climeport

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MEditerranean **PORT**s' Contribution to **CLI**mate Change Mitigation

Component 3

Benchmarking and Best Practices Report

PROJECT PART-FINANCED BY THE EUROPEAN UNION

INDEX OF CONTENTS

1 INTRODUCTION

The Benchmarking phase will allow that each port could be compared with their in terms of impact of greenhouse emissions. In the 3.3 phase the results expected will show the activities with the greatest impact concerning greenhouse emissions. Additionally, a classification of these activities according to their degree of impact in each port could be established. The final result of this phase will be a group of best practices for reducing the impact of the port activities studied. The main reason is to obtain a uniform description of the good practices with, at least, enough information to be evaluated by other ports in order to consider adopting it.

To consider the scope of the good practices to be collected by the project participants, different aspects needs to be taken into account:

Technical aspects:

Among the many activities that can be consider good practices of the ports in their contribution to GHG emissions effects mitigation, we will prioritize the ones focused in:

1. Reduction of energy consumption.
2. Reduction of waste generation.
3. Introduction of renewable energy sources in ports areas.

Geographical aspects:

Although the idea is to identify good practices among the CLIMEPORT project partners, good practices from other ports or industries with similar weather conditions and that can be sufficiently documented and transfer to the Mediterranean ports can be consider and documented, mainly by the non-port partners (AVEN, GOLEA and ITE).

Number of Best Practices to be identified and final selection procedure:

The final objective is to select the more representative and transferable good practices to be consider the CLIMEPORT Best Practices, to achieve this objective every port needs to document at least four (4) good practices, and the rest of partners at least three (3) good practices each one.

The final selection of the Best Practices will be carry out by a polling based on their quality (every CLIMEPORT partner will own 10 votes to distribute among the final set of good practices) and transferability (every CLIMEPORT port will assign 5 votes among the same set of good practices, based in their interest in adopting it).

2 METHODOLOGY

The method use to collect the information of the good practices will be based in a fiche form with a previously predefined set of registers that will be described in the following sections:

Minimum information required for every single good/best practices will comprise:

	Section	**Indication of the content**
1	Title of the practice	
2	Precise theme/issue tackled by the practice	
3	Objectives of the practice	
4	Location	- Country/Region/Port
5	Detailed description of the practice	- Origin - Timescale - Bodies involved/implementation - Process and detailed content of the practice - Legal framework - Financial framework
6	Evaluation	- Possible demonstrated results (e.g. through indicators - Possible success factors - Difficulties encountered - Investment/ Economic return if exists. - Estimation CO2 emissions reduction
7	Lessons learnt from the practice	
8	Contact information	
9	Other possible interesting information	- Website - Various documents (reports, presentations)

- **Title of the practice.**
  The title of the practice should be short but descriptive enough to be use as a clear identification among similar good practices, the use of acronyms can be useful, but with a full description asociated.

- **Precise theme/issue tackled by the practice.**
  The theme classified among the three main technical scope activities:
  a. Energy efficiency and savings.
  b. Renewable energy in ports.
  c. Waste reduction.
  Further to this, a specific issue can be added to clarify the effect or problems solved.

- **Objectives of the good practice.**
  Definition of the specific situation/problem or issue to be improved by the action, and the expected result when it was planned.

- **Location**
  Exact location where the good practice has been or it's planned to be adopted, country, region and Port o similar industry definition.

- **Detailed description of the practice**
  - Origin. By who and how it was the action conceived and implemented.
  - Timescale. It was a specific, time limited, or a permanent, once established action, in any case, starting date and foresighted duration.
  - Bodies involved/implementation. Which kind and exactly which ones stakeholders of the port community or surrounding actors was involved in the implementation of the good practices, public and private bodies.
  - Process and detailed content of the practice. Main steps and detailed process of the adoption, current situation in the foreseen plan.
  - Legal framework. Which national/regional laws helped the implementation of the good practices and which ones difficult or conditioned the way it was established.
  - Financial framework. Which finantial mechanism, funding opportunities if any, were or are forecasted to be used.

- **Evaluation**
  - Possible demonstrated results (e.g. through indicators, equivalent CO2 emissions reduction by GHG , energy saved, green energy generated, tonnes of waste saved, etc...)
  - Possible success factors. Main driving forces, solutions adopted in the implementation phases.
  - Difficulties encountered. Technical and non technical barriers overpassed
  - Investment. Total amount invested and potential incomes from the actions, economical indicators as ROI (Return Of Investment) or NPV (Net Present Value) should be used.
  - Estimation of equivalent CO2 emissions reduction
- **Lessons learnt from the practice.**
  Summary of conclusions, result and how it should be done again with the gained knowledge.

- **Contact information**

- **Other possible interesting information**
  - Website
  - Various documents (reports, presentations)

3 CLIMEPORT BEST PRACTICES

This section gathers the Best Practices identified by each participant port concerning Component 3.3 of the project.

3.1 Port Authority of Algeciras Bay

The APBA has developed a study to identify good practices to reduce the carbon footprint of activities in their port facilities. The proposals are grouped in relation to the significant aspect is intended to address as follows:

1. Reduction of energy consumption in the land port facilities.

2. Reduction of fuel consumption in port facilities on land.

3. Incorporate renewable energy in ports.

4. Incorporating green areas such as CO2 sinks in port.

These best practices are presented in the form of chips produced on the basis of the methodology provided by the MED Programme "BENCHMARKING BEST PRACTICES AND IDENTIFICATION: BEST PRACTICES DESCRIPTION". The following table shows in summary the list of proposed environmental practices, which are described in detail in the following paragraphs.

