# Territorial needs assessment for the Port of Dubrovnik

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# Document Control Sheet

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# Contents

# Introduction

This document illustrates the "carbon footprint" for the port of Dubrovnik created within the Interreg Italy-Croatia SUSPORT project, co-financed by the Interreg Program, based on the common methodology developed by WP Leader (D.1.3.2.1 ).

In particular, the objective of this document is to draw up an inventory of Greenhouse Gases (GHG) also known as "Carbon Footprint" and an action plan for their reduction, within the Dubrovnik port area.

This methodology makes it possible to develop a current and prospective assessment of energy requirements, providing the tools to guarantee the environmental sustainability of the port area over time, with the same quality of services offered, through the identification of innovative technical and organizational solutions linked to the supply and use of energy, whatever form it takes.

This energy and environmental plan, in addition to limiting the energy needs of the port area, sets as its objectives the reduction of GHG emissions, with particular attention to CO2. Reducing GHG emissions from ports is not only a measure to tackle global warming, but also contributes to promoting innovation, implementing energy efficiency, and improving the quality of life in the surrounding areas.

Although emissions in port areas represent only a small part of the total emissions that can be associated with the whole maritime transport logistics chain (which includes land transport to ports, port operations and maritime transport), any reduction of emissions in the port area not only improves local air quality and noise reduction, but also helps to reduce the global climate effect in a synergistic way. In this sense, port area management authorities have an important role to play in engaging actors in the port community to be more environmentally friendly and facilitate through initiatives the implementation of best environmental practices and the encouragement of measures aimed at improving energy efficiency and promoting the use of renewable energy in the port area.

*Figure 1. Port of Dubrovnik*

Moreover, together with the territorial need assessment carried out by each project partner, 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 best practice analysis will help the joint planning of environmental sustainability and port energy efficiency by improving the exchange of experiences between partners and providing a benchmark analysis at European and international level.

## Description of the port area

Dubrovnik is situated in the far south of the Republic of Croatia and Dubrovnik-Neretva County. The port of Dubrovnik - Gruž is located on the northern coast of the Gulf of Gruž and the eastern coast of the Bay of Rijeka Dubrovnik and has 1629 m of built coastline and 829 m of undeveloped coastline.

The port of Dubrovnik - Gruž is an important transport hub for local, regional and international maritime passenger traffic of the southern part of the Adriatic. In terms of number of arrivals, the most significant is the traffic of scheduled passenger vessels, while the total number of passengers is dominated by the segment of passengers from cruise ships.

Inland, the Port of Dubrovnik - Gruž is connected to the hinterland by the DC-8 road to the north and the Neuma corridor and south towards Montenegro. It is connected to neighbouring BiH by a 4.3km DC-223 road in the direction of the Ivanica border crossing.

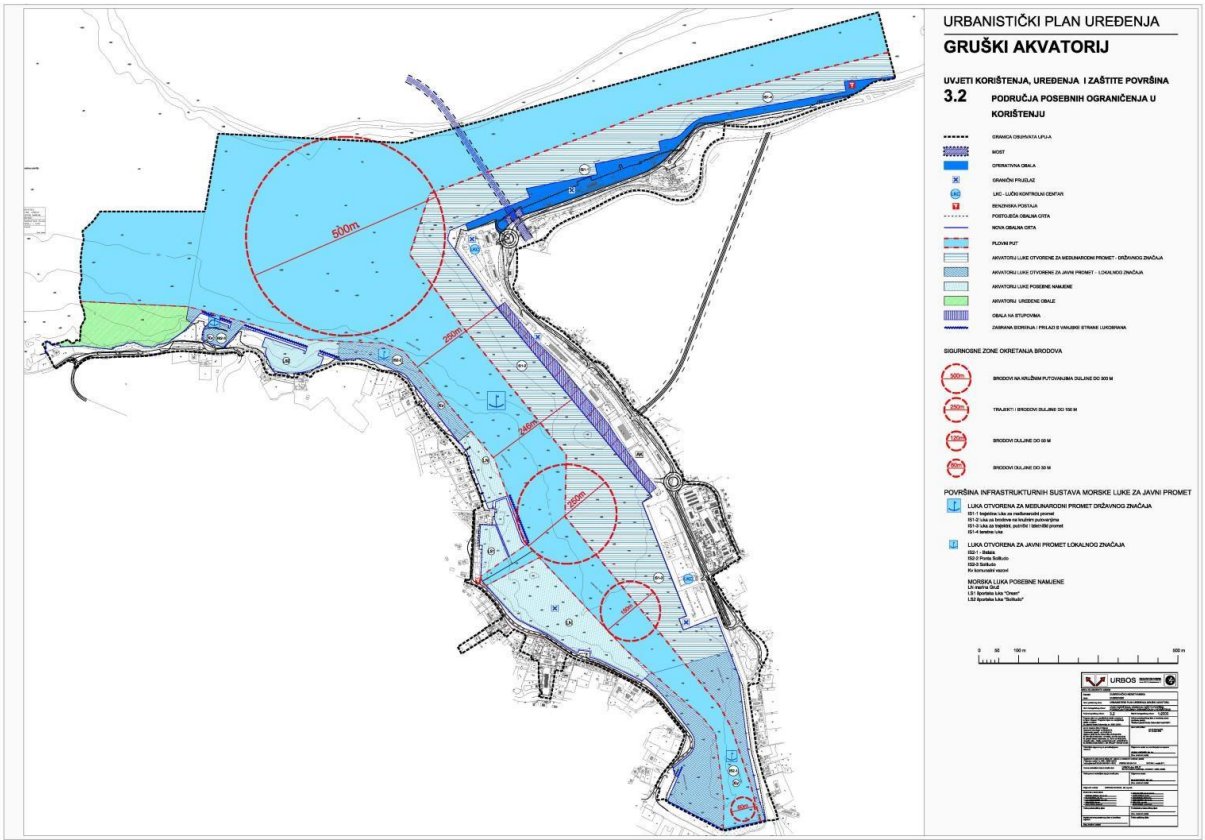


*Figure 2. Port area map from urban planning documentation*

## Legal framework and context

Maritime transport emits around 940 million tonnes of CO2 annually and is responsible for about 2.5% of global greenhouse gas (GHG) emissions. These emissions are projected to increase significantly if mitigation measures are not put in place swiftly. According to the 3rd IMO GHG study, shipping emissions under a business-as-usual scenario could increase between 50% and 250% by 2050, undermining the objectives of the Paris Agreement. Shipping emissions represent around 13% of the overall EU greenhouse gas emissions from the transport sector (2015).

In 2013, the Commission set out a strategy towards reducing GHG emissions from the shipping industry.

The strategy consists of 3 consecutive steps:

1. Monitoring, reporting and verification of CO2 emissions from large ships using EU ports
2. Greenhouse gas reduction targets for the maritime transport sector
3. Further measures, including market-based measures, in the medium to long term.

The contribution of the shipping sector to emission reductions consistent with the temperature goals of the Paris Agreement remains an important issue in the EU.

The recent amendment to the EU Emissions Trading System (ETS) Directive, by Directive (EU) 2018/410 of the European Parliament and the Council, emphasises the need to act on shipping emissions as well as all other sectors of the economy. The Directive also states that the Commission should regularly review IMO action and calls for action to address shipping emissions from the IMO or the EU to start from 2023, including preparatory work and stakeholder consultation.

The reduction of CO2 emissions is one of the main objectives of the EU and the whole objective is transposed trough several main Agreements and Directives:

- Paris Agreement (Agreement on taking urgent actions to fight climate change and its impacts.)
- IMO 2020 Sulphur Regulation
- Barcelona Convention for the protection of the Mediterranean
- EU 2030 climate and energy framework

- Sustainable and Smart Mobility Strategy – putting European transport on track for the future
- Clean Power for Transport: A European alternative fuels strategy
- DIRECTIVE (EU) 2018/2001 on the promotion of the use of energy from renewable sources
  - DIRECTIVE 2012/27/EU on energy efficiency
-

# Mapping out stakeholders

## Stakeholders importance mapping

This section deals with the mapping of major stakeholders in the programme area as a key element for their involvement in the project as well as for project results' dissemination. The table below maps stakeholders according to their influence on the project and their level of interest in the project

| | | POWER OF INFLUENCE | |
|---|---|---|---|
| | | LOW | HIGH |
| INTEREST | LOW | • General Public Media<br>• | • Ministry of economy and sustainable development<br>• Dubrovnik-Neretva county |
| | HIGH | • HOPS (Croatian transmission system operator)<br>• HEP ODS (Croatian distribution system operator)<br>• Shipping companies<br>Luka Dubrovnik d.d. port concessionaire | • Ministry of the Sea, Transport and Infrastructure<br>• City of Dubrovnik |

*Table 1. Stakeholders mapping due to importance*

## Stakeholders involvement strategies

Stakeholders are mapped according to their role and the benefit (or conflicts) their involvement could bring to the project. This also includes their current involvement and strategies to improve their support for project execution.

| STAKEHOLDER | ROLE | IMPORTANCE | CONTRIBUTION | BENEFITS | CONFLICTS | SUPPORT | STRATEGY |
|---|---|---|---|---|---|---|---|
| General public | Marginal | LOW | - | Awareness about the project and the final results | None | Unformal support | Inform about the project trough media coverage |
| Media | Marginal | LOW | - | Information transfer about the project and activities | None | Unformal support | Inform in all project phases |
| HOPS | Operative | HIGH | Directly involved in technical preparation of the project | Technical risk dissemination | None | Formal support | Part of the Project development unit |
| HEP ODS | Operative | MEDIUM | Directly involved in technical preparation of the project | Technical risk dissemination | None | Formal support | Part of the Project development unit |
| Shipping companies | Operative | MEDIUM | Information about future expectations and standardization | Project development according to future boat standards and risk dissemination | None | Unformal support | Inform about project development |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Luka Dubrovnik d.d. | Operative | MEDIUM | No contribution | Experience in operation and maintenance for risk dissemination | None | Unformal support | Inform in all project phases |
| Ministry of economy and sustainable development | Relevant | MEDIUM | No contribution | Political risk dissemination | None | Unformal support | Inform in all project phases |
| Dubrovnik-Neretva county | Relevant | MEDIUM | No contribution | Political risk dissemination | None | Unformal support | Inform in all project phases |
| Ministry of the Sea, Transport and Infrastructure | Key | HIGH | Directly involved in preparation of the project | Maximal project support | None | Formal support | Part of the Project development unit |
| City of Dubrovnik | Key | HIGH | Directly involved in preparation of the project | Maximal project support | None | Formal support | Part of the Project development unit |

*Table 2. Stakeholders involvement strategy*

# Carbon footprint emissions estimation

To determine the greenhouse gas emissions in the port area all relevant data has been collected from the stakeholders and usage of the port has been analysed in detail.

## Terrestrial emissions

### Electric energy

In the table and figure below we can see electricity consumption declared by users and confirmed with those invoices supplied directly by the electricity utility company.

| MONTH | DAY USAGE (kWh) | NIGHT USAGE (kWh) | TOTAL (kWh) |
|---|---|---|---|
| 01/2019 | 85.825 | 46.267 | 132.092 |
| 02/2019 | 74.966 | 39.655 | 114.621 |
| 03/2019 | 77.040 | 42.469 | 119.509 |
| 04/2019 | 69.648 | 41.409 | 111.057 |
| 05/2019 | 63.938 | 44.942 | 108.880 |
| 06/2019 | 75.041 | 55.929 | 130.970 |
| 07/2019 | 83.563 | 59.724 | 143.287 |
| 08/2019 | 87.028 | 63.432 | 150.460 |
| 09/2019 | 74.398 | 56.225 | 130.623 |
| 10/2019 | 59.929 | 42.245 | 102.174 |
| 11/2019 | 41.198 | 26.472 | 67.670 |
| 12/2019 | 41.246 | 25.250 | 66.496 |
| **TOTAL** | **833.820** | **544.019** | **1.377.839** |

*Table 3. Electricity consumption*

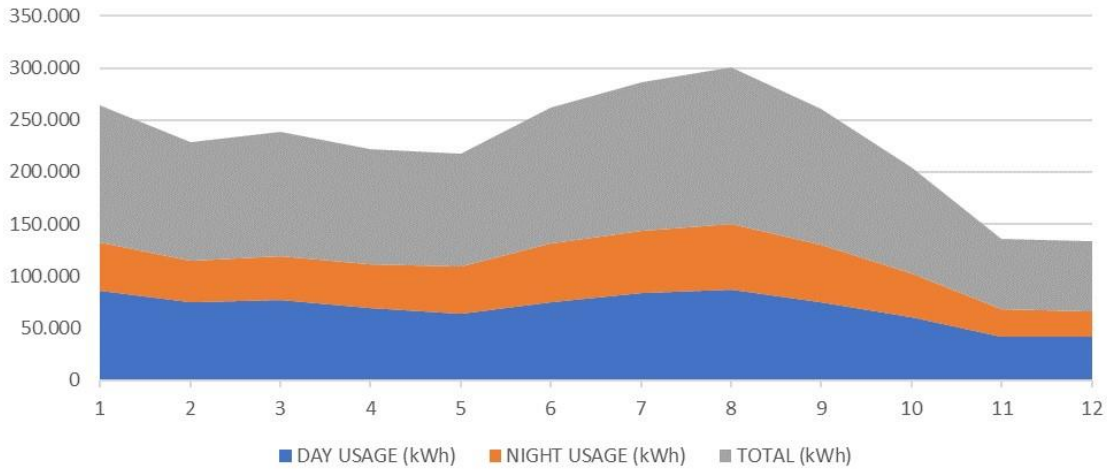


*Figure 3. Electricity consumption graph*

Specific CO2 emission factor per total electricity production in Croatia is 0.33 g/kWh. Based on total electricity consumption and emission factor, total CO2 emissions from electricity consumption is **455 tons**.

## Heating

Heating and cooling are based on electricity and GHG emissions are calculated in the previous section.

## Service vehicles

Below we have a list of service vehicles used bay the Port authority Dubrovnik.

| NUMBER | CAR MODEL | YEAR | POWER | EU NORM | $CO_2$EMISSION |
|---|---|---|---|---|---|
| 1 | FORD MONDEO | 2005 | 92 kW | EURO 4 | 182 g/km |
| 2 | OPEL CORSA | 2009 | 66 kW | EURO 4 | 124 g/km |
| 3 | SEAT LEON | 2018 | 85 kW | EURO 6 | 109 g/km |
| 4 | ŠKODA OCTAVIA | 2018 | 110 kW | EURO 6 | 118 g/km |
| 5 | PIAGGIO LIBERTY | 2006 | 3 kW | - | 75 g/km |
| 6 | PIAGGIO FLY | 2016 | 3 kW | - | 48,3 g/km |

*Figure 4. Service vehicles in the port*

Estimation of the usage inside port operational boundaries has been made and overall CO2 emission of service vehicles is **0,3 tons**.

## Port operational vehicles

Port of Dubrovnik-Gruž is mainly cruise port and many terrestrial emissions are related to road vehicles operating inside port boundaries. Below we can see number of entries of different vehicles inside port boundaries.

| VEHICLE TYPE | 2018. | 2019. |
|---|---|---|
| BUS | 24.251 | 24.698 |
| MINIBUS | 1.076 | 1.613 |
| COMBI | 1.535 | 1.811 |
| PASSENGER CAR | 75.314 | 77.711 |

| | | |
|---|---|---|
| OTHER | 3.337 | 4.983 |

*Figure 5. Port operational vehicles entries in the port*

Based on the estimation of their milage inside port boundaries and estimation of their standby use while waiting inside port boundaries, overall CO2 emission of operational vehicles is **50,2 tons**.

## Overall results

*area*

| NUMBER | CONTRIBUTOR | TONNES CO2 EQV | PERCENTAGE |
|---|---|---|---|
| 1 | Electric energy | 454,7 | 90,0% |
| 2 | Service vehicles | 0,3 | 0,1% |
| 3 | Port Operational vehicles | 50,2 | 9,9% |
| 4 | Heavy-duty vehicles | 0,0 | 0,0% |
| 5 | Other | 0,0 | 0,0% |
| | **Total** | **505,2** | **100%** |

*Table 4. Main terrestrial GHG contributors in the Dubrovnik port*

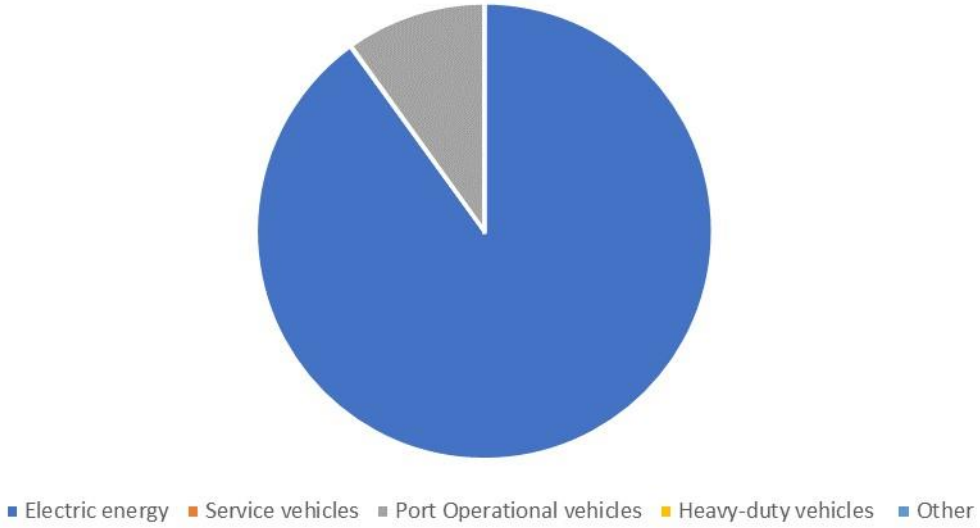


*Figure 6. Terrestrial emissions graph*

## Maritime emissions

According to the data from the lists of cruise ship entering the port of Dubrovnik Gruž, there were 423 cruise ship dockings in the port of Dubrovnik Gruž.

| Ship | HVSC | Entries | Length (m) |
|---|---|---|---|
| AIDAaura | NO | 2 | 202 |
| AIDAblu | NO | 31 | 253 |
| ARTANIA | NO | 1 | 231 |
| ARCADIA | NO | 2 | 285 |
| AURORA | NO | 2 | 272 |
| OCEANA | NO | 10 | 261 |
| ORIANA | NO | 4 | 260 |
| ARTEMIS | NO | 4 | 58 |

| | | | |
|---|---|---|---|
| ATHENA | NO | 20 | 58 |
| AZAMARA QUEST | NO | 3 | 180 |
| CELEBRITY CONSTELLATION | NO | 7 | 294 |
| CELEBRITY ECLIPSE | NO | 1 | 317 |
| BRAEMAR | NO | 1 | 195 |
| CARNIVAL HORIZON | NO | 2 | 321 |
| COSTA DELIZIOSA | YES | 36 | 294 |
| COSTA neoRIVIERA | NO | 1 | 216 |
| CROWN PRINCESS | YES | 3 | 290 |
| SEA PRINCESS | YES | 1 | 261 |
| CRYSTAL ESPRIT | NO | 13 | 86 |
| CRYSTAL SERENITY | NO | 1 | 250 |
| GOLDEN IRIS | NO | 1 | 164 |
| HORIZON | NO | 9 | 207 |
| KONINGSDAM | YES | 3 | 299 |
| OOSTERDAM | YES | 12 | 285 |
| LA BELLE DE L'ADRIATIQUE | NO | 22 | 110 |
| MARINA | NO | 1 | 239 |
| RIVIERA | NO | 6 | 239 |
| SIRENA | NO | 1 | 180 |
| MEIN SCHIFF 2 | NO | 12 | 262 |
| MSC Lirica | NO | 28 | 274 |
| MSC Poesia | YES | 24 | 293 |
| MSC Sinfonia | NO | 19 | 274 |

| | | | |
|---|---|---|---|
| NAUTICA | NO | 1 | 180 |
| NORWEGIAN SPIRIT | NO | 10 | 268 |
| NORWEGIAN STAR | YES | 22 | 294 |
| OCEAN DREAM | NO | 1 | 204 |
| PAN ORAMA II | NO | 2 | 49 |
| TO CALLISTO | NO | 20 | 49 |
| **Ship** | **HVSC** | **Entries** | **Length (m)** |
| QUEEN ELIZABETH | NO | 2 | 294 |
| QUEEN VICTORIA | NO | 3 | 294 |
| RHAPSODY OF THE SEAS | NO | 11 | 279 |
| RUNNING ON WAVES | NO | 3 | 63 |
| SEA CLOUD | NO | 3 | 109 |
| SEA DREAM I | NO | 1 | 104 |
| SEA DREAM II | NO | 2 | 104 |
| SEABOURN OVATION | NO | 1 | 211 |
| SEVEN SEAS EXPLORER | NO | 1 | 223 |
| SEVEN SEAS VOYAGER | NO | 4 | 207 |
| TBC 2 | NO | 13 | 264 |
| THOMSON CELEBRATION | NO | 26 | 214 |
| VIKING ORION | NO | 1 | 228 |
| VIKING SKY | NO | 2 | 228 |
| VIKING STAR | NO | 7 | 228 |
| VIKING SUN | NO | 4 | 228 |

*Table 5. List of cruise ships docking in Port of Dubrovnik*

The following table provides data from the Tier I-III standard, which prescribes permissible emission limits for harmful gases during the combustion of ordinary diesel (LFO - light fuel oil) with a Sulphur content of up to 0.1%.

| Polluter | 2012. Year (g/kWh) | 2020. Year (g/kWh) |
|---|---|---|
| $SO_2$ | 0,4 | 0,4 |
| NOx | 8,6 | 2,2 |
| $CO_2$ | 600 | 600 |

*Table 6. Permissible emission limits of marine diesel*

## Manoeuvring phase

According to data about average manoeuvring time during stay in the port and average fuel consumption of the cruise ships during manoeuvring, total manoeuvring CO2 emission has been calculated **5.742 tons**.

## Mooring phase

According to the data for permitted limit emissions of harmful gases during the combustion of marine diesel for 2012, and according to the data on passenger ships - cruise ships that docked in the port of Dubrovnik - Gruž and the time of their retention at the port, the quantities of discharged harmful substances into the surrounding air during the stay of ships on berth in the port and the operation of diesel engines were calculated. Total CO2 emissions in mooring phase is **30.603 tons**.

## Overall results

| NUMBER | CONTRIBUTOR | TONNES CO2 EQV | PERCENTAGE |
|---|---|---|---|
| 1 | Anchored ships | 0 | 0% |
| 2 | Ships manoeuvring | 5.742 | 16% |
| 3 | Moored ships | 30.603 | 84% |
| | **Total** | **36.345** | **100%** |

*Table 7. Main maritime GHG contributors in the Dubrovnik port area*

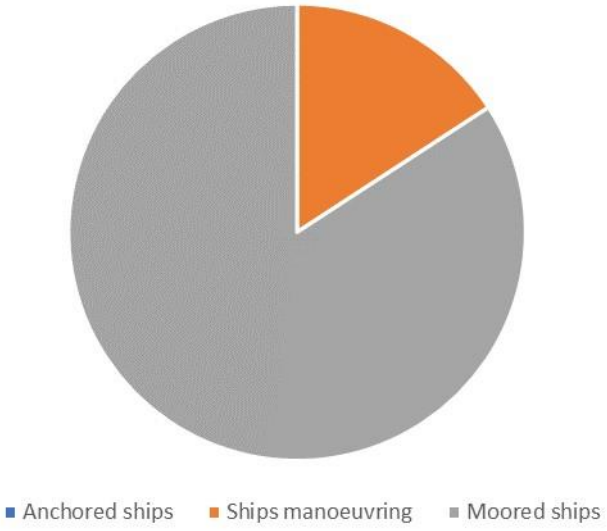


*Figure 7. Maritime emissions graph*

## Emissions summary

| NUMBER | CONTRIBUTOR | TONNES CO2 EQV | PERCENTAGE |
|---|---|---|---|
| 1 | Electric energy | 454,7 | 1,2% |
| 2 | Service vehicles | 0,3 | 0,0% |
| 3 | Port Operational vehicles | 50,2 | 0,1% |
| 4 | Heavy-duty vehicles | 0 | 0,0% |
| 5 | Other | 0 | 0,0% |
| 7 | Anchored ships | 0 | 0,0% |
| 8 | Ships manoeuvring | 5.742 | 15,6% |
| 9 | Moored ships | 30.603 | 83,0% |
| | **Total** | **36.849,8** | **100,0%** |

*Table 8. Overall GHG emissions*

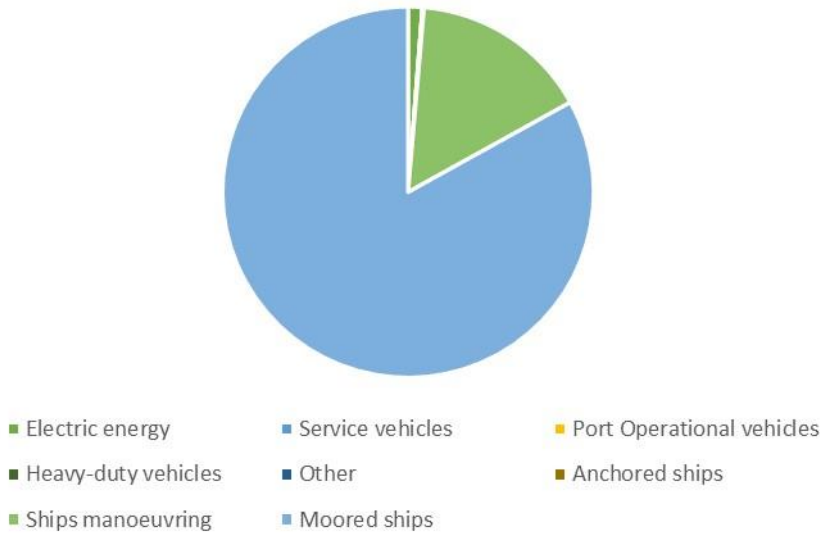


*Figure 8. Overall emissions graph*

# SWOT Analysis

SWOT analysis serves to identify key internal and external factors perceived as important to achieving project objectives as they stem from the current situation and previous project activities. All relevant elements are divided into two main categories:

1. Internal factors — Strengths and Weaknesses
2. External factors —Opportunities and Threats

| | Positive Impact | Negative Impact |
|---|---|---|
| Internal factors | STRENGTHS | WEAKNESSES |
| | • High Voltage Shore Connection (HVSC) project in development<br>• Photovoltaic power plant for own consumption in development<br>• Renovation of the main office building in development<br>• Port area outdoor LED lighting in development E-mobility car charging system project in development<br>Full support from the local and state level for the implementation of the projects | • Most of the maritime GHG emissions come from cruise ships at berth<br>• Most of the terrestrial GHG emissions come from the transport busses and cars related to cruise ships passengers<br>• Port is situated in the city and has limited connections and possibilities for inner energy resources<br>Awareness from other stakeholders using port area<br>High population concentration |
| External factors | OPPORTUNITIES | THREATS |
| | • Other users in the port area are encouraged to use new means of transportation of goods and people<br>• Using new smart technologies for better transport and area usage optimization IT Model for predictive port emissions Maritime traffic EU and international regulations on GHG emissions | • Relatively small area with an exponential increase of requests for port usage<br>• Increased interest for port usage by cruise ships, operating shuttle buses and visitors in general<br>Economic instability directly caused by the COVID19 |

# Conclusion

Overall CO2 emissions for the Port of Dubrovnik-Gruža are 36.850 tons. It is clearly visible that most of the emissions are related to cruise ships manoeuvring and mooring in the port, and terrestrial emission count only for the 1,4% of the total emissions.

| NUMBER | CONTRIBUTOR | TONNES CO2 EQV | PERCENTAGE |
|---|---|---|---|
| 1 | Electric energy | 454,7 | 1,2% |
| 2 | Service vehicles | 0,3 | 0,0% |
| 3 | Port Operational vehicles | 50,2 | 0,1% |
| 4 | Ships manoeuvring | 5.742 | 15,6% |
| 5 | Moored ships | 30.603 | 83,0% |
| | **Total** | **36.849,8** | **100,0%** |

*Table 9. Overall GHG emissions summary*

Considering that Port authority Dubrovnik already started to prepare High voltage shore connection project and maximizing usage of renewable energy sources inside operational area of the port gives as a clear footage of wat are main concerns and target areas. Tackling with maritime emissions in ports is a crucial element of making ports sustainable and friendly to the nearby surrounding.

# List of figures



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