European Commission

SOCIO-ECONOMIC STUDIES IN THE FIELD OF THE INTEGRATED MARITIME POLICY FOR THE EUROPEAN UNION

Tourist facilities in ports

Growth opportunities for the European maritime economy: economic and environmentally sustainable development of tourist facilities in ports

Study report

"Socio-economic studies in the field of the Integrated Maritime Policy for the European Union"

- The role of Maritime Clusters to enhance the strength and development in European maritime sectors – Executive summary
- Legal aspects of maritime monitoring & surveillance data – Summary report
- Legal aspects of marine environmental data – Summary report
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Growth opportunities for the European maritime economy: economic and environmentally sustainable development of tourist facilities in ports

Study report

Directorate-General for Maritime Affairs and Fisheries

Study done on behalf of the European Commission

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I. INTRODUCTION

The diversity of the continent makes the European Union (EU) an ideal holiday destination. The EU offers a wide range of activities in the areas of culture, natural heritage and leisure. In the past decade, the EU has welcomed a relatively new phenomenon into the EU tourism industry: cruise tourism. Due to its long expanses of coastline, historical sights and variety of cultures, the EU makes an ideal cruise destination. Because the cruise industry adds significant economic value to EU Member States, cruise tourism is an important sector for coastal regions and islands to attract.

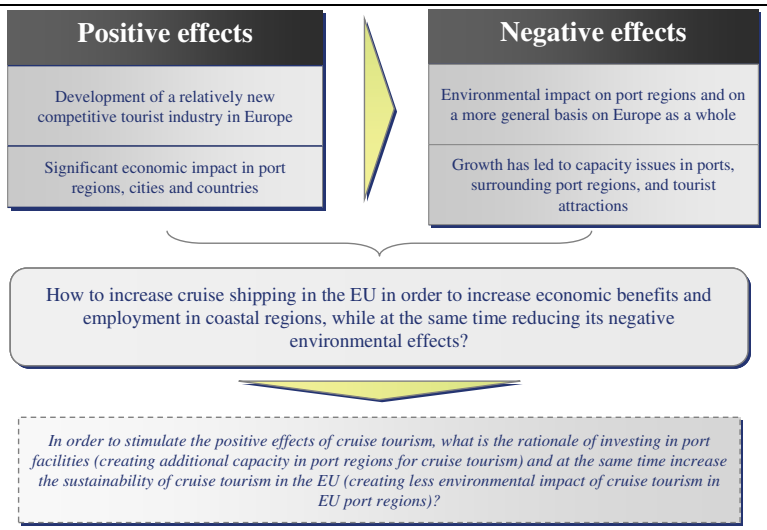
I.1. TOURIST FACILITIES IN PORTS

While cruise tourism adds significant economic value, it also leads to unwanted externalities, as cruise ships create air emissions, waste and noise in EU ports and seas. The Communication 'An integrated Maritime Policy for the European Union' (COM (2007) 575 final) stresses the importance of reconciling economic development, environmental sustainability and quality of life within coastal regions and islands. The Action Plan accompanying the Communication (SEC (2007) 1278) acknowledges the importance of promoting the development of quality coastal tourism and states that, as a first step, the Commission intends to assess the benefits for ports to invest in infrastructure and facilities for receiving tourists, in particular through cruise tourism.

Taking the positive and negative effects of cruise shipping into consideration, the following question arose in terms of the aim of the research, namely: 'How to increase economic benefits and job creation in coastal regions and islands, in particular through cruise tourism, whilst reducing its negative environmental effects'? The study was structured so as to address the objective of sustainable growth and development opportunities for coastal regions and islands through cruise tourism.

The ultimate aim of the study is to devise a quantitative indicator to calculate the return on investment in tourist facilities. *Figure I.1* presents a graphic overview of the relevance of this study and its main objective.

Figure I.1: Overview of the study



Source: Policy Research Corporation

Chronologically, the study was subdivided into four tasks. Tasks 1 and 2 are described in detail below.

Task 1: Tourist facilities in and around ports: the environment factor

The objectives of Task 1 were to provide an assessment of the economic rationale of investing in sustainable infrastructure and equipment (particularly the use of shore-side electricity) and to establish cost indicators for compliance with environmental legislation associated with tourist facilities in and around ports.

Task 2: Economic drivers for tourist facilities in ports

The key objective of Task 2 was to collect relevant information from both the demand and the supply side to strengthen the factual base for a SWOT analysis of EU cruise ports as regards tourist facilities, including the calculation of both direct and indirect economic effects.

Task 3: Testing results

This task was set up to validate the findings of the first two tasks.

Task 4: An indicator to clarify the return on investment in tourism facilities

The aim in this task of the project was to devise and calculate an indicator for the average return on investment when financing tourist facilities in ports.

This Study report takes the form of a comprehensive overview of the validated results found in Tasks 1 and 2. Its purpose is to present the main findings. Detailed methodology, assumptions and figures can be found in the final reports on 'The environment factor' and 'Economic drivers for tourist facilities', which can be downloaded from the European Commission website http://ec.europa.eu/maritimeaffairs.

I.2. OUTLINE OF THE CHAPTERS

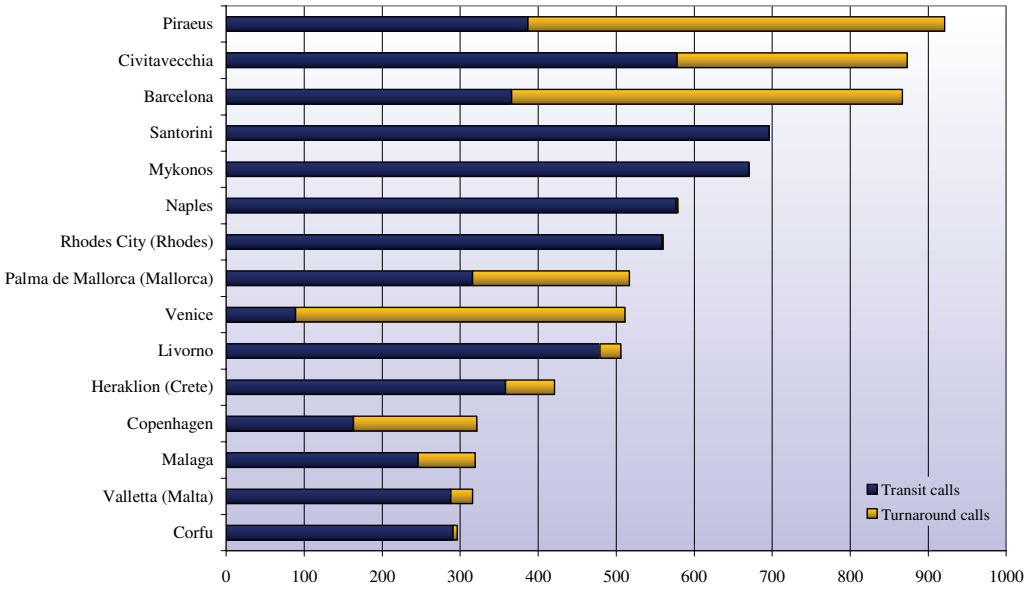
This report is structured into four chapters. *Chapter II* analyses the environmental effects (in terms of emissions and waste) of cruise tourism in EU Member States. *Chapter III* provides an analysis of the economic impact of cruise tourism in EU Member States. Subsequently, in *Chapter IV,* investment options of port facilities are discussed, both for the reduction of environmental effects and for increasing the economic impact of cruise tourism. Lastly, *Chapter V* contains conclusions and recommendations.

II. CRUISE SHIP ACTIVITY IN THE EUROPEAN UNION

European cruise tourism has shown significant and substantial growth in the past decade. Whereas Europe as a destination used to account for only a small fraction of the market, it now has developed into a primary market, with ships specifically designed for the regions in Europe.

Figure II.1 shows the number of cruise ship calls in the top 15 European Union ports, broken down into turnaround and transit calls. A cruise ship start its itinerary in a turnaround port, then travels to multiple ports (transit ports) and ends its journey in a turnaround port.