REDUCTION OF ENERGY CONSUMPTION	
Number	**Title**
1	Installation of transformers in accordance with the standard HD 428.1 S1.
2	Optimization of indoor lighting systems in buildings of the APBA.
REDUCTION OF FUEL CONSUMPTION	
Number	**Title**
1	Introduction of isolation in sanitary hot water pipes.
2	Incorporation of electric vehicles in the fleet of the APBA.
INCORPORATION OF RENEWABLE ENERGY SOURCES	
Number	**Title**
1	Installation of wind energy in port facilities.
2	Installation of photovoltaic energy in administrative buildings of the APBA
3	Installation of solar thermal energy in the building of the Port Police.
INCORPORATION OF GREEN AREAS SUCH AS CO2 SINKS	
Number	**Title**
1	Establishment of a model of gardening for the optimization of the capture and sequestration of CO_2 in the Green System of Port of Algeciras Bay

Source: Port Authority of Algeciras Bay

3.1.1 Reduction of Energy Consumption

According to the results obtained in this report, consumption of electric power in the land facilities of the Port of Algeciras Bay represents the indirect emission of 26,766.40 tonnes of CO2 equivalent per year (12.46% of its Carbon Footprint). In response, the APBA identifies the following best practices to reduce power consumption in all land port facilities.

3.1.1.1 Installation of Transformers in Accordance with Standard HD 428.1 S1

	Section	Indication of the Content
1	Title of the practice	**INSTALLATION OF TRANSFORMERS IN ACCORDANCE WITH STANDARD HD 428.1 S1**
2	Precise theme/issue tackled by the practice	Energy efficiency and savings.
3	Objectives of the practice	Reduce the energy consumption in the land port facilities.
4	Location	Electrical network of the Port of Algeciras Bay.
5	Detailed description of the practice	According to the document "The Scope for energy saving in the EU through the use of energy-efficient electricity distribution transformer" (European Cooper Institute, in collaboration with the European Commission), the total losses of electricity in the distribution networks in the UE represent the 6.5% of total electricity generated, and the 40% of these losses occur in transformers. Therefore, the energy efficiency of distribution transformers is a key factor in sustainable electrification. In the case of the Port of Algeciras Bay, the majority of installed transformers are old, some of them before 1990, so they don't have the required specifications of the new transformers in relation to energy efficiency and losses. Based on the foregoing, it is proposed the gradual replacement of existing transformers with new ones under the specifications of the standard HD 428.1 S1.
6	Evaluation	According to market research, the cost of this action implies a 6-8% increase over the initial cost of equipment, which for an equipment of 630 KVA is around 5,900 €. With each new transformer of 630 KVA under standard HD 428.1 S1, to an average load of 30%, estimated losses are 311 W less than with the transformers currently installed, so in a year will be an energy savings of 2,659 kWh. This translates into an approximate annual savings of 313 € and a reduction in annual GHG emissions of 1.02 tonnes of CO2 equivalent per new transformer installed.

7	Lessons learnt from the practice	APBA is currently undertaking a project through which it is analyzing the entire network of power distribution and the status of some of the transformers.
8	Contact information	
9	Other possible interesting information	"The Scope for energy saving in the EU through the use of energy-efficient electricity distribution transformer". (http://www.copperinfo.com/pdf/transformers.scope.pdf).

3.1.1.2 Energy Optimization of Interior Lighting Systems in Buildings of the APBA

	Section	Indication of the Content
1	Title of the practice	**ENERGY OPTIMIZATION OF INTERIOR LIGHTNING SYSTEMS IN BUILDINGS OF THE APBA**
2	Precise theme/issue tackled by the practice	Energy efficiency and savings
3	Objectives of the practice	Reduce the energy consumption in buildings of the APBA
4	Location	Maritime Station of the Port of Algeciras, Administrative Office of APBA, Conservation Building and Port Police Building
5	Detailed description of the practice	The analysis of different lighting systems installed at the Maritime Station of the Port of Algeciras, the Administrative Office of the APBA, the Conservation Building and the Port Police Building, has taken to develop the following actions, which complement each other and intended to reduce electricity consumption in these buildings: • Installation of lighting control systems: One of the factors affecting energy consumption for lighting is that the lights are usually turned on unnecessarily for long periods. We therefore propose to install occupancy sensors in areas of transit and buttons timed in WC. The implementation of this action will involve the installation of 73 sensors of presence (58 in the Maritime Station and 15 at the Administration Office) and 141 timed buttons (121 in the Maritime Station and 20 at the Administration Office.). • Replacing standard incandescent and fluorescent lamps: It is advisable to use high-efficiency lamps due to their high luminance, lower consumption and longer life. Electronic compact fluorescent lamps provide quality ambient lighting, and are essential for their low power consumption for those places where

lighting is required for long periods of time. These lamps can be used widely as they consume five times less than incandescent bulbs, with a life tenfold. On the other hand, they have the same cap that traditional light bulb which makes them very simple to implement.

- The implementation of this action would involve the replacement of 25 incandescent bulbs with compact fluorescent 20 W (10 in the Administration Office and 15 in the Port Police Building) and the replacement of 1,312 standard fluorescent tubes/old fluorescent tubes of 36 mm diameter with more efficient compact fluorescent 30W, 18W and 13W as the case (36 in the Administration Office, 1008 in the Conservation Building and 268 in the Port Police Building.).
- Replacement of magnetic ballasts with electronic ones: fluorescent tubes have greater efficiency, which in terms of lighting means you get a light level several times higher than incandescent bulbs to equal consumption, but the traditional ballasts dissipate much heat. It is therefore essential to replace conventional fluorescent tubes by those that use electronic ballasts, because they save energy, help correct power factor, as well as increasing their useful life. The implementation of this action would involve replacing 2,411 ballasts in the buildings of the APBA (1,379 in the Maritime Station, 400 at the Administration Office, 532 in Conservation Building and 100 in the Port Police Building).

