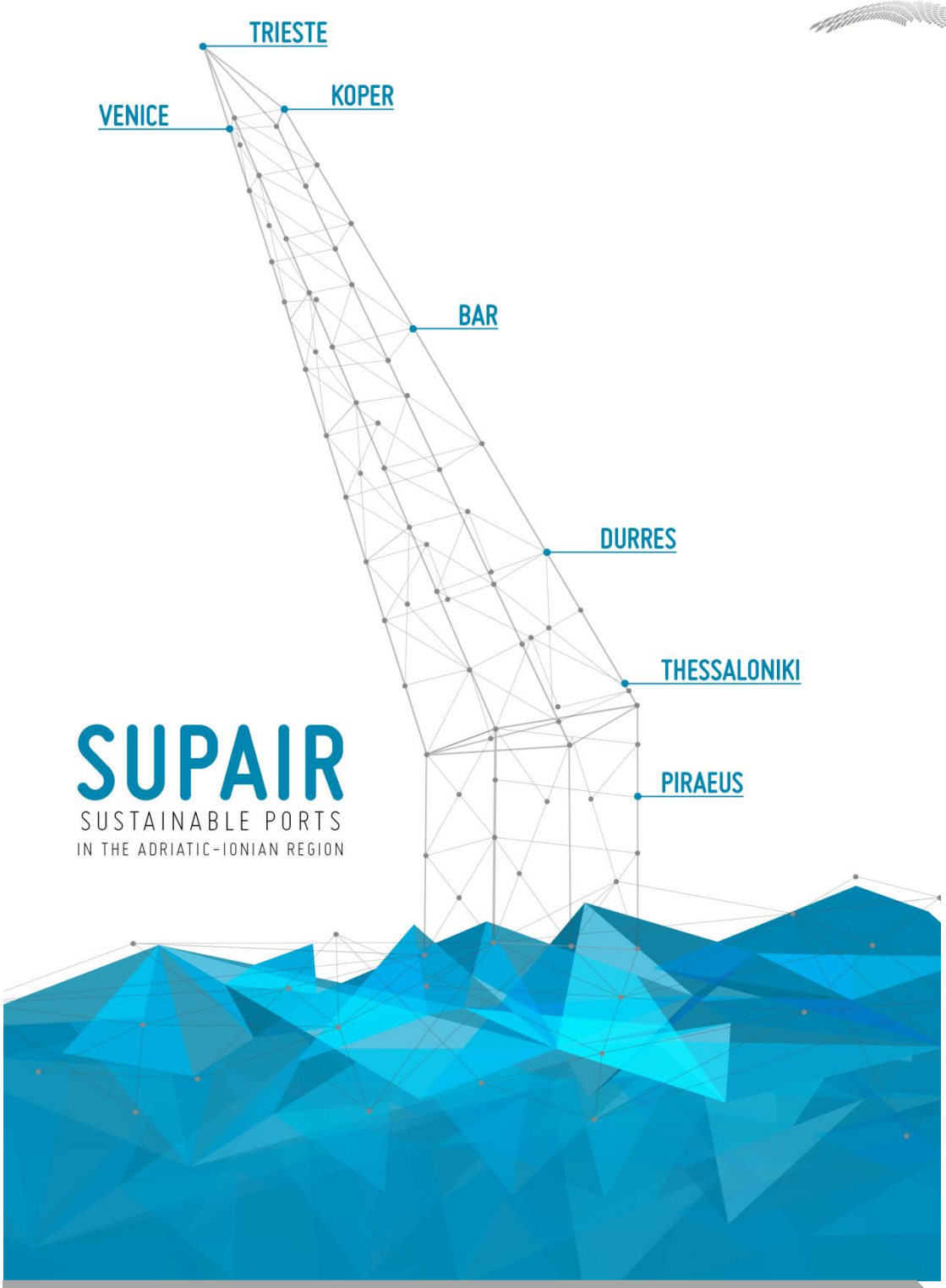


Action Plan for Sustainable and Low Carbon Ports of Venice and Chioggia

AUTHOR/AGENCY: Environmental Unit, North Adriatic Sea Port Authority

WPT1

Work package: WPT1

Deliverables title: T1.4.1 – Action Plan for a Sustainable and Low Carbon Port of Venice

Expected date: November 2019

Description: Action Plan for a Sustainable and Low Carbon Port of Venice (DT 1.4.1)

Partner in charge of deliverables: North Adriatic Sea Port Authority, ports of Venice and Chioggia

Document Author(s): Mara Pitaccolo

Dissemination level: PU - Public

Status: Draft

Version: 8

Date: 06/12/2019

Document Revisions

Revision History

Version	*Date*	*Author(s)*	*Organisation*	*Comment*
01-03	07.01.2019	Mara Pitaccolo Project R&D Unit (Editor)	NASPA	Draft chapters 1-4 Action Plan
04	23.01.2019	Marco Barbieri, Erika Rizzo –Enviromental unit (Contributors)	NASPA	Draft
06	29.01.2019	Andrea Menin – Technical Director	NASPA	Approval
07	12/03/2019	Lucio Rubini & Silvia Zampese	VIU / AREA	Review
08	06/12/2019	Marco Barbieri, Erika Rizzo –Enviromental unit (Contributors) / Mara Pitaccolo Project R&D Unit	NASPA	Final version chapters 1-4 Action Plan

The contents of this document reflect solely the author's opinions and the Programme Authorities are not liable for any use that may be made of the information contained herein

Table of Contents

1. Definition of "Sustainable Port as a Key Element for Wide Range Low Carbon Emission Strategies"

The green strategy of the North Adriatic Sea Port Authority - Ports of Venice and Chioggia (hereinafter NASPA) aims at constantly improving synergies for port development, both in terms of trades and environmental protection.

A "Green Port" represents a philosophy that innovates the way of thinking about the port and implements actions a series of practical activities and events with continuous commitment to the reduction of air pollution, protection of the Venetian Lagoon, re-development of the port areas and achievement of higher energy efficiency.

The three-year Operational Plan (POT), in line with Legislative Decree No. 169 dated 4 August 2016 is the port planning tool that outlines, at the local level, the initiatives and strategic actions for the development and growth of the port system, coordinated with urban planning tools.
NASPA has been established according to this recent regulatory provision and it encompasses the ports of Venice and Chioggia. A single system for what was historically defined as the "Venetian Lagoon Port", that is for a unique geographical, environmental and even more so today - due to the forming of the Metropolitan City - social and economic area.

A single Triennial Operating Plan, for a two-port system that serves the same market in a complementary way, each port with its specific characteristics and uniqueness.
The Triennial Operative Plan represents the political and programmatic approach that, through an analysis of the economic, productive and social components, identifies the most suitable strategies and tools to guarantee a balanced and coherent development of all the NASPA functions and to enhance relations with the local area in terms of cultural, environmental and architectural resources.
Therefore, the objective of the POT is to promote the sustainable development of the port from an economic, social, environmental and cultural point of view. Venice cannot live only based on tourism but needs its port activities which indeed represent an effective response to tourism monoculture, as well as the development of other economic activities such as crafts, trade and industry.

Being a Low Carbon Model Port for Venice and Chioggia means that the system shall develop and continue to generate "wealth" while preserving the historical, archaeological, urban and artistic heritage integrated into a context of environmental, natural and landscape that is both unique and extraordinary. The planning of the development of a port system that falls within a UNESCO site needs to be pursued from a system perspective that, through an intense participation process can constructively combine the anthropic activities with natural, environmental and landscape dynamics.

The prosperity of a port and its territory depends not only on maritime trade relations, but also on its local economic function. In fact, today it is increasingly clear that more traffic, productivity and market shares do not necessarily entail a benefit for the community.

Effective planning must create a port system that is meets the infrastructural, social and services capital needs of the area where it operates. The metropolitan city of Venice as well as the Veneto Region, in fact, are highly connected while their social and economic relations are such to underline their strong international value as well.

A century after the construction of Porto Marghera (1917), the context in which the Ports of Venice and Chioggia are immersed has, in fact, changed radically. Therefore, new development objectives must be identified to maintain them attractive and compliant with the needs of the land and the expectations of the world of work, rebuilding the bond that has faded also due to globalization and automation that are increasingly affecting the transportation and logistics industry.

IT and technological innovations linked to the supply chain are transforming the ports into capital intensive and land intensive industries to the detriment of employment. Therefore, strategies for the recovery or infill of port areas cannot be pursued without considering these trends as well.

From an economic point of view, NASPA targeted interventions that would ensure the development of port activities and the so-called Prosperity by increasing port competitiveness and favoring the work of established businesses.
Within the three-year 2019 -2021 public works program, a total of over 118 million euros have been allocated, of which more than 19 million are included in the annual budget for 2019, which add up to 215 million for the interventions already underway.
A sustainable economic development thanks to improved nautical accessibility, a fundamental condition for increasing traffic, roadway and railway accessibility. Thanks to the planned action plan, the industrial and urban traffic flow is positively affected, and the operations of established businesses improved.
From a promotional standpoint, activities aimed at promoting business are clustered by a commodity logistics chain and include initiatives such as trade fairs, foreign missions, incoming and BtoB meetings.

From a social point of view, sustainability involves a series of varied policies, keeping in mind that port activity involves a very large number of workers and generates bonds in a very large area.
In general terms, we must consider the actions for a Safe Harbor and the safety of workers and to this end NASPA has been investing in awareness campaigns, refresher courses and various initiatives involving the competent Authorities and the port operators.

Last but not least, there are the interventions on the security front for the sensitive port areas, the channels and the accesses, for which Venice is equipped with state-of-the-art systems and a Plan against illegal actions.
In terms of inclusion and equality, many activities of an Ethical Port are aimed at offering greater accessibility and usability of port spaces, providing tools for overcoming architectural

barriers, but also offering events for the dissemination of the culture of inclusion and carrying out welfare initiatives towards people in a state of social hardship in the areas where port infrastructures are located.

In terms of relationships with the territory, numerous activities of the Open Port targeted students, citizens, and visitors according to educational, informational and/or recreational objectives. These include opening the Waterfront, redevelopment with the prospect of making the areas livable and lived by the citizens, in harmony with minor port activities.

According to its Environmental Policy, NASPA Port Authority is committed to manage effectively the environmental challenges of its operations, 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 while, on the other hand, promoting environmental protection among its employees and the companies working at the Port of Venice.

On January 26, 2012 NASPA (*former Venice Port Authority*) was awarded its first ISO 14001 Certificate from the RINA Certification Agency and kept it in good standing over the years, with continuous commitment to improve its environmental management system.

Over the last 15 years, NASPA has been carrying out a series of practical green actions such as:

- restoration of the Venetian port waterfront;
- a massive remediation campaign of more than 110 hectares of land and water at the Venezia-Marghera Cargo Port;
- use of alternative energy and planning of infrastructure for renewable energy such as Liquefied Natural Gas (LNG)
- reducing greenhouse gas emissions and air quality monitoring through quaysides designed specifically to avoid any contamination from the Port into the lagoon.