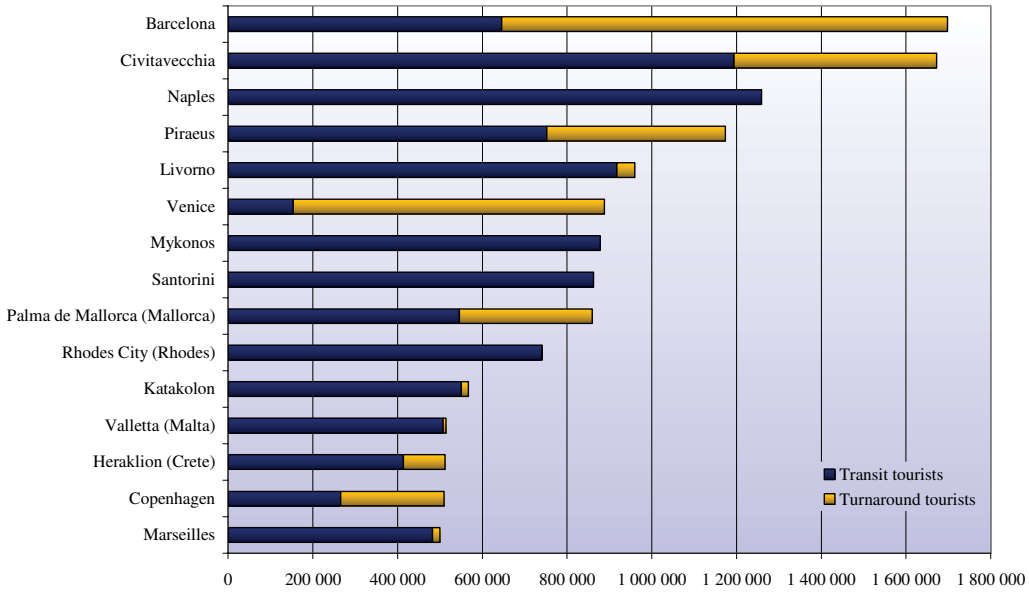
Figure II.1 : Number of cruise ship calls in the top 15 EU ports



Source: Policy Research Corporation

All (but one) of the ports in this top 15 listing are Mediterranean ports. Piraeus is the largest, with more than 900 calls, followed by Civitavecchia with almost 900 calls. When comparing these figures with actual passenger numbers, minor changes can be made to the ranking of the ports. Barcelona is the biggest port in terms of passenger numbers, receiving over 1 600 000 passengers per year, while Piraeus is the fourth biggest port. This is due to the fact that the ships sailing in the Aegean waters around the Greek islands are relatively smaller.

Figure II.2 : Numbers of passenger visits in the top 15 EU ports



Source: Policy Research Corporation

These numbers are impressive and, when they are all added together, sea cruising accounts for 18 884 cruise calls at EU destinations, generating over 27 million passenger visits in one of the 313 ports that receive cruise ships. Most of the cruise calls (71%) are in Mediterranean ports, 13% in Atlantic ports, 10% in Baltic ports and 5% in North Sea ports. The Black Sea region is last, with 1%.

Cruise tourism is a seasonal business, as cruise ships prefer to sail in mild climatic conditions in Europe. *Table II.1* shows the distribution of cruise calls for both the Mediterranean and North West Europe (Baltic and North Sea).

Table II.1 : Distribution of cruise ships in EU ports

	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec
NW EU	0	0	0	3%	13%	24%	28%	24%	10%	0	0	0
						76%						
Med	2%	2%	4%	8%	13%	11%	10%	11%	13%	15%	8%	3%
								73%				

Source: Policy Research Corporation

In North West Europe, 76% of all cruise calls take place during a three-month period from June to September. For the Mediterranean the main cruise season is three months longer; 73% of all cruises there take place between May and November.

Another aspect is the relative level of cruise shipping activity in a port. If the total number of cruise ship calls in a port is compared with calls of other industrial port activities (ferries, container ships, bulk carriers, etc), cruising is ultimately only a minor part of the port's total activity. *Table II.2* provides an overview of these data for seven EU ports, spread across the continent.

Table II.2 : Cruising as % of total shipping activities in ports

Port	Amsterdam	Barcelona	Civitavecchia	Dover	Helsinki	Piraeus	Warnemünde
Cruising as a % of total shipping activities	1.4%	8.6%	18.8%	0.6%	2.5%	3.2%	1.2%

Source: Policy Research Corporation

As can be seen, cruise ships account for only a minor part of the activity in a port. Even in the three most visited cruise ports (Barcelona, Civitavecchia and Piraeus), cruise ships account for less than 19% of the calls. Most ports have significant ferry activities (Barcelona, Civitavecchia, Dover, Helsinki, Piraeus and Warnemünde) and/or container, bulk or liquid tanker shipping (Amsterdam, Barcelona, Civitavecchia, Helsinki, Piraeus and Warnemünde), which makes up most of the port's activity.

III. THE ENVIRONMENT FACTOR IN CRUISE TOURISM

III.1. CONTEXT AND DEFINITIONS

Cruise ships come in different types and sizes, but are generally substantial in size and can carry large numbers of people. At berth, a cruise ship continues to require significant power to maintain its operations as (on average) 25% of the passengers and 50% of the crew remain on board. This power is generated by the ship's engines; therefore a cruise ship also generates emissions while it is at berth. Due to the berthing locations, which are often in city centres, the environmental impact caused by ships can be a contentious local issue in port cities around Europe. The reduced value of property as a consequence of pollutants in the air cannot be neglected, since it hinders the economic development of coastal regions.

This purpose of this chapter is to assess this environmental footprint caused by cruise tourism. The environmental footprint of cruise tourism has to be divided into direct impact (air emissions, waste/waste water and noise) and indirect impact (emissions, waste, crowds of tourists going on shore, transportation). This report deals only with the direct environmental effects.

Emissions are chemicals that are emitted as a result of the burning of fossil fuels. Large ships (cruise ships included) generally use residual oil (also referred to as heavy fuel oil). This type of fuel is high in sulphur (the average figure for the EU is 2.7% sulphur) and carbon, which gives rise to emissions of CO_2, SO_2 and particulate matter ($PM_{10/2.5}$). In addition to these emissions, NO_x is generated in the combustion process. *Table III.1* shows the emissions and their characteristics.

Most of these emissions have been the subject of extensive political debate. For sulphur dioxide, several measures have been put in place by the IMO (International Maritime Organisation) and at EU level. The first measure put in place by the IMO was the designation of two maritime regions (the Baltic Sea and the North Sea) as sulphur emission control areas (SECAs). In these areas, the level of sulphur permitted in bunker fuel is limited to 1.5%. A European Union directive on sulphur (2005/33/EC) further prescribes that ships must use 0.1% sulphurous fuel at berth, with effect from 1 January 2010.

Table III.1 : Emissions, impact and main effects

Emission type	Description	Impact	Main effects
NO_x	Nitrogen oxide	• Local • Regional • Global	• Health impacts (local) • Acidification of rain (regional) • Global warming (global)
SO_2	Sulphur dioxide	• Local • Regional	• Health impacts (local) • Acidification of rain (regional)
CO_2	Carbon dioxide	• Global	Global warming (global)
$PM_{2.5/10}$	Particulate matter	• Local	Health impacts (local)

Source: Policy Research Corporation

After emissions, the next thing that cruise ships create and that needs to be considered is waste. This study will categorise and quantify that waste. Another result of the presence of cruise ships in EU ports is the noise they generate. In this report noise will not be incorporated into the results as a measurable quantity; instead it will be included as a qualitative variable.

III.2. METHODOLOGY

As explained in the previous section, this part of the study is dedicated to the assessment of cruise ship emissions and waste in ports. First, it was necessary to define the terms. For the purposes of this study a cruise ship is considered to be a ship travelling to multiple destinations according to a fixed itinerary, carrying only tourists. Ferries (and even ships of sizes and facilities that are similar to ferries) are not included in this study, because they travel on a dedicated route. A port is defined as a seaport in one of the 22 coastal Member States of the EU. This means that inland river cruises are also excluded from this study.

Allocating ship emissions to ports is difficult. Cruise ships travel to a wide range of ports; some sail the same itinerary frequently, while other ships sail around the entire continent, ships stay longer. In some ports than in others; passengers embark or disembark, etc. Therefore a database was created with every cruise ship itinerary in European Union waters for 2009. In this database, the ports of embarkation and disembarkation (turnaround ports) were included separately, as well as all transit ports, the length of the cruise (in days) and the name of the ship. These data made it possible to link ports and cruise ships.

By assessing the emissions per hour for a specific cruise ship, it was possible to calculate the emission levels per port. For this purpose a methodology developed by Entec[1] was used. This method enabled emissions (NO_x, SO_2, CO_2 and PM) to be assessed in grams per kilowatt hour of power employed by a cruise ship. For every ship the power levels were entered into the database. Two types of ships were distinguished: the somewhat older ships, having a main engine for propulsion and auxiliary engines (power generators) for ship operations and the relatively newer diesel electric vessels with only generators that provide power for both electric propulsion and the ship's facilities. By using different load factors for these different types of engines, a fairly accurate estimate for the cruise ship emissions was obtained. As emissions are mainly dependent on the type of fuel that is burned, fuel with a sulphur content of 0.1% was chosen. In this way, it was possible to map cruise ship emissions as at 1 January 2010.

A wide range of sources were used for the assessment of waste[2]. The waste streams of one specific cruise ship, visited by *Policy Research* on a field trip, were also gathered. For more detailed information on the methodology that was used for this study, please see the report on Task 1.

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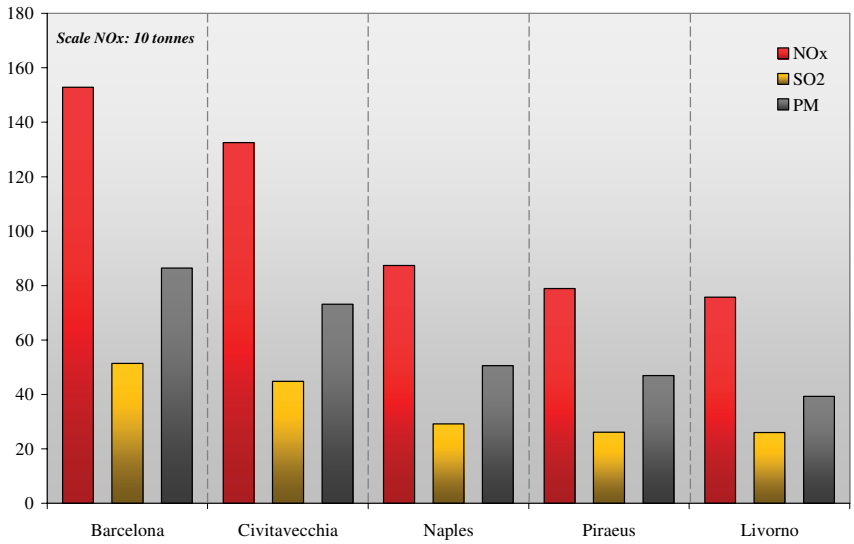
1 Entec, CONCAWE: Ship emissions inventory – Mediterranean Sea, 2007.

2 U.S. EPA, Cruise ship discharge assessment report, 2008; U.S. EPA, Cruise ship white paper, 2000; The ocean conservancy, Cruise Control, 2002; U.S. Commission on ocean policy, An ocean blueprint for the 21st century, 2004; Ross K. Dowling, Cruise ship tourism, 2006.

III.3. EMISSIONS OF CRUISE TOURISM IN THE EU AND ITS REGIONS

The environmental footprint of cruise ships in ports is expressed as the level of NO_x, SO_2 and PM emitted. CO_2 is irrelevant from a local perspective, as this gas contributes to global warming and has only a minor impact on local communities. *Figure III.1* shows the five destinations that have the highest cruise ship emissions.

Figure III.1 : Top 5 EU ports in emission levels in tonnes*



** Emissions based on 0.1% sulphurous fuel, and thus comparable with the situation as from 1 Jan 2010.*

Source: Policy Research Corporation

The level of emissions is dependent on the distribution of turnaround and transit calls in a port. A turnaround call tends to be longer than a transit call (12 hours instead of 8 hours), making the environmental footprint of a cruise ship higher in these ports. As was explained in the previous chapter, Barcelona and Civitavecchia have a larger proportion of turnaround calls, which explains the higher emission levels. The figures in *Table III.2* below are the result of quantifying the total emission levels from cruise tourism in the EU.

Table III.2 : Emissions from cruise tourism at sea and in EU ports in 2009

Emissions (tonnes)	NO_x		SO_2		CO_2		PM	
	Absolute	%	Absolute	%	Absolute	%	Absolute	%
At Sea	156 521	*89%*	96 288	*99%*	6 091 920	*85%*	15 006	*87%*
In Ports	20 296	*11%*	677	*1%*	1 076 411	*15%*	2 277	*13%*
Total	176 817	100%	96 965	100%	7 168 331	100%	17 283	100%

Source: Policy Research Corporation

The emissions in ports represent a relatively small percentage compared to emissions at sea, as can be seen from the table. The levels are low, especially if SO_2 is taken into consideration. The main reason for this is EU Directive 2005/33/EC, which lays down that all ships must use 0.1% sulphurous fuel (instead of the average 2.7% that is commonly used by ships). *'The environment factor'*, *Paragraph IV.2.1* presents a more detailed analysis of this directive and its impact.

Emissions in local communities cause damage to society. If people are (constantly) exposed to air that contains chemicals or fine dust, this can lead, *inter alia*, to health damage, reduced life expectancy. Therefore, emissions can also be expressed in terms of monetary damage to society – after all, health damage gives rise to health costs. The level of health damage (and consequently the costs for society) is dependent on the population density of the region in which the emissions are generated. A higher population density means that more people are exposed to the same emissions. *Table III.3* shows the emission levels of the top five destinations.

Table III.3 : Monetary values of emissions in the top five ports

Port	Monetary values of emissions
Barcelona	€ 35 357 049
Naples	€ 23 095 597
Piraeus	€ 19 390 289
Civitavecchia	€ 15 788 177
Livorno	€ 10 536 863

Source: Policy Research Corporation

The values expressed in the above table are the costs to society. Hence, if emissions can be reduced by means of investment in port facilities, then society will benefit.

III.4. WASTE GENERATED BY CRUISE TOURISM IN EUROPE

The waste streams of a cruise ship can be categorised as follows: bilge water, sewage water, greywater, solid waste, hazardous waste and ballast water. Definitions of these types of waste can be found in *'The environment factor'*, *Paragraph IV.5*. Various studies have investigated the production of waste from cruise ships, which makes it possible to estimate the waste produced by an average cruise ship. These estimates can also be found in *Paragraph IV.5*. During a field visit, *Policy Research* also obtained the waste figures of a specific large cruise ship[3] over a three-month period. The outcomes are shown in *Table III.4*. Because cruise ships produce significant waste streams, cruise lines have increasingly been putting effort into the reduction of waste. For example, water recycling units are installed to recycle greywater, and solid waste is compressed to improve waste handling onshore.

Table III.4 : Average waste production for a specific ship

Type of waste	Liter per month	Liter per week
Bilge water	125 000	31 250
Sewage	5 744 000	1 436 000
Grey Water	22 960 000	5 740 000
Solid waste	675 000	168 750

Source: Policy Research Corporation

[3] For confidentiality reasons, the name of the ship is not mentioned.

IV. THE ECONOMIC FACTOR OF CRUISE TOURISM

IV.1. CONTEXT AND DEFINITIONS

Cruise ships introduce a significant economic impact into port areas. A ship spends money on port and handling fees and it brings in large groups of tourists that visit the area around the port and its cultural or historical attractions[4].

The growth rates and related economic impact recorded in the past decade have tempted many policy makers, from the local to the European level, to attract this industry to their ports. With ships becoming larger and carrying more passengers, attracting an average cruise ship can boost local shop sales, tour sales and other businesses. However, attracting cruise ships also comes with costs attached, as it is necessary to provide a berth (quay), security (ISPS), transport facilities (parking areas for coaches, trains, etc.) and (dis)embarking facilities (terminal) for those ports that want to become a turnaround port. These facilities may require substantial investments by port authorities.

The question that needs to be answered is whether attracting cruise tourism is economically beneficial for a port region. This means that, from an investment point of view, there should be a positive return on investment for the local community. In this chapter, the economic impact of cruise tourism will be analysed in order to generate economic parameters that can be used to calculate the economic return and related payback periods of investments in port facilities.

IV.2. METHODOLOGY

The economic impact of cruise tourism on local economies consists of three different types of spending categories: passenger, crew and ship expenditures. The economic impact generated by shipbuilding, cruise ship suppliers and the setting up of headquarters of the cruise companies are left out of the analysis, as this impact does not necessarily ultimately affect coastal regions.

The results of the port survey conducted by G.P. Wild and BREA[5] provide valuable input for the assessment of passenger expenditures. This study was based on 17 400 surveys that were conducted in different European cruise destinations. Based on these results the average amounts per passenger (going onshore) were extracted, and broken down by category (transit or turnaround passenger). *Table IV.1* shows the average expenditures for a transit tourist. Based on the survey results, the percentage of passengers participating in an organised tour is assumed to be 65%. It is assumed that around 80% subsequently purchase a tour on the ship, while 20% purchase the tour onshore. This has consequences for expenditures, since tours that are prebooked on a cruise ship tend to be more

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[4] Further information on the cruise industry's impact on the European economies can be found in the report published yearly by the European Cruise Council 'Contribution of Cruise Tourism to the economies of Europe, GP Wild International, 2009' (www.europeancruisecouncil.com).

[5] G.P. Wild & BREA, Preliminary summary of European port survey results (December, 2008).

expensive (by around 50%). Taking these distinctions into account, a weighted average of the expenditures on tours for all transit passengers (that go onshore) was calculated.

Table IV.1 : Expenditures by a transit tourist in EU destinations

Expenditure category	Participate in organised tour	Do not participate in organised tour	Weighted average
Tours and entrance fees	30	10	23
Food and beverages	10	10	10
Shopping	15	15	15
Transportation	0	5	2
Port fees	5	5	5
Other	5	5	5
Total	*65*	*50*	*60*

Source: Policy Research Corporation

For turnaround passenger expenditures, research shows that the average expenditure per turnaround passenger visit is around 100 euro, but the results vary significantly. In order to obtain a reliable overview of the turnaround passenger expenditures, the same methodology as for determining the transit passenger expenditures was used, which meant that an assessment was made of the different expenditure categories (based on studies conducted by individual port authorities).

Table IV.2 : Expenditures by a turnaround tourist in EU destinations

Expenditure category	Overnight stay	No overnight stay	Weighted average
Tours and entrance fees	15	5	9
Food and beverages	35	5	17
Shopping	20	5	11
Transportation and parking fees	20	20	20
Hotels	70	0	28
Port fees	5	5	5
Other	5	5	5
Total	*170*	*45*	*95*

Source: Policy Research Corporation

Table IV.2 shows the figures that were used to calculate the expenditures per turnaround passenger, which indicate that the average amount per turnaround passenger for the calculation of the economic impact on the local economies of the EU was € 95.

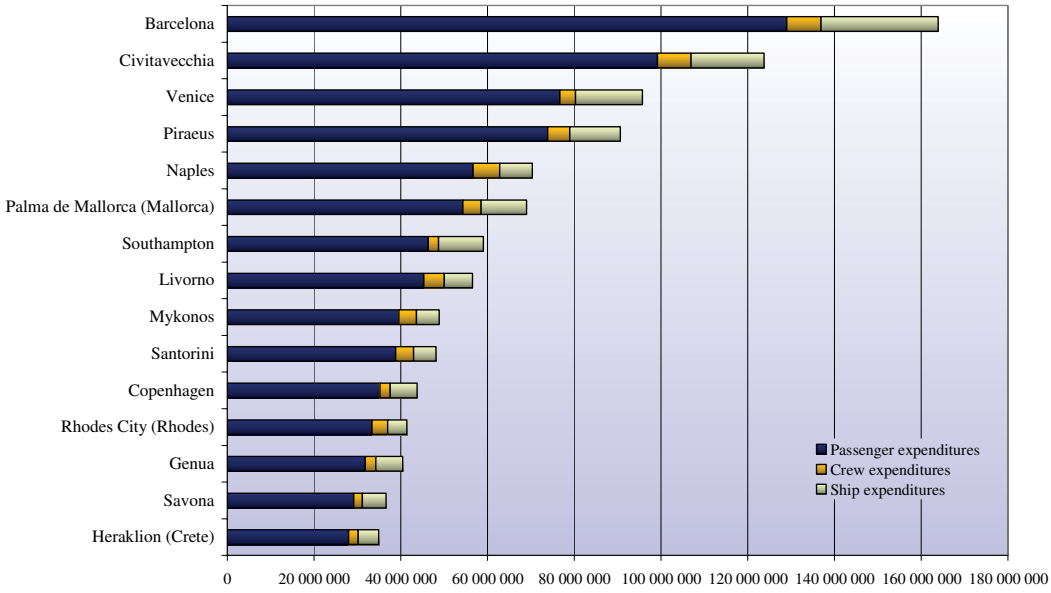
For crew and ship expenditures a similar approach was adopted. Crew tend to spend € 25 per disembarkation, and it was found[6] that (on average) 50% of the crew disembark per port visit. For ship expenditures in ports, it was calculated that ships spend € 6 per transit passenger per transit call and € 24 per turnaround passenger for a turnaround call (embarkation and disembarkation combined). The difference between these costs is due to the necessary costs for luggage handling and customs for turnaround passengers.

For each port the ships travelling to the port were listed, and the details of each ship (i.e. the number of passengers and crew) were included. Using connecting ship and port data it was possible to allocate expenditures to each individual cruise port in the European Union. For detailed information on the methodology and sources behind these calculations, see *'The economic factor'*, *Paragraph II.3.1.*

IV.3. RESULTS

Figure IV.1 shows the top 15 EU cruise ports based on expenditure levels.

Figure IV.1 : Top 15 EU cruise ports based on expenditures



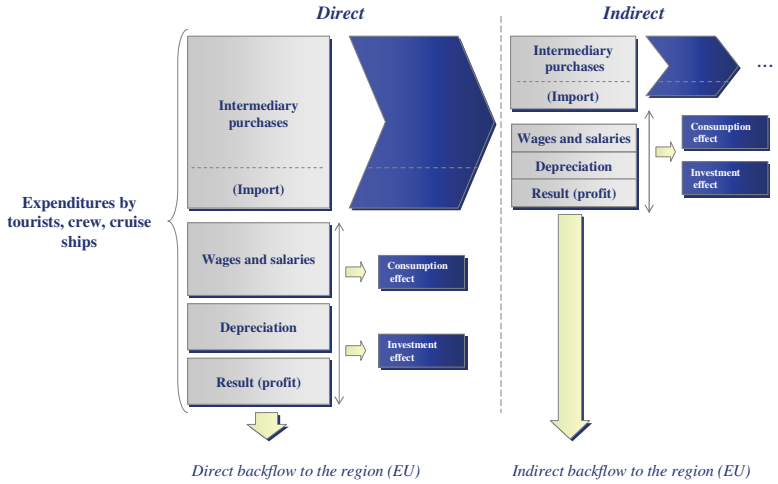
Source: Policy Research Corporation

Tourists who spend money in a port region inject money into a local economy and consequently into the generation of jobs. In order to calculate the number of jobs, the value added that is generated in a local economy had to be calculated. Therefore, an economic impact analysis was conducted.

An economic impact analysis uses the expenditures of tourists to calculate the direct economic impact on a local economy. For every product sold in (for example) a shop, a shop owner made purchases from its suppliers. These costs are qualified as intermediary purchases. Input-output models, containing the relative share of intermediary purchases for every euro spent in an industry, were obtained to quantify this information for each EU Member State.

[6] Through field visit and expert interviews done by *Policy Research.*

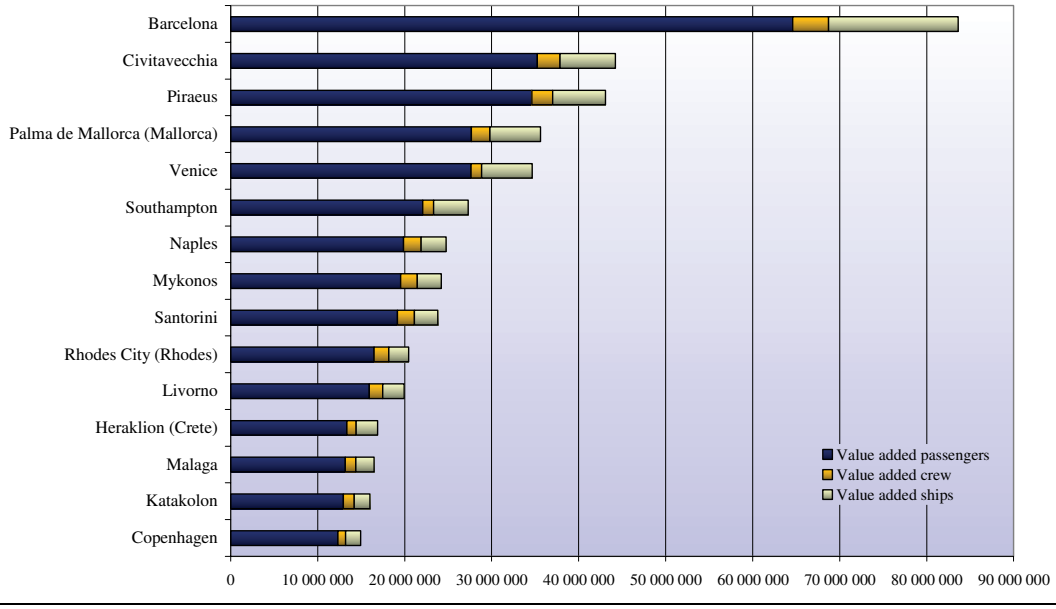
Figure IV.2 : Economic impact analysis model



Source: Policy Research Corporation

By subtracting the intermediary purchases from the total money spent in a local economy, we obtain the value added. *Figure IV.3* shows these figures for the top 15 EU cruise ports.

Figure IV.3 : Top 15 EU port regions based on value added



Source: Policy Research Corporation

As can be seen in *Figure IV.3,* the ports that have the highest value added levels are mainly in the Mediterranean area. *Table IV.3* shows the distribution of cruise tourist spending over the EU regions.

Table IV.3 : Distribution of cruise tourist spending (in €) over EU sea basins

Sea basin	Passengers	Crew	Ships	Total expenditures	Total direct value added
Baltic Sea	146 700 305	13 243 519	23 087 508	183 031 332	73 280 692
North Sea	103 520 315	6 759 881	20 851 956	131 132 152	58 909 502
Atlantic Ocean	139 445 485	13 931 319	19 548 714	172 925 518	81 674 312
Mediterranean Sea	1 107 940 455	97 109 569	178 298 112	1 383 348 136	607 395 479
Black Sea	1 372 935	188 838	182 778	1 744 551	696 875
Total	*1 498 979 495*	*131 233 125*	*241 969 068*	*1 872 181 688*	*821 956 861*

Source: Policy Research Corporation

In addition to its direct economic impact, cruise tourism also generates an indirect economic impact. The shop owner example can be used again to demonstrate this. The intermediate purchases made by a shop owner in a cruise destination create turnover for its suppliers. This turnover leads in turn to intermediate purchases from those supplying the suppliers, payment of wages, et cetera (as shown in *Figure IV.2*).

Since it is hard to determine whether this impact is actually generated in the coastal/port regions, it is left out of the analysis for the port region. After all, a shop owner may buy its goods from a supplier in another country, city or region. Nevertheless, these effects have been calculated and quantified and are shown in *Table IV.4*. Moreover, other economic activities related to or dependent on cruise tourism have been quantified. For more information on these figures or the methodology, see *'The economic factor'*, *Paragraph III.3* and further.

Table IV.4 : Total economic impact (in €) of cruise tourism in the EU-22 coastal states

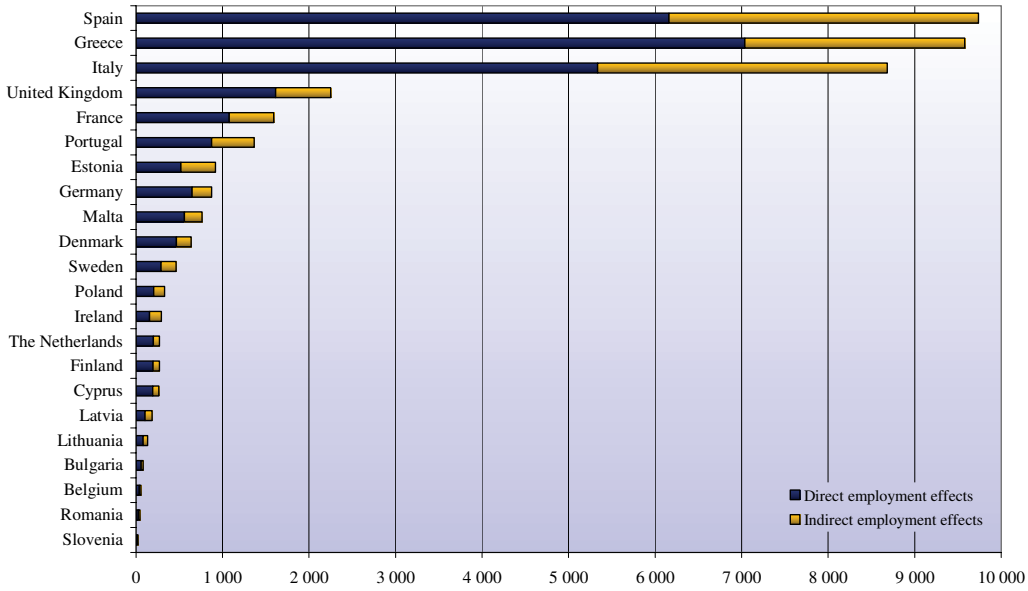
Determinants of cruise expenditures	Direct expenditures	Economic impact					
		Direct value added	Indirect value added	Total value added	Direct employment	Indirect employment	Total employment
Cruise expenditures	1 872 181 688	821 956 861	526 874 974	1 348 831 835	25 867	12 957	38 824
Shipbuilding	5 191 000 000***	1 371 000 000*	1 495 000 000**	1 146 068 466	37 000***		37 000
Cruise line offices and crew	1 150 000 000**	****	****	****	55 000***		55 000
Total	*8 213 181 688*	-	-	-	*117 867*	-	*130 824*

* *Based on the value added percentage of the manufacturing industry in the individual shipbuilding countries (Italy, Germany, France, Finland and other)*
** *Based on the multiplier of the sector 'transport equipment production' for each individual shipbuilding country the indirect expenditures were calculated*
** *For the indirect effects the assumption was made that the value added percentage is 30% in all indirect sectors*
*** *Information originates from G.P. Wild (2009) Contribution of cruise tourism to the economies of Europe*
**** *Location (country) of offices is unknown; value added is left outside the analysis*

Source: Policy Research Corporation

Cruise passengers spend almost two billion euros in total in European destinations, with a direct economic impact of over 800 million euros. For each EU Member State the average amount of value added for one job in the industries affected by cruise tourism was calculated. By dividing the total value added by this figure, the number of jobs per industry (and subsequently per country) was calculated. *Figure IV.4* shows these numbers.

Figure IV.4 : Number of jobs generated in the EU by cruise tourism



Source: Policy Research Corporation

V. INVESTING IN PORT FACILITIES

The aim of this study is to ascertain whether investments in port facilities are beneficial for port communities and/or coastal regions. Two types of port facilities will be considered: those that reduce the environmental footprint of cruise tourism and those that enhance the economic impact of cruise tourism.

V.1. FACILITIES THAT REDUCE THE ENVIRONMENTAL FOOTPRINT OF CRUISE TOURISM

This section is mainly dedicated to shore-side electricity for cruise ships as a method of reducing emissions of cruise ships in EU ports. Alternatives for shore-side electricity will be discussed further on.

V.1.1. SHORE-SIDE ELECTRICITY

Shore-side electricity, also known as 'cold ironing', is a technique in which a ship connects to a land-based power source and stops using its engines to power the ship. Therefore, it has been suggested as a technique to reduce shipping emissions in ports. The concept is relatively easy; a ship connects to shore generated power and emissions are reduced, as its engines will be switched off (or set to low usage).

V.1.1.1. Advantages

The advantages of shore-side electricity are twofold: it reduces emissions and eliminates noise.

V.1.1.2. Disadvantages

Shore-side electricity also comes with some disadvantages. First of all, the reduction of emissions is limited, as the generation of electricity also contributes to environmental impact. *Table V.1* shows the emissions generated by shore power compared to ship generated power.

Table V.1 : Emissions of shore generated power compared to ship generated power (1 kWh)

Type of production facility	NO_x	SO_2	CO_2	PM
Coal power plant	1.05	2.75	340.56	4.33*
Oil power plant	0.46	0.82	266.76	0.01
Gas power plant	0.34	0.002	201.96	0.001
Cruise ship**	11.67	0.4	690	0.3

* *Filters on coal powered plants can reduce these emissions*

** *Assumed averages for a diesel electric powered cruise ship using 0.1% sulphurous fuel*

Source: Policy Research Corporation based on: EEA, Air pollution from electricity generating combustion plants, 2008; Entec, CONCAWE: Ship emissions inventory – Mediterranean Sea, 2007.

As can be concluded from the table, the production of 1 kWh coal power generates more emissions (except for NO_x and CO_2) than 1 kWh of power generated on a cruise ship using 0.1% sulphurous fuel. The results of converting the figures into reduction percentages are shown in *Table V.2*.

Table V.2 : Reduction potential of shore generated power compared to ship generated power

Cruise ship versus shore power	NO_x	SO_2	CO_2	PM
Coal power plant	91%	0	51%	0
Oil power plant	96%	0	61%	98%
Gas power plant	97%	99%	71%	100%

Source: Policy Research Corporation

The energy mix for each EU Member State was incorporated in the analyses for shore-side electricity. The four most frequently visited/popular cruise countries are presented in *Table V.3,* plus France and Sweden due to their relatively 'green' energy mix.

Table V.3 : Energy mix of the most popular EU cruise countries plus France and Sweden

Country	Coal	Oil	Gas	Nuclear	Renewable	Other
Italy	16%	15%	50%	0%	19%	0%
Spain	23%	8%	30%	20%	18%	2%
Greece	53%	16%	17%	0%	14%	0%
United Kingdom	38%	1%	35%	19%	6%	0%
France	5%	1%	4%	78%	12%	0%
Sweden	1%	1%	0%	47%	50%	0%

Source: Policy Research Corporation

As can be concluded from the table, the energy production in these countries is still largely dependent on coal-fired power plants. If the emissions generated by this type of power plants were considered, it would be irrational from an environmental viewpoint to switch from ship generated power to shore-side generated power. The energy mix used by France and Sweden is also included in the table. Since these countries have a relatively clean energy mix, shore-side generated power offers an attractive alternative in these countries.

Secondly, the reduction of emissions by using shore-side electricity is further limited by the (dis)connection time. It will take between half an hour and an hour to connect and disconnect a ship. On an average stay in port of 10 hours, this means that for 15% of the time the ship is not connected and is still using its engines. Thirdly, the costs of shore-side electricity installations are high (€ 6.75 million for one installation supplying just one ship), due to the fact that ships use a different power frequency (60 H_z instead of the EU 50 H_z) and the high power requirements. For a port like Barcelona, at least five installations are required (although in reality eight ships can be at berth simultaneously, so eight installations may actually be required), which demands an investment of € 33.5 million. Next to these costs, there are annual costs of € 500 000 for staff and maintenance. Fourthly, the costs of electricity are much higher when compared with the costs for ship generated power. Even if ships use MDO (0.1% sulphur) and the VAT on electricity is exempted, the costs of electricity outweigh the costs of ship generated power. If shore-side electricity is to be provided to cruise ships at the same cost, the EU or local communities would have to subsidise the electricity. For more detailed information on these items, see *'The environment factor'*, *Paragraph V.1 et seq*.

V.1.1.3. Cost-benefit analysis

The rationale for investing in shore-side electricity was investigated by conducting a cost-benefit analysis. Three types of cost-benefit analysis were run in order to gain different perspectives. The main inputs for the analyses were the costs to be incurred by ports and cruise lines on the cost side and the reduction of emissions as benefits (transformed into monetary values). If the reduction percentages of shore-side electricity are based on the average EU-25 energy mix[7], 38 EU cruise ports have a positive cost-benefit ratio and an average payback period of 3.8 years[8]. If the energy mix of the individual Member States were used, 19 ports would have a positive investment case. The incorporation of the 2020 renewable energy targets (generating a 'greener' energy mix in the EU Member States) should not affect that number. The cost-benefit analysis revealed that, for 38 ports, a total investment of € 671 million is needed (connections to shore-side electricity onshore and refitting of 157 ships); annual costs are € 52 million (including € 19 million for e.g. maintenance and port staff and € 35 million for subsidising electricity). If the local energy mix is taken into account, for the 19 ports this would involve a total investment of € 413 million and annual costs of € 31 million (of which € 9.5 million on maintenance and port staff and € 22 million on subsidising electricity). Since no economic benefits were found, the cost benefit analyses were run strictly on the basis of societal benefits, i.e. less health damage due to the reduction of emissions.

V.1.2. OTHER EMISSION REDUCTION SYSTEMS

Seven ship based emission reduction systems (abatement technologies) were investigated as possible alternatives to shore-side electricity. Two of these technologies (selective catalytic reduction and sea water scrubbers) have been used in order to assess their cost effectiveness compared with shore-side electricity. These ratios are shown in *Table V.4*.

Table V.4 : Shore-side electricity

	SSE	SCR	SWS
Return on investment ratios (present value of net benefits (10 years 4%) / investment costs	2.02	16.99	7.21
Return on investment ratios (present value of net benefits (10 years 6%) / investment costs	1.84	15.42	6.55

Source: Policy Research Corporation

The ratios express the fact that an investment of € 1 will lead to a return of € 1.84 in societal benefits (reduced emissions) for shore-side electricity (considering a discount ratio of 6% and a discount period of 10 years). For the same period and discount rate, an investment of € 1 in selective catalytic reduction generates € 15.42 in societal benefits. The figures indicate that abatement technology is more beneficial than shore-side electricity. The reasons for this are threefold: (1) the EU-directive on low sulphur fuel leads to substantial emission reductions, (2) abatement techniques reduce emissions both at berth and at sea, and (3) no connection or disconnection time is needed. From a public

[7] Assessed by Entec for and approved by DG Environment: Service contract on ship emissions: assignment, abatement and market-based instruments. Task 2a Shore- side electricity, 2005.

[8] Payback period is based on non-discounted yearly net societal benefits; the time value of money is not incorporated.

perspective, there are two additional benefits: (1) no additional port investments are required and (2) no subsidies on electricity will have to be provided. From a cruise line perspective, the benefit of keeping a low-cost fuel basis (if a certain threshold is exceeded) applies in the case of sea water/fresh water scrubbers.

V.2. FACILITIES THAT ENHANCE THE ECONOMIC IMPACT OF CRUISE TOURISM

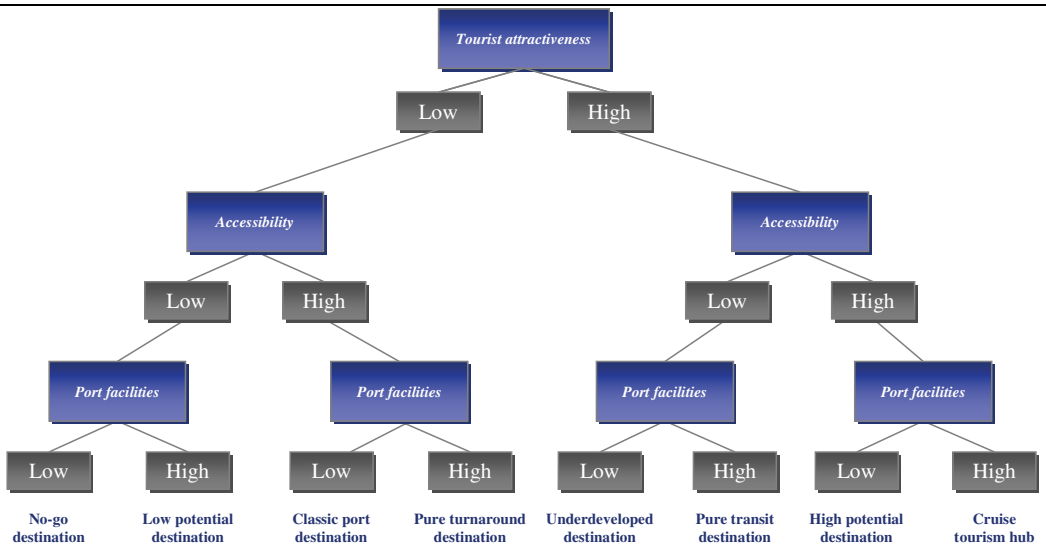
The second part of this chapter (and study) is dedicated to investments in facilities that enhance the economic impact of cruise tourism.

V.2.1. TOURIST FACILITIES IN PORTS

Investments in port facilities can attract (additional) cruise tourism to a port region and can therefore provide a return on investment if the additional economic impact that will be created outweighs the necessary investments. Before a port invests in port facilities it should consider its strategic position as a cruise destination. In *'The economic factor', Chapter IV* et seq, a toolbox is provided for ports to assess their position.

A port typology was identified with eight categories, ranging from a 'no-go' destination (i.e. having no attractions whatsoever) to a cruise tourism hub (which is a major venue for cruise tourism). In order to determine these typologies, three determinants were used: (1) tourist attractiveness, (2) accessibility and (3) port facilities. For more detailed information on how to apply these determinants to an individual port, see *'The economic factor', Paragraph IV.1.2* et seq. Based on how individual ports score on these determinants, ports can determine what level of tourist facilities is needed in their ports. *Figure V.1* shows the model that was used to classify ports in one of the eight port typologies.

Figure V.1 : Model for classifying ports into port typologies



Source: Policy Research Corporation

Table V.5 shows the level of port facilities required for different types of destinations. The minimum facilities required for transit ports are shown in the left-hand column of the table. A port that wants to develop into an established turnaround port should provide seven facilities.

Table V.5 : Level of facilities needed for different type of ports

General / transit facilities		Turnaround only facilities	
Sufficient draught	1	**Luggage handling facilities**	5
Sufficient quay capacity	2	**Security and custom facilities**	6
Parking facilities in direct neighborhood / coach service to parking facilities	3	**Terminal**	7
Waste disposal facilities	4		

Source: Policy Research Corporation

But how does a port know whether investment in port facilities makes sense (i.e. generate economic benefits)? In addition to improving its tourist attractiveness (e.g. by investing in improving a destination's image, building piers, etc) or investing in improving its accessibility (e.g. by investing in road extensions, acquiring an international airlift, etc), it can also anticipate trends in the cruise tourism business. *Table V.6* lists the trends that were identified for cruise tourism in the European Union. The associated opportunities and threats have also been identified.

Table V.6 : Trends, opportunities and threats for cruise ports

Trends	Opportunities	Threats
Increasing ship capacity	More tourist activity	Lower income per passenger due to pressure to lower port fees/rates
Shorter cruises	More turnaround activity	Shorter duration of visit per port
Declining average age	More demand for child friendly attractions and facilities	
More experienced cruisers	Exploitation of regional benefits (exploring regional sites)	
Emergence of the budget cruise tourist	More added value ending up in region (more tours booked onshore)	• Lower overall level of tourist expenditures • Potentially conflicting interests between cruise lines and ports
Emergence of the exploring cruise tourist	• Exploitation of regional benefits (exploring regional sites) • More value added ending up in regions (more tours booked onshore)	
Emerging cruise markets (China and India)	Exploitation of mass tourism	Destination capacity problems (crowding)
Expanding cruise season	More cruise activity outside peak season	
Stricter ISPS code		Difficulties to comply with code because significant investments are required

Source: Policy Research Corporation

Specific opportunities can be exploited by investing in port facilities (for example to cater for the trend in shorter cruises) or by investing in more attractions for families/children in and around the port area to attract the growing segment of family cruises. Threats can cause deterioration of the cruise business in established ports (especially with regard to the current crisis). Ports can anticipate these threats by investing in their facilities, but also by investing in better services (e.g. better airport-port interface, attractive tours offered at reasonable prices) in close cooperation with the industry. *'The economic factor', Paragraph IV.2* provides a detailed explanation of how to anticipate specific trends.

On a broader and more general level, cruise ports should be aware of their strategic direction before considering investments in port facilities. Based on the developments in cruise tourism, three generic strategies were drawn up that encompass the opportunities and threats. *Table V.7* shows these strategies, together with the strategic objectives.

Table V.7 : Generic port strategies and objectives

Strategy	Aimed at exploiting the opportunity of:	Aimed at conquering the threat of:
The operational excellent destination	More turnaround activity	• Lower income from tourists • Lower income from cruise ships
The individual tourist orientated destination	• Exploiting regional benefits of self organising tourists (more added value) • Exploiting new markets: younger travellers, upcoming markets	• Lower income from tourists • Lower income from cruise ships • Crowding
The exclusive/unique destination	Exploiting new (luxurious) segments that value uniqueness	

Source: Policy Research Corporation

The operationally excellent destination

The operationally excellent destination is driven by minimising costs and handling tourism flows most efficiently. This type of destination is mass-driven, has excellent accessibility and facilities for the reception of (mass) tourist flows. This type of destination is best compared with a pure turnaround destination. Investments in port facilities in ports that are pursuing this strategy should be focussed on improving the passenger-ship-destination interface (e.g. dedicated quays for cruise ships, sufficient handling capacity, sufficient coach parking places, etc.).

The individual tourist orientated destination

The individual tourist orientated destination is focused on delivering the highest value for individual tourists who want to schedule their own time and activities during a visit. The destination offers high accessibility (to its tourist attractions), is tourist friendly and offers excellent tourist facilities in its port and the immediate surroundings. This type of destination can be described either as a pure transit destination or a cruise tourism hub. Investments in port facilities in ports that pursue this strategy should be focused on improving the passenger-to-destination interface (e.g. dedicated cruise quays, sufficient and high quality public transport, sufficient coach parking places, tourist information, etc.).

The exclusive/unique destination

The exclusive/unique destination focuses on small segments of the tourism market that are looking for uniqueness. This destination is mostly located in the proximity of large ports so that tourist hotspots can still be visited within acceptable time frames. It offers excellent port facilities, but is relatively inaccessible from its hinterland. This type of destination can therefore be described as a pure transit destination. Investments in port facilities in ports pursuing this strategy should be focused on improving/sustaining its uniqueness (e.g. limited draught, limited handling capacity, etc.).

VI. CONCLUSIONS & RECOMMENDATIONS

VI.1. INVESTING IN SUSTAINABLE PORT FACILITIES

VI.1.1. SHORE-SIDE ELECTRICITY

The case of shore-side electricity for cruise ships requires extensive consideration and analysis. This study sets out the pros and cons, which are explained in more detail below.

Pro: Societal benefits

The net present value for investments in shore-side electricity is positive for 38 cruise ports in the European Union, but only when seen from a welfare point of view. If the specific (or actual) energy mix of the individual Member States is included, 19 cruise ports have a positive investment case. Future energy mix targets affect the level of societal benefits, but do not affect the number of positive investment cases.

Con: Complexity and costs

Because of the substantial power levels that are required by cruise ships at berth, installing a shore-side electricity facility at cruise quays is a complex matter. In addition to substantial investment costs, there will also be annual costs for the transportation of the electricity, maintenance and port officials handling the facility. Furthermore, no real cash flows will result for ports offering shore-side electricity – a factor which limits the business case considerably.

Con: Limited reduction potential

Most electricity is generated in fossil-fuelled power plants, which generate emissions. Environmental benefits will therefore only apply if the origin of the shore power is either renewable (solar, hydro, wind, etc.) energy, nuclear or gas power. Replacing ship emissions by power plant emissions can be locally beneficial if the power plant is located outside the port/city area. However, this is only beneficial for PM emissions, since this is the only emission type with a locally limited dispersion (CO_2 has a global impact and SO_2/NO_x both have a regional environmental impact).

Another important point to consider is the limited connection time in ports, which is restricted to 85% of the total time. This means that for 15% of the time there are no environmental benefits for a port area. Finally, cruise ship activity is seasonal and accounts for a fraction (10 percent) of the total emissions of cruise ships in the European Union. Therefore, shore-side electricity reduces the emissions that are caused by the industry by only a small percentage.

Con: Electricity costs

Fuel prices and the US dollar have both dropped significantly as a result of the economic crisis. Because current electricity prices significantly exceed fuel prices in the European Union (which is also due to the lower price in US $), there are additional costs for public (port) authorities: these costs are incurred to subsidise electricity.

Reason: Societal benefits of legislation

EU legislation enforcing a maximum sulphur level of 0.1% in fuel used at berth (effective from 1 January 2010) already delivers significant societal benefits for port regions. Therefore, the cost benefit ratios for investing in shore-side electricity have decreased substantially. Currently, 2.7% sulphurous fuel is used in ports outside SECAs (with the exception of Venice and Civitavecchia) and 1.5% sulphurous fuel is used in ports within SECAs (and Venice and Civitavecchia). The difference of 2.6% and 1.4% respectively in sulphur contents means significant additional emissions (and consequently welfare benefits that could be achieved through shore-side electricity) if legislation were not in place.

Summing up

Shore-side electricity presents a difficult case for cruise ships and requires a great deal of consideration and analysis for each individual port. From an individual port perspective it may still be attractive to invest in shore-side electricity, but the assessment of welfare benefits should depend on the origin of the shore energy, its reduction potential and the costs of fuel generated electricity compared to shore generated electricity. Since cruise ship activity in most ports is a relatively small share of the total port activities, and tends to be seasonal and infrequent, it may be more beneficial for ports to invest in shore-side electricity facilities for other frequent and all year round activities (like container shipping and ferries). These ship types require (significantly) lower power levels, which in turn makes investments lower and more acceptable.

VI.1.2. OTHER EMISSION REDUCTION METHODS

If shore-side electricity is compared with other reduction systems, the cost-effectiveness of shore-side electricity is significantly lower than the reduction methods of either selective catalytic reduction (SCR) or sea water scrubbers (SWS). These methods prove to have several advantages. It is more cost effective (from a welfare point of view) to refit a ship with SCR and SWS, although currently it is technically unfeasible to install both technologies simultaneously on ships. Furthermore, in the case of SWS, washing water criteria (the discharged water from a scrubber) should be developed, making the technology feasible as an economically attractive alternative to low sulphur fuels. Ships that are refitted cause fewer emissions at sea (even if high sulphur fuel is used), which makes it an attractive alternative for shore-side electricity.

For cruise operators it may be interesting to invest in abatement technology, as this allows them to continue using (cheaper) residual oils. If sulphur and/or nitrogen restrictions are extended in the future, the benefits will increase even further. Moreover, this technology may present the industry/companies within the industry with an advantage if a possible emission trading scheme is to be launched. Abatement technologies may offer the greatest benefits in the long term, both for ports and for industry.

The cost of these technologies is obviously an important factor in the investment decision.

VI.2. INVESTING IN TOURIST FACILITIES IN PORTS

Investing in tourist facilities in ports is dependent on the objectives that are set by the ports. Three 'ideal' objectives can be formulated for cruise ports:

a/ Becoming a pure turnaround destination

For ports having a port region with low tourist attractiveness (the no-go, low potential and classic port destination), the maximum that can be achieved in the short-to-medium term is to become a pure turnaround port. As the level of tourist attractiveness is extremely difficult to influence, ports in these categories should not try to position their destinations as an attractive transit destination or cruise tourism hub, as the benefits to be achieved will not outweigh the costs that will need to be incurred in order to attract cruise tourism. A port within a region that has a low level of attractiveness to tourists should (from an economic point of view) only attract cruise tourism to its region if there is sufficient domestic or international demand for a turnaround point in the port's region. Moreover, accessibility is the main factor in the success of a turnaround destination.

In order to fully exploit the opportunities and overcome the threats, ports that pursue this strategic objective should follow the operational excellence strategy. Such a strategy enables these ports to exploit the opportunity of more turnaround activity, whilst overcoming the threats of lower port fees and lower expenditures per tourist. Investments in port facilities should therefore be aimed at improving the ship-destination-passenger interface (dedicated cruise berths, sufficient parking lots for coaches, etc.).

b/ Becoming a pure transit destination

For ports operating within a region with high tourist attractiveness, two strategies are available. A port can focus on becoming either a pure transit destination or a cruise tourism hub. Becoming a cruise tourism hub may be the ideal objective to pursue, but realistically there can only be a few hubs within the European continent. A pure transit destination may be just as effective in acquiring economic benefits from cruise tourism, since significant investments may be required in order for it to become a turnaround hub. Moreover, the net economic benefits of attracting smaller and more luxurious segments to a port region could outweigh the net benefits of attracting mass cruise tourism. Ports that want to pursue this objective can follow one of two strategies: either becoming an *individual tourist oriented destination* or becoming an *exclusive/unique destination*. The strategy of choice depends on the level at which the port is positioned in relation to other ports and the availability of tourist attractions. If a port wants to pursue the strategy of becoming an *individual tourist oriented destination,* it should focus on optimal accessibility of its tourist attractions, so that tourists can organise their own trips. Regional efforts and/or investments in enhanced tourist friendliness are important for this strategy. In this way, the destination can exploit the opportunities of exploring tourists and/or budget driven cruise tourists. In the meantime, it can overcome threats such as lower income due to lower tourist expenditure and port fees, as this type of tourist will tend to generate more value added that ends up in the port region.

Ports that want to become an exclusive/unique transit destination should focus primarily on excellent tourist facilities in the port and its hinterland, whilst at the same time maintaining its focus on receiving limited groups of cruise tourists.

c/ Becoming a cruise tourism hub

Ports that want to become (or to remain) a cruise tourism hub should pursue the strategy of an *individual tourist oriented destination* in order to make the most of the opportunities and overcome the threats. To exploit these opportunities (more turnaround activity, more tourist activity, younger travellers and mass tourism), ports should focus on developing a wide range of dedicated port facilities for cruise ships, tourist friendliness and accessibility.

VI.3. LIMITATIONS AND ITEMS FOR FURTHER RESEARCH

The results found in this study have been reviewed and validated in close cooperation with the cruise industry, European ports, port organisations and all relevant stakeholders.

This study was specifically dedicated to cruise ships in EU ports, which is only a marginal part of the activities of most ports. It will therefore be interesting to study the case of shore-side electricity (and alternatives) for a comprehensive set of port activities. In this way, insights can be gained into the cost effectiveness of shore-side electricity per port activity. This type of holistic approach is needed in order to secure maximum environmental (societal) benefits for every euro invested.

The second part of this study dealt with the question of how the economic impact of cruise tourism can be increased by investing in port facilities. As the outcomes need to be applicable to all EU seaports, the analyses were conducted on an abstract level. Hence, the outcomes provide a helpful tool for ports, but do not take account of the actual strengths, weaknesses, opportunities and threats of the individual ports. Therefore, an analysis should be carried out at individual port level in order to incorporate all the relevant parameters that influence the position of that particular port within the cruise tourism market.

European Commission

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