ACTION	EVALUATION
Lighting Control Systems	Total cost: 25,294.44 € Annual savings: 29,996 €/ year Reducing emissions: 144.05 t CO_2 eq/year
Replacement lamps	Total cost: 11,481 € Annual savings: 1,041.31 €/ year Reducing emissions: 5 t CO_2 eq/ year
Replacement ballasts	Total cost: 52,131 € Annual savings: 15,058.61 €/ year Reducing emissions: 72.32 t CO_2 eq/ year
Total	Total cost: 88,906.44 € Annual savings: 46,095.92 €/ year Reducing emissions: 221.31 t CO_2 eq/ year

Source: Port Authority of Algeciras Bay

According to the results of the report EEGEI&HC, the power consumption at the Maritime Station of the Port of Algeciras, the Administrative Office of the APBA, the Conservation Building and the Port Police Building, involved in 2008 the indirect emission of 1,501.07

		tonnes of CO2 equivalent. With the implementation of the proposed actions would achieve a reduction of 15% of the annual GHG emission approx.
6	Evaluation	
7	Lessons learnt from the practice	The installation of lighting control systems must be coordinated with the change of type of lamps, because the equipments of fluorescence tubes do not support a lot of on and off. In its place should be placed compact fluorescent lights.
8	Contact information	
9	Other possible interesting information	To complement this action, the APBA is considering the possibility of enrolling in the European Programme called "Greenlight". This Programme, launched in February 2000 by the Directorate General for Energy and Transport of the European Commission, is a voluntary initiative to combat pollution, which aims that consumers of electricity in the residential sector (both public and private) agree to install in their buildings the more efficient lighting technology, whenever this is possible and the lighting quality is maintained or improved. The Greenlight Programme aims to reduce energy consumption of internal and public illumination throughout Europe, to achieve a reduction in the level of pollution and limit global warming. It also seeks to improve the quality of visual conditions while saving money. The most important part of the Programme is the document of accession, signed by the Partner and the Commission, in which the Partner commits to: • For existing spaces: Improve at least 50% of all eligible spaces owned by the Partner or has long-term rent, or reduce total energy consumption for lighting by at least 30%. The eligible areas are those where lighting can be improved. • For new spaces: Choose the new facilities so that there isn't an alternative that maintains or improves the quality of illumination provided by the chosen installation and that would not consume less electricity, in exchange for an additional investment which could be profitable.

3.1.2 Reduction of Fuel Consumption

According to the results, the consumption of fossil fuels in the land facilities of the Port of Algeciras Bay is equivalent to the direct emission of 23,593.90 tonnes of CO2 equivalent/year (10.98% of its carbon footprint). In response, APBA identifies the following best practices to reduce fuel consumption in the land facilities of the port.

3.1.2.1 Introduction of Insulation in the Sanitary Hot Water pipes

	Section	Indication of the Content
1	Title of the practice	**INTRODUCTION OF INSULATION IN THE SANITARY HOT WATER PIPES**
2	Precise theme/issue tackled by the practice	Energy efficiency and savings.
3	Objectives of the practice	Reduce fuel consumption in the boiler of ACS.
4	Location	Conservation Building and Seaport Police Building.
5	Detailed description of the practice	Currently, the boiler of sanitary hot water production installed in Conservation Building provides service both the building itself and the Port Police Building. To minimize energy losses associated with the distribution of hot water, especially to the Port Police Building, is very important a proper insulation of pipes of ACS, that in addition to avoiding imbalances in the network between remote areas and next to the boiler, which also translates into a reduction in water consumption. Poor insulation leads to energy losses by conduction and a waste of water, because you need to let the water run longer to reach the right temperature due to losses. In this context, the action to take is to provide sufficient insulation to the pipes of ACS, being the minimum thickness of the insulating layer, in agreement with previous studies, 30 mm.
6	Evaluation	The adoption of this action has a cost of 1,000 € and would mean an annual savings of 2,130 €/year, so the return on investment would take place at 0.47 years. In environmental terms, this action would save 2,630 liters of heating oil annually, which translates into a reduction in annual GHG emissions of approximately 7.2 t CO2 equivalent/year.
7	Lessons learnt from the practice	
8	Contact information	

9	Other possible interesting information	The Regulation of Thermal Installations in Buildings (RITE, by its acronym in Spanish), approved by Royal Decree 1027/2007 of July 20, establishes the conditions to be met by facilities that are designed to meet the demand for thermal comfort and hygiene through heating, cooling and hot water facilities, to achieve a rational use of energy. One of the energy efficiency requirements established by the RITE translates into better insulation in the equipment and pipelines of thermal fluids. With the approval of the current RITE, along with DB-HE1 Basic Document "Limiation of energy demand" in the Technical Building Code and Royal Decree 47/2007 (Basic procedure for energy certification of buildings in new construction), Spain has completed the transposition of European Directive 2002/91/EC on energy performance of buildings.

3.1.2.2 Incorporation of Electric Vehicles to theFleet of APBA

	Section	Indication of the Content
1	Title of the practice	**INCORPORATION OF ELECTRIC VEHICLES TO THE FLEET OF THE APBA**
2	Precise theme/issue tackled by the practice	Energy Efficiency and savings.
3	Objectives of the practice	Reduce fuel consumption in vehicles serving the APBA.
4	Location	Port Police, Port of Algeciras Bay.
5	Detailed description of the practice	In recent years the performance of electric vehicles has greatly improved and now they are a real alternative to conventional vehicles with gasoline or diesel engines, as they have low costs, minimal maintenance and easy driving. The electric vehicle is powered by electricity stored in rechargeable batteries, which allow them to operate with zero direct emissions, in addition to not generate noise pollution. Because they are much simpler and easier than usual engines, with fewer moving parts, have a lower risk of failure, reducing maintenance costs. On the other hand, electric vehicles don't need regular changes of oil and filters like conventional gasoline engines. For all the foregoing, the APBA proposes to incorporate electric vehicles to the fleet of the Port Police.
6	Evaluation	The electric car battery has an approximate cost of 7,000 €, and the electricity consumed in its lifetime is 2,000 €. This represents one third of the fuel consumed by a gasoline or diesel car over its life. Moreover, the cost of batteries and electricity tend to decline with