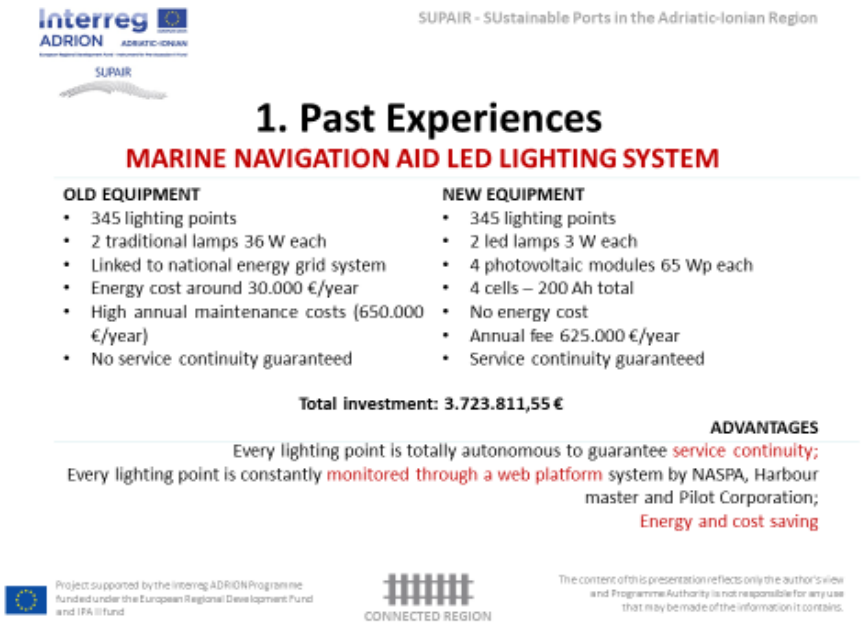


Figure 1 Table summarizing NASPA past actions on energy conservation

The following figure summarizes the strategies and actions implemented by NASPA as described above (Figure 2).

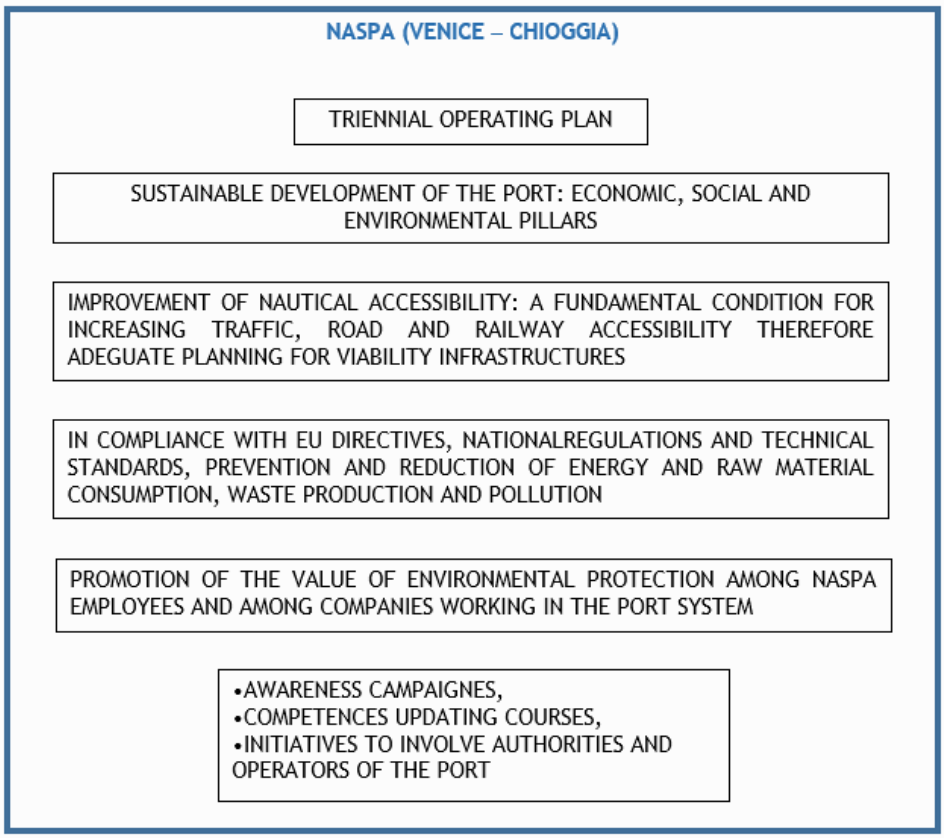


Figure 2 Framework of sustainability strategies and actions implemented by NASPA

In this document, sustainability strategies and actions implemented by NASPA accordingly to the Triennial Operating Plan, which reflect Espo Top 10 environmental priorities for the port sector 2018, focus on the following four themes, which are notably the first four identified by Espo itself, as shown in Figure 3:

1. Air quality;
2. Noise;
3. Relationships with local community;
4. Energy consumption and climate change.

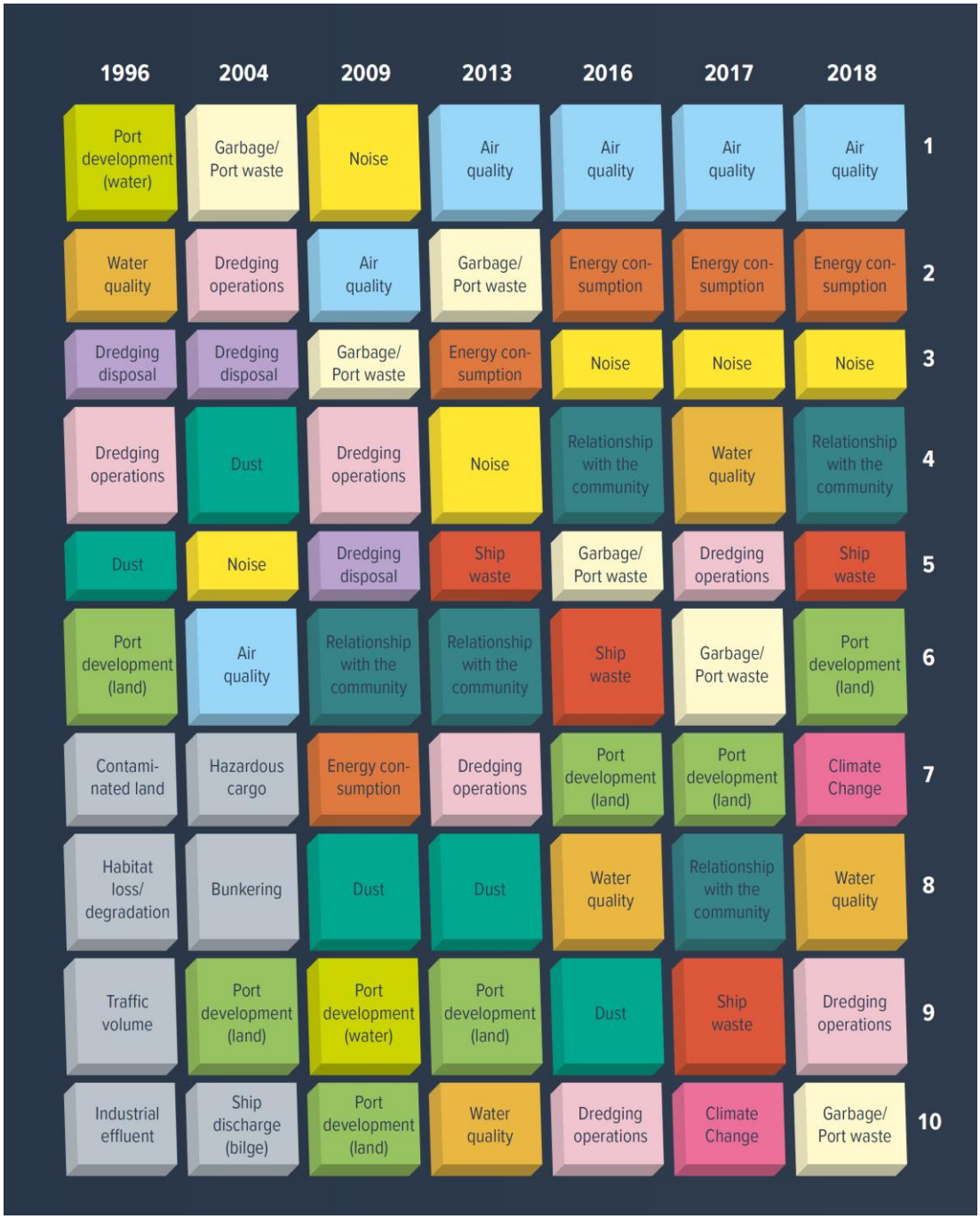


Figure 3 Top 10 environmental priorities of the port sector over the years (ESPO ENVIRONMENTAL REPORT 2018 - EcoPortsinSights 2018).

1. Since 2012, NASPA has renewed every year its voluntary "Venice Blue Flag Agreement", signed with the Venice Harbor Master, the Venice Municipality and several leading cruise companies. According to this agreement, cruise companies with port of call in Venice – Marittima aim at safeguarding the environment of the City by using fuel with lower sulfur content. Moreover, air quality has been monitored over the course of several campaigns with focus on various elements

such as SOx, NOx and particulates, in collaboration with the Regional Environmental Agency (indicator: PM reduction related to Green action e.g. Venice Blue Flag Agreement[1]).
In the shipping sector, investments made in non-fossil energy sources, including LNG, have been promoted at the Venice Port.

2. Berthed vessel-related noise is monitored in sensitive areas close to downtown (see point "3 Relationships with local community" listed above).
   According to the results of monitoring activities, NASPA provided guidelines to improve noise management and reduction to the terminal where shipping companies call to.
   The future installation of fixed monitoring points to monitor the noise generated by ships in the urban areas are under evaluations.

3. numerous events implemented by NASPA are related to the Open Port project and involve students, citizens, and visitors with a focus on educational, informational and/or recreational activities.
   These activities call for port terminals involvement as well as the involvement of local public authorities (harbor master, fire brigade, etc.).
   The relationship with the local community is considered a fundamental matter in order to increase awareness for stakeholders' perception and needs.

4. Considering NASPA objectives for the efficient use of energy and the commitment for use of renewable energy sources, in 2010 NASPA (former Venice Port Authority) adopted a LED technology system in the passenger terminal, with 70% energy saving compared to traditional light fixtures. Evaluation of energy consumption in port areas will take place to identify possible actions to be implemented to reduce CO_2 emissions (CO_2 emissions will be the indicator).
   NASPA, which in the past years has developed a plan to decrease glare pollution on the public port areas for viability, is now implementing it according to the phases identified as priorities.

[1] In the port of Venice, since 2007, a proactive strategy was applied to reduce the impact of the passenger port sector on air quality. This strategy, which saw the signing of voluntary agreements between NASPA, the Maritime Authority and all the cruise companies with port of call in Venice, establishes the compulsory use of green fuel at mooring and when entering the lagoon, applying even more restrictive limits than those established by international and national regulations (SECA, IMO and similar) and this allowed obtaining significant environmental benefits at the local level. The application of the voluntary agreements has been evaluated by the Regional Agency for Environmental Prevention and Protection of Veneto (ARPAV) and, given the benefits obtained, the Venice Blue Flag was also renewed in 2017 (the ships operate with 0.1% sulfur fuel, right from the Lido inlet)

2. Understanding current port operations and management models

The North Adriatic Sea Port Authority - Ports of Venice and Chioggia (hereafter NASPA) is an independent public body according to the Italian Port Law. 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 were 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 average turnover is up to €100 million/year deriving from concession fees and port tariffs for goods.

NASPA is a multipurpose port system with a landlord port model governance approach that directs, plans, and promotes state-owned property, coordinates and controls port operations that are carried out by private companies on a concession basis, ensuring and leveraging the common areas. The 26 port terminals have direct railway and highway connections (7 commercial and 19 privately-owned).
In 2017, the total throughput was about 25,134,624 tons. With 611,383 TEUs handled in 2017, Venice is one of the leading Adriatic container ports. Venice is also the leading Adriatic Sea home port (1,446,635 passengers in 2017). NASPA is the only Italian Port with access to inland waterways trough the Po Valley (Mantua and Cremona), helping decarbonizing transport. Its aim is to build a "Model Port" that respects the environment, is safe, open and ethical.

Nautical accessibility to the Venice and Chioggia ports is complex due to physical and environmental constraints as well as due the interference of «local» traffic. NASPA is working to provide navigation support in order to improve navigation safety and the competitiveness of its commercial operations.
A strong cooperation is in place with the Italian Coast Guard, in particular for the use of AIS data in order to feed LoGIS PCS[2] with:

- real time information
- studies based on statistical data
- ATON navigation

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

[2] The Port of Venice's Port Community System LogIS is a web-based IT system Its applications enable the management of all ship-related documents and are subdivided into modules. This system is a crucial tool for all those involved in port community shipping and port and logistics activities, including the Harbourmaster's Office, Shipping Agents, Freight Forwarders, Pilots and Terminal Operators. Compatibility and expansion
All the components of LogIS are integrated into a single platform. As a result, LogIS acts as the Port of Venice's ‘‘single window’’. In addition, LogIS has been designed to communicate with other third-party applications thanks to a specific EDI (Electronic Data Interchange) component. As a result, it can easily integrate into the port operators' management systems

Europe - including 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;
- The Adriatic – Baltic Corridor.

The Port of Venice is also the northernmost terminal of the Motorways of the Sea that crosses the Eastern Mediterranean and connects Central Europe with North Africa and the Middle East.

The Port of Venice 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 trade segments, it is the only port in Italy to benefit from a river port providing freight transport by barge along the Po River.

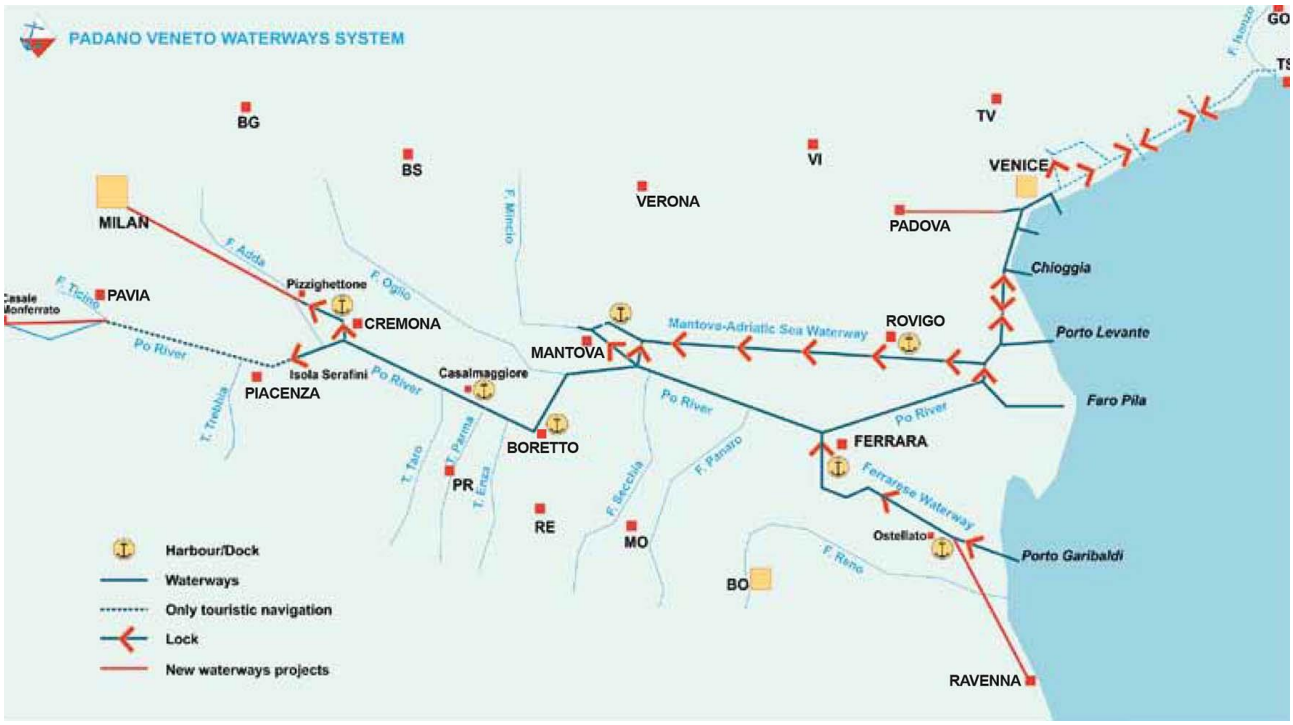


Figure 1 - IWW System of the Po River

The Port of Venice, along with other North Adriatic ports, is located in the right place and 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 CO_2.
In the period marked by the great recession (2008-2015) trades (containers expressed in TEU terms) of the North Adriatic Sea (from Ravenna to Rijeka) increased by 48.4%.

In the transportation system, ports represent the connection point between the maritime and land transportation methods. There are four traditional land-based transportation methods to which we refer: railway, road, river/IWW and pipeline, to which we now add an additional method: 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 river system.

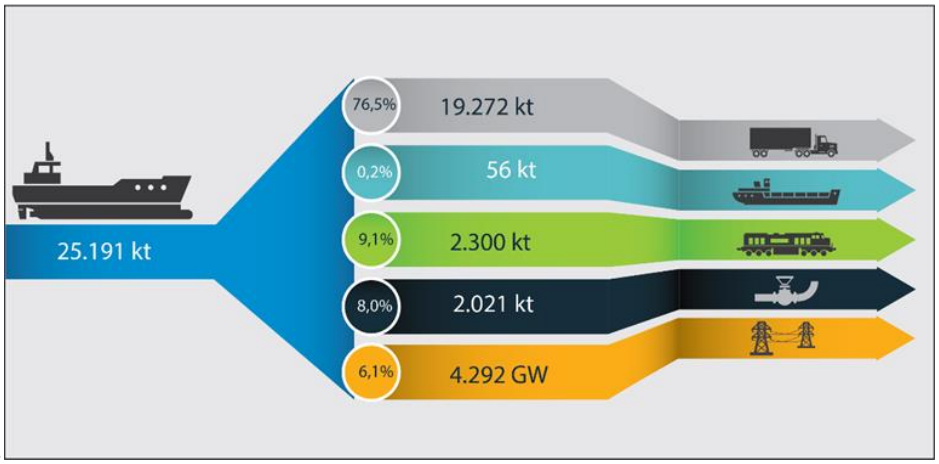


Figure 2 - *Cargo Modal breakdown of the Port of Venice for the year 2017 (Source: AdSPMAS)*

The Port of Chioggia offers only road and river transportation methods while railway accessibility, although available, is not currently in use.

Nautical accessibility of a regulated lagoon port (Mo.S.E. System)

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) inlets for the port of Venice, and the Chioggia inlet for the port of Chioggia.

Figure 3 - The North Adriatic Sea Port Authority System

The Lido inlet allows access to the terminals of Marittima and is dedicated to cruise traffic and to large yachts. According to the current orders of the Maritime Authority, it allows access of ships up to 340 m with a draft of 9.10 m.

The port inlet of Malamocco leads to the area of S. Leonardo with moorings dedicated to the management of petroleum products; to the area of Fusina, where a terminal for the motorways of the sea was recently built; and to the area of Porto Marghera, where the industrial terminals are located.

Access is via the large Malamocco-Marghera navigation canal, which extends for about 20 km, with a depth of -12 m, matching the quota established by the current regulatory plan. The evolution basins have a diameter of 350 m.

Along this access channel to the Marghera areas, one-way traffic is permitted (platooning of ships), alternating with ships up to 45 meters wide and 10.9 meters during the day. The internal channels (Canale Industriale Sud, Canale Industriale Ovest, and Canale Industriale Nord) are partly excavated matching the maximum quota established by the regulatory plan.

The Inlet of Chioggia leads to the port areas of Isola Saloni and Val da Rio and transit is granted to vessels with draft up to 7.00 m.

Moreover, in order to ensure navigability, an assessment is currently underway to rationalize and improve access signaling at the ports of Venice and Chioggia and to install new lights along the internal channels and LEDs fixtures along the pier of the port island to each bollard, in order to facilitate mooring operations.

In 2016, five "fog detectors" were installed along the Malamocco-Marghera channel, including a weather station at Fusina, whose data are transmitted, via AIS (Automated Information System), to all ships that, therefore, can use up-to-date information on the navigability status through their on-board instrumentation.
With the goal of increasing navigation monitoring and safety, the use of AIS tools is being encouraged on a larger number of vessels crossing the port channels. In this respect, NASPA, also in order to check work compliance, has pre-written the use of these systems for all vessels to service the water basins and dredges used in the excavations of the canals.

At the three port inlets, work is underway on the construction of the MOSE system (automated submersed anti-flooding gates), for the protection of the Venice lagoon from high waters. The MOSE system, a permanent infrastructure that sets a physical barrier for accessing the Venice lagoon, will turn the Ports of Venice and Chioggia into ports with regulated access.
At each inlet, locks allow the transit of ships or boats even when the MOSE system is closed. The primary infrastructure (lock) is located at the entrance of Malamocco, south bank, and will allow the transit of a ship 280 m long and 39 m wide in all weather conditions.
The management of this barrier system will have to respond both to the needs of safeguarding the Lagoon and to the defense of the lagoon settlements, and to the maintenance of port activities useful to the international, national and regional economies served by the Port of Venice.
Therefore, it will be appropriate to set up a "Management Cabin" that includes NASPA and other authorities (Harbourmaster and others) so as to guarantee business-continuity of port operations during bad weather conditions (high tide and closed MOSE barriers).

Railway accessibility

At the Port of Venice, in line with the National Strategic Plan of Ports and Logistics (PSNPL), NASPA and the subsidiary Esercizio Raccordi Ferrovieri of Porto Marghera SpA (in-house operator), has completed extraordinary maintenance interventions on the plants under concession and on the locomotives in order to maintain them efficiently and in compliance with current safety regulations, in particular by adjusting them to what is established by Decree 1/2015 of the National Railway Safety Agency (ANSF).

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, through the Venezia Mestre station (via a single electrified track): the latter is the fundamental hub of the Venice junction, as both the goods traffic from the port, and those from/to the Venice Santa Lucia station, located in the historic area of the city.

The Venice Marghera Scalo Railway Area consists of tracks that connect the port terminals and industrial companies (24 connections) with the industrial parks and the Venezia Marghera Scalo railway station, falling within the port area of the Port of Venice. It extends for about 65 km, part of the state property and part of municipal property. The District consists of:

- the Venezia Marghera Scalo, freight station for the arrival/departure of trains part of the connections in the port area (consisting of 12 electrified tracks with a module up to 750 m and 17 support), connects the Marghera Scalo District of Venice to the national network by the Venezia Mestre-Venezia Marghera Scalo line
- support beams of: Parco Breda (10 tracks), Parco Nuovo (8 tracks) and Parco Petroli (4 tracks);
- base connection, with connections from the Venice station of Mestre that connects the Venice Marghera Scalo Station the parks and the roads, in a promiscuous way with the road system.

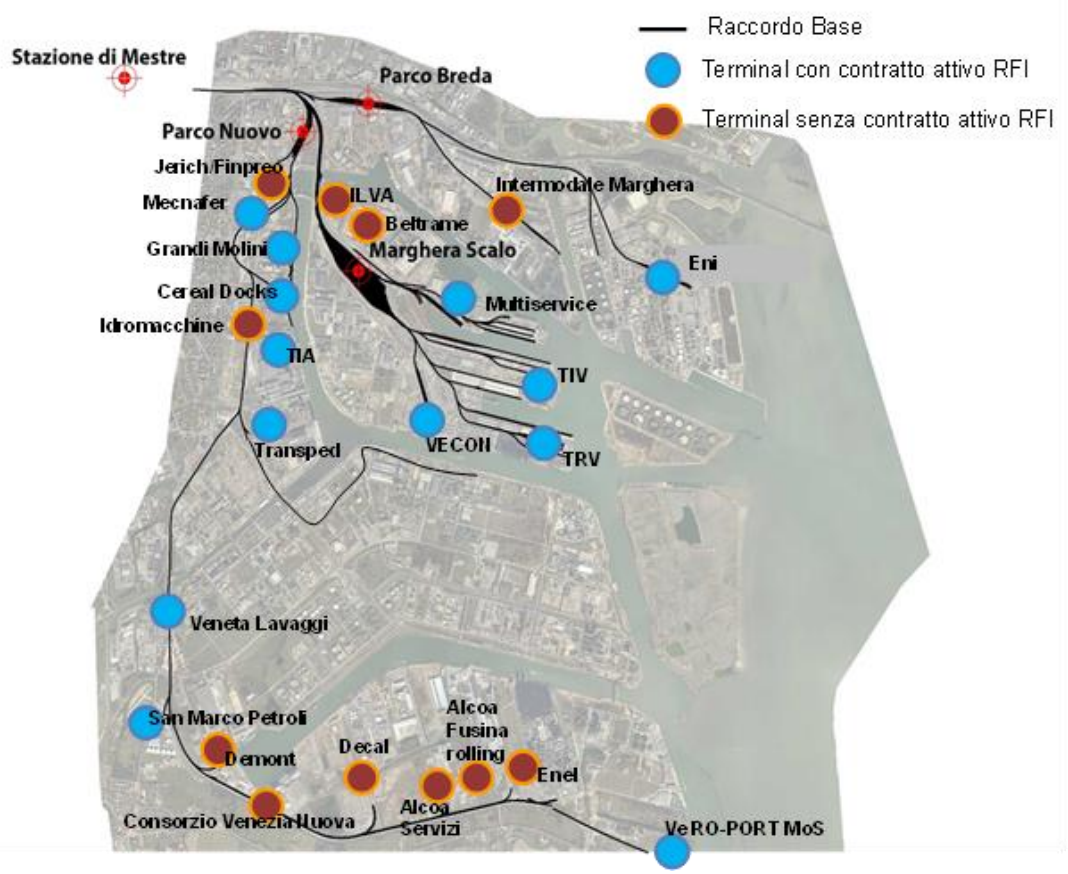


Figure 4 - Railway system of Porto Marghera – Venice Fusina RoRo-RoPAx district

The main goods handled at the Rail District of the Port of Venice are iron and steel products (in 2016 about 51% by weight of total traffic), energy (18%), agri-food (17%), chemicals (7%) and semi-trailers and containers (7%). An important share is that of the new traffic of semi-trailers to and from the Ro-Ro/Ro-PAx Terminal of Fusina for scheduled connections with Greece, trains operational since November 2015 and that now represent about 3% by weight of the overall area.

In general, also thanks to the recent incentive policies, the objective is that to promote additional intermodal traffic to and from Central and Eastern Europe through Porto Marghera. At the same time, it is advisable to provide for and encourage consolidation, and possibly even an increase in traffic based on existing business relations, given the general positive trend of the sector.

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 particular, the accessibility of the Port of Venice locally 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 ensures reduced transit times to the main hinterland locations.

Figure 5 - Road accessibility

The ports of Venice and Chioggia are located in areas where industrial, commercial and urban functions coexist. This promiscuity of functions calls for the need to govern the aspects related to the inclusion of urban mobility and heavy mobility. This problem is tackled through the pilot Action No. 1 (see over for details).

Air quality

Air quality is identified as a priority matter, and this is certainly connected to the health of the people working or living near the port. For this reason, the legislator has introduced different regulations, gradually stricter, aimed at reducing the impact of the maritime sector on air quality. In the context of the 2020 Strategy, the European Commission adopted the Transportation White Paper that established a list of initiatives aimed at promoting a single European transportation area with the general objective of reducing "greenhouse gas" emissions by 60% by 2050. Globally, CO_2 emissions from the maritime transportation sector should be reduced by 40% (and 50% if practicable) by 2050, compared to 2005 levels.

At international level, the environmental regulations for vessels and maritime transportation have been introduced by the Inter-national Maritime Organization (IMO), the competent authority for all aspects related to maritime traffic, from navigation to transportation rules and safety.

In 1997, the "International Convention on the Prevention of Pollution from Ships", known as MARPOL 73/78, was amended in the section related to air pollution caused by ships: Annex VI,

which came into force in May 2005, established that from 1 January 2012 all the fuel on board vessels must have a sulfur content of less than 3.5% by mass. From 2020, the sulfur content should not exceed 0.5%.

The same Convention defines stricter limits in case of Controlled Emissions Areas (ECA), identified and governed by a specific procedure by IMO ruling: for Sulfur Emission Control Areas (SE-CA), the fuel used in navigation must have a Sulfur content of less than 0.1% effective from 2015. As far as NOx emissions are concerned, the progressive reduction is expected with greater controls on the new generation "Tier III" engines, in force in the ECA areas. The same annex also provides for the use of equivalent measures (scrubber) for the abatement of emissions in compliance with legal limits.

Furthermore, at European level, the 2016/802/EU Directive on the reduction of sulfur content of liquid fuels (codification) is implemented at the national level with Legislative Decree No. 112 dated 16 July 2014 which introduced the following limits:

- from 01/01/2010 it is forbidden to use fuels for marine use with sulfur content higher than 0.1% by mass on ships at berth;
- since 2012 the maximum sulfur content for ships in navigation is 3.5% by mass, to be reduced to 0.5% effective from 2020. From 1 January 2018, for the Adriatic Sea and the Ionian Sea and from 1 January 2020 for the other sea areas, a maximum sulfur content of 0.10% by mass shall apply, provided that the Member States of the European Union that share the same sea areas apply equal or inferior sulfur contents;
- paragraph 6 of art. 295 establishes that for all passenger ships operating a scheduled service from or to a port of the EU, it is mandatory to use fuel for marine use with a sulfur content of less than 1.5% in mass in Italian territorial waters and in Italian nature reserves areas.

In addition, Directive 2014/94/EU on the development of the infrastructure for alternative fuels (DAFI) provides that seaports belonging to the Trans European Transport Network, must supply, by 31 December 2025, supply points for Liquefied Natural Gas (LNG) for inland or sea shipping.
The Directive has been implemented in Italy with Legislative Decree No. 257/2016. The decree establishes the minimum requirements for the construction of alternative fuel infrastructure, including recharging points for electric vehicles and refueling points for liquefied and compressed natural gas, hydrogen and liquefied petroleum gas, as well as specifications common techniques for charging and refueling points, and information requirements for users.

Energy Consumption

Energy consumption is the second priority for European ports. At the national level, Law 84/1994 (Article 4-bis) establishes the obligation to draw up the "Plan for the energy and environmental sustainability" of the port, in which the specific initiatives aimed at reducing the impact of port activities on the environment must be specified. The guidelines for the drafting of the Energy Plans have been published by the Italian Ministry of the Environment in January 2019.

Alternative Fuel

As established at EU level by Directive 2014/94/EU on the development of alternative fuels infrastructure (DAFI), the maritime ports belonging to the TEN-T central network ("Trans-European Transport Network"), must, by December 31, 2025, put in place an appropriate number of refueling points for LNG (liquefied natural gas). The Directive has been implemented in Italy with Legislative Decree No. 257 of 2016.

The trend of the last few years is to use "LNG" directly for sea and land traction due to its reduced environmental impact and its high energy performance.
In the road transport segment, LNG-powered vehicles are increasingly present, such as the Stralis Iveco model, already acquired by large Veneto road haulage companies.
The network of distributors is also under development; the last inaugurated one is the refueling station at the interport of Padua. In maritime transport, the technology of "dual fuel" engines (Diesel/LNG) has already been established and several ships are already operating across the globe.

Since 2014, NASPA has made use of CEF European programs to develop the use of LNG as alternative road and shipping fuel, in particular through the Poseidon Med I and II projects and with the "GAINN, Italian LNG Strategy" initiative coordinated at the national level by the Ministry of Infrastructure and Transport.
Based on the analysis of the evolution of LNG consumption volumes defined in the study commissioned by the Port Authority of Venice to ECBA in 2015, it was clear that, in 2030, the demand for the Port of Venice will be equal to 873,000 tons/year, for uses split as follows: 73% for road transport, 19.7% for shipping, and the remaining portion for port/local services.
It is useful to clarify that, following the implementation of these estimates, 13 cruise ships with a tonnage of over 180,000 tons were ordered with LNG fuel, whose annual consumption is equal to 34,000 tons/year/ship.
As part of the aforementioned European and national initiatives, in response to this demand, the Port of Venice plans to build new infrastructures for LNG logistics, in particular a coastal depot and a means of transport for distribution and bunkering. These initiatives have already obtained European co-financing for the design phase and are being assessed by the European Commission to receive further co-financing for their implementation.

The other interventions in the energy sector will be grouped, as established by the Guidelines for the drafting of the Port System Regulatory Plans, as follows:

- the energy consumption of vessels, from large ships to small service boats. This category refers to the electrical connection of the quays and the use of LNG as fuel with the related infrastructures for refueling;
- energy consumption of buildings and port facilities, including equipment such as cranes, refrigerated warehouses, and service vehicles. This category of intervention includes all civil works (insulation, fixtures, efficient heating systems, screens against heat dissipation, etc.) and lighting of the external areas;
- actions that do not directly involve efficiency enhancements, but that could trigger significant energy savings through the application of incentive schemes to support terminal operators who invest in less energy-intensive plants/equipment and/or renewable energy sources, or with inclusion of consumption and energy efficiency criteria and good practices in the selection processes of dealers and procurement processes.

Waste Cycle Management
The matter of waste (port and ships) had an intermediate ranking in the priorities in the last monitoring, probably because of the revision of Directive 59/2000/ EU on the Port Reception Facility (Official Journal of the European Union C115/5 of 1 April 2016). There has been a the long debate on the adequacy of existing plants to receive also the new waste generated by ships (for example the waste generated by scrubbers) and the related obligation of processing and

control in all the ports concerning collection plans and waste management. As provided by the law in force: *"The waste collection and management plan is updated and approved in accordance with regional waste planning, at least every three years and, in any case, at the presence of significant operational changes in the management of the port"*.

Sustainable development of port infrastructures

From a national legislation point of view, the obligations related to the creation of new port infrastructures or maintenance of the existing ones, envisage administrative procedures, related to characterization and reclamation carried out by the Ministry of the Environment according to the provisions of Law Decree 152/2006, considering that Porto Marghera (cargo port) falls within the perimeter of SIN - Site of National Interest.

Energy consumption and energy performance indicators

CONTEXT ANALYSIS

The analysis focused on the area/processes directly managed by NASPA and on the operators that use the terminal areas under concession, including the quay and the building complex, depots and associated facilities. The results shown in the tables below are partly the outcomes of the TALKNET project activities. [3]

TERMINALS	ACTIVITIES
North Adriatic Sea Port Authority	Headquarters
TIV Terminal Intermodale Venezia SpA	Containers Terminal
VECON SpA	Containers Terminal
Multi service Srl	Multipurpose Terminal
TRV Terminal Rinfuse Venezia SpA	Multipurpose Terminal
VRPM Venice Ro-Port-Mos scpa	Ro-Ro/Ro-Pax
VTP Venezia Terminal Passeggeri SpA	Cruise Terminal

EQUIVALENT TONS OF OIL (TOE) CONSUMPTION AND CO2 EMISSIONS

In this context, consumptions and CO_2 emissions referred to the same terminal activities, as shown in the two tables below have been respectively measured by "TOE" and "tCO_2" that represent performance indicators. For each of the six operators analyzed, the tables below show the details of consumption and emissions (year 2017).

[3] NASPA is the leading European project TalkNET, co-funded by the Interreg CENTRAL EUROPE Program. The main objective of this project was to develop actions to support the activation of new intermodal services. Indeed, TalkNET planned to implement and promote coordination among the stakeholders of the freight transport logistics chain in central Europe, to make logistic nodes (ports and interports) more efficient and eco-friendlier and to support the implementation of new services and small infrastructures. This section summarizes the results of the analysis carried out according to TalKNET for the identification of actions aimed at improving the energy performance of NASPA. These actions were identified from mapping the "as-is" processes and then defining goals for the expected "to-be"

Referring to the year 2017, the total consumption amounts to 5,590.8 TOE and CO_2 emissions amount to 13,733 tCO_2.

Table 1.5 - TOE consumptions in 2017

OPERATORS	ACTIVITIES	2017 [TOE]
TIV Terminal Intermodale Venezia SpA	Container Terminal	1,285.6
VECON SpA	Container Terminal	1,256.4
Multi service Srl	Multipurpose Terminal	949.3
TRV Terminal Rinfuse Venezia SpA	Multipurpose Terminal	1,039.9
VRPM Venice Ro-Port-Mos scpa	Ro-Ro/Ro-Pax	214.8
VTP Venezia Terminal Passeggeri SpA	Passengers Terminal	844.9
	TOTAL	5,590.8

Table 1.6 - CO_2 emissions in 2017

OPERATORS	ACTIVITIES	2017 [tCO2]
TIV Terminal Intermodale Venezia SpA	Container Terminal	3,712.6
VECON SpA	Container Terminal	2,946.8
Multi service Srl	Multipurpose Terminal	2,716.8
TRV Terminal Rinfuse Venezia SpA	Multipurpose Terminal	2,364.3
VRPM Venice Ro-Port-Mos scpa	Ro-Ro/Ro-Pax	504.2
VTP Venezia Terminal Passeggeri SpA	Passengers Terminal	1,488.3
	TOTAL	13,733.0

“TOE” and “tCO2” have been respectively calculated according to UNI CEI EN 15900:2010, and UNI ISO 14064.

3. Stakeholders consultation

During the first SUPAIR focus Group held in May 2019, qualified attendees discussed the topics to be included in the Action Plan and presented the companies' strategies and case studies on energy saving, establishing an agenda for future actions (the RSPP and Operations Manager were of senior level). A second Focus Group was organized, as a follow up, by popular demand in December 2019, in synergy with another INTERREG CENTRAL EUROPE funded Project, namely "TalkNET: Transport and Logistics Stakeholders Network", also led by NASPA.
As a durable and sustainable SUPAIR result, the Focus Group sessions will be part of the Action Plan strategy, e.g. there will be periodic stakeholders' consultation organized by NASPA so to deliver the best possible low Carbon Port Action Plan based on real evidence and needs in the years to come (at least 2 meetings per year).

Strengths

- The Port of Venice is a green port that strives to further reduce the carbon footprint of port operations
- Port stakeholders fully support this policy with innovative applications

Weaknesses

- Different levels of Laws and guidelines can weaken private appetite for port investments

Opportunities

- Public funding combined with private capital and financing
- Applying KAIZEN[4] and other total quality procedures in the companies, so as to help reduce energy-intensive operations

[4] KAIZEN is an approach to create continuous improvement based on the idea that small, ongoing positive changes can reap major improvements. Typically, it is based on cooperation and commitment and stands in contrast to approaches that use radical changes or top-down orders to achieve transformation. Kaizen is core to lean manufacturing, or The Toyota Way. It was developed in the manufacturing sector to lower defects, eliminate waste, boost productivity, encourage workers' purpose and accountability, and promote innovation.
As a broad concept that carries myriad interpretations, it has been adopted in many other industries, including healthcare. It can be applied to any area of business, and even to personal life. Kaizen can use a number of approaches and tools, such as value stream mapping, which documents, analyzes and improves information or material flows required to produce a product or service, and Total Quality Management (TQM), a management framework that enlists workers at all levels to focus on quality improvements. Regardless of the methodology, in an organizational setting, the successful use of Kaizen rests on gaining support for the approach across the organization, and from the CEO down.
KAIZEN is a compound of two Japanese words that together translate as "good change" or "improvement," but Kaizen has come to mean "continuous improvement" through its association with the lean manufacturing methodology. Kaizen has its origins in post-World War II Japanese quality circles. These circles or groups of workers focused on preventing defects at Toyota and were developed partly in response to American management and productivity

Threats

- Public Private cooperation is needed to achieve further development in order not to leverage the results and harmonize energy consumption in the public and private areas of the Cargo commercial port of Venice Marghera (high complexity, one of the biggest industrial areas in Europe - 2000 ha)

STAKEHOLDER CATEGORY	RELEVANT STAKEHOLDERS (Name of the Organization)	INVOLVED IN THE FG (Yes or not)	Contribution of the Sustainable and Low-carbon Port	
			NEEDS (list 2/3 of the main relevant needs)	INVOLVEMENT IMPACT
Terminal operator	Terminal Rinfuse Venezia SPA	yes	Investments for cutting energy leakages/waste from main electric cabin (national network) to terminal cabin (estimated approx.. in 40k euros/year)	Involvement: easy Impact: large
company providing personnel for port operations	Nuova CLP Venezia	yes	Must create and use clear KPI to measure and have a common definition of energy source and energy type. Pay attention not to shift the problem from lesser consumption to more Co2 created via old sources. Lean production and total quality practices (KAIZEN etc) must be way of work in the port community. First item to be practically addressed: the port area is not connected with public transport	Involvement: easy Impact: medium
Terminal operator	Terminal Intermodale Adriatico Srl	yes	Critical points remain the ROI - Return on Investment Index and the timing of investments required for reducing energy consumptions. Passengers ship are investing a lot in renewable energies propelled vessels, but this is not always the case in the commercial / cargo sector.	Involvement: easy - Impact: large
Terminal operator	Multiservice srl	yes	Multipurpose terminals are the most complicated to apply energy reducing procedures, due to heterogeneous areas and means of cargo lifting/operations. Concessions should be longer to have better ROI on investments. Traditionally, Rubber Tired Gantry Cranes (RTG) are propelled by diesel (some are hybrid but very costly).	Involvement: easy - Impact: large
Terminal operator (Passengers)	VTP Spa	yes	Passengers terminal in Venice is a world class best practice in terms of efficiency. Electric vehicles already in use. Request for a specific questionnaire to get more details from terminal operators so to draft the energy plan baseline.	Involvement: easy - Impact: large

STAKEHOLDER CATEGORY	RELEVANT STAKEHOLDERS (Name of the Organization)	INVOLVED IN THE FOCUS GROUP (Yes or not)	Contribution of the Sustainable and Low-carbon Port	
			NEEDS (list 2/3 of the main relevant needs)	INVOLVEMENT IMPACT easy, medium, difficult Sector impact: small, medium, large
Terminal operator	Venice Ro Port Mos SCPA	yes	Investments for cold ironing are outdated by new technologies - need to recover cost of investment made years ago and make new more efficient ones	Involvement: easy Impact: large
Public utilities	VERITAS Spa	yes	Authorities must have long term vision and plans that stem from "as-is" deep analyses are right instrument to reach goals.	Involvement: easy Impact: medium
Terminal operator	Grandi Molini Italiani spa	yes	Energy Management Plan is seen as a big opportunity in terms of improving productivity and money savings. Nevertheless, Porto Marghera is very peculiar and private and public areas are very close, not always clear if public funding can be available. There is a need for public funding to boost investments in energy savings infrastructures.	Involvement: easy Impact: large
Terminal operator	Cerealdocks Marghera Srl	yes	Break bulk company is extremely energy intensive (average consumption is 4 MegaWatt /year). KAIZEN methodology helped us to reduce consumptions: need to spread the method to all port .Need for public funding to leverage private equity and financing.	Involvement: easy Impact:large

consultants who visited the country, especially W. Edwards Deming, who argued that quality control should be put more directly in the hands of line workers. As with lean manufacturing, Kaizen is complementary to Six Sigma.

4. Evaluation framework

The North Adriatic Sea Port Authority – NASPA, as reported in the 2018 - 2020 Three-year Operational Plan, aims at promoting the sustainable development of the port from an economic, social, environmental and cultural point of view.

From the economic point of view, the Port Authority of the North Adriatic Sea started a series of targeted interventions to guarantee the development of the port activities and the so-called Prosperity, increasing the competitiveness of the Port and favoring the work of the established enterprises.

A sustainable economic development thanks to the improvement of nautical accessibility, a fundamental condition for increasing traffic, as well as road and rail accessibility. The planned interventions positively affect the fluidity of industrial and urban traffic and improve the operation of the established activities.

Social sustainability involves a series of varied policies, taking into account that port activities involve a high number of workers and affect a large area.

From the point of view of the relationship with the local areas, there are numerous Open Port activities, which are differentiated depending based on whether they are designed for students, citizens, visitors and depending on the educational, informational and/or recreational objective.

The environmental sustainability of port activities implies actions for a Green Port and is implemented, as already detailed in the relevant sections of Chapter 2, in the planning and implementation of activities aimed on the one hand, at containing and reducing consumption, waste and pollution and on the other hand at using innovative technologies to reduce environmental impact both in the case of new construction projects and in the management and maintenance of existing ones.

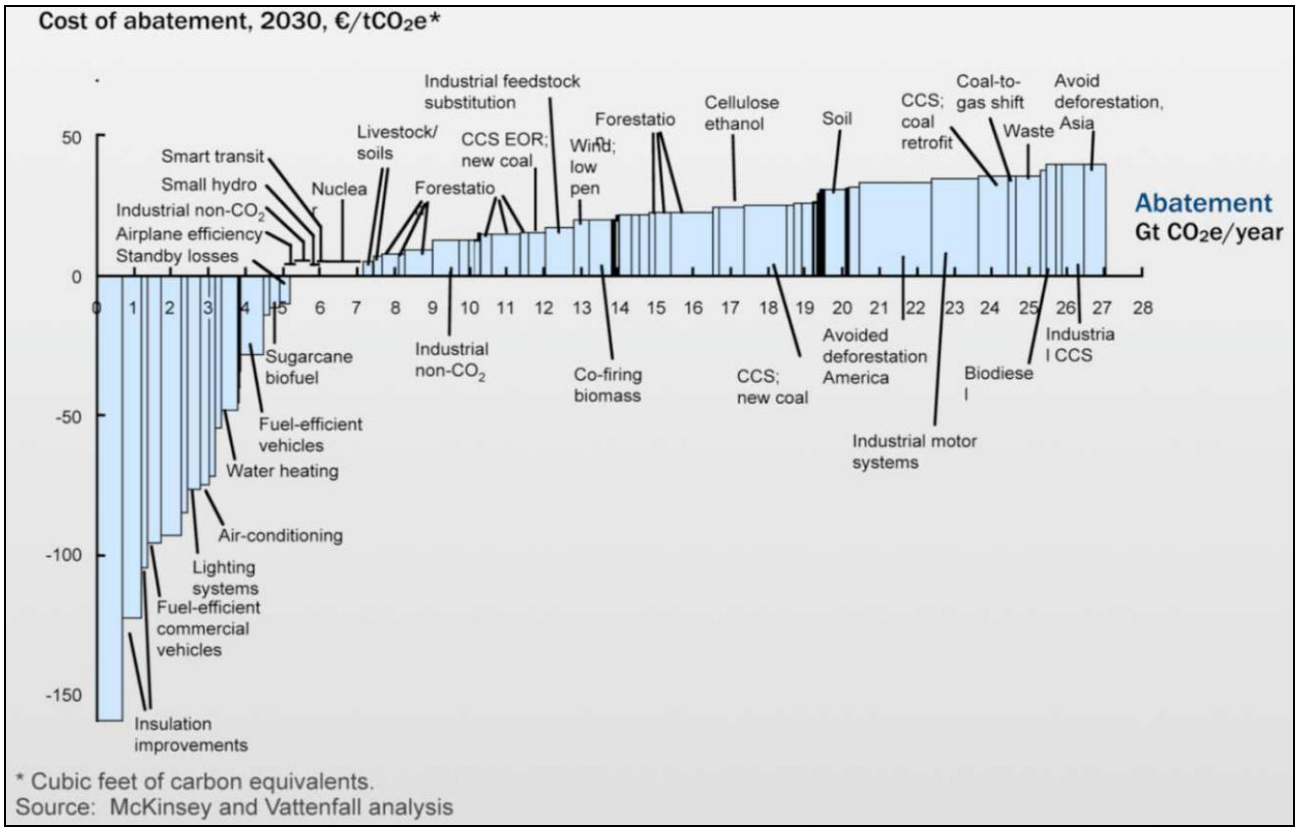
Considering the area in which AdSP MAS operates, and the port areas that, especially with regard to those of the Commercial Port of Marghera, may have electricity networks and infrastructures characterized by a certain age due to the "age" of the port settlement, it is necessary to approach the issue of energy efficiency improvement through a series of subsequent steps, through a continuous improvement approach.

Specifically, the transition to an energy-sustainable settlement may take place in three steps:

1. The first step is to reduce the need for energy consumption, while guaranteeing the same services and functions.
2. The second step consists in reducing primary energy consumption, that is using the most efficient conversion technologies based on the context and using adjustment and control systems that are as "smart" as possible.
3. Finally, the third step focuses on the use of renewable energy sources to meet all or part of the primary energy consumption needs, now reduced to a minimum.

In short, this means working first on the energy efficiency of the system and then on its supply using renewable energy sources.

As it is possible to see from the figure shown below, almost all energy efficiency actions are cost-effective (the cost for reducing emissions is negative).



Economic advantage for reduced emissions

NASPA action plan considers the above-mentioned sustainable approaches and strategies as well as provides the following possible actions to implement. Also, it provides a framework for the preliminary assessment of the possible actions.

NASPA action plan will include the assessment on the Smart Traffic Management Tool. The Smart Traffic Management Tool will be developed according to the latest know-how available (analysis, design, development, debugging, etc.).

Also, the action plan will include a general assessment of the current situation, an overview of the most up-to-date technologies, benchmarking against similar contexts and a design for implementation. The document will evaluate energy savings through specific performance indicators and will be drafted on the basis of a common method stated in the “Guidelines for Sustainable and Low-carbon Ports” (WPT1.2).

In line with European guidelines, it is possible to address all environmental issues and define company policy in the field of voluntary participation to the ISO 14001 management system. This tool does not identify the issues to tackle but represents the framework of reference on which to define environmental objectives and set consequent activities. As the European Sea Port Organization (ESPO) highlights in the Environmental Review 2019 document, environmental priorities in ports at European level have changed significantly over the years. The picture below shows the top ten environmental priorities of EU ports for 2019.

Figure 7 — Top 10 environmental priorities of European ports for 2019 (source: ESPO 2019)

The NASPA Pilot Actions assessed are the following:

Action 1 - Design and implementation of a Smart Traffic Management Tool to improve the port performances landside

The North Adriatic Sea Port Authority has also started an internal reorganization phase aimed at making more effective the data infrastructure and systematically integrating the geographical component into its databases, thus obtaining significant improvements in the ability to analyze and interpret the wealth of data managed by its offices.

Furthermore, the development of the "Smart Traffic Management Tool" includes an assessment to obtain comprehensive knowledge of the infrastructures and energy demand developed on the allocation of structures and activities carried out inside the port area.

In general, many other actions established by the project and the development strategy of the Port Authority effectively aim at improving the efficiency of the Data Infrastructure and especially at boosting the use of geographical data analysis techniques. Regarding this, it is worth noting that the availability of a coherent and structured Geographical Information System is the first condition for carrying out spatial-based information processing such as index formulation, scenarios comparison, statistical and economic surveys, all useful in the decision-making processes within complex contexts such as a Port System.

The report will show a relational database and the data model is mainly subdivided into four groups:
1. Processes
2. Datasets
3. Software
4. Issues

Action 2 - Energy performance diagnosis of the NASPA buildings for their requalification.

NASPA will develop an energy diagnostic system for the public property or public use buildings as required by Presidential Decree No. 412 dated 26 August 1993, art. 5, chapter 15 (regarding

the use of renewable energy), and by Law No. 10 dated 9 January 1991 (regarding regulations for the implementation of the national energy plan on the rational use of energy, energy saving and fostering of renewable energy sources).

The aim is defining the state of the art regarding the energy performance of each building as well as gaining the needed funding to plan and implement the improvements and/or the new technologies in the building as needed to achieve constant and continuous improvement originating from the decrease of energy consumption and therefore the decrease in environmental impact.

The energy performance of the buildings at the port will be defined on the basis of the quantity of energy needed each year to meet the need of each building and that corresponds to the global annual basic energy needs in primary energy for heating, air conditioning, ventilation, hot water, lighting, and plants operation (e.g. elevators, escalators). In order to achieve a classification, the energy performance of the buildings is expressed by the index of non-renewable global energy performance “EPgl,nren”.

This index takes into consideration: the basic energy needs in primary non-renewable energy for heating and air conditioning in winter and summer (EPH,nren and EPC,nren), the basic energy needs in primary non-renewable energy for hot water (EPW,nren), the basic energy needs in primary non-renewable energy for ventilation (EPV,nren), the basic energy needs in primary non-renewable energy for artificial lighting (EPL,nren), and basic energy needs in primary non-renewable energy for the transportation of people or goods (EPT,nren).

Therefore, the above-mentioned index represents the sum of the individual energy needs for the building analyzed. The index of non-renewable global energy performance is expressed in kWh/sq.m. per year in relation to the surface.

Assessing the energy performance of the buildings aims at obtaining a tool that could be useful first of all at evaluating the energy conditions of the buildings at the port and thus at deducing, planning and implementing those interventions for energetic requalification that have been identified as needed.

The certification of energy performance is a tool that will help, when the improvements will be implemented, to increase the value of the buildings which by then will be characterized by low energy consumption. The increased efficiency, within the renovation interventions, will decrease the level of C02 emissions when the building is in use.

In the planning of the activities to achieve the energy performance certification, the recent Guidelines for drafting the documentation for environmental and energy planning at the ports, published by the Italian Ministry for the Environment, will be taken into proper consideration.

The buildings where NASPA wishes to achieve the energy performance certification are located at the Porto Marghera commercial port, as well as at the Marittima Port, in the island of Venice. In detail, the buildings where NASPA wishes to obtain its energy performance certification are the following:

- Buildings No. 12-13: NASPA offices (registered offices of NASPA, Marittima – VE);
- Building No. 255: offices (under concession, Marittima – VE);
- Buildings No. 16-17: offices (under concession, Marittima – VE);
- Buildings No. 447-449: warehouses (NASPA premises, Porto Marghera - VE).

Therefore, the aforementioned energy performance certification for the buildings listed above will enable NASPA to be in compliance with the national regulation that aims at reducing energy consumption and improving quality of life, by means of reducing CO2 production.

Action 3 - Port grid efficiency update

NASPA is considering the possibility of enhancing the port grid and modernize the terminals medium voltage cabins, in order to gain:

- Economic benefits, due to dedicated grid to each terminal;
- Management benefits, due to more autonomy at each terminal in terms of electricity thanks to specific ad-hoc contracts and the possibility to self-generate power through power plants (e.g. photovoltaic plants).

Action 4 - Energy Efficiency of Machinery

A dedicated electrical supply line for the machinery operating at quays, docks and port services areas in order to switch from a diesel power supply model to an electric power supply model.
A study could be carried out on the machinery (e.g. cranes), exploiting a new technology that can save and reuse the otherwise dissipated energy.
Reefer plugging system to green electric energy supply chain.

Action 5 - Green transfer services between Porto Marghera and the city suburbs

NASPA is considering the possibility of adopting an hybrid bus and to realize an electric car energy supply point in Porto Marghera, and two electric car energy supplies points in Venice.

Action 6 – Development, dissemination and data collection by means of a questionnaire to gather specific data on the activities of each terminal carried out at the Port of Venice.

For each type of terminal, a questionnaire will be developed in a tailored way considering, for example:

- the type of goods managed;
- the type of means of transportation;
- accurate assessment of energy consumption associated to each machinery as well as the associated power demand;
- energy demand that the terminal could need to develop improvement plans in terms of energy efficiency;
- an estimate of the number of terminal workers that could need and/or benefit from public transportation. Also, an estimate of the hours when the service could be more needed;
- and an estimate of the need of the crews working on vessels to reach the commercial port for the same above-mentioned service, which could enable quick links from the commercial port to the town of Marghera;

- proposals for improvements (measures and interventions) that could be carried out in collaboration with NASPA.

The questionnaire will be distributed among the Port of Venice terminal operators to collect from each operator specific data to define the baseline needed to identify possible improvements in terms of energy efficiency.

The questionnaire will be developed in a way to gather information about the possible need of the terminal operator to establish a dialog with NASPA on future possible improvements, as they could be included in the concession agreement documents, in terms of development and payback, considering also the duration of the concession.

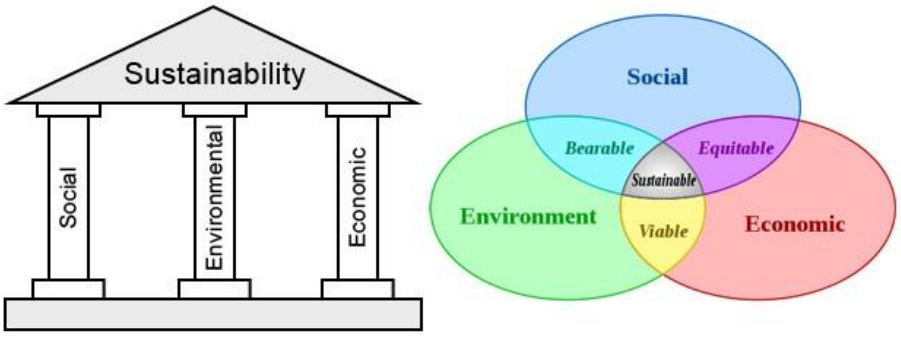
Evaluation Framework.

This section offers an assessment of the six actions described above according to NASPA Evaluation Framework as follows.

The Evaluation Framework is developed to provide outputs considering a pre and post project scenario for the application of each pilot intervention, and is based on the following criteria:

- Economic value referred both to the tangible (e.g. buildings) and intangible (e.g. logistic data management) aspects of efficiency improvement - Economic pillar of sustainability;
- Carbon footprint - Environmental pillar of sustainability;
- Benefits for terminal workers and vessels crews - Social pillar of sustainability
- Level of compliance of the Port of Venice system to the requirements of the Guidelines for energy and environmental planning in Italian ports published by the Italian Ministry of the Environment together with the Ministry of Transport.

Figure 8 - Sustainability pillars



Pilot intervention	Economic value referred both to the tangible (e.g. buildings) and intangible (e.g. logistic data management) aspects of efficiency improvement (Economic pillar of sustainability)		Carbon footprint (Environmental pillar of sustainability)		Benefits for terminal workers and vessels crews (Social pillar of sustainability)		Level of compliance of the Port of Venice system to the requirements of the Italian Ministry of the Environment Guidelines for energy and environmental planning in Italian ports	
	Pre-intervention	Post-intervention	Pre-intervention	Post-intervention	Pre-intervention	Post-intervention	Pre-intervention	Post-intervention
Action 1 - Design and implementation of a Smart Traffic Management Tool to improve port performance landside.	3	5	2	4	3	5	2	5
Action 2 – Energy performance diagnosis of NASPA buildings for their requalification.	2	4	2	4	n.a.	n.a.	2	5
Action 3 – Port grid efficiency update	2	5	2	4	2	4	2	5
Action 4 – **Port** Machinery Energy Efficiency	2	5	2	4	2	4	2	5
Action 5 – Green transfer services between Porto Marghera and the city suburbs	n.a.	n.a.	2	4	2	5	2	3
Action 6 – Development, dissemination and data collection by means of a questionnaire aimed at gathering specific data about the activities carried out at each specific terminal at the Port of Venice.	n.a.	n.a.	2	4	3	4	3	4

Each criteria is assigned a value from 1 to 5, where: 1=very low; 2=low; 3=average; 4=high; 5=very high // n.a.= not applicable

5. Action plan solutions design

The NASPA, as reported in the 2018 – 2020 Three-year Operational Plan, aims at promoting the sustainable development of the port from an economic, social, environmental and cultural point of view.

The environmental sustainability of port activities is implemented through planning and activities aimed, on the one hand, at limiting and reducing consumption, waste and pollution and, on the other hand, at using innovative technologies to reduce environmental pressure both in the case of new works and in the management and maintenance of existing ones.

The Authority, aware of the complexity of its processes and of the fact that such complexity can determine a certain degree of uncertainty in the results to be achieved, undertakes to adopt an objective approach based on data, analysis and facts.

The management of the relationships with the stakeholders is also important in this context.

For this reason, NASPA promotes actions to communicate externally to the stakeholders the information regarding the commitments undertaken for environmental sustainability and the results achieved.

In line with the above, on 02/10/2019, NASPA, in cooperation with the concessionaires of the macro-port island of Marghera, Venice and Fusina, organized a technical meeting to assess and explore the possibilities of energy efficiency improvements at the port, as well as to share and discuss ideas on how to achieve energy efficiency improvement since the concessionaires represent the main parties involved in the issue. They are all companies with high energy consumption needs. Therefore, as already demonstrated over time, they actively participate and show significant interest in participating to energy efficiency improvements and from them NASPA over time has collected and continues to receive input for improvement, becoming a promoter of synergies and best practices.

The following issues were discussed during the technical meeting: -

- Diagnosis for the energy requalification of port buildings;
- Analysis of the flow of incoming and outgoing goods from the port;
- Administrative access procedures at the port area related to logistics;
- Efficiency improvement of port lighting;
- Transfer services, with green vehicles, for the connection of the macro island of Marghera to the city;
- Efficiency improvement of the electrical distribution network at the port;
- Energy efficiency Improvement for port equipment;
- Electrical connections of quays for supplying self-propelled cranes;

more specific analyses have been started for:

- Diagnosis for the energy requalification of buildings: construction of thermal insulation on walls and roofs as well as replacement of windows and doors. These interventions make it possible to significantly reduce winter and summer air conditioning and heating consumption; the activity can be completed with the construction of heat pump systems by removing, where present, the current methane generators.

- Analysis of the flow of goods for the various infrastructures: optimizing motorized vehicle traffic incoming and outgoing from and to the port both in terms of wait time and renewal over time of the type of vehicle (replacement of traditional vehicles with electrically powered or hybrid ones);
- Administrative access procedures in the port area related to logistics: interventions to optimize the bureaucratic/administrative flow for goods monitoring and management of the entire supply chain with the goal of turning paper control practices into IT tools. These harmonized interventions may prevent waiting times for the goods and their handling (temporary positioning)
- Efficiency improvement of port lighting: replacement of the current damaged lighting fixtures and installation of new LED illumination lights equipped with devices to manage their turn on time; this intervention would halve the power used while keeping the same levels of illumination;
- Transfer services, with green vehicles, for connecting the macro island of Marghera to the city: plan for the means of transfer through the purchase of hybrid or electric buses and the installation of fast recharging stations;
- Efficiency improvement of the port electrical distribution network: setup of independent electricity supply points for each Stakeholder (port terminal operators) so as to optimize the power used to obtain electrical substations (MD) with POD supplies properly sized for the actual energy needs. This activity will also allow assessing the implementation of self-generating energy plants, such as photo-voltaic or co-generation ones;
- Efficiency improvement of port equipment: assessing the replacement of diesel generators currently in use for the port equipment with equivalent electrical ones, in particular for the Refeer outlets and cranes. For the specific case of self-propelled cranes, a plan is under review for the design of devices (on-board equipment) that allow the recovery of energy during their normal operation. The energy recovered, not through standard systems available on the market, may be reused during the loading and unloading of the ship. The objective is to reduce the consumption of diesel fuel and consequently the reduction of CO2 emissions into the atmosphere;
- Plan for the design of the quay electrical connections to supply the self-propelled cranes: the design for an adequate electrical connection network will make it possible to power the quay equipment.

In order to be able to draw up the targeted designs, in accordance with the foregoing, an on-line questionnaire was drawn up for the collection and processing of data and specific requests received from the Stakeholders.

6. Strategies for action implementation

As required by Article 4-bis of Law 84/1994 and subsequent amendments and additions, AdSP MAS is drawing up the Plan for the energy and environmental sustainability of the port system (DEASP), with specific initiatives aimed at reducing the impact of port activities on the environment.

From an energy point of view, actions for the efficiency improvement of existing infrastructures will be evaluated.

With respect to the foregoing, and to the objectives of the SUPAIR project, AdSP-MAS wishes to proceed through an in-depth study of the issues related to:

- Diagnosis for the energy requalification of port buildings;
- energy efficiency improvement for port equipment;
- Transfer services, with green vehicles, for the connection of the macro island of Marghera to the city;
- Efficiency improvement of the electrical distribution network at the port;

a) Diagnosis for the energy requalification of port buildings

NASPA analyzed buildings with two different types of use. The examined buildings are named as: 12/13, 16/17, 255 (buildings located in Venice), 447-448-449 (buildings located in Marghera) and these are (E.2 and E.8) type buildings:

- Buildings used as offices and comparable to E.2 in the case of buildings 12,13,16,17,255, and 448
- Buildings used for industrial and artisan activities and comparable to E.8 in the case of buildings 447 and 449

In the case study of buildings E.2, it was found that the buildings - being structures dating back to the early twentieth century despite being renovated in 2007 - have low thermal insulation.

This factor causes a high energy consumption, both in terms of fuel use for winter heating and electricity for summer air conditioning.

Acting through the implementation of special energy requalification works such as the insulation of walls and floors, the replacement of windows and doors and the construction of heat pump systems removing the current methane heat generators, it will be possible to significantly reduce energy consumptions and related CO2 emissions.

In the case study of the buildings E.8 that are not heated and are mainly used for storing materials, the study of efficiency improvement was not considered, as no significant energy consumption was recorded.

b) Efficiency improvement of the electrical distribution network at the port

Currently, the electricity distribution network is licensed under a special multi-year "Energy Service" contract with a specialized company that periodically manages and maintains it in synergy with AdSP MAS, which is responsible for planning and implementation.

This activity would ensure:

- Cost-effective benefits through the development of an electrical network and optimization of the supply points for each terminal; it will ensure over time improvement in both maintenance management and energy efficiency deriving from the possibility of benefiting from specific electrical power supplies for the development of investment plans;
- management benefits through independent management options in terms of contractual electrical power supply agreements and the possibility of building self-generating energy plants such as photo-voltaic, co-generation ones or any other type as deemed necessary.

c) Energy efficiency Improvement for port equipment

During the technical meeting held on 02/10/2019 the stakeholders seemed to have the desire for new, more efficient and sustainable electricity supplies. The request for a new infrastructure

concerns the possibility of having a dedicated power supply for powering equipment in the square and quay. The planning for a new port infrastructure under the competence of AdSP-MAS could be useful for port terminal operators in order to program and invest in the replacement of equipment powered by diesel generators with electrical equipment.

Self-propelled cranes: Therefore, NASPA is considering to carry out a specific feasibility study for the implementation of an energy efficiency improvement device based on energy recovery, now dissipated during the various load handling stages, mobile cranes (self-propelled), and port cranes not powered by the electrical supply and electro-diesel supplied.

More specifically, it consists in being able to make use of what the most modern technological innovations in electric power management offer, also thanks to the recent development of the so-called "electric cars", in order to prevent or reduce voluntary dissipation, now common in different stages of work for the cranes in question.

Technically, many electro-diesel cranes (Gottwald but not only those) are equipped with energy dissipation devices necessary during some of the work stages. In order to make these "energy dissipating equipment" as obsolete as possible or in any case to make energy management more efficient by reducing diesel consumption, two successive steps have been identified:

1. The first is an accurate physical and technological study of the structure of a "typical machine" and the methods of ordinary use, to determine the true energy consumption involved, the value of "voluntary" dissipations and therefore the potential "energy saving" to be achieved by adopting energy recovery technologies.

2. Carrying out a feasibility study for the implementation of these technologies at the port in a theoretical-practical way, that is through the electronic design of a possible piece of equipment and its practical implementation in prototype terms on an appropriate scale in order to demonstrate the feasibility of this application.

Through these steps, it will be possible to assess the economic advantage "for each crane " (in terms of liters of fuel saved) and the consequent assessment of the lower emission of CO2.

In addition, this study will involve the drawing up of electrical construction diagrams, for a "sample prototype" made according to the current practice that can allow the implementation of a prototype model useful in the subsequent step of industrialization.

Regarding the prototype, the consumption parameter recordings shall be highlighted in order to make the "energy savings" and the lower emission of CO2 recognizable by the community, even if not technically savvy.

Currently for handling goods there are 890 kW cranes powered by diesel fuel with an average consumption of 135,000 liters each for an average work of 3,200 hours/year.

Replacing the current diesel cranes with electric ones of matching power and for the same hours of use, it would be possible to obtain the primary energy savings and reduction in CO2 emissions shown in the following table:

PRE-INTERVENTION	
Energy carrier	Diesel
Annual consumption	135,000 liters
Diesel cost	0.52 €/liter
Diesel fuel annual expenditure	70,200 €/year
Annual primary energy consumption	115 TEP
Annual CO2 emissions	357 tonnes of CO2

POST-INTERVENTION	
Energy carrier	Electricity
Annual consumption	270 MWh
Electricity consumption	0.164 €/kWh
Electricity annual expenditure	44,280 €/year
Annual primary energy consumption	47 TEP
Annual CO2 emissions	80 tonnes of CO2

SAVINGS		
TOE	tonnes of CO2	EURO
68	277	26,000
59%	78%	37%

Reefer outlets: For the management of refrigerated containers in the port areas there are 12kW power outlets powered by diesel generators.

One of the possibilities brought up during the technical meeting is the replacement of the current refrigeration system with diesel fuel supply with a dedicated system generating electricity possibly from renewable sources.

By way of example, considering one of the systems, located on port macro island, consisting of 56 electrical outlets powered by diesel, it is possible to estimate that the implementation of electricity supply would lead to savings in primary energy and reduction in CO2 emissions as shown below:

PRE-INTERVENTION	
Energy carrier	Diesel
Annual consumption	144,750 liters
Diesel cost	1.16 €/liter
Diesel fuel annual expenditure	167,870 €/year
Annual primary energy consumption	124 TEP
Annual CO2 emissions	383.6 tCO_2

POST-INTERVENTION	
Energy carrier	Electricity
Annual consumption	290.3 MWh
Electricity consumption	0.164 €/kWh
Electricity annual expenditure	46,449 €/year
Annual primary energy consumption	54 TEP
CO2 Annual emissions	92.4 tonnes of CO2

SAVINGS		
TOE	tCO2	EURO
69.7	291.2	121,421
56%	76%	72%

The implementation of these activities is mainly linked to:

- the installation of supply points dedicated to each terminal operator so that they have at their disposal specific supplies of electrical power appropriate to their energy needs.
- the installation of a dedicated electrical network for refrigerating containers in the port areas.
- energy efficiency improvements, especially in the Nordic countries (e.g. Norway) is also moving towards the electrical connections of port quays in order to power self-propelled cranes (e.g. Gotwald). This activity for the port of Venice is subordinate to an accurate design based on the knowledge of technical/operational data of each terminal. The collection of the necessary technical information will begin by having each terminal operator fill out the questionnaire prepared with the feedback of the stakeholders. This document will be filled out online on a special web platform and updated every year on the basis of the progress made.

d) Transfer services, with green vehicles, for the connection of the macro island of Marghera to the city

The pollution caused by vehicle traffic is subdivided into two types:

- vehicle traffic for economic and managerial activities;
- vehicle traffic for industrial activities;

the containment, even at the local level, of pollution caused by these emission sources can be achieved through:

- strategies for reducing individual pollution levels (each individual vehicle)

- reduction of sources generating pollution (all vehicles in the area under consideration).

NASPA in order to address local individual pollution is planning, in the short term, to purchase two electric vehicles to replace those powered by traditional fuel (gasoline). The trend over time and the progressive replacement of vehicles with similar hybrid vehicles or vehicles with a lower environmental impact than the current ones.

However, a number of factors need to be taken into account:

- the obsolescence of the vehicles to be replaced: in terms of LCA (analysis of the environmental impact based on the life cycle of the vehicle), as well as in economic terms, may not make it profitable to replace a vehicle still in good condition for a new one, even if more efficient.
- Presence of infrastructures for recharging car batteries.

NASPA is setting up the installation of two fast charging points for cars (two fast charging outlets for each point). This planning established the positioning of a charging station (with two outlets) in Marghera in via del Commercio near the entrance gate of the port Molo A and a charging station (with two outlets) will be positioned in Venice near the Maritime station of the passenger marina (near People Moever - air connection infrastructure equipped with a shuttle that connects the areas of Tronchetto and Marittima with Piazzale Roma Venezia). This set up, in high traffic areas, will make them accessible not only to AdSP-MAS employees, but also to external people.

The electrical infrastructure through the positioning of fast charging stations will save for each vehicle recharged, between 5 and 13 tonnes of CO2 equivalent during the life cycle of the vehicle. In order to make the transition to electric and/or hybrid powered cars even more virtuous, the construction of photo-voltaic systems that provide, at least in part, green energy for recharging cars is also being examined.

For the pollution factor due to the total number of sources generating pollution (all vehicles in the area under consideration), the methods for its containment are linked to the monitoring of vehicular traffic in order to promote traffic control and modal re-balancing in favor of public transport and non-motorized mobility.

In order to be able to improve and act as far as possible with regard to pollution due to the total quantity of pollution sources, NASPA is considering the purchase of a hybrid bus to be made available to the port community. This bus will have to guarantee the connection between the port and the outskirts of the cities of Marghera and Mestre.

The pollution reduction due to vehicular traffic for the handling of goods incoming and outgoing from the various terminal operators, is an issue that NASPA is also addressing in view of a detailed analysis on the amount of goods handled by road, rail and sea.

The detail of this information and the consequent possible improvement will also originate from the answers to the previously mentioned questionnaire that each terminal operator will have to fill out every year. Therefore, it will be possible to assess the most appropriate implementation strategies to reorganize the "INCOMING" and "OUTGOING" traffic from the port, aligning it with the overall logistical activity of the port.

7. Coordination with relevant plans

As explained in Chapter 6, NASPA is drawing up the Document for energetic and environmental planning in the port system – DEASP detailing specific initiatives aimed at reducing the impact of port activities on the environment.

The above-mentioned interventions have an impact both at a local level, intended as a port area, and therefore are connected to the DEASP, and at a wider level, certainly involving all communication routes to and from the port.

It should be noted that, for example, interventions aimed at rationally improving efficiency for using and recovering energy will significantly reduce both the use of fossil fuels and the related amount of CO2 not released into the atmosphere with obvious advantages for the environment. Even the practical replacement of heat generators in buildings with heat pump systems meets the requirements of the "thermal account" that provides economic incentives for the use of renewable energy sources.

The planned interventions for the efficiency improvement of the lighting systems, outside the purely commercial nature of the Marghera port or for the road network areas open to public use (PICIL Project of NASPA), in accordance with the local directives in the field of light pollution specified by Regional Law No.17/2009, establish the progressive replacement of luminaries equipped with SOX lamps with new high-performance lamps and in particular with luminaries equipped with optic devices that prevent glare.

With reference to the theme of logistics and management of vehicle flows "INCOMING" and "OUTGOING " from the port, the efficiency improvement will contribute to the reduction of wait times and parking of commercial vehicles and wait time for goods subject to the usual administrative, port and customs procedures. A new management of the flows would guarantee a reduction of the pollution generated by vehicles on the port and adjacent area, in addition to increasing and allowing an economic advantage for the port community.

Finally, the implementation of a transfer service from and to the port for the community would allow the reduction of vehicles (personal cars) entering the port with the direct consequence of limiting the pollution generated by motor vehicles. Therefore, the opportunity for the purchase of a hybrid bus that can connect the port macro island with Marghera (e.g. via Fratelli Bandiera/railway station) and Mestre (e.g. Corso del Popolo/railway station) are being assessed.

8. Assessment design and implementation

NASPA planned and started up a specialized technical service for the analysis of the current situation of port operations and services in the areas of competence of the Port Authority of the North Adriatic Sea for the Ports of Venice and Chioggia, in accordance with national and EU legislative and regulatory provisions.

In order to optimize the flow of the logistic port operations, with consequent reduction of environmental impact, good practices cards (BP) will be developed and produced, using as reference other European or international port environments, to be distributed to the port operators with the subsequent assessment of the applicability of the proposed methods of operation (BP) for the ports of Venice and Chioggia.

Therefore, a dissemination workshop for the port community will be held in Venice, on occasion of two meetings lasting at least 4 hours. The final objective is to define, through direct interviews with the port operators and the representatives of the Port Authority, or through bibliographic research or similar, which best practices of port operations can be replicated for the models in use at the Commercial Port of Marghera (VE), at the Ro-Pax Port of Fusina (VE) and at the cruise sector of Marittima - Venice. The models of port operations of excellence will be illustrated, referring to the different operational aspects of each macro chain (containers, liquid and solid bulk, Ro-Ro -Ro-Pax, passengers) linked to the ship cycle. Thus, this objective shall identify the operational models to achieve high operational standards, in terms of capacity, quality, efficiency, reliability, competitiveness, safety, environmental and social sustainability. The activities described above will be explained to the Stakeholders.

9. Monitoring Plan

NASPA developed, together with the port operators, a questionnaire useful for the collection of data concerning energy aspects and the type of port operating vehicles used by each terminal in order to acquire and share the improvements carried out in the port area on a yearly basis. The questionnaire loaded on a specific web platform will make it possible, through an annual reminder, to include in the questionnaire the variations or innovative changes carried out at each terminal or fleet of port vehicles in general. The collection of energy information will be essential for energy saving assessments, especially during the design stage.

The efficiency improvement of the electricity distribution network and the medium voltage substations will allow the development of a measurement system consisting of specific control points.
The modernization and efficiency of the medium voltage electrical network will have positive effects on the accurate assessment of consumption including predictive ones; this activity will also make it possible to improve the management of port plants.

The analysis and comparison of consumption and statistical production data will make it possible to identify over time specific performance indexes for the area of competence, for example:

- Index KWh /container handling;
- Index kWh/goods stored;
- Index kWh/Refeer;
- Index Smc /climate trend;
- Index Liters of fuel/km made by vehicles.

The aforementioned continuous monitoring activity, supported by the updating of the data acquired through the web platform, represents, for the so-called "Deming Cycle: Plan, Do, Check, Act", the “Check” stage.

The implementation of the provisions of this stage will allow identifying and achieving further improvement objectives.