Interreg
Italy - Croatia
SUSPORT

EUROPEAN UNION

Cross-border study on port environmental sustainability and energy efficiency

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Contents

Introduction

Environmental sustainability and energy efficiency are some of the most challenging objectives to be pursued in port areas. In the last decades, increasing attention has been given to these topics, especially in the European context. This led to a large number of actions devoted to reducing the emissions of pollutants and developing new tools and policies to reduce the environmental impact of navigation and port operations. In this context, the SUSPORT project aims to provide its contribution. The project gathers all the main ports from Italy and Croatia, offering a very useful channel to share past experiences and best practices dealing with port environmental sustainability and the improvement of energy efficiency in port areas. In this context, several research and pilot projects have been financed by the European Union through different funding programs, providing a quite strong basis that shall be considered by each stakeholder who approaches the topic. Nevertheless, each port has its peculiarities (geographical location, type of handheld goods, type of visiting vessels, relevant stakeholders, etc.) that shall be considered when planning actions to improve sustainability and energy efficiency. In SUSPORT project, the current situation of the port area and the identification of its needs have been carried out by each port in the so-called Territorial Needs Assessment (TNA).

The present document aggregates and comments on the overall results of local TNAs, carried out according to the joint methodology provided in deliverable D.3.2.1. This cross border study defines the state of each port at the beginning of the SUSPORT project and provides a first assessment of the needs connected to the energy efficiency enhancement and emissions reduction. To this end, it is essential to assess the current status of the port emissions, map the key stakeholders and combine these outcomes to identify opportunities and risks which might affect the subsequent phases of the project. Moreover, it provides an overview of the global environmental impact of port activities in the whole project area, analysing and decomposing the Green House Gasses (GHG) emissions by source. Each partner within the SUSPORT project has been requested to contribute to the cross-border study, carrying out their TNA according to common methodology in order to collect homogeneous information. In particular, a common procedure to define port GHG emissions in 2019 has been followed by each partner. Some small nonconformities due to the specific port environment or data availability issues are here properly highlighted. Then PP03-VIU was in charge to coordinate, analysing and integrating the TNAs composing the cross-border study including the overall analysis related to the whole project area (the Adriatic Sea). The document is structured as follows. In the first part, it aggregates statistics related to the traffic and goods/passengers flows for the involved ports. Then, after illustrating the involved stakeholders, information on emissions is reported, both in a non-aggregated and aggregated form for the whole programme area. These data are then commented on in order to identify the most important actions that can be put in place to improve port energy efficiency and lower their environmental impact.

Scope of Document

The main aim of this document is to collect and consolidate the most relevant findings of the TNA carried out by each project partner. The document will clearly define the baseline that will be affected by the pilot actions.

Moreover, together with the best practice analysis, this document provides a solid basis for carrying out the action plan for enhancing the environmental sustainability and energy efficiency of the ports in the Programme Area, which provides the framework for the development of the actions carried out by each port involved in SUSPORT project.

Hence, the present cross-border study will help the joint planning of environmental sustainability and port energy efficiency by improving the exchange of data between partners and providing a benchmark regarding the CO2 emissions in port areas.

The Project Area

In the present section, the project area is described (Fig. 1). In detail, for each port where a pilot action will be put in place, the main statistics about their operations in 2019 are provided along with the number of stakeholders involved in the preliminary phase to assess the baseline values of emissions and assure the success of the pilot actions.

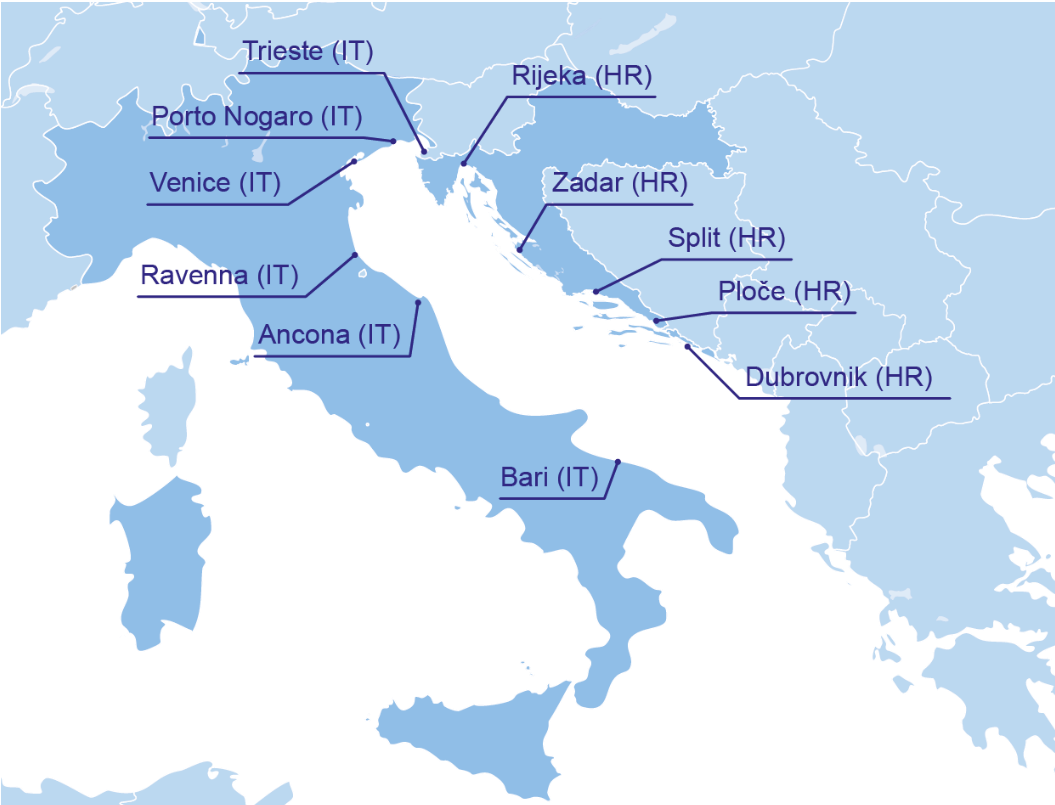

Figure 1 - Ports considered in the cross border study

It is worth noticing that in many cases a single port authority is responsible for multiple ports. It is the case of almost all the Italian port authorities that have been grouped according to the decree n. 169/2016. On the contrary, in Croatia, single port authorities are in charge of single ports. The ports included in this cross border study are all the port authorities involved in SUSPORT project. They are listed in Table 1 along with the acronyms that will be used hereinafter. In Table 2, the main traffic statistics related to the ports in the project area are reported, including a comparison with the values in Italy, Croatia and the combined cross-border reference values.

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Table 1 - Ports included in the cross border study

Acronym	Complete Name	Ports within the study
LP - AdSP MAO	Autorità di sistema portuale del Mare Adriatico Orientale	Trieste, Monfalcone
PP1 - COSEF	Consorzio di sviluppo economico del Friuli	Porto Nogaro
PP2 - AdSP MAS	Autorità di sistema portuale del Mare Adriatico Settentrionale	Venezia, Chioggia
PP5 - AdSP MACS	Autorità di sistema portuale del Mare Adriatico Centro-Settentrionale	Ravenna
PP6 - AdSP MAC	Autorità di sistema portuale del Mare Adriatico Centrale	Ancona
PP8 - AdSP MAM	Autorità di sistema portuale del Mare Adriatico Meridionale	Bari, Brindisi, Manfredonia, Barletta, Monopoli
PP9 - LUR	Lučka Uprava Rijeka	Rijeka
PP11 - LUZ	Lučka Uprava Zadar	Zadar
PP12 - LUS	Lučka Uprava Split	Split
PP13 - LUP	Lučka Uprava Ploče	Ploče
PP14 - LUD	Lučka Uprava Dubrovnik	Dubrovnik

Main Ports' Statistics

Table 2 – Main traffic statistics for the ports in the project area (Source: Eurostat)