		time, while oil prices tend to rise. With an average price of 0.37 € per 100 kilometers, they are about 15 times more profitable than gasoline models. Economically, this action represents an investment that, given current subventions, the benefits of registration tax and fuel economy posed by these vehicles, would be fully amortized over the period of their normal life. From an environmental viewpoint, the vehicles that provide service to the Police of the Port of Algeciras Bay, according to the report EEGEI&HC, generate a direct emission of 3.67 tonnes of CO2 equivalent/vehicle (annual average). With the same level of activity, an electric vehicle would generate an indirect emission of 0.29 tonnes of CO2 equivalent (annual average).
7	Lessons learnt from the practice	The new batteries for electric vehicles have autonomy of approximately 150 kilometres, which is sufficient to meet the daily needs of vehicles currently used by the Port Police.
8	Contact information	
9	Other possible interesting information	The Plan of Activation and Energy Efficiency Savings 2008-2011, approved by the Council of Ministers on August 1 2008, includes in its Action 4 the development of a pilot project of introducing electric vehicles in order to demonstrate the feasibility technical, energetic and economic of this alternative mobility. The MOVELE Project, managed and coordinated by the IDEA, intends to introduce in urban environments, in a term of two years (2009 and 2010), 2000 electric vehicles in various categories, features and technologies, in a broad group of companies, institutions and individuals, as well as the installation of 500 charging points for these vehicles, being one of its objectives to demonstrate the technical feasibility and energy from the electric mobility in urban environments, placing Spain among the few real experiences demo of mobility technologies with electricity. (http://www.idae.es/index.php/mod.pags/mem.detalle/relcategoria.1029/id.490/relmenu.52)

3.1.3 Incorporation of Renewable Energy Sources

In Spain, as provided in the Renewable Energy Plan (PER, by its acronym in Spanish) 2005-2010, 12.1% of total energy consumption in 2010 will be supplied by renewable sources, contributing to the production of 30.3% of gross electricity consumption. Biofuels contribute with a 5.83% of petrol and diesel consumption for transport. In relation to the PER 2011-2020, currently being drafted, the Directive 2009/28/EC of the European Parliament and the Council, of 23 April 2009, on the promotion of the use of energy from renewable sources, requires each State shall prepare a National Action Plan on Renewable Energy (PANER, by its acronym in Spanish) to achieve the national targets set in the Directive. For Spain, these objectives mean that renewable energy should be a 20% of the gross final energy consumption, with a percentage in the transport of 10%, in 2020, as stated in the PANER published in June 2010.

In this context, the APBA has been developing for several years the studies of the viability for the implementation of renewable energy sources at its port facilities. One example is the solar thermal system installed in 2007 that complements the hot water boiler in the Conservation Building, which generated 20.30 GJ of energy in 2008. Following this line of work, are presented below the most recent alternatives that have been studied.

3.1.3.1 Installation of Wind Energy in Port facilities

	Section	Indication of the Content
1	Title of the practice	**INSTALLATION OF WIND ENERGY IN PORT FACILITIES**
2	Precise theme/issue tackled by the practice	Renewable energy in ports.
3	Objectives of the practice	Reduce GHG emissions resulting from electricity consumption
4	Location	External breakwater, Port of Algeciras Bay
5	Detailed description of the practice	The industrial ports and their environment are privileged places for the construction and operation of wind farms. Wind conditions of the sea coast provide, in principle, good possibilities for harnessing wind. The low roughness of the surface causes a friction and a braking of the wind on the sea very low, and too that wind speed does not undergo major changes with changes in the turbine hub height, allowing use towers rather low, about 0.75 times the diameter of the rotor (usually, wind towers located on land have 1 diameter of rotor, or even more). Moreover, the wind at sea is generally less turbulent than on land, so for a wind turbine located in the sea you can expect a lifetime greater than for other located on the ground (turbulence decreases the lifetime of the generators). These wind farms are installed in infrastructures that penetrate the

		sea, and on the immediate environment of the service area of the port. In this way, sea conditions and the technology experimented in land wind farms can be exploited. Wind farms in operation at the south of Ebeltoft, on the east coast of Denmark, at the port of Rotterdam, along the Delta Plan in the Netherlands, at the port of Marseille and at the port of Bilbao, are pioneers and clear examples of the viability of these projects. In a first approximation of the study carried out by the APBA, is proposed the installation of 5 wind turbines of 2 MW per unit, implying a minimum annual production of 21023 MWh. The facility is technically feasible. However, the main difficulties are the installation of a small stretch of submarine cable to carry power, the definition of groundings and, of course, the realization of the facility that requires the use of heavy cranes for assembly of the stretchs of the tower.
6	Evaluation	Installation of 5 wind turbines involves a total cost of 11,071,298 €. Revenue from electricity sales are estimated at 1,607,547 € (taking into account the costs related to loss of energy produced in transformers and cables than 32,300 €). The amortization costs are estimated at 1,328,640 €. The result is an economic return of 278,907 € per year. In environmental terms, this action would mean an injection of green energy in the network of 20,609,572kWh/year. This would compensate the annual electricity consumption by the APBA, and would imply a reduction in annual GHG emissions of approximately 7,920 t CO2 equivalent/year.
7	Lessons learnt from the practice	
8	Contact information	
9	Other possible interesting information	According to Wind Resource Study of Spain, the situation of the Port of Algeciras Bay has a high eolic potential. (To find the wind resource available in any area of the country and on the Spanish coast, go to the Geographic Information System developed by IDEA: http://atlaseolico.idae.es/

3.1.3.2 *Installation of Photovoltaic Energy in administrative Buildings of APBA*

