y

LNG demand from port operations

- Two groups of potential future LNG consumers are identified:
 - yard cargo manipulation machinery
 - electricity production for ships supply
- Yard cargo manipulation machinery
 - Foreseen is most viable option: DDF upgrade
 - Fuel consumption ratio in not more than 50:50 (diesel:LNG) is expected
 - Expected LNG consumption of 500 t/y
- Electricity production (generator sets)
 - 27 MW (electrical) installed power
 - 4.000 working hours
 - Expected LNG consumption of 20.000 t/y

Cumulative LNG demand

	Medium term 2015-2020		Long term 2030	
LNG Demand	tons LNG/week	tons LNG/year	tons LNG/week	tons LNG/year
Maritime transport	10	500	30	1.000
Road transport	20	1.000	100	5.000
Port movers	10	500	10	500
Port EE power	400	20.000	400	20.000
TOTAL LNG DEMAND	440	22.000	540	26.500

- LNG ship bunkering is foreseen only in minor extent
- Shall LNG bunkering comes more into focus, calculation based on consumption 5.000 t LNG / year / ship can be taken into account
- In the mid-term, we expect above all the introduction of LNG for vehicles (Heavy Duty) in road transport
- Significant increase of ships using LNG for propulsion is expected only within 3-5 years

The LNG plant and supply system

- To raise any LNG infrastructure in Koper some state level acts should be adopted **first**. For the moment, LNG is not foreseen neither as cargo and neither as a fuel.
- Plant supply modalities possible by:
 - Ships
 - Trains
 - Trucks
- LNG transfer types possible via:
 - Containerised solutions
 - Pumping from fixed tanks
- Bunkering variants:
 - Ship to ship
 - Truck to ship
 - LNG bunkering terminal to ship

Various examples of mobile L-CNG stations



„Containerised“ LNG storage



Source: ESN – Way Forward SECA report

LNG trailers



Classical LNG tanks and gasificators

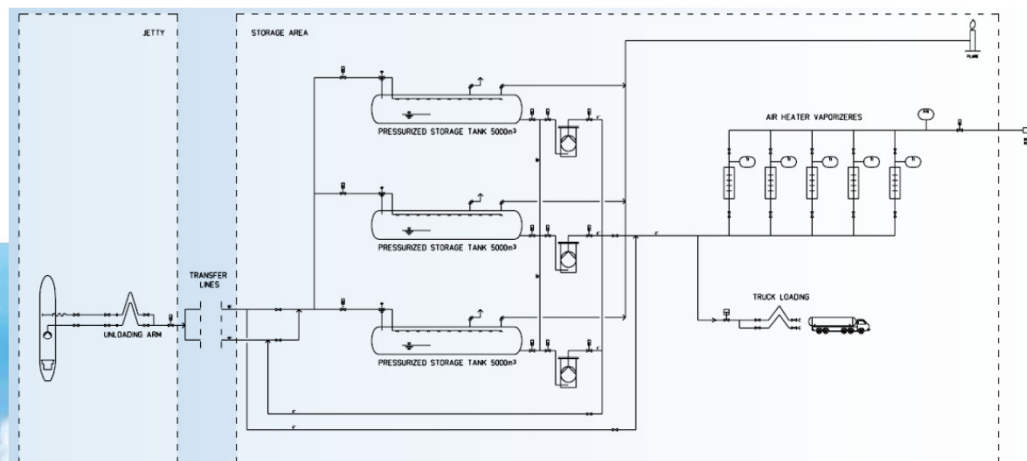
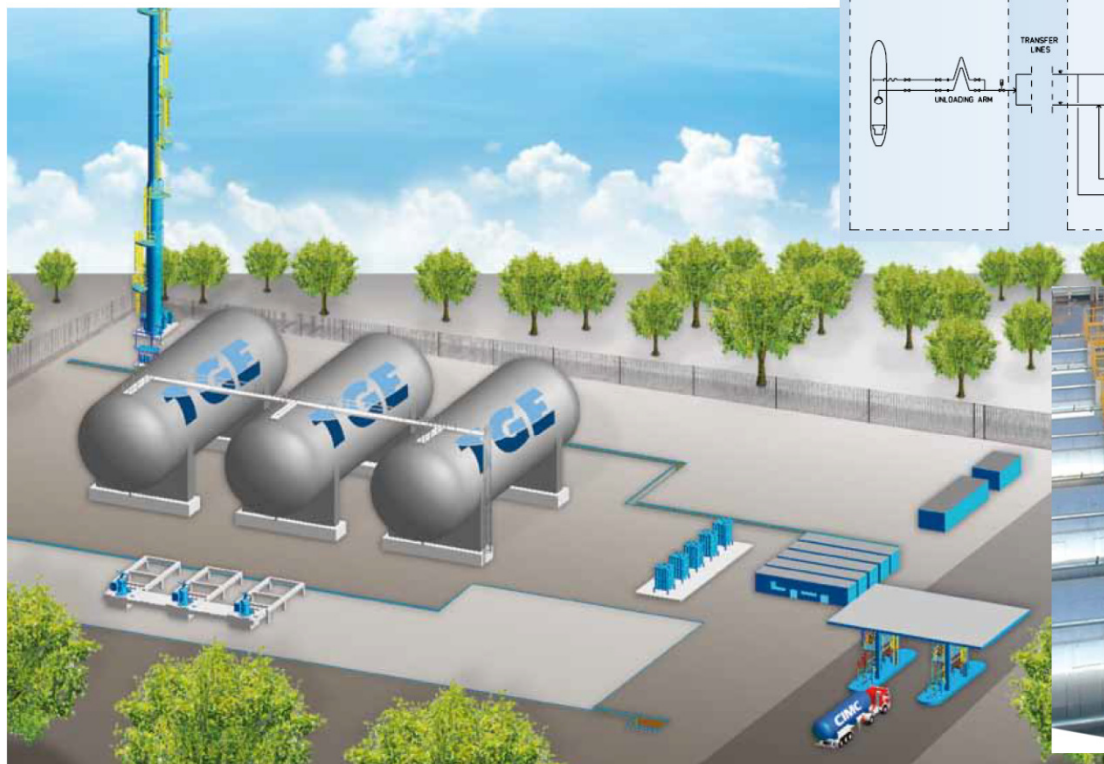


LCNG Truck Filling Station (Innogas-2011 Norway)



Small Scale LNG storage & Distribution Terminals

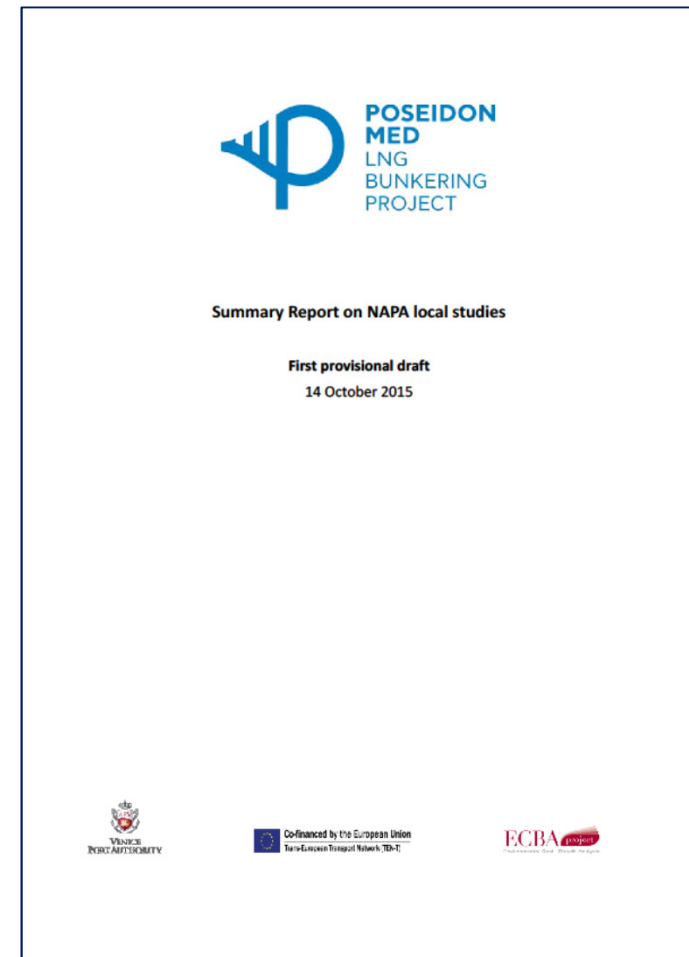
Source: TGE Gas Engineering



Comparison among North Adriatic ports

- Ports compared:
 - Venice
 - Trieste
 - Koper
 - Rijeka
- Comparison objective:
 - Use of LNG to achieve Poseidon Med project targets
 - Targets are directly related to:
EU Parliament Directive 2014/94/EU
- With another words:

GHG  **with LNG**
CLEAN AIR 



Comparison among North Adriatic ports LNG demand analysis in NAPA ports

Aim of the local study in the context of local/national planning

Short description of the infrastructures analyzed to deliver LNG through port refueling points

	Venice	Trieste	Koper	Rijeka
LNG bunker. storage tanks:	yes	yes	no	yes
Acceptance of small LNGC:	yes	no	no	yes
ship-to-ship refueling:	yes	yes	no	yes
truck-to-ship refueling:	yes	yes	yes	yes
LNG trailers filling:	yes	yes	no	yes
vehicle refueling station:	yes	yes	yes	yes
power generation:	no	no	yes	no

Comparison among North Adriatic ports LNG supply chain

LNG end-users types analysed

Investigation field boundaries for LNG market analysis

Maritime transport:	Venice	Trieste	Koper	Rjeka
LNG ships calling port:	yes	yes	yes	yes
inland waterways:	yes	no	no	yes
port services (tugs):	yes	yes	no	yes

Road transport:	Venice	Trieste	Koper	Rjeka
HDV (in-out transport):	yes	yes	yes	yes
HDV (local traffic):	yes	no	no	yes
CNG available (L-CNG stat):	yes	no	yes	yes

Overall demand in 2030 (LNG values in tonnes)

	Venice	Trieste	Koper	Rjeka
Total LNG demand at 2030:	797,688	30,000	26,500	11,258

Comparison among North Adriatic ports LNG supply chain

Possible size of the storage plant

Capacity and total surface

	Venice	Trieste	Koper	Rijeka
LNG storage plant evaluated:	yes	yes	no	yes
	120.878 m ³	330 m ³	no LNG storage!	2,000 m ³

Possible LNG supply sources - and related means of transport

Direct procurement from a LNG producing country

	Venice	Trieste	Koper	Rijeka
	Direct procurement from LNG producing countries	No direct procurement	No direct procurement	No direct procurement Krk import terminal!

Krk import terminal might have an important role for all NA ports

Direktiva 2014/94/EU



Ministrstvo za infrastrukturo

... Alternative fuels are electricity, **liquefied and compressed natural gas** and hydrogen

... The national targets for the use of liquefied natural gas (LNG) transport:

up to 2025:

- ensure adequate number of the supply points in harbours for supplying ships with LNG,
- ensure adequate number of places for LNG supply, at least in the core TEN-T network, for heavy duty vehicles,
- to ensure adequate distribution system for LNG.

The (LNG) study for Koper Conclusions:

...

At the moment, any solution that might suggest raising any static (built) LNG flow or storage infrastructure in the Port of Koper area is not credible.

...