Port	N. Ships	N. Pax Ships	% Pax Ships	N. Fright Ships	% Freight Ships	Total GT (kton)	GT Pax Ships (kton)	% Pax Ships	GT Freight Ships (kton)	% Freight Ships	Mean GT (ton)	Mean GT Pax (ton)	Mean GT Freight (ton)
Dubrovnik	35,031	34,006	97.07%	838	2.39%	33,685	31,832	94.50%	1,845	5.48%	962	936	2,202
Ploce	2,266	43	1.90%	2,214	97.71%	10,734	32	0.30%	10,641	99.13%	4,737	744	4,806
Rijeka	1,672	1,168	69.86%	486	29.07%	16,836	1,864	11.07%	14,930	88.68%	10,069	1,596	30,720
Split	23,145	15,001	64.81%	8,104	35.01%	55,520	20,910	37.66%	34,535	62.20%	2,399	1,394	4,261
Zadar	16,535	8,601	52.02%	7,922	47.91%	30,407	8,634	28.39%	21,772	71.60%	1,839	1,004	2,748
Ancona	2,068	58	2.80%	1,958	94.68%	55,389	3,082	5.56%	52,188	94.22%	26,784	53,138	26,654
Bari	2,764	216	7.81%	2,535	91.71%	59,696	10,211	17.10%	49,423	82.79%	21,598	47,273	19,496
Barletta	362	n.a.	0.00%	362	100.00%	1,641	n.a.	0.00%	1,641	100.00%	4,533	n.a.	4,533
Brindisi	1,833	30	1.64%	1,701	92.80%	33,713	1,903	5.64%	30,786	91.32%	18,392	63,433	18,099
Chioggia	660	2	0.30%	609	92.27%	1,923	1	0.05%	1,892	98.39%	2,914	500	3,107
Monfalcone	702	n.a.	0.00%	541	77.07%	7,573	n.a.	0.00%	7,539	99.55%	10,788	n.a.	13,935
Porto Nogaro	405	n.a.	0.00%	401	99.01%	1,929	n.a.	0.00%	1,927	99.90%	4,763	n.a.	4,805
Ravenna	4,082	15	0.37%	3,348	82.02%	45,515	663	1.46%	43,734	96.09%	11,150	44,200	13,063
Trieste	2,530	55	2.17%	2,308	91.23%	77,355	4,501	5.82%	72,759	94.06%	30,575	81,836	31,525
Venezia	3,903	517	13.25%	3,289	84.27%	85,063	21,978	25.84%	62,972	74.03%	21,794	42,511	19,146
Total	**97,958**	**59,712**	**60.96%**	**36,616**	**37.38%**	**516,979**	**105,611**	**20.43%**	**408,584**	**79.03%**			
Croatia	285,456	171,065	59.93%	112,774	39.51%	380,377	96,207	25.29%	283,776	74.60%	1,333	562	2,516
Italy	472,540	40,517	8.57%	428,079	90.59%	2,865,882	404,595	14.12%	2,455,367	85.68%	6,065	9,986	5,736
Italy + Croatia	757,996	211,582	27.91%	540,853	71.35%	3,246,259	500,802	15.43%	2,739,143	84.38%	4,283	2,367	5,064
% Italy + Croatia	**12.92%**	**28.22%**		**6.77%**		**15.93%**	**21.09%**		**14.92%**				

In the project area, most of the traffic is composed of freight vessels. In terms of total Gross Tonnage (GT), in 2019, the first port in the area is Venice, followed by Trieste. Considering the number of ships the first port is Dubrovnik, which however mostly operates passenger transport (over 90% in terms of both the number of ships and the GT). Rijeka, Split and Zadar show a more balanced split between passenger and freight traffic in terms of the number of ships; but considering the GT of vessels in all the cases the balance moves towards freight vessels that are characterised, in general, by higher mean GT compared to the passenger vessels in Croatia. On the other hand, considering the Italian ports, the average GT of passenger vessels is usually higher than the freight one.

Table 3 – Statistics for the ports in the project area relating to passenger transport (Source: Eurostat)

Port	N. Cruise ship	N. Other Pax	GT Cruise Ship (kton)	GT Other Pax (kton)	N. Cruise Pax	N. Other Pax	Total N. Pax
Dubrovnik	533	33,473	27,631	4,201	78,000	2,332,000	2,410,000
Ploce	10	33	22	10	0	383,000	383,000
Rijeka	24	1,144	1,488	376	0	114,000	114,000
Split	274	14,727	12,765	8,145	0	4,958,000	4,958,000
Zadar	125	8,476	6,290	2,344	1,000	2,318,000	2,319,000
Ancona	58	n.a.	3,082	n.a.	19,000	1,089,000	1,108,000
Bari	133	83	10,191	20	165,000	1,226,000	1,390,000
Barletta	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Brindisi	30	n.a.	1,903	n.a.	16,000	504,000	520,000
Chioggia	2	n.a.	1	n.a.	n.a.	n.a.	n.a.
Monfalcone	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Porto Nogaro	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Ravenna	15	n.a.	663	n.a.	n.a.	n.a.	n.a.
Trieste	55	n.a.	4,501	n.a.	n.a.	n.a.	n.a.
Venezia	350	167	21,912	66	571,000	283,000	854,000
Total	**1,609**	**58,103**	**90,449**	**15,162**	**850,000**	**13,207,000**	**14,056,000**
Croatia	1,434	169,631	52,143	44,064	79,000	34,063,000	34,142,000
Italy	4,704	35,813	395,354	9,241	5,018,000	81,512,000	86,530,000
Italy + Croatia	6,138	205,444	447,497	53,305	5,097,000	115,575,000	120,672,000
% Italy + Croatia	**26.21%**	**28.28%**	**20.21%**	**28.44%**	**16.68%**	**11.43%**	**11.65%**

In fact, in Italy (as shown in Table 3) most of the passenger traffic is represented by large cruise ships, whereas in Croatia a large fleet of small passenger ferries and RoPax operates to assure the transport from/to the small islands in Dalmatia. The whole cross-border area represents a relevant part of the passenger transport sector for the two considered countries (Italy and Croatia). The number of calls and total GT is over 25% and 20% of the sum of the national traffic, respectively, whereas the total number of passengers is over 10%. Considering only the cruise sector, the area represents about 16.5 % of the total number of passengers handled in Italy and Croatia. Regarding this sector, it shall be bared in mind that data refers to a pre-pandemic situation. In 2020, the number of passengers, especially the cruise ship ones, experienced a substantial drop due to the measures related to COVID-19 pandemic. Moreover, in 2021 the Italian government imposed a limitation on the size of cruise vessels that can enter the "Bacino di San Marco" in Venice. This limitation is expected to reduce the total number of calls and GT of passenger vessels in the port of Venice, while it is expected an increase passenger transport in other Adriatic ports, such as Trieste.

Table 4 – Statistics for the ports in the project area relating to freight transport (Source: Eurostat)

Port	N. Liquid Bulk	N. Dry Bulk	N. Container Ship	N. Spec. Carrier	N. Geng. Cargo	GT Liquid Bulk (kton)	GT Dry Bulk (kton)	GT Container Ship (kton)	GT Spec. Carrier (kton)	GT Geng. Cargo (kton)	t of Goods Handled	TEU Handled
Dubrovnik	n.a.	n.a.	n.a.	3	835	n.a.	n.a.	n.a.	1	1,844	21,000	n.a.
Ploce	77	45	104	3	1,985	784	1,322	1,240	50	7,245	3,507,000	33,956
Rijeka	11	23	311	3	138	16	184	14,099	0	631	3,356,000	287,920
Split	139	222	48	3	7,692	701	478	461	5	32,890	1,942,000	9,430
Zadar	84	58	n.a.	2	7,778	432	81	n.a.	6	21,253	418,000	n.a.
Ancona	42	32	458	n.a.	1,426	75	858	8,510	n.a.	42,745	5,313,000	212,444
Bari	33	71	139	1	2,291	213	1,433	1,433	34	46,310	6,134,000	86,088
Barletta	99	19	n.a.	n.a.	244	420	102	n.a.	n.a.	1119	1,084,000	n.a.
Brindisi	408	97	2	n.a.	1,194	4,433	3,243	50	n.a.	23,060	8,583,000	1,654
Chioggia	n.a.	89	2	n.a.	518	n.a.	196	9	n.a.	1,687	1,597,000	0
Monfalcone	n.a.	108	1	70	362	n.a.	2121	4	2564	2,850	4,489,000	319
Porto Nogaro	n.a.	12	9	n.a.	380	n.a.	80	35	n.a.	1,812	1,440,000	n.a.
Ravenna	807	607	565	44	1,325	8,796	13,875	9,569	1,627	9,867	31,348,000	246,983
Trieste	480	54	654	1	1,119	26,866	1,166	24,731	18	19,978	60,333,000	917,866
Venezia	639	353	945	30	1,322	8,972	7,619	18,288	1,056	27,037	27,935,000	547,563
Total	**2,819**	**1,790**	**3,238**	**160**	**28,609**	**51,708**	**32,758**	**78,429**	**5,361**	**240,328**	**157,500,000**	**2,344,223**
Croatia	750	410	463	19	111,132	8,629	3,117	15,800	67	256,163	20,580,000	331,304
Italy	12,845	2,496	9,102	1,432	402,204	211,868	56,021	377,750	66,117	1,743,611	508,074,000	9,795,968
Italy + Croatia	13,595	2,906	9,565	1,451	513,336	220,497	59,138	393,550	66,184	1,999,774	528,654,000	10,127,272
% Italy + Croatia	**20.74%**	**61.60%**	**33.85%**	**11.03%**	**5.57%**	**23.45%**	**55.39%**	**19.93%**	**8.10%**	**12.02%**	**29.79%**	**23.15%**

Regarding the freight sector (Tab. 4), in the cross-border area, the main port is Trieste which handles about the double of tons of goods and containers compared to the second port in the area (Ravenna for goods and Venice for containers). Considering the whole area, it represents a relevant share of the national maritime freight sector of Italy and Croatia. In terms of tons of goods handled, the project area represents nearly 30%; by including handled containers, some 23%. The two leading sectors are dry bulk, mainly due to the port of Ravenna and liquid bulk, mainly due to the port of Trieste. Besides, the container sector represents a relevant share of the total cross-border traffic (more than 60% in terms of calls, about 20% in terms of GT). However, it shall be noted that large vessels visit only a restricted set of ports (Trieste, Venice, Rijeka, Ancona and Ravenna). The other ports are more involved in small feeder ships traffic with a limited number of handled containers.

Moreover, some of the ports, especially the ones with large passenger traffic, did not implement any fixed infrastructure to handle containers, thus it is not interested in such kind of traffic.

Involved Stakeholders

Table 4 shows the number and type of stakeholders involved in the development of the TNAs in the cross-border area considered in the SUSPORT project.

Table 5 – Stakeholders involved in the cross-border area
** Number of questionnaires; ** Some categorical items; *** All categorical items*

	Port services	Port companies	Railway	Logistic agencies	Shipping companies	Administrations	General public	Other
LP - AdSP MAO*	670	-	-	325	-	64	-	-
PP1 - COSEF	3	2	-	6	-	3	-	1
PP2 - AdSP MAS**	6	15	1	1	1	8	-	2
PP5 - AdSP MACS	9	18	-	2	1	1	-	-
PP6 - AdSP MAC***	-	-	-	-	1	3	1	-
PP8 - AdSP MAM	-	-	-	-	-	-	-	-
PP9 - LUR**	4	3	-	-	-	4	-	-
PP11 - LUZ**	3	1	-	-	1	9	1	3
PP12 - LUS	42	5	-	28	32	5	-	9
PP13 - LUP**	1	2	-	-	-	7	1	3
PP14 - LUD**	2	1	-	-	1	4	1	1
TOTAL	740	47	1	362	37	108	4	19

Carbon Footprint of Port Operations in Project Area

Aiming to improve the port environmental sustainability and energy efficiency, the main goal is to reduce the emissions of Green House gases (GHG). These emissions can be expressed in equivalent tonnes of CO2 and mapped by source. In the SUSPORT project, many actions will be planned and tested to reduce port emissions. Hence, to assess the results of the project, it is mandatory to define a baseline to evaluate the improvement obtained by the application of innovative solutions and technologies. Hence, the emissions related to 2019 are reported. Only PP13 (Ploce Port Authority) reported the emissions related to 2020. First, the emissions assessed for each port area are decomposed into the main sources. Specific comments about lacking data of local assumptions are provided too. Then, the overall aggregate results for the whole project area are gathered and analysed.

Decomposition of Emissions

In the following, the composition of the terrestrial and maritime emissions is provided for each port included in the cross border study. According to the joint methodology (D3.2.1), the following categories have been considered for terrestrial emissions:

- Electric energy
- Heating
- Service vehicles
- Port operational vehicles
- Heavy-duty vehicles
- Railway tractors
- Others: including the emissions due to power generators or actuators, recharges of air conditioners, consumption of gas not previously entered (Natural gas and LPG for domestic use)

Concerning maritime emissions, the following categories have been considered:

- Naval Port sevices: including all the shipborne emissions coming from port service vessels (tugs, pilot boats, etc.)
- Anchored ships: emissions related to the ships while anchored nearby the port and waiting for access
- Ships manoeuvring: emissions deriving from the manoeuvring phase of the ships up to their arrival at berth and subsequent inverse departure of the ship
- Moored ships: the emissions produced during the actual mooring phase of the ship at berth, including waiting and cargo loading and unloading operations (e.g. goods and/or trailers and/or the transit of passengers, etc.)

LP - AdSP MAO

All the voices have been considered according to the methodology. Other includes: refills of air conditioners, power generators or actuators, consumption due to any companies that manage secondary activities under a concession under Art. 45 bis of the Navigation Code and other greenhouse gases, not falling within the categories covered by the questionnaire

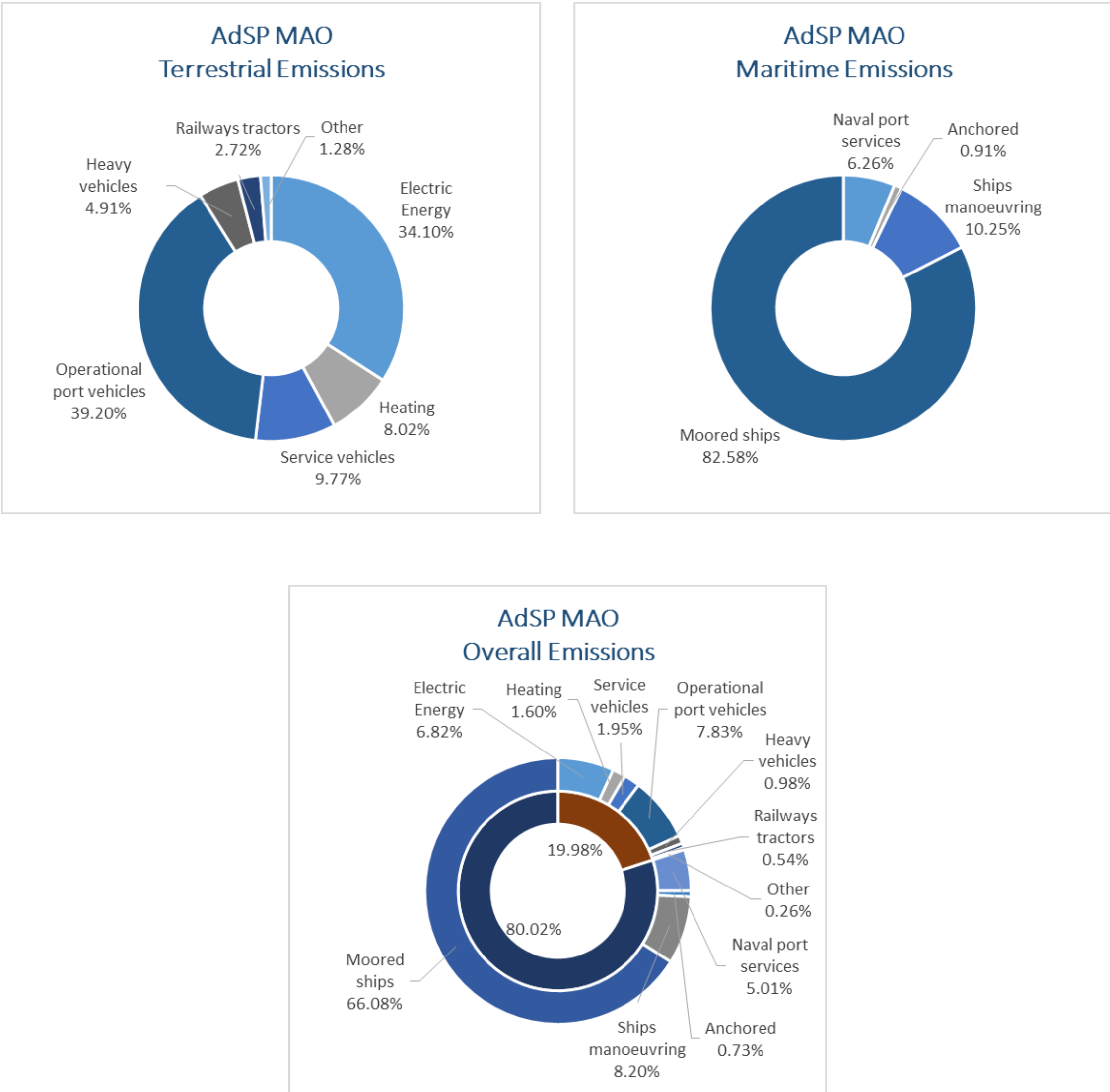


Figure 2 - Decomposition of Emissions (AdSP MAO)

PP1 – COSEF

For the case of Porto Nogaro, the maritime emissions comprehend also the contribution from port service vehicles (tugs, etc.). Moreover, the anchored ships' contribution was neglected due to data unavailability.

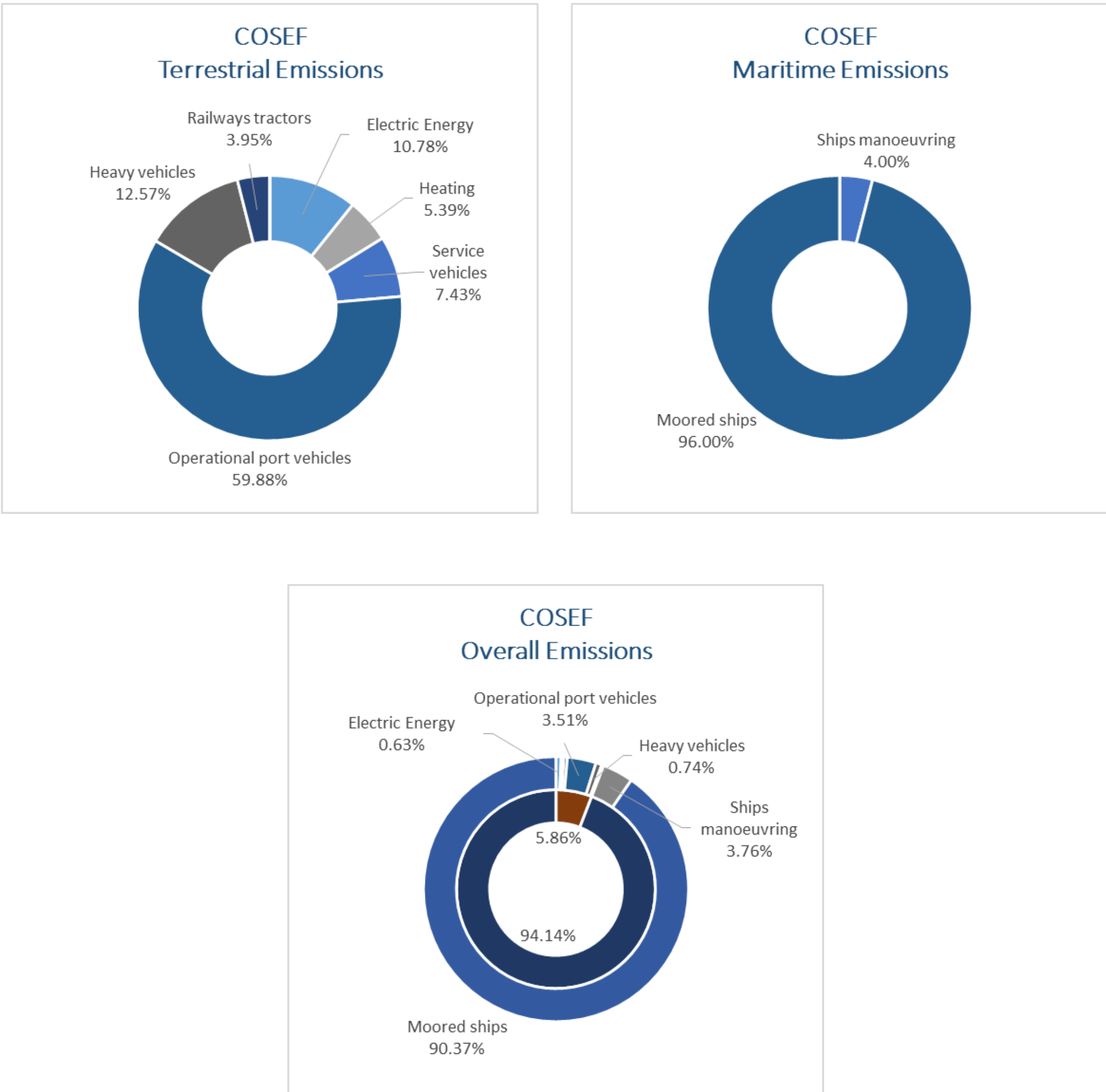


Figure 3 - Decomposition of Emissions (COSEF)

PP2 - AdSP MAS

For the ports of Venice and Chioggia, the moored category covers also the emissions from anchored ships since was not possible to split the two phases. For the same reason, the manoeuvring category includes also emissions from involved service vessels (tugs, pilot boats, etc.).

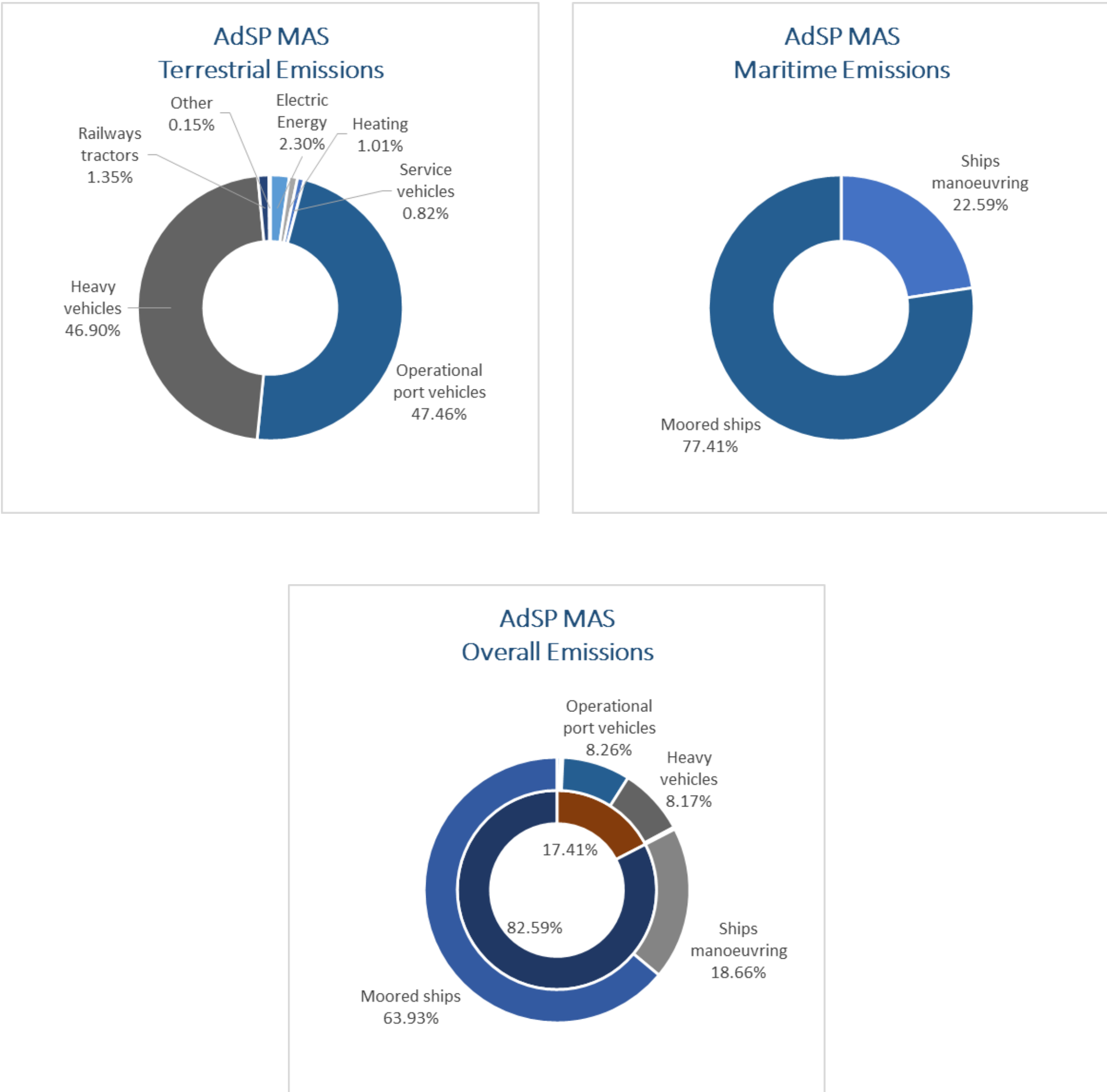
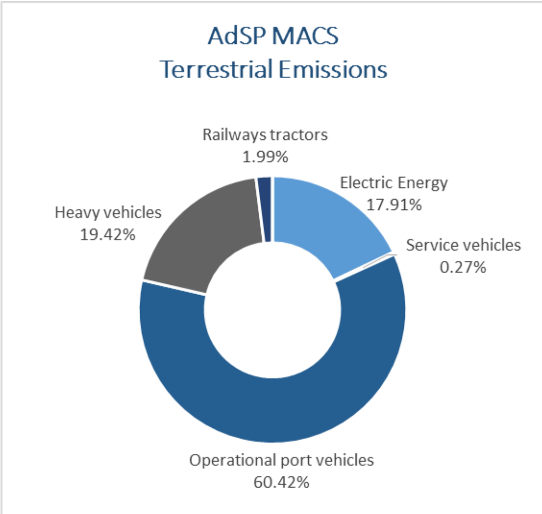
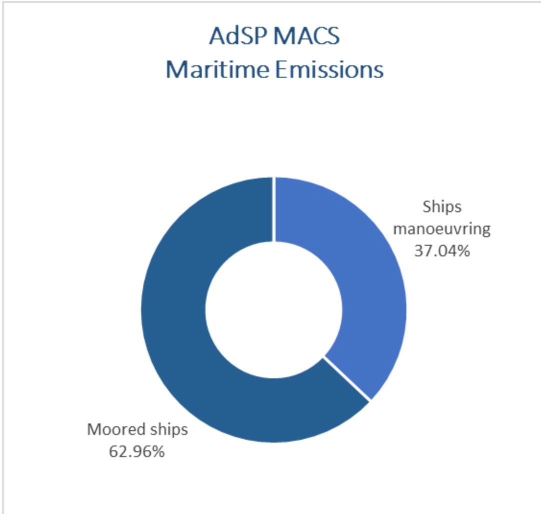


Figure 4 - Decomposition of Emissions (AdSP MAS)

PP5 - AdSP MACS

For the port of Ravenna, the manoeuvring category includes also emissions from involved service vessels (tugs, pilot boats, etc.).





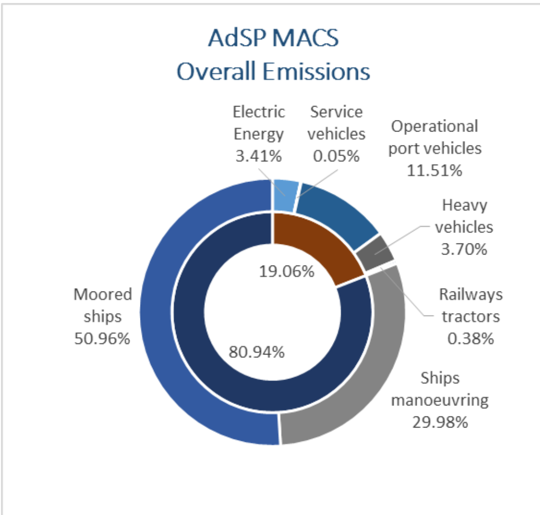


Figure 5 - Decomposition of Emissions (AdSP MACS)

PP6 - AdSP MAC

For the port of Ancona, other category includes emissions from: passenger cars, busses, light-duty vehicles. Moreover, due to data lacking, the emissions from anchored ships were discarded.

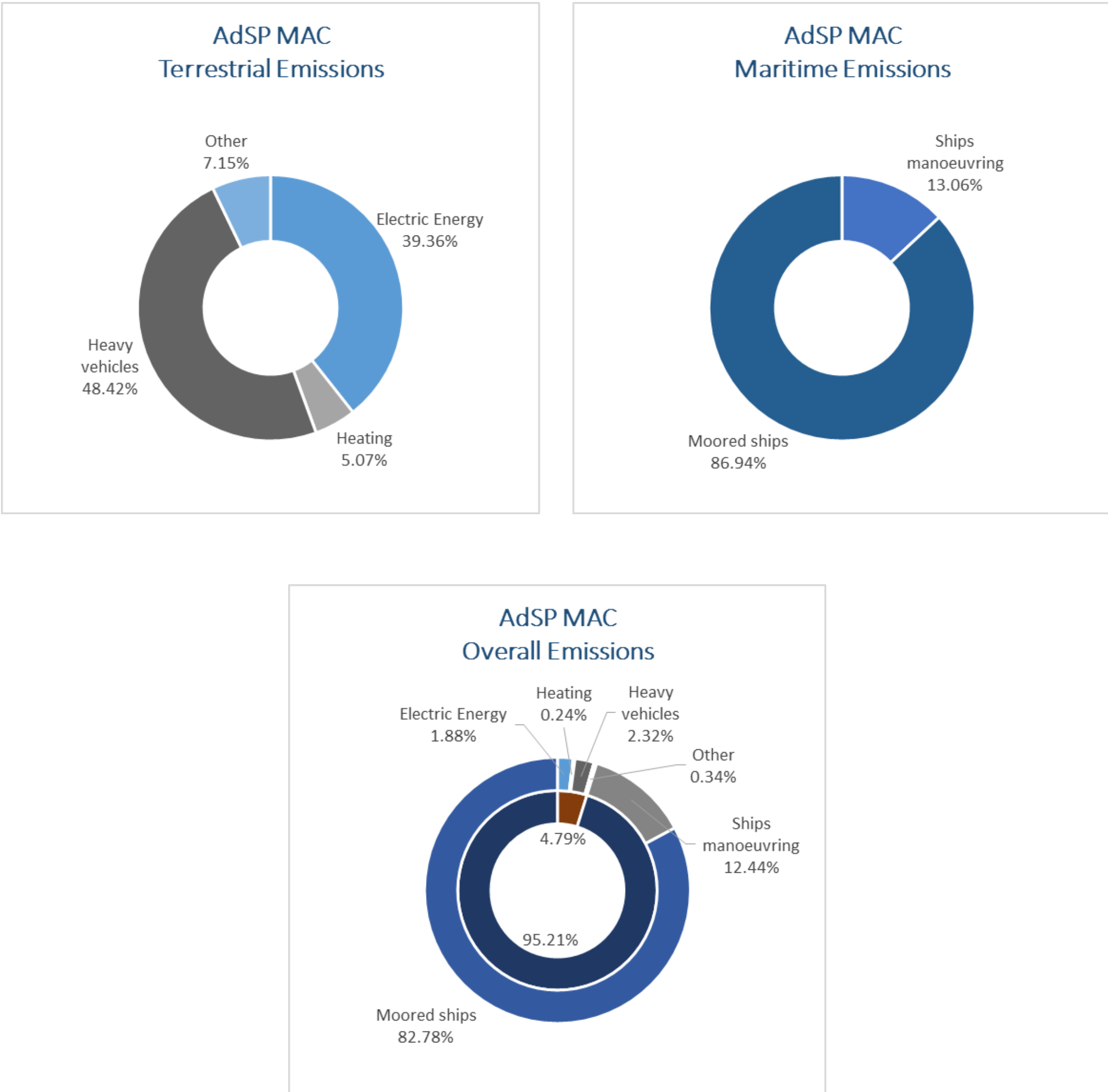
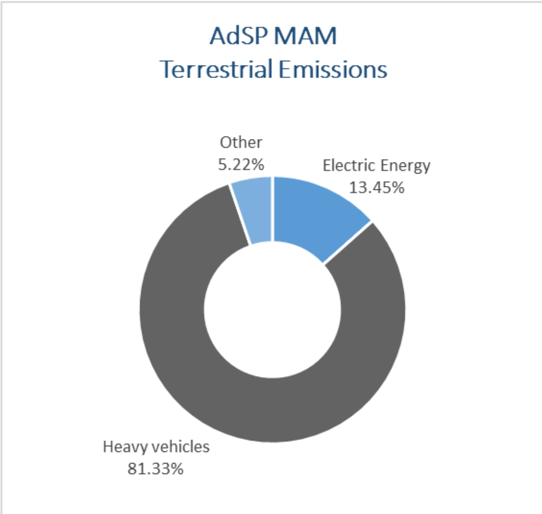
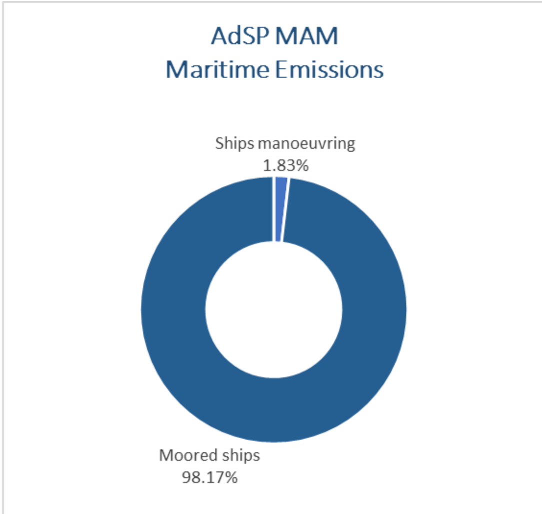


Figure 6 - Decomposition of Emissions (AdSP MAC)

PP8 - AdSP MAM

Due to data lacking, AdSP MAM discarded all the following categories: service vehicles, operational port vehicles, railway tractors, naval port services and anchored ships. The other category refers to emissions relating to refrigerant gas reintegration.





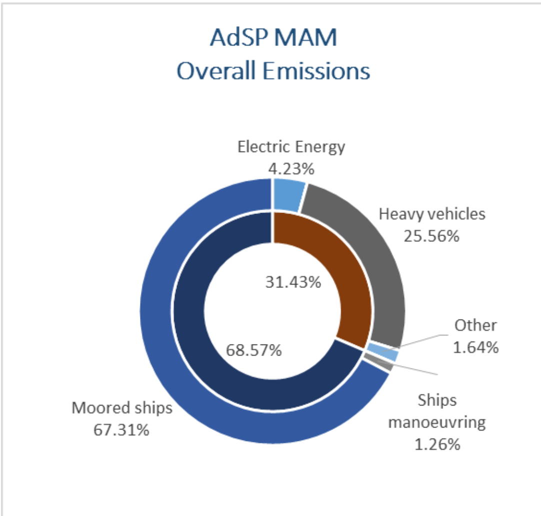
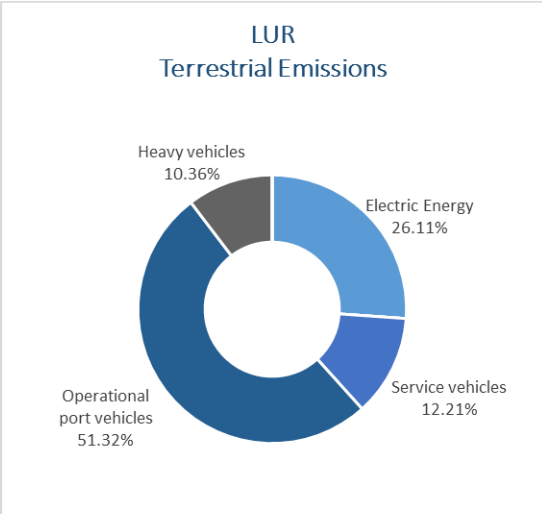
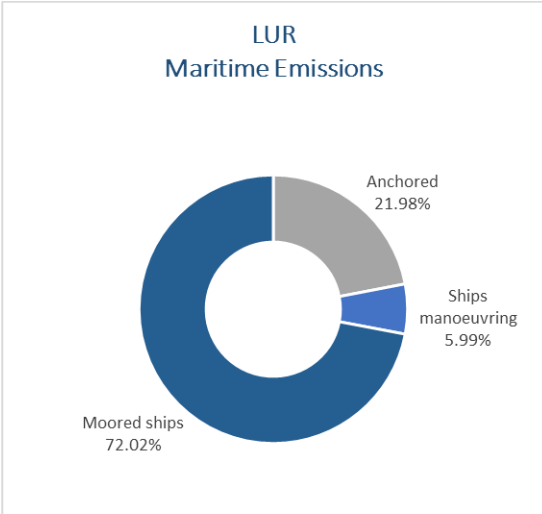


Figure 7 - Decomposition of Emissions (AdSP MAM)

PP9 - LUR

Due to data lacking, LUR discarded emissions related to naval port services.





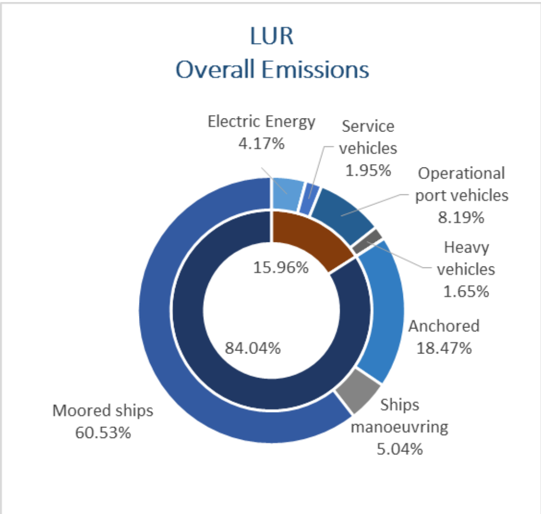


Figure 8 - Decomposition of Emissions (LUR)

PP11 - LUZ

For the port of Zadar, the heavy vehicles category included the emissions coming from the road traffic within the port area (private cars, busses, light-duty vehicles, etc.).

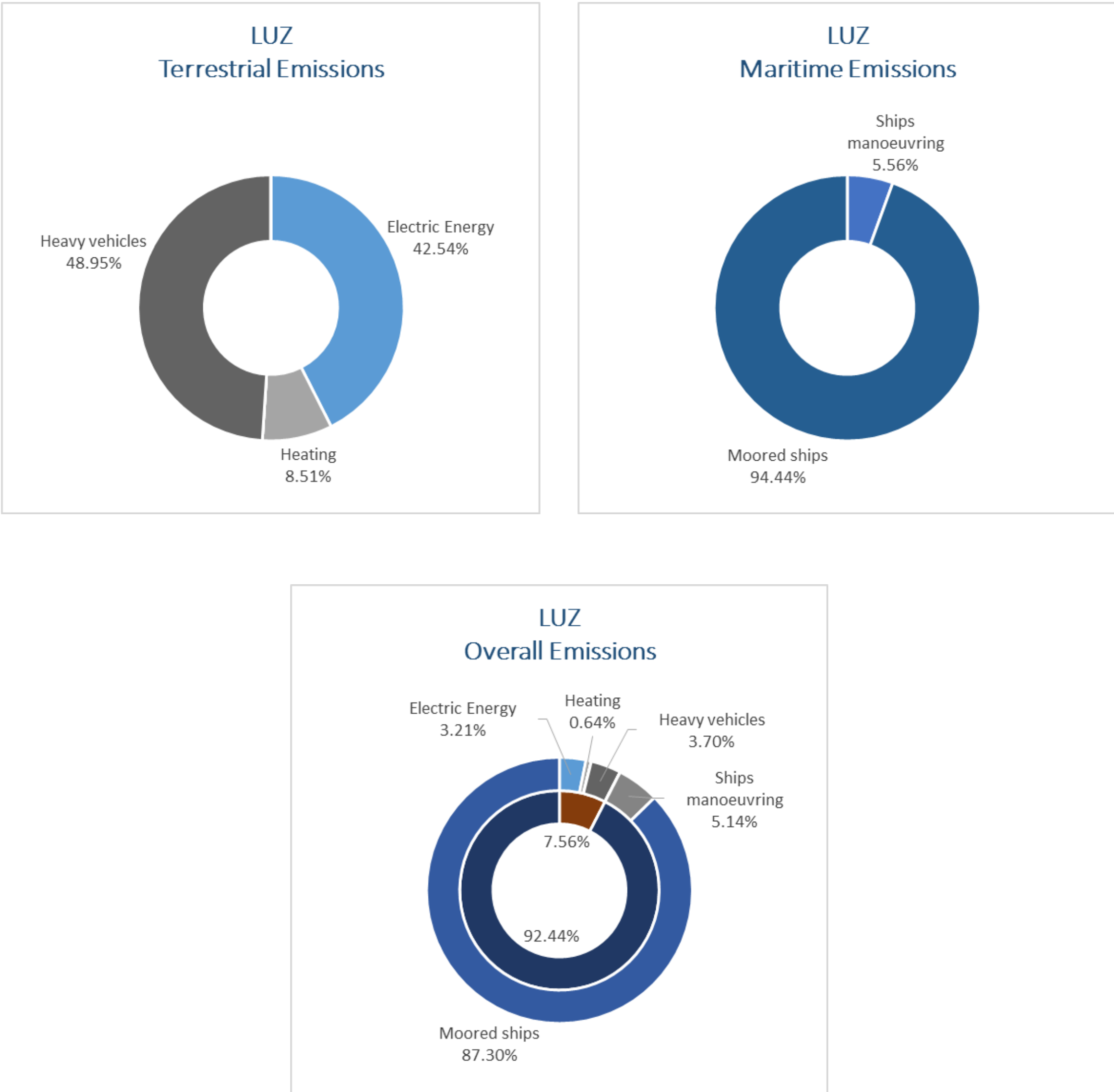
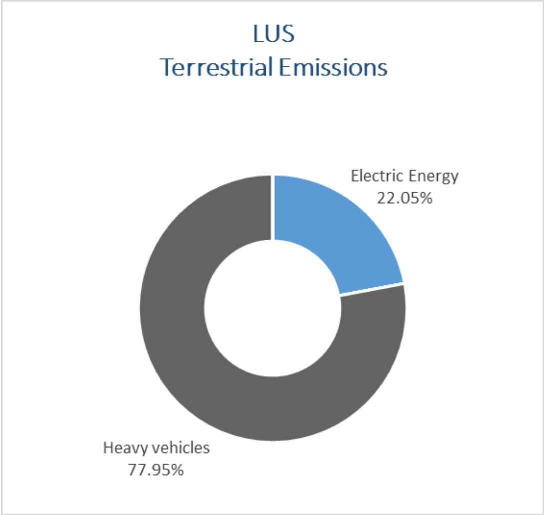
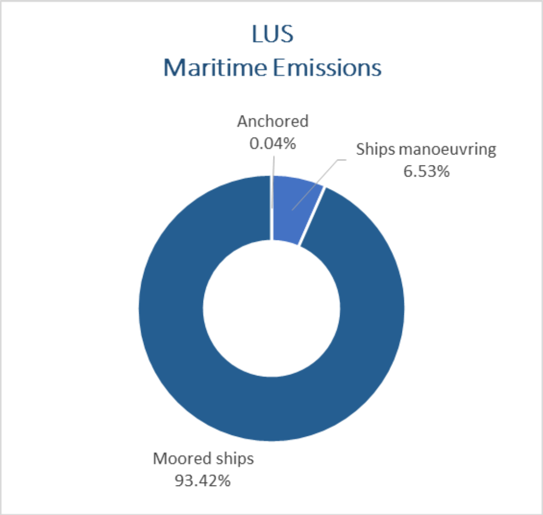


Figure 9 - Decomposition of Emissions (LUZ)

PP12 - LUS

For the port of Split, the heavy vehicles category included the emissions coming from the road traffic within the port area (private cars, busses, light-duty vehicles, etc.).





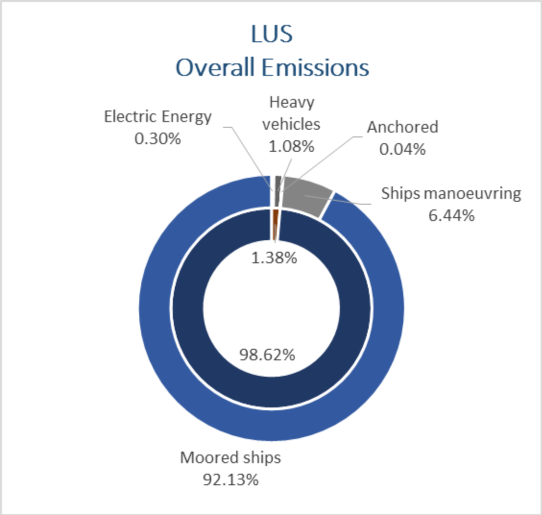
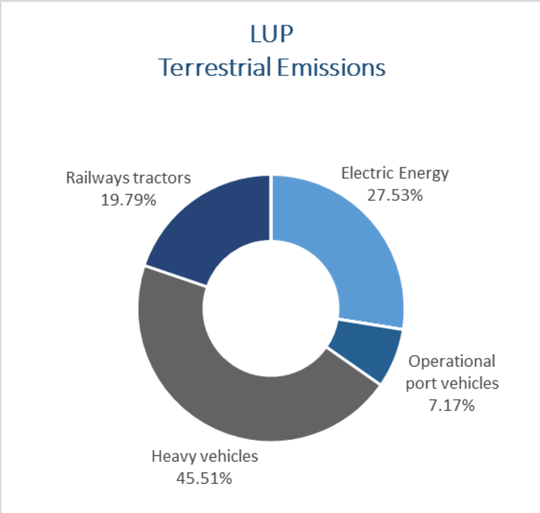
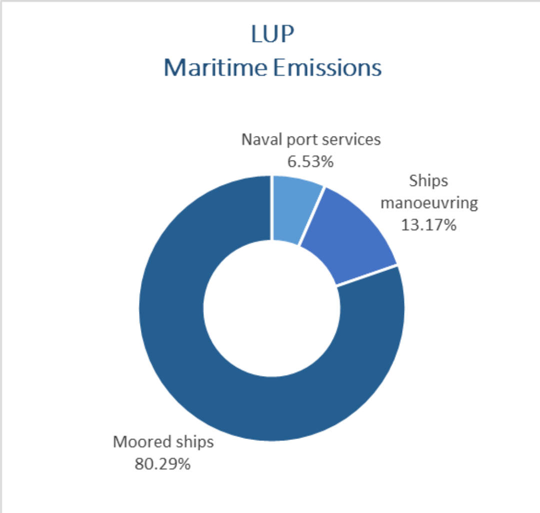


Figure 10 - Decomposition of Emissions (LUS)

PP13 - LUP

For the port of Ploče, the moored ships and anchored ships categories have been grouped. Moreover, due to data lacking, service vehcles have been discarded.





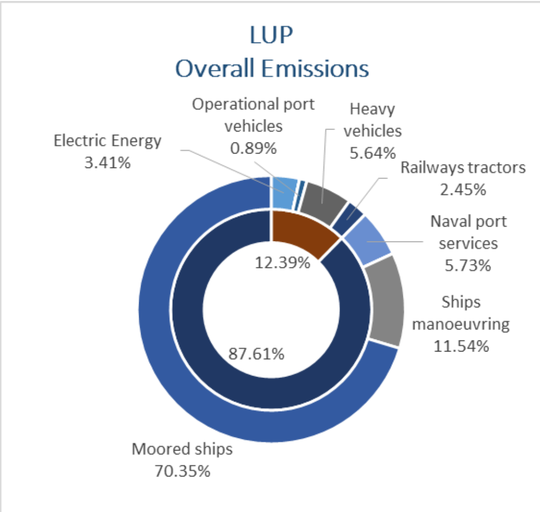


Figure 11 - Decomposition of Emissions (LUP)

PP14 - LUD

For the port of Split, the heavy vehicles category included the emissions coming from the road traffic within the port area (private cars, busses, light-duty vehicles, etc.).

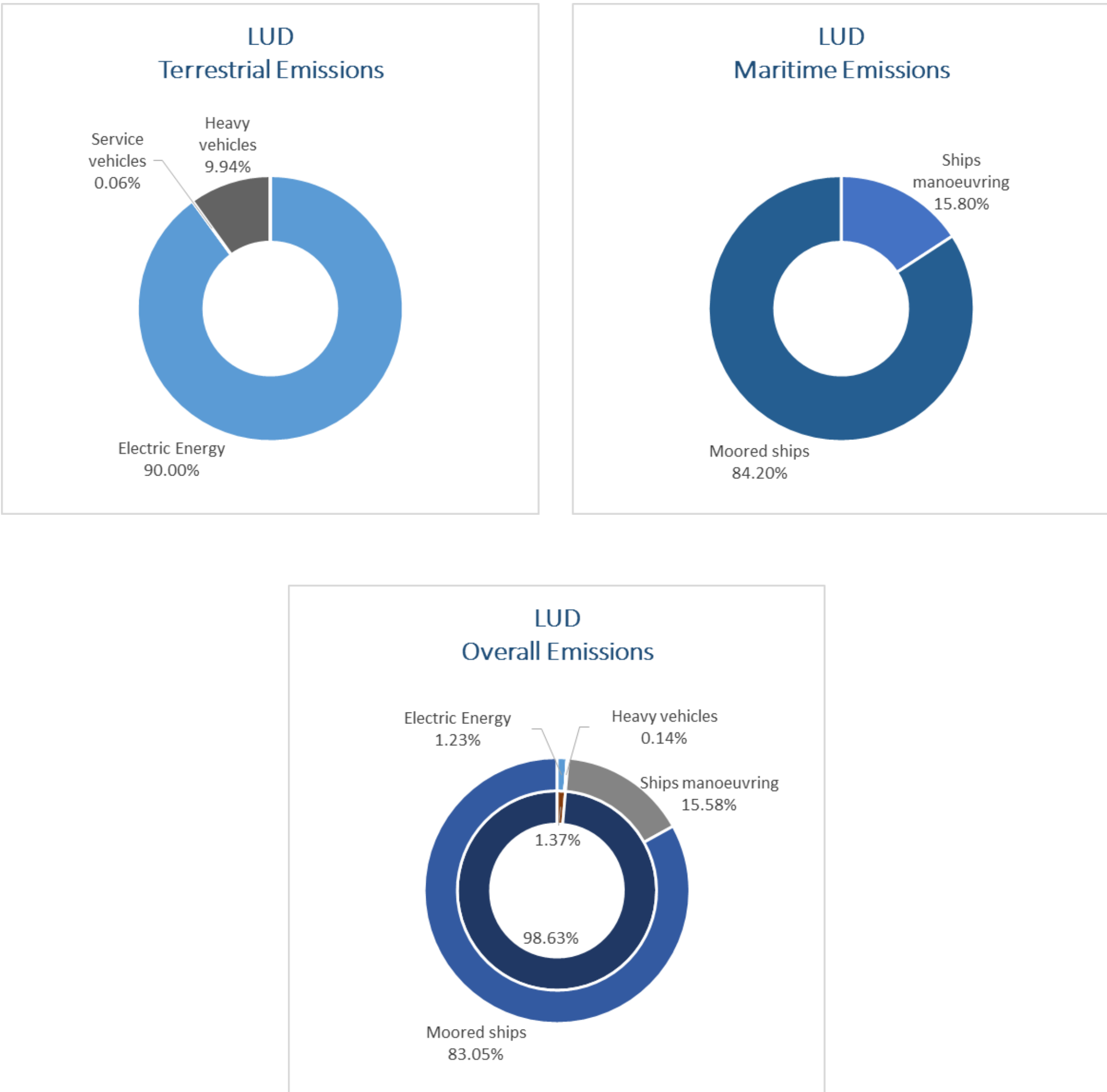


Figure 12 - Decomposition of Emissions (LUP)

Aggregate results of the overall geographical area

Considering the whole project area which includes all the ports involved in the present cross border study, the aggregate picture of GHG emissions is provided in Table 6.

Table 6 - Ports included in the cross border study

Category	t CO2eq	%
Electric energy	20192.1	3.21%
Heating	3230.7	0.51%
Service vehicles	4223.1	0.67%
Operational port vehicles	43519.4	6.93%
Heavy vehicles	32262.1	5.14%
Railway tractors	1875.0	0.30%
Other	1231.0	0.20%
Naval port service	8800.3	1.40%
Anchored ships	5714.6	0.91%
Ships manoeuvring	93592.4	14.90%
Moored ships	413635.8	65.84%
TOTAL	**628276.4**	**100.00%**

The emissions in the project area can be decomposed as for Figures 28 and 29.

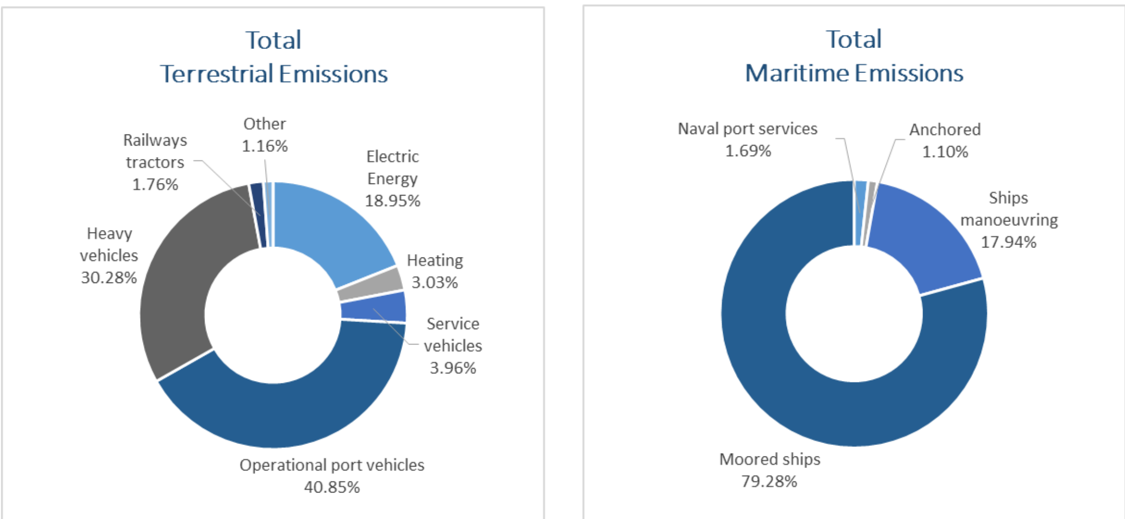


Figure 13 - Decomposition of Terrestrial and Maritime Emissions

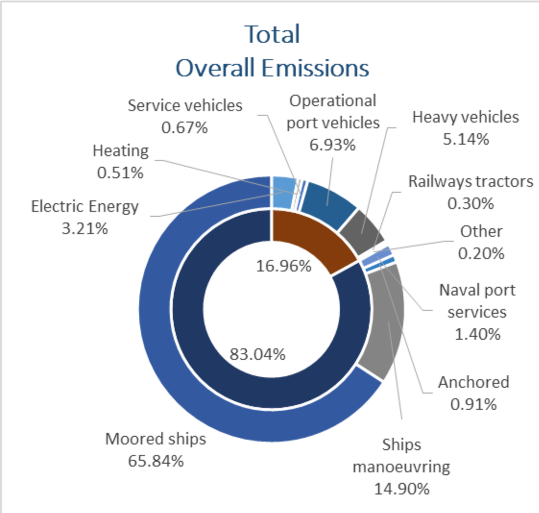


Figure 14 - Decomposition of Overall Emissions

In Table 7, a comparison of the composition of the GHG emissions in the ports involved in the cross-border study is provided.

Table 7 – GHG composition (tabular comparison)

	TERRESTRIAL							MARITIME			
	Electric Energy	Heating	Service vehicles	Operational port vehicles	Heavy vehicles	Railways tractors	Other	Naval port services	Anchored	Ships manoeuvring	Moored ships
LP - AdSP MAO	6.82%	1.60%	1.95%	7.83%	0.98%	0.54%	0.26%	5.01%	0.73%	8.20%	66.08%
PP1 - COSEF	0.63%	0.32%	0.44%	3.51%	0.74%	0.23%	0.00%	0.00%	0.00%	3.76%	90.37%
PP2 - AdSP MAS	0.40%	0.18%	0.14%	8.26%	8.17%	0.24%	0.03%	0.00%	0.00%	18.66%	63.93%
PP5 - AdSP MACS	3.41%	0.00%	0.05%	11.51%	3.70%	0.38%	0.00%	0.00%	0.00%	29.98%	50.96%
PP6 - AdSP MAC	1.88%	0.24%	0.00%	0.00%	2.32%	0.00%	0.34%	0.00%	0.00%	12.44%	82.78%
PP8 - AdSP MAM	4.23%	0.00%	0.00%	0.00%	25.56%	0.00%	1.64%	0.00%	0.00%	1.26%	67.31%
PP9 - LUR	4.17%	0.00%	1.95%	8.19%	1.65%	0.00%	0.00%	0.00%	18.47%	5.04%	60.53%
PP11 - LUZ	3.21%	0.64%	0.00%	0.00%	3.70%	0.00%	0.00%	0.00%	0.00%	5.14%	87.30%
PP12 - LUS	0.30%	0.00%	0.00%	0.00%	1.08%	0.00%	0.00%	0.00%	0.04%	6.44%	92.13%
PP13 - LUP	3.41%	0.00%	0.00%	0.89%	5.64%	2.45%	0.00%	5.73%	0.00%	11.54%	70.35%
PP14 - LUD	1.23%	0.00%	0.00%	0.00%	0.14%	0.00%	0.00%	0.00%	0.00%	15.58%	83.05%
TOTAL	3.21%	0.51%	0.67%	6.93%	5.14%	0.30%	0.20%	1.40%	0.91%	14.90%	65.84%

Discussion

It is worth noticing that, in the project area maritime emissions are the largest contributor (83.04% of the total emissions of GHG). This situation is even more emphasised for mainly passenger ports, such as Dubrovnik, Split or Zadar, where maritime emissions can reach more than 90% of the total since the terrestrial emissions are limited to the lighting system, the heating of the terminal a small number of service vehicles and the traffic emissions within the port area.

By decomposing the maritime emissions, the first contribution comes from moored vessels (79.28% of the maritime emissions of GHG), followed by ships manoeuvring (17.94% of the maritime emissions of GHG). The contribution from manoeuvring is strictly dependent on the port access and layout. It reaches the maximum value in the only channel port considered in the present study: Ravenna (37.04% of the maritime GHG emissions). It is worth noticing that several ports grouped in this last category the emissions coming from service vessels (e.g. tugs, pilot boats, etc.). Emissions from moored and anchored ships relate to the port efficiency which determines the hotelling and standby time respectively. Besides, in several cases, no information about anchored ships, i.e. ships waiting to enter the port, were available. Hence, in the project area, it is expected that total maritime emissions should be slightly increased.

Regarding the terrestrial emissions, the main contributors are operational port vehicles (40.85% of the terrestrial emissions of GHG), heavy vehicles entering the port area (30.28% of the terrestrial emissions of GHG) and electric energy (18.95% of the terrestrial emissions of GHG). It is worth noticing that for mainly passenger ports, electric energy consumption represents the main source of terrestrial emissions, reaching, for instance, 90% of terrestrial emissions in the port of Dubrovnik. However, the balance is very influenced by the port layout and on the distances between port access and terminals, which impacts especially the heavy vehicles category accounting also for the road traffic in the passenger ports.

Conclusions

The present document presented and commented the current status of the cross-border area that will be impacted by the SUSPORT project. In addition to the project area statistics, the main involved stakeholders have been reported to assure their involvement in the SUSPOTR project to enhance its visibility and maximise its outcomes. Moreover, GHG emissions have been mapped in the project area. Data refers to a pre-pandemic situation, hence, the GHG emissions are not affected by the effects of COVID-19, which caused in many cases a drop in port activities and, consequently, in the related emissions. This is especially true for the passenger ports, that experienced a heavy reduction of calls and passengers (especially the ones related to the cruise sector) in 2020.

Nevertheless, the document provided a portrait of the emissions of GHG that, together with the Best Practices will provide a strong baseline to effectively plan the pilot actions that will be implemented during SUSPORT project. Form this consolidation process most important conclusions are the following. First, it can be concluded that most of the emissions in the project area come from moored ships. Hence, it is expected to gain relevant benefits from the application of technologies that reduce such kinds of emissions (e.g. cold ironing, fuel switch, etc.). Regarding terrestrial emissions, different actions might have a greater impact depending on the type of port. For mainly passenger ports, the actions reducing electric energy consumption (e.g. replacing the lighting system, improving the efficiency of buildings, etc.) are expected to have greater benefits. Regarding mainly freight ports, the reduction of the emissions coming from operational vehicles and equipment (e.g. electrification, adoption of electric vehicles, etc.) is expected to have the highest impact on GHG emissions. Nevertheless, these general considerations are not valid in each particular situation. Hence, the specific situation shall be carefully analysed and considered to improve the port sustainability and energy efficiency.