	Section	Indication of the Content
1	Title of the practice	**INSTALLATION OF PHOTOVOLTAIC ENERGY IN ADMINISTRATIVE BUILDINGS OF THE APBA**
2	Precise theme/issue tackled by the practice	Renewable energy in ports.
3	Objectives of the practice	Reduce GHG emissions resulting from electricity consumption.
4	Location	Port Authority facilities.
5	Detailed description of the practice	Photovoltaic solar energy is the direct conversion of sunlight into electricity through an electronic device called "solar cell" through the physical phenomenon known as "photovoltaic effect". Solar radiation reaches the modules that produce electric power as direct current. This direct current can be stored or injected into the electric net to be used directly or converted into alternating current. Its visual impact is modest, are clean and no noise. Maintenance costs are low and their modular nature makes them very flexible, easy to install and covering a wide range of power demands. Like other clean energy, helps reduce emissions of greenhouse gases, especially CO2. The installation of photovoltaic panels on the roofs of buildings to harness the energy of sunlight helps to produce electricity without taking up useful space. The potential of the Port of Algeciras in covered surfaces well oriented to the sun, such as warehouses, gazebos for vehicles or buildings (ie, without occupation of new spaces), is over 20,000 m2 in which it's possible to install more than 10,000 m2 of photovoltaic panels with a total peak power of more than 1,500 kWp and having an annual electricity supply of more than 2.5 GWh/year. Implement these facilities will require the development of a specific technical project which justifies the installation as well as modifications or reinforcements would be needed on the structure and/or top of each building. • First, it is necessary to decide the order and grouping of facilities to undertake, and make arrangements with the Supplying Company with respect to evacuation points. • For each selected group, develop a technical project to justify the final solution adopted and the evacuation point according to directions from the Supplying Company. This technical project will also be used for the processing and legalization of the installation and as a basis for the Facultative Direction of the construction of

<table>
<tr><td></td><td></td><td>the facility.</td></tr>
<tr><td>6</td><td>Evaluation</td><td>The installation of solar fields in all the facilities of the APBA would cost a total of 9,792,511 €, broken down as follows:
<table><tr><td>APBA Building: 133,548 €</td><td>Storage shed: 2,186,120 €</td></tr><tr><td>APBA Building Parking: 170,235 €</td><td>Conservation Building: 1,117,364 €</td></tr><tr><td>Maritime Station: 1,276,952 €</td><td>PIF Building: 683,612 €</td></tr><tr><td>Port Police: 218,612 €</td><td>Fish Market: 3,692,038 €</td></tr><tr><td>Millán Picazo Auditorium: 86,738 €</td><td rowspan="2">OPE Command Center: 133,610 €</td></tr><tr><td>Old Administration Building : 93,682 €</td></tr></table>
The implementation of the action in all buildings of the APBA would mean a production of 2,515,394 kWh per year, broken down as follows:
<table><tr><td>APBA Building: 3,256 kWh/year</td><td>Storage shed: 57,638 kWh/ year</td></tr><tr><td>APBA Building Parking: 40,942 kWh/year</td><td>Conservation Building: 288,554 kWh/year</td></tr><tr><td>Maritime Station: 323,017 kWh/year</td><td>PIF Building: 173,122 kWh/year</td></tr><tr><td>Port Police: 57,241 kWh/ year</td><td>Fish Market: 945,004 kWh/year</td></tr><tr><td>Millán Picazo Auditorium: 21,649 kWh/year</td><td rowspan="2">OPE Command Center: 34,493 kWh/year</td></tr><tr><td>Old Administration Building: 23,478 kWh/year</td></tr></table>
In terms of emission of greenhouse gases, the adoption of this action would mean stop emitting 966.58 t of CO2 equivalent per year, broken down as follows:
<table><tr><td>APBA Building: 12.78 t CO_2 eq/year</td><td>Storage shed: 220.81 t CO_2 eq/year</td></tr><tr><td>APBA Building Parking: 15.73 t CO_2 eq/year</td><td>Conservation Building: 110.88 t CO_2 eq/year</td></tr><tr><td>Maritime Station: 124.12 t CO_2 eq/year</td><td>PIF Building: 66.52 t CO_2 eq/year</td></tr><tr><td>Port Police: 22.00 t CO_2 eq/year</td><td>Fish Market: 363.13 t CO_2 eq/year</td></tr><tr><td>Millán Picazo Auditorium: 8.32 t CO_2 eq/year</td><td rowspan="2">OPE Command Center: 13.25 t CO_2 eq/year</td></tr><tr><td>Old Administration Building: 9.02 t CO_2 eq/year</td></tr></table></td></tr>
<tr><td>7</td><td>Lessons learnt from the practice</td><td></td></tr>
<tr><td>8</td><td>Contact information</td><td></td></tr>
<tr><td>9</td><td>Other possible interesting information</td><td>According to the Daily Average Radiation study, presented by the National Institute of Meteorology of Spain, which was generated from isolines of annual global solar radiation on horizontal surface, the Port of Algeciras Bay has a high solar potential. (For to know the solar resource available in Europe, see: “Súri M., Huld T.A., Dunlop E.D. (2005). PV-GIS: a web-based solar radiation database for the calculation of PV potential in Europe. International Journal of Sustainable Energy, 24, 2, 55-67).</td></tr>
</table>

3.1.3.3 *Installation of a solar thermal power plant in the Port Police Building*

	Section	Indication of the Content
1	Title of the practice	**INSTALLATION OF A SOLAR THERMAL POWER PLANT IN THE PORT POLICE BUILDING**
2	Precise theme/issue tackled by the practice	Renewable energy in ports.
3	Objectives of the practice	Reduce fuel consumption in the boiler of ACS
4	Location	Port Police Building
5	Detailed description of the practice	Solar thermal power consists of the collection and application of solar radiation for use as thermal energy. The thermal energy from the sun reaches the sensors, heating the fluid flowing inside (water with antifreeze). This energy, in the form of hot water, is exchanged to another circuit where it's accumulated in a storage tank until it can be used as Sanitary Hot Water (ACS). Currently, the ACS boiler, installed in the Conservation Building, has an oil-fired boiler that is complemented with a solar thermal system, serving the building itself and the Port Police building. The action to take is the installation of an additional set of solar panels on the roof of the building of the Port Police to supply directly to this building, delaying as far as possible the pumping of ACS from the Conservation Building. The system would be connected by a three-way valve so that when the supply of the installation is finished, the ACS would enter in service from the boiler in the Conservation Building.
6	Evaluation	The adoption of this action will cost 10,370 €. The action would mean an annual saving of 780 €/year, so the return on investment would take place in about 13 years. In environmental terms, this action would save 950 liters of heating oil annually, which translates into a reduction in annual GHG emissions of about 2.6 t CO2 equivalent/year.
7	Lessons learnt from the practice	Under the Renewable Energy Plan in Spain 2005-2010, on 19 May 2010 was published in the Official Gazette the Resolution of the Presidency of the Institute for Energy Diversification and Saving of Energy, establishing the call and bases for enabling the habilitation of companies in the SOLCASA Programme, of thermal solar energy in buildings. This program aims to establish a funding system that promotes a quality offer adapted to the needs of users of hot water and air conditioning in buildings, using solar energy.

8	Contact information	
9	Other possible interesting information	According to the Daily Average Radiation study, presented by the National Institute of Meteorology of Spain, which was generated from isolines of annual global solar radiation on horizontal surface, the Port of Algeciras Bay has a high solar potential. (For to know the solar resource available in Europe, see: "Súri M., Huld T.A., Dunlop E.D. (2005). PV-GIS: a web-based solar radiation database for the calculation of PV potential in Europe. International Journal of Sustainable Energy, 24, 2, 55-67).

3.1.4 Incorporation of Green Areas such as CO_2 sinks

The concept "sink", in relation to climate change, was adopted at the United Nations Framework Convention on Climate Change 1992. A sink of greenhouse gases under the Convention, is any process, activity or mechanism which captures one of these gases (or one of its precursors, or an aerosol) from the atmosphere, and store it. Within the Kyoto Protocol, the definition is limited to certain land use activities, land use change and forestry (planting new forests, forest management and agricultural land management, etc.) that result in capture of CO2 in the atmosphere and subsequent storage in the form of vegetable matter. The capture of CO2 helps to reduce the concentration of GHGs in the atmosphere, and therefore to mitigating climate change.

In this context, the APBA has established a line of collaboration with the Faculty of Biology, University of Seville, to implement a pioneering step in ports: optimization of its plantations and green spaces from the point of view of consumption CO2 of the plant species planted. Through this study, the APBA would establish a gardening model for the optimization of the capture and sequestration of CO2 in the Green System of the Port of Algeciras Bay.

3.1.4.1 *Establishment of a Gardening Model for the Optimization of the Capture and Sequestration of CO_2 in the Green System of the Port of Algeciras Bay*

	Section	Indication of the Content
1	Title of the practice	**ESTABLISHMENT OF A GARDENING MODEL FOR THE OPTIMIZATION OF THE CAPTURE OF CO_2 IN THE GREEN SYSTEM OF THE PORT OF ALGECIRAS BAY**
2	Precise theme/issue tackled by the practice	Incorporation of green areas such as CO_2 sinks
3	Objectives of the practice	Optimization of green areas such as CO2 sinks
4	Location	Port of Algeciras Bay
5	Detailed description of the practice	The implementation of this good practice requires the completion of a preliminary study, currently under development, comprising the following stages: 1. Analysis and evaluation of the current situation of the Green System of the Port of Algeciras. During this first phase determines the current situation of the Green System, with identification of trees and scrub, and their quantification. 2. Study of the possibilities of transformation and improvement of the Green System consolidated. From the data obtained in the previous phase, it will be established the possibilities for transformation and improvement of the Green System, developing a first (and general) landscape model. 3. Study of new areas that may be included in the green system. From computerized maps and samples of the different areas that could be part of the Green System of the Port of Algeciras Bay, a first general model of landscape potential, indicating potential species, will be presented. In this model, the alternatives for the different planting areas that are functionally capable of supporting alternatives of implementation of vegetation will be considered. They will also refer to the different structural elements: alignments, roundabouts, geometric formations, irregular formations, hedges. 4. Quantification the CO2 sequestration capacity of the Green System in its current state. Once known species of trees and shrubs of the current Green System displayed on a significant amount to the establishment of calculating carbon, will be measured the current capacity of CO2 sequestration. Also, the total amount of CO2

		sequestered in the biomass of green system and water usage per specie invested in the carbon uptake will be calculated. 5. Quantification of the CO2 sequestration capacity of the green system to develop in new zones and in consolidated zones. Once established a catalogue of potential species to be introduced in the new areas or in the consolidated areas, will be measured its CO2 sequestration capacity, and will be calculated the scheduled sink capacity for the presented model. It will also determine the total amount of CO2 potentially sequestered in their biomass in relation to the evolution of the proposed model of Green System, as well as water consumption per specie invested in capturing the carbon. It will also assess the role of lung (oxygen emission) of the proposed Green System, compared with the currently existing. 6. General model of gardening of the consolidated areas and new areas. It will propose a general model of gardening based on computerized maps. It will display a comparative approach, in qualitative terms, of the generated quality differential, in relation to the microclimate, with the proposed model. 7. General model of CO2 sequestration in the final proposal. It will show the carbon sequestration capacity of the proposed model, total and by area, together with the expenditure of water. It will also show a quantified approach of the model of gardening, presented as "lungs of oxygen". In summary, this preliminary study includes an inventory of species and landscaped areas, the analysis of the possibilities to improve these areas as well as those which are eligible for new vegetation, the determination -both quantitatively and qualitatively- of the species of trees and shrubs to plant, and the calculation of CO2 capture capacity, the oxygen emission capacity of the current and projected plantings, and its evolution over time. Ultimately, determining which species are most effective, exceeding the role of "landscape", to add now the CO2 sink function as his role of green lung.
6	Evaluation	The evaluation of this action will be obtained from the conclusions drawn from the preliminary study, currently under development.
7	Lessons learnt from the practice	The Research Group of Ecology, Cytogenetics and Natural Resources, of the Department of Vegetal Biology and Ecology (Faculty of Biology, University of Seville) is responsible for carrying out the preliminary study, a field in which the Group stands out for its experience in study-pioneer- of the capacity of the vegetal species to absorb CO2. The Research Group is led by Manuel Enrique Figueroa, Professor of Ecology at the University of Seville and Director of the Office of

		Sustainability of the Andalusian University.
8	Contact information	The CO2 sequestration capacity of different species to be studied is measured by a Waltz Infrared Gas Analyzer (IRGA), open system. The total amount of CO2 sequestered in the biomass of different species to be studied is determined by the establishment of biometric models.
9	Other possible interesting information	

3.2 Port of Koper – Luka Koper

3.2.1 Production of Electricity Using Solar Energy-Photovoltaic Plant

	Section	Indication of the Content
1	Title of the practice	**PRODUCTION OF ELECTRICITY USING SOLAR ENERGY-FOTOVOLTAIC PLANT**
2	Precise theme/issue tackled by the practice	- Renewable energy in ports - Reduction of CO2 emissions
3	Objectives of the practice	- production of renewable energy using solar power - sustainable development of the port - energy self-sufficiency - producing 2 MWp
4	Location	- Luka Koper, Slovenia
5	Detailed description of the practice	- Origin: Luka Koper - Timescale: permanent, 30 years, ongoing process - Bodies involved/implementation: Luka Koper - Process and detailed content of the practice: all the documentation is produced, the exact location in the port is selected, panels have been ordered; planned layout in 2010 - Legal framework: national directive 2006/32/EC on energy end-use efficiency and energy services, Kyoto protocol, national directive 2009/28/EC on the promotion of the use of energy from renewable sources. - Financial framework: Regulation for the support of electricity produced from renewable energy sources, Slovenian Gazette n. 37/09)
6	Evaluation	Possible demonstrated results (e.g. through indicators): -production of 2MWp green energy using solar power; - reduction of 1.100 tons of CO2 equivalents, or 2.3 % less emissions of CO2 in Port of Koper Possible success factors: -sustainable strategy of Luka Koper -implemented environmental policy aimed for reducing GHG emissions - the goal to become energy self sufficient port

		- the problem of port large electricity consumption Difficulties encountered: - the need for additional strengthening of facilities/ roofs(extra costs) -the need for extra wiring (extra costs) -still a high price of panels according to the guaranteed purchase price of produced electricity Investment/ Economic return: -investment of 5 M€ -ROI is 16 years Estimation CO2 emissions reduction: - for 2 MWp solar power plant means the reduction of 1300 t CO2/year
7	Lessons learnt from the practice	We will be able to evaluate only when the system (solar power plant) will be placed and will be operational. Some problems can still occur.
8	Contact information	Luka Koper
9	Other possible interesting information	http://www.zivetispristaniscem.si/index.php?page=static&item=17

3.2.2 Energy Efficient Outdoor Lightning System

	Section	Indication of the content
1	Title of the practice	**ENERGY EFFICIENT OUTDOOR LIGHTING SYSTEM**
2	Precise theme/issue tackled by the practice	- Energy efficiency and savings of CO_2 - Lowering light pollution
3	Objectives of the practice	Artificial lights at ports, sometmes burning 24 hours a day, can have negative effects on wildlife, including disorientation, confusion of biological rhythms that are adapted to a day/night alternation, and a general degradation of habitat quality and on the other hand upward light radiation means more consumption of energy in ports. Objectives: - Lowering light pollution of the port (adaptation of lighting - the proportion of luminous flux, radiated upward, is equal to 0%; appropriate range of wavelengths of emitted light). - reduction of energy consumption (replacement of existing bulbs with energy-saving - using High Pressure Sodium lamps, using motion sensors at specific areas of the port-garages).
4	Location	Port of Koper (all terminals)
5	Detailed description of the practice	- Origin: Luka Koper has this action conceived and has a 2 year plan for the full implementation. - Timescale: it is a 3 year project (till 2012) for the full implementation of the system. - Bodies involved/implementation: Luka Koper - Process and detailed content of the practice: the first stage of the project a detailed inventory of lighting in the whole port was performed and a detailed plan of required intervention was established. The project is divided is segments – port areas, where the lightening has to be in adjusted. Already 60 % of the port lighting system is adjusted. - Legal framework: Decree on limit values due to light pollution of environment (Slovenian gazette, n. 81/2007, 109/2007). - Financial framework: none.
6	Evaluation	- Possible demonstrated results (e.g. through indicators: efficiency of 100 lm/W, lifetimes (16.000–24.000 - Possible success factors: legislative requirement, interest in the local community (complaint) for lowering the ports light pollution. - Difficulties encountered: during the project also in some cases

		the changing the pillars, the additional installation of lighting shields, replacement of reflectors is re - Investment/ Economic return if exists: 15 % of the reduction of consumed electricity for lightening (reduction of 3,3 MWh/year). - Estimation CO2 emissions reduction: 1800 t of CO2/year.
7	Lessons learnt from the practice	We received great approval from local communities and societies.
8	Contact information	Luka Koper
9	Other possible interesting information	-

3.2.3 Port Waste Management Center

	Section	Indication of the content
1	Title of the practice	**PORT WASTE MANAGEMENT CENTRE**
2	Precise theme/issue tackled by the practice	Waste reduction
3	Objectives of the practice	The recycling circle in Port of Koper begins with collecting and processing secondary materials in the port waste management centre, which then become ingredients in recycled-content products. When consumers choose recycled products, they create a loop that ensures the overall success and value of recycling. The Port of Koper is a multipurpose port featuring the requisite equipment and certification for the handling and storage of all types of cargo. A variety of waste materials are produced as a consequence of its operations and these are sorted and collected separately for recycling and processing in the **Port waste management centre.** Pursuant to the terms of its environmental permit, the Waste Management Centre encompasses also a facility for processing bio-degradable waste - such as waste timber, fruit and soya cargo remnants - into compost. *Luka Koper* also provides bio-degradable waste processing services for other enterprises and organisations in the region. One of the largest of these is *Komunala Koper* (the local provider of municipal

		services) for which the facility shreds and composts vegetative cuttings. Each year the port has to deal with 4000 tonnes of waste material.
4	Location	Port of Koper- Port waste management centre 
5	Detailed description of the practice	- Origin: Luka Koper - Timescale: it is a permanent facility, established in 1998. - Bodies involved/implementation: Luka Koper, **Ministry of the Environment and Spatial Planning** (licensing). - Process and detailed content of the practice: the centre has around 12.000 m2 of operational area, of this 1.200 m2 is intended for the separate collection of wastes, and 3.500 m2 is intended for processing bio-degradable waste - such as waste timber, fruit and soya cargo remnants - into compost which is further used in agriculture. The centre will be in 2010 upgraded with a modern center for the separate collection of hazardous wastes. In the centre each year 2500-3000 tonnes of waste material are sorted. - Legal framework: Rules on the management of waste (Slovenian gazette, n. 34/08). - Financial framework: none.
6	Evaluation	- Possible demonstrated results (e.g. through indicators: Port of Koper manages to collect separately 85 % of port waste material (that is 2900 tonnes/year). - Possible success factors: the improvement of cleanliness and enhance the general countenance of the port area, the reduction of the mixed municipal waste and disposal to land fields, more recycled material, sale of produced compost. - Difficulties encountered: none. - Investment/ Economic return if exists: each year about 1500 tonnes less material is landfill that means the 65.000 € is saved. - Estimation CO2 emissions reduction: 10 % (500 t/year)

7	Lessons learnt from the practice	Some waste material could be further reused as bio fuel.
8	Contact information	Luka Koper
9	Other possible interesting information	-

3.2.4 Economy Software for Optimised Fuel Consumption for Harbour Mobile Cranes

	Section	Indication of the content
1	Title of the practice	**ECONOMY SOFTWARE FOR OPTIMISED FUEL CONSUMPTION FOR HARBOUR MOBILE CRANES**
2	Precise theme/issue tackled by the practice	- Energy efficiency and savings
3	Objectives of the practice	- Reduction of fuel consumption - Reduction of operational costs for port cranes
4	Location	- Luka Koper-Terminal for general cargo
5	Detailed description of the practice	- Origin: Liebherr-Werk Nenzing GmbH - Timescale: permanent application, from 2007 - Bodies involved/implementation: Luka Koper - Process and detailed content of the practice: the strategy of the port is to purchase energy efficient mechanization. The integrated software enables reduced fuel consumption. All new purchased cranes have integrated software.
6	Evaluation	- Possible demonstrated results (e.g. through indicators: due to a special software adaptation the overall fuel consumption is being remarkably reduced (on average by approx. 20%) which has a direct positive impact on the crane's operation costs. - Possible success factors: the main driving force for energy saving activities are sustainable development of the port, reduction of operational costs and thus increased competitiveness of the port. - Estimation CO2 emissions reduction: 90 t CO2 per year per crane.
7	Lessons learnt	- Our strategy is to buy energy efficient mechanization (equipment, engine replacement with equipment, engines meeting cleaner

	from the practice	standards).
8	Contact information	Luka Koper
9	Other possible interesting information	http://www.liebherr.com/lh/en/default_lh.asp

3.2.5 Using NH3 for Cooling System Instead of CFCs

	Section	Indication of the content
1	Title of the practice	**USING NH_3 FOR COOLING SYSTEM INSTEAD OF CFCs**
2	Precise theme/issue tackled by the practice	- energy efficiency and savings - reduction of carbon footprint of the company
3	Objectives of the practice	As a result of environmental problems related to global warming and depletion of the ozone layer caused by the use of synthetic refrigerants (CFC's, HCFC's and HFC's) experienced over the last decades, the return to the use of natural substances for refrigeration purposes, appears to be the best long-term alternative. Refrigeration systems for cooling applications at low temperatures at Fruit Terminal use a cascade refrigeration system with NH_3 as working fluid. On the other hand NH_3 can cause environmental and health problems (it is toxic, moderately flammable in concentration in the air from 15,5 to 28%), if accidental leakage happen.
4	Location	Luka Koper - Fruit Terminal
5	Detailed description of the practice	- Origin: Luka Koper-Fruit terminal - Timescale: ongoing - Bodies involved/implementation: Luka Koper - Process and detailed content of the practice: Advantages of ammonia: - Environmental: ODP Ozone Depletion Potential= 0, GWP (Global Warming Potential< 1; High values for energy efficiency; Excellent thermodynamic properties: high critical temperature 132oC, large latent heat, large vapour density, excellent for heat transfer.In vapour condition it is easier then the air; Easy detection (warning); Low price.

		- Legal framework: Regulation 842/2006/EC of the European Parliament and of the Council on certain fluorinated greenhouse gases - Financial framework: none
6	Evaluation	- Possible demonstrated results (e.g. through indicators: up to 20 % of energy efficiency improvement, no emissions of CFCs - Possible success factors: reducing the use of CFCs, lower cost in case of using HN3. - Difficulties encountered: many produced heat is still not recuperated and reused. - Investment/ Economic return if exists: not available - Estimation CO2 emissions reduction: 1000 t/year (calculated regarding better energy efficiency)
7	Lessons learnt from the practice	-
8	Contact information	Luka Koper
9	Other possible interesting information	-

3.2.6 Vessel Speed Reduction Entering in the Port

	Section	Indication of the content
1	Title of the practice	**VESSEL SPEED REDUCTION ENTERING IN THE PORT**
2	Precise theme/issue tackled by the practice	- Energy efficiency and savings - Maritime safety - Reduction of air emissions
3	Objectives of the practice	The speed reduction program asks that vessels entering or leaving the Bay of Koper to observe a maximum 1-2 knot speed limit in a zone that extends 2 nautical miles seaward. The Port proposed reducing the speed limit used by cruise and cargo vessels when travelling in Slovenian sea waters (20 nm) to maximum 12 knots for cargo ships and 15 knots for cruise ships. This action can significant improve air quality along coastline communities and help to reduce greenhouse gas emissions.

		Objectives: - the reduction of NOx, PM and GHGs, - a fuel economy benefit, - improvement of the safety.
4	Location	Bay of Koper
5	Detailed description of the practice	- