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Territorial Needs Assessment - Ports of Venice and Chioggia

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Contents

The objective of this document is to assess the state-of-the-art situation in terms of various emissions in the port areas of Venice and Chioggia. In particular, the Territorial Needs Assessment (TNA) will focus on the Inventory of GreenHouse Gases (GHG) – also called "Carbon footprint". It is based on the figures and data of the year 2019.

Introduction

NASPA (North Adriatic Sea Port Authority) is an independent public body according to the Port Italian Law in force. Its task is to guide, plan, promote and monitor port activities in the European Core port of Venice and European Comprehensive port of Chioggia, which was recently merged in 2017. It is also in charge of maintaining infrastructures and dredging, overseeing the supply of services of general interest (Nautical services among them, waste management and others), managing the State Maritime Property and planning the development of the port. The throughput average is up to €100 million/year deriving from concession fees and port tariffs for goods.

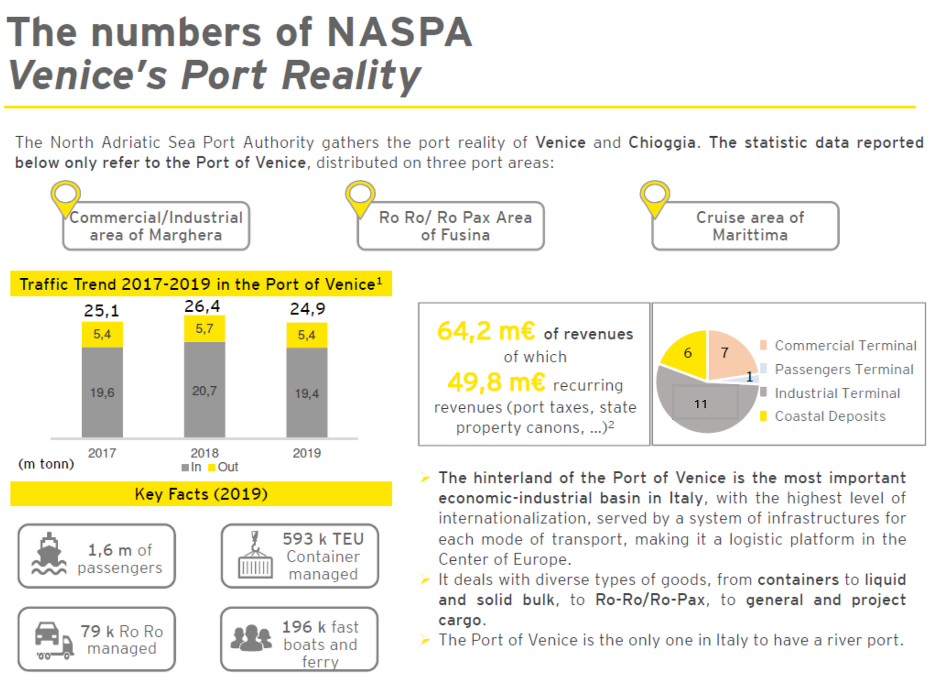


Fig. 1 – Port of Venice main trends 2017-2019

Description of the port area

NASPA is a multipurpose port system with a landlord port model governance, that directs, plans, promotes state-owned property, coordinates and controls port operations that are carried out by private companies on concessions basis, guaranteeing and leveraging the common playing field. The 25 port terminals have direct railway and highway connections (7 commercial and 18 privately-owned).

COMMERCIAL TERMINALS
1.Terminal Intermodale Adriatico (TIA)
2.Multiservice
3.Terminal Intermodale Venezia (TIV)
4.Terminal Rinfuse Venezia (TRV)
5.Transped
6.Vecon
7.Venice Ro-Port Mo.S.

INDUSTRIAL TERMINALS
8. Alcoa Trasformazioni
9. Cereal Docks Marghera
10. Colacem
11. Enel Produzione Fusina
12. Grandi Molini Italiani (GMI)
13. Idromacchine
14. ArcelorMittal Italia
15. AFV Acciaierie Beltrame
16. Consorzio Venezia Nuova
17. Simar
18. Pilkington

OIL TERMINALS
19. Eni
20. Decal
21. Petroven
22. S. Marco Petroli
23. I.E.S.
24. Versalis

PASSENGER TERMINAL
Venezia Terminal Passeggeri (VTP)

Fig. 2 – Terminals Port of Venice

For further information related to the port terminals: https://www.port.venice.it/en/terminals.html

Strategically located at the top end of the Adriatic Sea, at the intersection of the main European transport corridors and of the Motorways of the Sea (MoS), the Port of Venice is in a position to act as the European gateway for trade flows to and from Asia. The Port of Venice's position means it can act as the main entry point to a vast area of central Europe - including amongst others North-Eastern Italy, Austria and Bayern - in addition to Eastern Europe and some of the European Union's most dynamic markets.

The Port of Venice is also located at the intersection of two main European Corridors, the Mediterranean Sea Corridor and the Baltic-Adriatic Corridor.

The Port of Venice is also the northernmost terminal of the Motorways of the Sea that cross the Eastern Mediterranean and connect Central Europe with North Africa and the Middle East. Along with other North Adriatic ports, it is in the right place at the right time to exploit its geographical advantage of being the closest point to the heart of manufacturing Europe, saving 5 sailing days on a typical trip from Shanghai to Munich, saving also 135 kg/TEU of Co2. It is one of the major European ports for project and general cargo, and one of the main port in the Adriatic for the number of containers handled.

A leader in many traffic segments, it is the only port in Italy with access to inland waterways trough the Po Valley (Mantua and Cremona), benefitting from a river port providing freight transport by barge along the Po river, helping decarbonizing transport. Its aim is to build a "Model Port" that respects the environment, is safe, open and ethical.

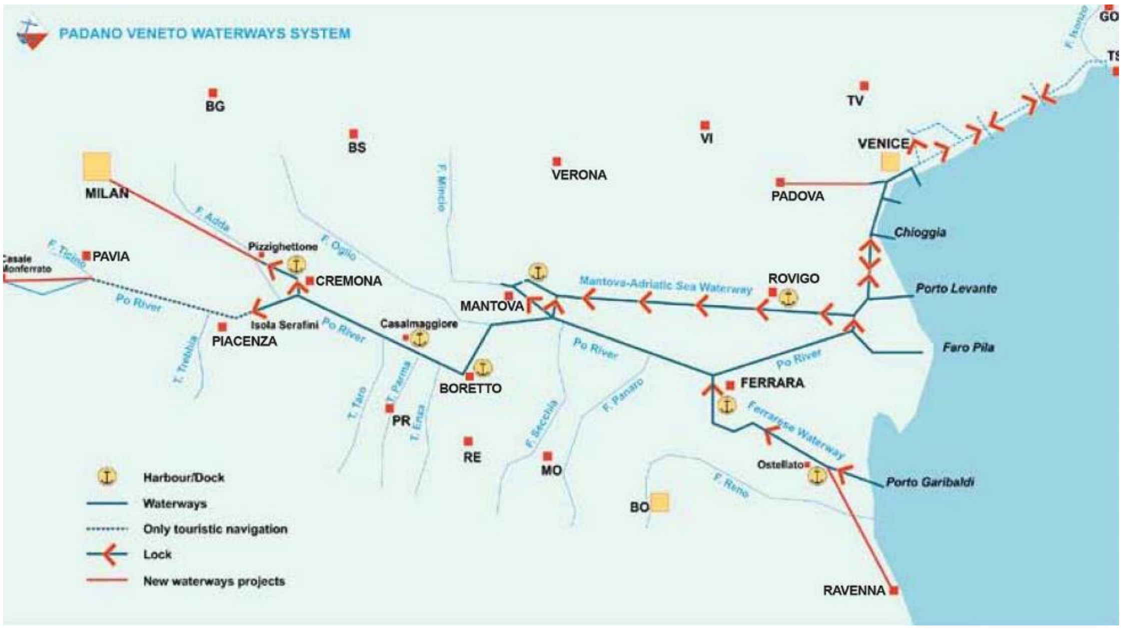


Fig. 3 – IWW System Po River

The port in figures

The Port of Venice stretches over an area of more than 2,045 hectares: this corresponds to 5% of the total surface and 11% of the built-up area of the Municipality of Venice. It includes more than 30 kilometres of quaysides that in turn host 163 berths organised in the Port's 25 terminals, catering for commercial, industrial and passenger traffic.

Within the port there are two very distinct areas, namely Porto Marghera- which hosts the logistics, commercial and industrial activities -, and the Port in Venice, which has mainly risen around the Marittima passenger port and minor berths where passenger services are organised and supplied to cruise ships, hydrofoils and yachts.

The port of Porto Marghera occupies more than 1,447 hectares of industrial, commercial and tertiary operational areas; it includes more than 662 hectares of canals, basins, roads and railways, and is served by 12 kilometers of active quaysides that can welcome ships with a draught up to 11.5 meters. A dense infrastructure network serves the Port of Porto Marghera, and includes roads and junctions (40 kilometers), rail tracks (more than 135 kilometers) and optical fiber (7 kilometers).

The Venice side of the Port, dedicated to passenger traffic, covers an area of more than 26 hectares, with built-up areas accounting for 4,73 hectares and the water basin for 12,37 hectares in the

Marittima passenger port. There are five main areas to the passenger port: the Marittima Passenger Port, San Basilio, Santa Marta, Riva delle Zattere and Riva degli Schiavoni, in addition to Fusina, on the mainland, that caters for ferries. The Marittima passenger port is Venice's cruise terminal: it can berth up to ten ships simultaneously in its 3.5 kilometers of quaysides and 10 terminals, for a total of 11 berths. The Fusina ferry terminal stretches over 36 hectares of land and provides 4 berths.

The Port of Chioggia is located between the islands of Pellestrina and Sottomarina: it is the southernmost access point to the Venice Lagoon. The only access point to the port is the Chioggia Inlet, that is 550 m wide with a navigable depth of 8m below the sea level.

In 2019 the total throughput was about 24.917.830 tons. With 593.070 TEUs handled in 2019 Venice is one of the leading Adriatic container ports. Venice is also leading Adriatic's home port (1.397.428 passengers in 2019).

ESPO								
	2018 - 2018 January - December			2019 - 2019 January - December			Diff.	
	IN	OUT	TOTALE	IN	OUT	TOTALE	TOTALE	%
TOTAL TONNAGE	**20.726.041**	**5.774.187**	**26.500.228**	**19.484.114**	**5.433.716**	**24.917.830**	**-1.582.398**	**-5,9**
LIQUID BULK	**8.461.903**	**901.083**	**9.362.986**	**8.348.065**	**669.652**	**9.017.717**	**-345.269**	**-3,6**
of which:								
Crude oil	0	0	0	0	0	0	**0**	
Refined (petroleum) products	7.310.552	450.817	7.761.369	7.197.873	323.928	7.521.801	**-239.568**	**-3,0**
Gaseus, liqufied or compressed	0	0	0	0	0	0	**0**	
Chemical products	923.760	383.966	1.307.726	890.940	280.831	1.171.771	**-135.955**	**-10,3**
Other liquid bulk	227.591	66.300	293.891	259.252	64.893	324.145	**30.254**	**10,2**
DRY BULK	**7.251.339**	**134.342**	**7.385.681**	**6.048.215**	**135.712**	**6.183.927**	**-1.201.754**	**-16,2**
of which:								
Cereals	885.553	43.284	928.837	593.893	67.921	661.814	**-267.023**	**-28,7**
Foodstuff/Fodder/Oil seeds	1.575.698	9.343	1.585.041	1.516.898	12.234	1.529.132	**-55.909**	**-3,5**
Coal and lignite	2.105.278	0	2.105.278	1.381.096	5.536	1.386.632	**-718.646**	**-34,1**
Ores/cement/lime/plasters	420.482	3.157	423.639	372.831	0	372.831	**-50.808**	**-11,9**
Metallurgical Products	1.799.540	61.026	1.860.566	1.581.236	3.299	1.584.535	**-276.031**	**-14,8**
Chemical products	110.394	5.060	115.454	122.178	0	122.178	**6.724**	**5,8**
Other dry bulk	354.394	12.472	366.866	480.083	46.722	526.805	**159.939**	**43,5**
GENERAL CARGO	**5.012.799**	**4.738.762**	**9.751.561**	**5.087.834**	**4.628.352**	**9.716.186**	**-35.375**	**-0,3**
of which:								
Containerized	2.234.000	3.467.390	5.701.390	2.275.864	3.412.269	5.688.133	**-13.257**	**-0,2**
Ro-Ro	880.959	960.532	1.841.491	840.220	923.414	1.763.634	**-77.857**	**-4,2**
Other general cargo	1.897.840	310.840	2.208.680	1.971.750	292.669	2.264.419	**55.739**	**2,5**
ADDITIONAL INFORMATION								
Number of Calls			**3.594**			**3.363**	**-231**	**-6,4**
Gross Tonnage			**81.786.912**			**78.113.793**	**-3.673.119**	**-4,4**
Number of local and ferry passengers	**107.169**	**102.894**	**210.063**	**100.232**	**96.308**	**196.540**	**-13.523**	**-6,4**
of which:								
Local (< 20 miles journey)	50.534	49.535	100.069	46.926	46.328	93.254	**-6.815**	**-6,8**
Ferry passengers	56.635	53.359	109.994	53.306	49.980	103.286	**-6.708**	**-6,0**
Cruise passengers			**1.577.785**			**1.617.945**	**40.160**	**2,5**
"Home Port"	670.974	667.628	1.338.602	698.309	699.119	1.397.428	**58.826**	**4,3**
"Transits" (to be counted once)			239.183			220.517	**-18.666**	**-7,8**
Number of Containers (in TEU)	**334.697**	**297.553**	**632.250**	**308.567**	**284.503**	**593.070**	**-39.180**	**-6,1**
"Hinterland"	**334.697**	**297.553**	**632.250**	**308.567**	**284.503**	**593.070**	**-39.180**	**-6,1**
of which:								
Empty	190.825	22.625	213.450	160.490	16.741	177.231	**-36.219**	**-16,9**
Full	143.872	274.928	418.800	148.077	267.762	415.839	**-2.961**	**-0,7**
"Transshipped"	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
of which:								
Empty	0	0	0	0	0	0	**0**	
Full	0	0	0	0	0	0	**0**	
Ro-Ro units	**38.892**	**42.647**	**81.539**	**37.796**	**41.415**	**79.211**	**-2.328**	**-2,8**
Number of private vehicles	**18.111**	**18.303**	**36.414**	**17.251**	**17.707**	**34.958**	**-1.456**	**-3,9**
Number of commercial vehicles	**24.955**	**19.991**	**44.946**	**18.635**	**23.183**	**41.818**	**-3.128**	**-6,9**

Table 1 – PORT OF VENICE – THROUGHPUT STATISTICS January – December 2019 (Source NASPA)

ESPO								
	2018 - 2018 January - December			2019 - 2019 January - December			Diff.	
	IN	OUT	TOTALE	IN	OUT	TOTALE	TOTALE	%
TOTAL TONNAGE	754.532	267.436	1.021.968	803.669	514.606	1.318.275	296.307	28,9
LIQUID BULK	0	0	0	1.905	0	1.905	1.905	
of which:								
Crude oil	0	0	0	0	0	0	0	
Refined (petroleum) products	0	0	0	0	0	0	0	
Gaseus, liqufied or compressed petroleum products and natural gas	0	0	0	0	0	0	0	
Chemical products	0	0	0	1.905	0	1.905	1.905	
Other liquid bulk	0	0	0	0	0	0	0	
DRY BULK	647.452	15.010	662.462	703.495	59.036	762.531	100.069	15,1
of which:								
Cereals	11.510	0	11.510	11.220	0	11.220	-290	-2,5
Foodstuff/Fodder/Oil seeds	42.392	0	42.392	57.947	0	57.947	15.555	36,6
Coal and lignite	0	0	0	0	0	0	0	
Ores/cement/lime/plasters	313.848	3.700	317.548	396.645	0	396.645	79.097	24,9
Metallurgical Products	0	1.916	1.916	0	981	981	-935	-48,7
Chemical products	120.503	0	120.503	119.256	0	119.256	-1.247	-1,0
Other dry bulk	159.199	9.394	168.593	118.427	58.055	176.482	7.889	4,6
GENERAL CARGO	107.080	252.426	359.506	98.269	455.570	553.839	194.333	54,0
of which:								
Containerized	0	467	467	0	256	256	-211	-45,1
Ro-Ro	0	55	55	0	83	83	28	50,9
Other general cargo	107.080	251.904	358.984	98.269	455.231	553.500	194.516	54,1
ADDITIONAL INFORMATION								
Number of Calls			336			360	24	7,1
Gross Tonnage			972.574			1.254.581	282.007	28,9
Number of local and ferry passengers	0	0	0	0	0	0	0	
of which:								
Local (< 20 miles journey)	0	0	0	0	0	0	0	
Ferry passengers	0	0	0	0	0	0	0	
Cruise passengers			0			0	0	
"Home Port"	0	0	0	0	0	0	0	
"Transits" (to be counted once)			0			0	0	
Number of Containers (in TEU)	0	69	69	0	56	56	-13	-18,8
"Hinterland"	0	69	69	0	56	56	-13	-18,8
of which:								
Empty	0	0	0	0	0	0	0	
Full	0	69	69	0	56	56	-13	-18,8
"Transshipped"	0	0	0	0	0	0	0	
of which:								
Empty	0	0	0	0	0	0	0	
Full	0	0	0	0	0	0	0	
Ro-Ro units	0	5	5	0	63	63	58	1.160,0
Number of private vehicles	0	0	0	0	0	0	0	
Number of commercial vehicles	0	0	0	0	0	0	0	

Table 2 – PORT OF CHIOGGIA – THROUGHPUT STATISTICS January – December 2019 (Source NASPA)

Port Connections – Ports of Venice and Chioggia

In the transport system, the ports represent the connection point between the maritime and the land modes. There are four classic terrestrial modes to which we refer: railway, road, river/IWW and pipeline - to which we now add an additional modality, the digital ICT network.

The Port of Venice handles most of the traffic on the road, an increasingly large share of railways, and smaller shares by pipeline and on the river system.

Nautical accessibility

The nautical accessibility to the ports of Venice and Chioggia is ensured by the great navigation channels connected to the sea through three port inlets: Lido (cruise lines) and Malamocco (Cargo) for the port of Venice, Chioggia inlet for the port of Chioggia.

Two separate access points for the two Venice Port facilities

The Port of Venice includes two main port areas each of which has its own separate access: the Malamocco port mouth serves cargo ships (commercial/industrial traffic), while the Lido port mouth serves passengers ships (cruise ships, ferries, fast ships and yachts).

The port can be accessed year-round at any time, including at night, and in all weather conditions. As a result, the Port of Venice can be accessed 24/7/365.

Access to the cargo port

Dedicated to cargo ships, the Malamocco port inlet is 12 m deep. Merchant ships reach the commercial/industrial port facilities through the Malamocco-Marghera Channel which is 11,5 m deep and leads directly to the cargo terminals.

Access to the passenger port

The S. Nicolò port mouth is located between Punta Sabbioni and the Lido, and serves passenger traffic alone. Cruise ships, ferries, high speed crafts and yachts reach the Marittima facilities through the Giudecca Channel.

The inland waterway port

The Port of Venice is the only port in Italy to have an inland waterway port. Navigation along the only navigable river in Italy connecting the sea and the inland enable cargo, including containers, to be transported by barge to Cremona and Mantua.

Fig. 4 - The North Adriatic Sea Port Authority system

Fig. 5 – Access from the sea - Venice

Access to the port of Chioggia

The Port of Chioggia is located in the basin of the same name, which is an integral part of the Venice Lagoon, and is in communication with the Adriatic Sea through its own inlet. There are two ports of call: Isola Saloni and Val da Rio.

Isola Saloni

It represents the old port located in the urban fabric of Chioggia, occupying an area of approximately 100,000 square meters, 1,350 meters of docks and over 47,000 mc of private warehouses.

Val da Rio

It is the new port complex equipped with yards, docks, covered warehouses, railway junction, business centers, customs gate and offices for local authorities and small / medium enterprises.

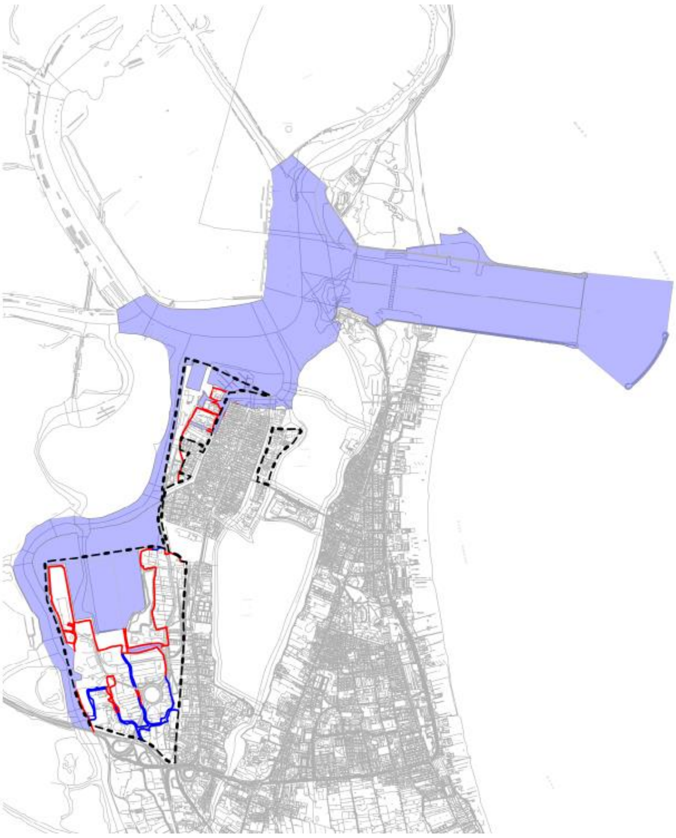


Fig. 6 – Access from the sea - Chioggia

Railway accessibility

The Port of Venice has its own marshalling yard and is connected to the main international railroad corridors. The Venice Port Authority plans to extend its internal railway system as a means to support intermodal and sustainable transport. The ports of Venice and Chioggia are directly connected to the main TEN-T corridors being respectively part of the Core and Comprehensive network.

In particular, the Port of Venice is connected to the national network through the Venice Marghera Scalo port and through the Venezia Mestre station.

The Railway District of Venezia Marghera Scalo, as defined by NASPA Decree 3/2017, has a total length of about 65 km and consists essentially of:

the national freight station of Venezia Marghera Scalo (with its exchange track and reception and departure siding);

the fan of sidings of Parco Breda (serving the northeast port area);

the fan of sidings of Parco Nuovo (serving the southwest port area);

Raccordo Base, branching from the station of Venezia-Mestre up to single gate of linked terminals;

railway sidings, with tracks and sidings, within each area of the port.

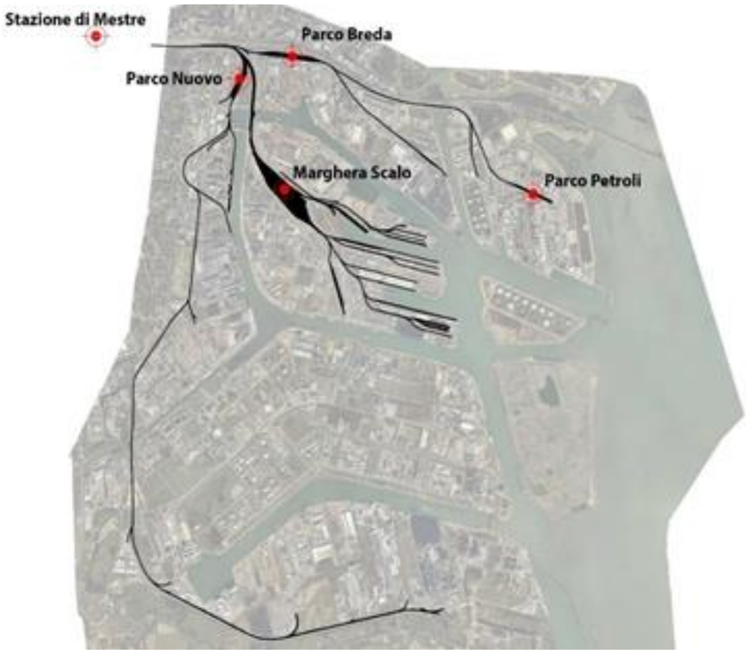


Fig. 7 - Porto Marghera Railway Port District and linked terminals

Numerous interventions aimed at strengthening the cargo railway station of Venice-Marghera are foreseen. The list of such include "Eu-standard" tracks to accommodate 750mt long trains, the doubling of the track along Via Elettricità, a new station at the current Breda Railway Cargo Park and a centralised control system.

Moreover, a new railway bridge will make it possible to considerably reduce maneuvering times for convoys coming from or going to the or destined for the south-western area of the port, eliminating the passage of cargo through Mestre passenger station.

The main freight categories handled by train are steel products (57% of total freight), energy products (19%), “agrifood” products (14%), chemical products (7%) and containers/roro (2%).

In the medium-long run, thanks to full operability of all public-private investments foreseen, and in particular of a new container terminal (Montesyndial), forecasts predict that Rail freight will grow to 3.5 million tons equal to 10.000 train/year.

An important share is given by the traffic of semi-trailers to and from the Ro-Ro/Ro-PAx Terminal Fusina for scheduled connections with Greece, trains operational since November 2015 and which today represent about 3% by weight of the overall area.

In general, also thanks to the recent incentive policies, the objective is that other new intermodal traffic to and from Central and Eastern Europe will be headed by Porto Marghera.

ERF -Esercizio Raccordi Ferroviari is the Single Railway Shunting Operator at the port of Venice.

Fig. 8 – Railroad access to the port of Venice

The port of Chioggia has a total of 3,600 meters of railway connection with the new one docks and is connected to the railway station of the city of Chioggia.

Fig. 9 – Railroad connections of the port of Chioggia

Road Accessibility

The ports of Venice and Chioggia are directly connected to the main TEN-T corridors being respectively part of the Core and Comprehensive network.

In relation to the accessibility of the Port of Venice, on a local scale it is guaranteed by a good motorway network connected directly to the port terminals. The motorway network also includes an adequate network of state and regional roads that guarantee reduced transit times to the main hinterland locations.

The northern part of Venice – Porto Marghera area – has immediate road access the strategic road network (A4/E70 motorway), eastbound towards Friuli-Venezia-Giulia and westbound to Verona - Quadrante Europa Dryport and Lombardia region, while the motorway A13 provides access southbound to Rovigo, Bologna and Adriatic regions.

In order to improve land accessibility to the port of Venice, NASPA is planning new multimodal connections able to serve better the southern part of Porto Marghera. Indeed, this port area is the most active and a variety of development activities are underway, as realization of new logistic and container terminal or update of existing ones.

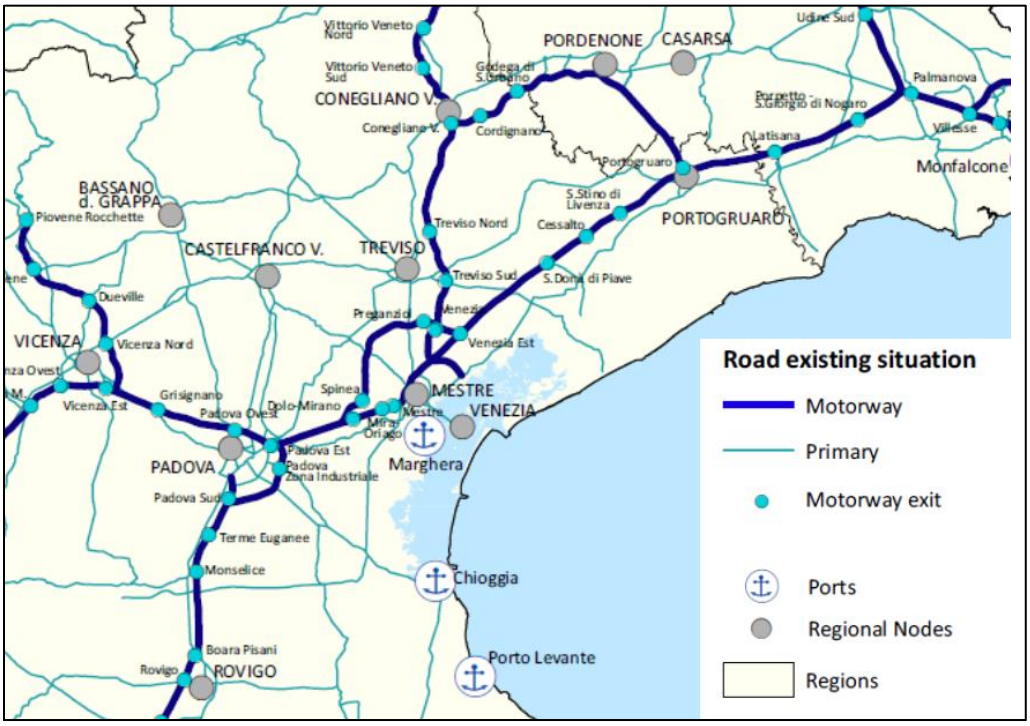


Fig. 10 - Road accessibility

Marghera (cargo)

The Port of Venice includes two main port facilities: Marghera and Marittima. Cargo traffic inbound and outbound from the Marghera facility travels down via dell'Elettricità which is directly linked to the Romea State Road (SS309-E55), the Padana Superiore Regional Road (SR11) and the motorways (A4 and A27). In turn, these roads link the Port of Venice to the Lisbon-Kiev, Berlin-Palermo, Baltic-Adriatic European Corridors.

Marittima, S. Marta, S. Basilio (passengers)

Road access to the Marittima area of the Port and other port facilities located on the island of Venice (S. Marta and S. Basilio) is provided by the Ponte della Libertà which is well connected to the Romea State Road (SS309-E55), Padana Superiore Regional Road (SR11), the Triestina State Road (SS14) and the motorways (A4 and A27).

In addition to the two main accesses described above, there is access to the port dedicated to the traffic of Ro-Ro and Ro-Pax ships, located in Fusina (VE).

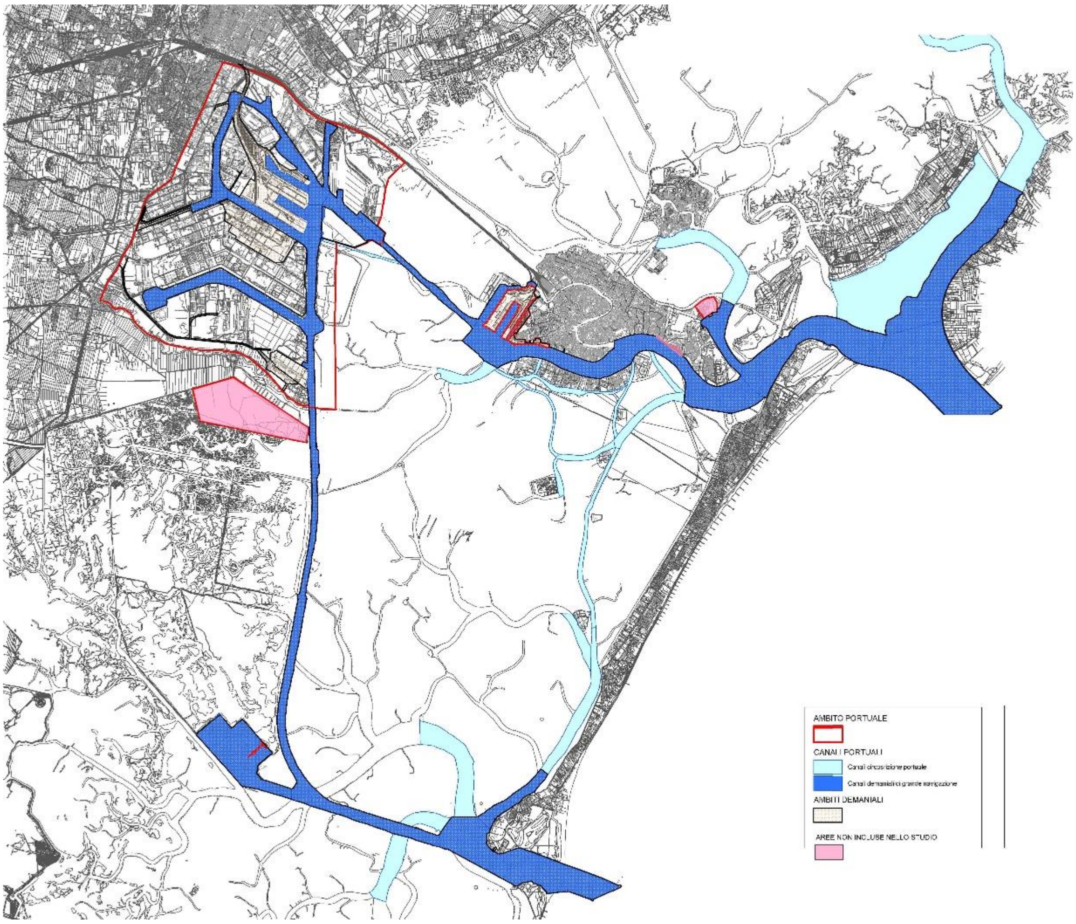
Fig. 11 - Road access to the port of Venice

With regard to the port of Chioggia is connected to the national and international transalpine motorway network. The main connecting axis leads directly into the SS434 Romea.

Fig. 12 - Road access to the port of Chioggia

Port areas analysed in the TNA (D.3.2.4)

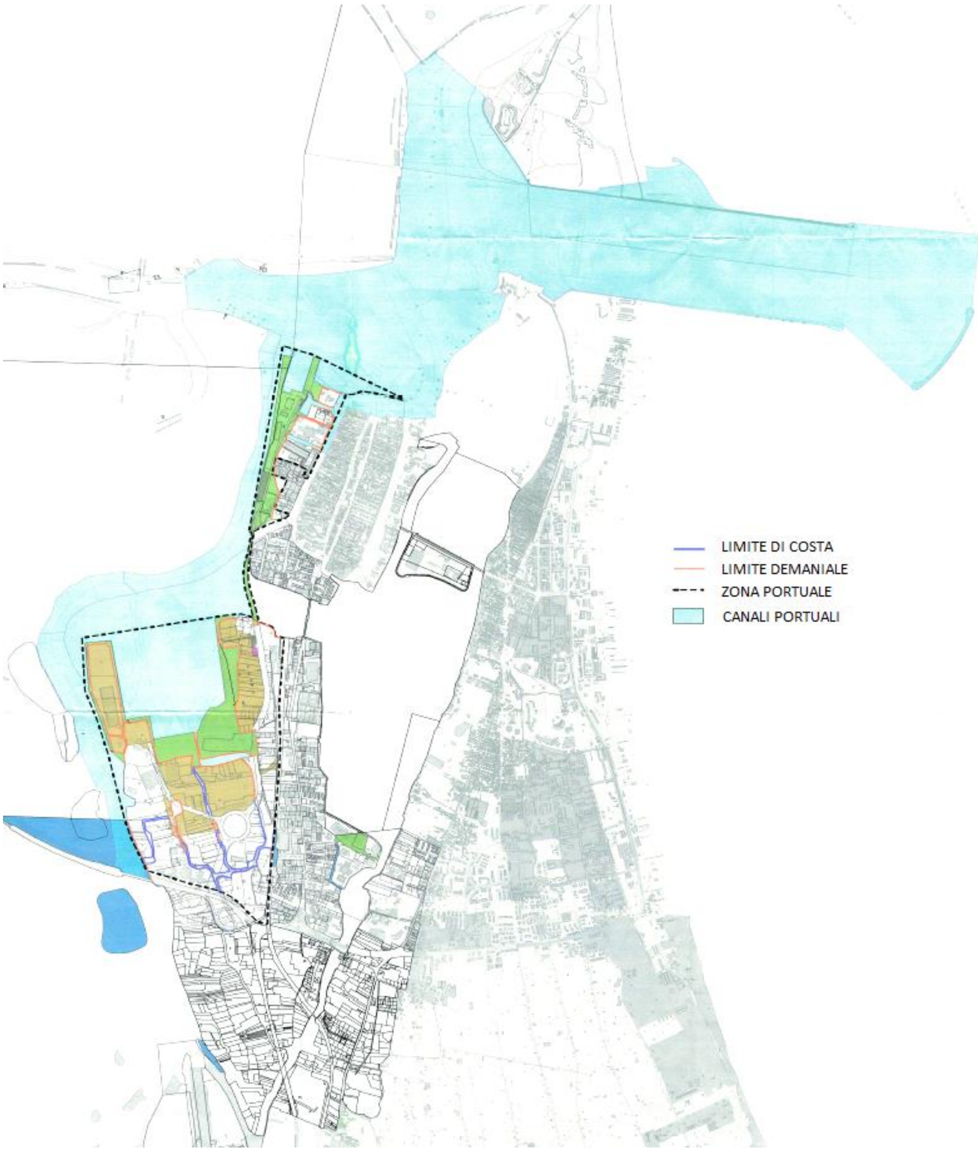
For the purposes of Territorial Needs Assessment – Ports of Venice and Chioggia, the following maps show the areas analysed for the implementation of the Inventory GHG.



Legenda:
- Port area
- Port canals:
canals sorrounding the port
navigation canals
-**state property area**

Areas non included in the study

Fig. 13 – Venice port area considered for the Inventory GHG



Legenda:
Coast limit
State property limit
Port area
Port canals

Fig. 14 – Chioggia port area considered for the Inventory GHG

NASPA current environmental policy

The North Adriatic Sea Port Authority, in order to continuously improve the management of the environmental aspects of its activities, has defined specific objectives, plans and procedures. Indeed, the sustainable development of the port system of the Veneto Region is the strategic goal of the Three-Year Operational Plan defined in 2017.

Nevertheless, since 2011 NASPA set its own Environmental Policy and started developing its own ISO 14001 environmental management system (EMS), which represents a practical tool able to monitor the environmental aspects related to port activities, their impacts and the positive effects of the green initiatives, and which has been certified in 2012.

According to its Environmental Policy, the Port Authority is committed to continuously improve the management of its environmental aspects developing a sustainable supply chain, investing in new technologies and enhancing international and national cooperation. Moreover, NASPA aims, on one hand, at preventing and reducing energy and materials consumption, waste production and pollution, on the other hand, at promoting the value of environmental safeguarding among its employees and among companies working in the Port of Venice.

In 2018, NASPA EMS has been improved with updates according to the most recent ISO 14001. Also it has been integrated with NASPA quality management system (QMS), and the certification, always renewed.

Thus, Venice port system is committed to be a sustainable green port, focusing on the enhancing of performances concerning air quality, protection of the Venetian Lagoon, requalification of port areas, alternative fuels (electric, LNG, hybrid, hydrogen) and reduction of energy consumption.

In this framework, the Ports of Venice and Chioggia, also thanks to several European projects related to these issues, invest in refining and developing tools to facilitate CO2 emissions reduction. Moreover, they encourage the entrepreneurial initiatives aimed at enabling energy transition, stimulating circular economy and improving the quality of air, water and soil.

Well one-third of the European projects in which the North Adriatic Sea Port Authority is involved are strongly geared towards a sustainable development of the Venetian ports. In the programming period (2014-2020).

With the EALING project (Connecting Europe Facility Programme) on the development of interventions for onshore power supply (OPS) solutions, there are 8 projects that have environmental sustainability among the most qualifying points, in line with the European guidelines of the EU Green Deal.

Among these, NASPA is engaged, together with important port operators, in the development of a supply, refueling and distribution network of liquid natural gas, an alternative fuel that allows to almost completely eliminate emissions of sulfur oxides (-95%) and fine dust (PM10 -90%), and to reduce carbon dioxide emissions.

This involves the construction of the first liquid natural gas deposit in Porto Marghera with a capacity of 32,000 m³, promoted by the Venice LNG company, and the construction of a barge for the transport of liquid natural gas by the company Rimorchiatori Riuniti Panfido, capable of transporting 4,000 m³ of LNG between the storage terminal and the vessels to be refueled.

Thanks to these initiatives, which provide for a total investment of 136 million euros, co-financed by 28 million euros of European contributions from the Connecting Europe Facility Programme (POSEIDON MED II, VENICE LNG FACILITY and GAINN4SEA projects), the port of Venice will be the first port in the Adriatic to complete the logistics chain for the supply and supply of liquid natural gas to ships, thus allowing the Venetian port system to be in line with the provisions of the EU Directive 2014/94 on infrastructure for alternative fuels, as adopted by the Italian law with the Legislative Decree 2016/257.

Other environmental sustainability projects include the placement of columns for the power supply of cars in the port area, digitalisation of railway maneuvers (TALKNET), a campaign for monitoring noise pollution, also through the purchase and permanent positioning of acoustic detection units that will be located in the port areas (CLEANBERTH); electric cars and installation of LED lighting in the S. Marta, S. Andrea and S. Basilio areas (SUSPORT) - and the "energy diagnosis" of the buildings, studies to support the Document of energy-environmental planning of the Port System (DEASP) and Action Plan to improve the energy efficiency and sustainability of the Port of Venice (SUPAIR).

The above strategies and objectives reflect and integrate with what is highlighted by the European Sea Port Organization (ESPO) in the document EcoPorts Port Environmental Review 2020, which shows how the environmental priorities in ports at European level have changed a lot over the years. Figure 15 shows the order of priority of the environmental interventions found in the year 2020.

Fig. 15 – Top 10 environmental priorities of European ports for 2020 (ESPO 2020)

Air quality, climate change and energy efficiency represent respectively the first, the second and third among the priority elements for European ports, and NASPA, with its best practices developed over the years, continues to plan, design and implement measures and interventions in this sense. Key issues such as Air quality, Climate change and the third, top priority of Energy efficiency, are all closely interlinked, as one influences the other to a great degree.

Climate change continues to rise in priority ranking for ports since becoming a recognised priority issue in 2017. This makes compliance with climate legislation, the reduction of carbon emissions and climate-proofing port infrastructure very important priorities for European ports. Increasingly, collaborative efforts are being applied as industrial and community stakeholders seek to develop a low-carbon economy and to become carbon-neutral.

Mapping out stakeholders

Stakeholders that have been involved in the TNA for the Inventory GHG are the following:

Public administration (Venice & Chioggia)

- Harbourmaster
- Customs Agency
- Finance Police
- Border Police
- Border Inspection Unit – PIF (Venice)
- Maritime and Air Health Office – USMAF (Venice)
- Vigili del Fuoco (Chioggia)

Ship services (Venice & Chioggia)

- Shipping Agents
- Other ship services

Ground services (Venice & Chioggia)

- Honorary consulate (Venice)
- Freight forwarders - Customs agents
- Passengers services
- Other ground services

Entities carrying out general services (ship & ground) for the management and maintenance of common parts in the port area (Venice & Chioggia)

Technical-nautical services (Venice & Chioggia)

- Piloting (only consumption and emissions for road mobility and offices)
- Tugs
- Mooring assistance
- Guardie ai Fuochi
- Conepo (Venice) / Doria Servizi Ecologici Srl (Chioggia)

Port Terminals (Venice)

- Venezia Terminal Passeggeri S.P.A.
- Terminal Rinfuse Venezia SpA
- Multi Service Srl
- Terminal Intermodale Venezia SpA
- PSA - Vecon SpA
- Venice Ro-Port-Mos Scpa
- Terminal Intermodale Adriatico Srl
- Transped SpA
- ENEL SpA
- Cereal Docks SpA
- Colacem SpA

Port Terminals (Chioggia)

- SO.RI.MA SpA
- Soc. Coop. Impreport
- K-Logistica Srl

<u>Railway services (Venice)</u>

- ERF

Stakeholders importance mapping

		POWER OF INFLUENCE	
		LOW	**HIGH**
INTEREST	**LOW**	PUBLIC ADMINISTRATION SERVICES OF GENERAL INTEREST: ▪ SHIP SERVICES ▪ GROUND SERVICES ▪ ENTITIES CARRYING OUT GENERAL SERVICES ▪ TECHNICAL-NAUTICAL SERVICES RAILWAY SERVICES: ▪ ERF	SHIPPING COMPANIES
	HIGH	PORT TERMINALS: ▪ MARITIME PASSENGERS TERMINAL ▪ COMMERCIAL TERMINALS ▪ INDUSTRIAL TERMINALS	INSTITUTIONS: ▪ MINISTRY OF ECOLOGICAL TRANSITION ▪ MINISTRY OF SUSTAINABLE INFRASTRUCTURES AND MOBILITY ▪ EUROPEAN COMMISSION (DG MOVE, DG ENV, DG REGIO, CINEA)

Table 3 – Stakeholders mapping due to importance

Stakeholders involvement strategies

Stakeholders have been involved through ad hoc meetings and initiatives:

- Stakeholders consultations – Focus Groups organized by NASPA for the definition of actions aimed to improve the energy performance, May 2019 and December 2019.
- Digital meetings organized by NASPA with port terminals, 10-11 March 2021.

Due to the pandemic, in the year 2020 contacts with stakeholders have been carried out mainly by e-mail and digital meetings.

Carbon footprint emissions estimation

Also basing on the Methodology for the implementation of the territorial needs assessment (D.3.2.1), the methodology used to develop the Inventory of GreenHouse Gases (GHG) is referred the UNI EN ISO 14064 standard, which identifies the equivalent carbon dioxide (CO2eq) as a unit of measurement for the assessment of greenhouse gas emissions, as established by the Convention on Climate Change (UNFCCC).

For the quantification of total CO2 emissions, a calculation method was used based on the use of specific emission factors (EF).

The unit emission factors refer to the single activity and in the case of this inventory they take into consideration the contribution of CO2 alone.

The formula used to calculate the emissions is the following:

$$Emission_{(g,s,c)} = AD_{(s,c)} \cdot EF_{(g,s,c)} \quad [t\,CO2]$$

which assesses the emission (quantity) of gas "g", produced by a certain source or emission source "s", from fuel "c", multiplying activity (AD) * its emission factor (EF).

Terrestrial emissions – Port of Venice

This section estimates the terrestrial emissions associated with the functions/activities/possible sources described below:

NASPA buildings

Emissions estimated:

• the direct emissions associated with eg. the air conditioning of buildings and related activities such as the use of vehicles from the owned fleet;

• indirect emissions associated with the consumption of electricity (office air conditioning, lighting, office equipment, etc.).

Management and maintenance of common parts in the port area

Emissions estimated:

- Direct emissions referred to
  - Services of general interest (ship and ground), e.g.:
    - collection and disposal of waste from land and ship
    - Street cleaning
    - Management of green areas
    - Cleaning and remediation of pollution in port waters
  - Technical-nautical services:
    - Piloting (only consumption and emissions for road mobility and offices)
- indirect emissions associated with the consumption of electricity (lighting of common areas and road signs, operation of equipment and service systems).

Other private port buildings other than those present in the terminals, with the following functions:

Ship services

- Shipping agents
- Other ship services

Ground services

- Honorary Consulate

- Freight forwarders-customs agents
- Passenger services
- Other ground services

State bodies and Public Administration

- Harbourmaster
- Customs Agency
- Finance Police
- Border Police

As far as private buildings mentioned above are concerned, the estimation includes:

- indirect emissions associated with eg. the air conditioning of buildings and related activities such as the use of vehicles;
- indirect emissions associated with the consumption of electricity (office air conditioning, lighting, office equipment, etc.).

Maritime Passengers Terminal

This section estimates the emissions associated with energy uses relating to the activities carried out by the operator Venice Terminal Passeggeri S.p.A.

As far as the Maritime Passengers Terminal mentioned above is concerned, the estimation includes:

- direct emissions associated with the consumption of natural gas for the air conditioning of buildings and with the consumption of diesel fuel for port handling;
- indirect emissions associated with the consumption of electricity (winter / summer air conditioning, port handling, internal and external lighting).

Commercial Terminals

This section estimates the emissions associated with energy uses relating to the activities carried out by commercial terminal operators: Terminal Rinfuse Venezia, Multiservice, Vecon, TIV, Venice Ro-Port MoS.

Emissions estimated:

- direct emissions associated with the consumption of natural gas and LPG for the air conditioning of buildings and the consumption of diesel and petrol for port handling and for the use of company fleet vehicles;
- indirect emissions associated with the consumption of electricity (winter / summer air conditioning, port movements, internal and external lighting).

Industrial Terminals

This section estimates the emissions associated with energy uses relating to the activities carried out on the docks in state-owned areas and connected to port operations, by some private operators for which data deemed significant have been made available: Cereal Docks, Colacem, ENEL, Idromacchine, Terminal Intermodale Adriatico, Transped.

Emissions estimated:

- direct emissions associated with the consumption of natural gas and LPG for the air conditioning of buildings and the consumption of diesel and petrol for port handling and for the use of company fleet vehicles;
- indirect emissions associated with the consumption of electricity (winter / summer air conditioning, port handling, internal and external lighting).

Road Mobility Service inside the port

In this study, the emissions associated with road traffic have been estimated for the access routes to the following areas:

- Marghera
- Marittima
- Fusina

Access to Marittima station

The emissions associated with vehicle accesses to the San Basilio station and the Marittima station were quantified respectively.

Access to Ro-Ro e Ro-Pax at Fusina Terminal

The emissions associated with the accesses of vehicles to the Fusina ferry port, dedicated to the traffic of Ro-Ro and Ro-Pax ships, were quantified.

Railway mode

This section estimates the emissions associated with the railway shunting carried out by ERF. As far as railway mode mentioned above is concerned, the estimation includes:

- direct emissions associated with the consumption of diesel fuel for railway shuntings.

STATIONARY SOURCE EMISSIONS:

Electric energy

SCOPE	EMISSIONS [tonCO_2]	EMISSIONS [%]
Electric energy	**733**	**2,3%**

- ***Description of the specific data sources employed:*** With reference to the consumption of electricity, this can depend on various operations ranging from routine operations related to buildings and the functions they perform, to lighting and service systems (e.g. shore power for boats), to electrified work machinery (e.g. tools for container handling). It is specified that although some work machinery are generally thought of as mobile sources, they use electricity from the grid and as such are reported in relation to the invoices for the purchase of electricity.
- ***Description of methods and tools for data collection:*** template to be filled by the subject/organization working in a building or managing specific activities. The template have been developed and sent by NASPA by email to the different organizations involved in the analysis.
- ***The specification of the adopted calculation tier as defined by IPCC (2006):*** the calculation have been carried out according to the international standard ISO 14064 : 2006.
- ***Description of all the methodological assumptions and parameters employed (e.g. type of gases, emission factors, average routes inside the port areas, activity values, etc.):*** Please see *Table n 5 – Emission factors and conversion.*

Heating

SCOPE	EMISSIONS [tonCO_2]	EMISSIONS [%]
Heating	**320**	**1,0%**

- ***Description of the specific data sources employed**:* in general, this category takes into consideration the combustion of fuels for heating and domestic hot water or for the operation of generating sets (fixed and mobile emergency generators), combustion for the generation of energy and the structures that employ combustion processes; this category also includes diesel fueled cranes.
- ***Description of methods and tools for data collection:*** template to be filled by the subject/organization working in a building or managing specific activities. The template have been developed and sent by NASPA by email to the different organizations involved in the analysis.
- ***The specification of the adopted calculation tier as defined by IPCC (2006):*** the calculation have been carried out according to the international standard ISO 14064 : 2006.
- ***Description of all the methodological assumptions and parameters employed (e.g. type of gases, emission factors, average routes inside the port areas, activity values, etc.):*** Please see *Table n 5 – Emission factors and conversion.*

NON-STATIONARY SOURCE EMISSIONS:

Service Vehicles

Port operational vehicles

Heavy-duty vehicles

Railway tractors

SCOPE	EMISSIONS [tonCO_2]	EMISSIONS [%]
Service Vehicles	**262**	**0,8%**
Port operational vehicles	**15.104**	**47,5%**
Heavy-duty vehicles (T.I.R.)	**14.926**	**46,9%**
Railway tractors	**431**	**1,4%**

- ***Description of the specific data sources employed:*** mobile sources refer in particular to the use of means that may be functional to the transport of goods or people or still used in service operations carried out within the port area. In most cases the emissions are associated with the consumption of fuel and in particular of diesel. Within this category of sources we identify for example the traffic of heavy vehicles, those of trains, service vehicles, technical / operational vehicles.
- ***Description of methods and tools for data collection****:* template to be filled by the subject/organization working in a building or managing specific activities. The template have been developed and sent by NASPA by email to the different organizations involved in the analysis.
- ***The specification of the adopted calculation tier as defined by IPCC (2006):*** the calculation have been carried out according to the international standard ISO 14064 : 2006.
- ***Description of all the methodological assumptions and parameters employed (e.g. type of gases, emission factors, average routes inside the port areas, activity values, etc.):*** For the purpose of quantifying the CO2 emissions associated with this activity, a model was adopted that took into account the following study areas, relating only to transport associated with commercial terminals:
  - Off-terminal transport: the emissions of vehicles in transit along the routes from the main traffic junctions in Mestre area and the entrance to the real port island are counted. In this case, various flows of vehicles in transit were considered and developed starting from the study *"Final Report 2011 Survey of service times for the entry and exit of vehicles at the commercial port of Marghera"*

• On-terminal transport: in which the emissions of incoming vehicles awaiting customs checks are counted, those of the emissions of vehicles from the entrance hub to the port island to the quay and finally the emissions related to loading and unloading operations.

Moreover, please see *Table n 5 – Emission factors and conversion.*

Other

OTHER NON-STATIONARY SOURCE EMISSIONS:

SCOPE	EMISSIONS [tonCO_2]	EMISSIONS [%]
Other	**49**	**0,2%**

- ***Description of the specific data sources employed:*** in addition to the activity data listed above, there are still activities related to mobile sources whose data are not directly usable for the purpose of quantifying emissions and which therefore require the adoption of a model.
- ***Description of methods and tools for data collection:*** template to be filled by the subject/organization working in a building or managing specific activities. The template have been developed and sent by NASPA by email to the different organizations involved in the analysis.
- ***The specification of the adopted calculation tier as defined by IPCC (2006):*** the calculation have been carried out according to the international standard ISO 14064 : 2006.
- ***Description of all the methodological assumptions and parameters employed (e.g. type of gases, emission factors, average routes inside the port areas, activity values, etc.);***
  The models used in the evaluation of this key category are the following:
  • Road mobility of service inside the port
  • Intermodal road / rail terminals and road interports falling within the port area.
  Moreover, please see *Table n 5 – Emission factors and conversion.*

Overall results

SUMMARY OF CONTRIBUTIONS TO THE PRODUCTION OF GREENHOUSE GASES IN THE TERRESTRIAL SECTOR, IN THE PORT OF VENICE - 2019

SCOPE	EMISSIONS [tonCO_2]	EMISSIONS [%]
Electric energy	**733**	**2,3%**
Heating	**320**	**1,0%**
Service Vehicles	**262**	**0,8%**
Port operational vehicles	**15.104**	**47,5%**
Heavy-duty vehicles (T.R.I.)	**14.926**	**46,9%**
Railway tractors	**431**	**1,4%**
Other	**49**	**0,2%**
Total	**31.825**	**100%**

Maritime emissions – Port of Venice

In this study, the emissions associated with navigation activities in the port area were estimated, divided respectively into the section from the Malamocco harbor entrance for freight ships (commercial / industrial traffic), and from the Lido harbor entrance for passenger ships (cruise traffic, ferries, fast ships and yachts).

For the item vessels, it includes the consumption associated with: tugs, pilots, fire guards.

The following table shows the relative summary of the emissions associated with the three areas described above.

Anchor phase

Manoeuvring phase

Mooring phase

SCOPE	EMISSIONS [tonCO_2]	EMISSIONS [%]
Anchor and Mooring phase	**116.868**	**77,4%**
Monoeuvring phase	**34.101**	**22,6%**

- ***Description of the specific data sources employed:*** mobile sources refer in particular to the use of means that may be functional to the transport of goods or people or still used in service operations carried out within the port area. In most cases the emissions are associated with the consumption of fuel and in particular of diesel. Within this category of sources we identify for example the traffic of vessels (boats, mooring service, means of service, tugs).
- ***Description of methods and tools for data collection:*** template to be filled by the subject/organization working in a building or managing specific activities. The template have been developed and sent by NASPA by email to the different organizations involved in the analysis.
- ***The specification of the adopted calculation tier as defined by IPCC (2006):*** the calculation have been carried out according to the international standard ISO 14064 : 2006.
- ***Description of all the methodological assumptions and parameters employed (e.g. type of gases, emission factors, average routes inside the port areas, activity values, etc.):***

  CO2 greenhouse gas emissions associated with naval activities can be estimated as a function of the ship's energy needs expressed in kilowatt hours (kWh) multiplied by an emission factor (EF) expressed in terms of grams per kilowatt hour (g / kWh) according to the following equation:

$$Emissions = Energy * EF \ \ [t\ CO_2]$$

Energy is a function of the maximum continuous rated power (MCR) of the motor expressed in kW, multiplied by a load factor (LF) which represents the load on the motor during each operating mode and is expressed without a unit of measurement, multiplied by the operating time (h) for each navigation mode (e.g. approach or maneuver) for which emissions have been estimated.

$$Energy = MCR * LF * h \ [kWh]$$

The load factor is the ratio of the power of an engine at a given speed to the MCR power of the engine.

The load factor of the propulsion engine is estimated based on the theory that the load of the propulsion engine varies according to the cube of the ship's speed. Therefore, the load factor of the propulsion engine is estimated by dividing the effective speed (AS) in knots by the maximum speed of the ship (MS) in knots and taking the cube of the ratio between the two quantities, as illustrated by the following equation:

$$LF = (AS/MS)^3$$

The activity is measured in hours of operation. The transit time in an area is estimated by determining the time required to move through the area. This is estimated by taking the distance (D) in nautical miles (nm) and dividing it by the ship's actual speed (AS) in knots.

$$h = D/AS \ [h]$$

The EF emission factors (ICCT, 2017) are based on the hypothesis of using fuel with a low sulfur content. A medium-speed diesel engine with maximum engine speeds above 130 rpm (and generally above 400 rpm) is considered as the main reference engine.

Engine	**gCO_2 / kWh**
Main engine (MSD/HSD)	658
Auxiliary engine (SSD/MSD/HSD)	696
Auxiliary boilers, steam boilers	962

Table 4 – Emission factors by type of source associated with navigation activities

In addition to the main engine, the auxiliary engines used to generate electricity for on-board applications, the boilers used for fuel heating and for the production of hot water or steam are considered.

In the quantification model it is assumed that the boilers are used only at reduced speeds, for example when maneuvering in port and when the ship is stationary.

The data relating to the parameters considered in the calculation model, and in particular MCR and MS, load factors of the auxiliary engines, load factors of the boilers for the different types of ships, are taken from the literature.

The values of:

- AS (actual speed to calculate the main motor load factor)
- D (navigation distance)
- AS (navigation speed)

were calculated taking into account the requirements relating to the speed of navigation contained in the relevant ordinances of the Harbourmaster - Venice Coast Guard, and were calculated for the maneuvering phases in the port area.

On the basis of the detailed data relating to all landing procedures, the following information was also obtained:

- characteristics of the ship
- gross tonnage
- operational mooring time

from which it was therefore possible to calculate the emissions relating to the Maneuvering phase and the emissions relating to the Mooring phase for each case.

Moreover, please see *Table n 5 – Emission factors and conversion.*

Overall results

SUMMARY OF CONTRIBUTIONS TO THE PRODUCTION OF GREENHOUSE GASES IN THE MARITIME SECTOR, IN THE PORT OF VENICE - 2019

SCOPE	EMISSIONS [tonCO_2]	EMISSIONS [%]
Anchor and Mooring phase	**116.868**	**77,4%**
Monoeuvring phase	**34.101**	**22,6%**
Total	**150.970**	**100%**

Flusso di fonte	[EF] Fattore di emissione	Unità di misura [EF]	Note
District cooling	0,1	kg/kWh	ENEA - primary energy conversion factors provided for by the Ministerial Decree of 26 June 2015 "minimum requirements"
Electricity (Network)	276,3	g CO_2/kWh	ISPRA, 2020 - Table 2.4 - Emission factors of national electricity production and electricity consumption (g CO2 / kWh).
Electricity (Solar)	0	g CO_2/kWh	
Diesel fuel for motor vehicles	3,151	t CO_2 / t	ISPRA 2020- Table A6.2 Fuels, national production, carbon emission factors density is 0.84 kg / dm³ [Annex 1 - Ministerial Decree of 13 February 2013]
Heating oil	3,155	t CO_2 / t	ISPRA 2020 - Table A6.2 Fuels, national production, carbon emission factors

Flusso di fonte	[EF] Fattore di emissione	Unità di misura [EF]	Note
			density is 0.84 kg / dm³ [Annex 1 - Ministerial Decree of 13 February 2013]
District heating	0,3	kg/kWh	ENEA - primary energy conversion factors provided for by the Ministerial Decree of 26 June 2015 "minimum requirements"
LPG	3,026	t CO_2 / t	ISPRA, 2020 - Table A6.2 Fuels, national production, carbon emission factors density is 0.47 kg / dm³ [Annex 1 - Ministerial Decree of 13 February 2013] density in the gaseous state 1.898 kg / m3
Marine diesel	3,17	t CO_2 / t	Lloyds Register Engineering Services, 1995
Natural gas	1,972	t CO_2 / 10^3std cubic mt	ISPRA, 2020 - Table A6.1 Natural gas carbon emission factors
Petrol	3,14	t CO_2 / t	ISPRA 2020 - Table A6.2 Fuels, national production, carbon emission factors density is 0.75 kg / dm³ [Annex 1 - Ministerial Decree of 13 February 2013]
Private cars	241,9981	gCO_2/km	SINANET - database of the average emission factors of road transport in Italy - urban area
Light commercial vehicles	336,0266	gCO_2/km	SINANET - database of the average emission factors of road transport in Italy - urban area
Industrial vehicles	983,6798	gCO_2/km	SINANET - database of the average emission factors of road transport in Italy - urban area

Flusso di fonte	[EF] Fattore di emissione	Unità di misura [EF]	Note
Bus	1.113,02	gCO_2/km	SINANET - database of the average emission factors of road transport in Italy - urban area
Parking of industrial vehicles with the engine running	10,41	$kgCO_2$/h	Gainess et al. 2006

Table n. 5 – Emission factors and conversion

Emissions summary – Port of Venice

TABLE OF THE OVERALL PERCENTAGE RATIOS OF ALL GHG EMISSIONS FROM THE PORT OF VENICE - 2019

SCOPE	EMISSIONS [tonCO_2]	EMISSIONS [%]
Electric energy	**733**	**0,4%**
Heating	**320**	**0,2%**
Service Vehicles	**262**	**0,1%**
Port operational vehicles	**15.104**	**8,3%**
Heavy-duty vehicles (T.R.I.)	**14.926**	**8,2%**
Railway tractors	**431**	**0,2%**
Other	**49**	**0,0%**
Anchor and Mooring phase	**116.868**	**63,9%**
Monoeuvring phase	**34.101**	**18,7%**
Total	**182.795**	**100%**

Terrestrial emissions – Port of Chioggia

This section estimates the emissions associated with the functions described below.

A.S.Po. Chioggia buildings

As far as buildings mentioned above are concerned, the estimation includes:

- the direct emissions associated with eg. the air conditioning of buildings and related activities such as the use of vehicles from the owned fleet;
- indirect emissions associated with the consumption of electricity (office air conditioning, lighting, office equipment, etc.).

Management and maintenance of common parts in the port area

Emissions estimated:

- Direct emissions referred to
  - Services of general interest (ship and ground), e.g.:
    - collection and disposal of waste from land and ship
    - Street cleaning
    - Management of green areas
    - Cleaning and remediation of pollution in port waters
  - Technical-nautical services:
    - Piloting (only consumption and emissions for road mobility and offices)
- indirect emissions associated with the consumption of electricity (lighting of common areas and road signs, operation of equipment and service systems).

Commercial Terminals

This section estimates the emissions associated with energy uses relating to the activities carried out by commercial terminal operators: SO.RI.MA. S.p.A., Soc. Coop. Impreport. K-Logistica Srl.

As far as commercial terminals mentioned above are concerned, the estimation includes:

• direct emissions associated with the consumption of diesel fuel for port handling and for the use of company fleet vehicles

Road Mobility Service inside the port

In the present study, the emissions associated with road traffic were estimated.

Railway mode

This section estimates the emissions associated with the railway shunting.

As far as the railway mode mentioned above is concerned, the estimation includes:

- direct emissions associated with the consumption of diesel fuel for railway shuntings.

SUMMARY OF CONTRIBUTIONS TO THE PRODUCTION OF GREENHOUSE GASES IN THE TERRESTRIAL SECTOR, IN THE PORT OF CHIOGGIA - 2019

SCOPE	EMISSIONS [tonCO_2]	EMISSIONS [%]
Electric energy	**99**	**4,5%**
Heating	**11**	**0,5%**
Service Vehicles	**151**	**6,8%**
Port operational vehicles	**926**	**41,7%**
Heavy-duty vehicles (T.R.I.)	**1.035**	**46,5%**
Total	**2.221**	**100%**

For the relevant information regarding key categories of the terrestrial sector in the port of Chioggia, the same approach reported for the key categories treated for the port of Venice have been adopted.

Maritime emissions – Port of Chioggia

In this study, the emissions associated with navigation activities in the port area were estimated in the section from the Chioggia harbor mouth to the docks.

The item vessels includes the consumption associated with: tugs, pilots, fire guards.

SUMMARY OF CONTRIBUTIONS TO THE PRODUCTION OF GREENHOUSE GASES IN THE MARITIME SECTOR, IN THE PORT OF CHIOGGIA - 2019

SCOPE	EMISSIONS [tonCO_2]	EMISSIONS [%]
Anchor and Mooring phase	**11.254**	**91,1%**
Monoeuvring phase	**1.093**	**8,9%**
Total	**12.347**	**100%**

For the relevant information regarding key categories of the terrestrial sector in the port of Chioggia, the same approach reported for the key categories treated for the port of Venice have been adopted.

Emissions summary – Port of Chioggia

TABLE OF THE OVERALL PERCENTAGE RATIOS OF ALL GHG EMISSIONS FROM THE PORT OF CHIOGGIA - 2019

SCOPE	EMISSIONS [tonCO_2]	EMISSIONS [%]
Electric energy	**99**	**0,7%**

SCOPE	EMISSIONS [tonCO_2]	EMISSIONS [%]
Heating	**11**	**0,1%**
Service Vehicles	**151**	**1,0%**
Port operational vehicles	**926**	**6,4%**
Heavy-duty vehicles (T.R.I.)	**1.035**	**7,1%**
Anchor and Mooring phase	**11.254**	**77,2%**
Monoeuvring phase	**1.093**	**7,5%**
Total	**14.569**	**100%**

SWOT Analysis

STRENGHTS

1. The Port of Venice is a green port that strives to further reduce port operations carbon footprint.

2. The subjects involved in the project are on average sensitive to the implementation of environmental and energy best practices.

3. Port stakeholders fully support this policy with innovative applications.

WEAKNESSES

1. Absence of dedicated PODs (Point of Delivery) for some of the terminal operators involved in the analysis makes difficult installing systems for self-generation of electricity (i.e. photovoltaic systems) and obtaining more focused energy data.

2. Absence of reward / incentive mechanisms for terminal operators wishing to invest in low CO_2 emissions processes and technologies: these mechanisms could increase their commitment to the adoption of good practices aimed at reducing and containing environmental impacts.

3. Lack of the possibility (NASPA) to directly manage aspects related to naval traffic in port (e.g. environmental aspects).

OPPORTUNITIES

1.The use of alternative fuels could reinforce the possibility to attract private investments. Concretely, this means the development of port traffics and thus new business opportunities.

2. The deployment of alternative fuels and innovation technologies for green&smart ports has a double implication of "less pollution more efficiency" for ports. Efficiency is strictly linked to a higher competitiveness.

3. Public funding blended with private capitals and financing.

4. Application of total quality procedures in the companies, so to help reduce energy-intensive operations.

5. Creation of private-public partnerships to mitigate the lack of the possibility to manage directly energy efficency measures.

THREATS

1. Financial gap: the use of alternative fuels requires high investments: deep feasibility assessments are required to evaluate the expected return on investment.

2. Public-Private cooperation is needed to achieve further developments in order to leverage the results and harmonize energy consumptions in the public and private areas of the Cargo commercial port of Venice Marghera (high complexity, one of the biggest industrial areas in Europe).

3. Technological and digital gap.

4. Different levels of laws and guidelines can rule out the private interest for port investments

Conclusions

Considering the main results of the carbon footprint, they have shown that the most relevant emission categories for the ports of Venice and Chioggia are the following:

Port of Venice

SCOPE	EMISSIONS [tonCO_2]	EMISSIONS [%]
Anchor and Mooring phase	**116.868**	**63,9%**
Monoeuvring phase	**34.101**	**18,7%**
Port operational vehicles	**15.104**	**8,3%**
Heavy-duty vehicles (T.R.I.)	**14.926**	**8,2%**

Port of Chioggia

SCOPE	EMISSIONS [tonCO_2]	EMISSIONS [%]
Anchor and Mooring phase	**11.254**	**77,2%**
Monoeuvring phase	**1.093**	**7,5%**
Heavy-duty vehicles (T.R.I.)	**1.035**	**7,1%**
Port operational vehicles	**926**	**6,4%**

From carbon footprint to opportunities for energy transition

Considering the results of the "Carbon Footprint" of both the Port of Venice and the Port of Chioggia and therefore, more specifically, the summary of the overall emissions associated with the various functions rearranged by incidence of the total CO2 value, it can be seen that for both ports, the two areas of activity that have the greatest impact are those relating to "Naval traffic (mooring phase)" and "Naval traffic (Manoeuvring phase)".

If considered in relation to the four typical categorizations of the *"SWOT analysis (strengths, weaknesses, opportunities, and threats)"*, this can be seen as a *"weakness"* for NASPA, since any impacts of the naval sector on the port system do not derive from management and environmental aspects directly manageable and verifiable by NASPA. On such management and environmental aspects, NASPA can only exercise an influence, however significant, by carrying out orientation and coordination functions towards the various stakeholders involved in these activities.

Nevertheless, just as an accurate definition of a problem allows to consequently identify its solution, in this way also in the case of the "weakness" described above, it turns out a revision of it in terms of "opportunity". Falling within a context oriented to energy transition that sets itself ambitious development objectives, this opportunity is specifically represented by the fact that since the past few decades forms of cooperation between the public and private sectors have existed and are feasible (Public Private Partnership - PPP). It deals with specific financial schemes designed for the financing of projects and works of public interest, where the public plans a concerted operation in which several subjects, even of various kinds, can participate depending on the characteristics of the operation itself.

This opportunity, which however implies appropriate and considerable time to activate synergies and projects with high degrees of complexity, also brings out and highlights those further opportunities that can be carried out immediately, or in any case in significantly quicker times, depending on the economic availability too. These opportunities are expressed in solutions that see NASPA as a possible direct implementing subject and which are represented, by way of example, by the implementation of preparatory studies on new technologies and fuels with low or zero "carbon footprint" for the energy transition, along also with actions such as the replacement of diesel / petrol powered cars with electric ones, the replacement of traditional lighting systems with LED lighting systems, or the construction of photovoltaic systems on state-owned buildings, etc. In this context, and to this end, the needs of NASPA are basically translated into economic needs, as a *"conditio sine qua non*" to be able to develop its own projects for energy efficiency in view of energy transition and, ultimately, of ecological transition.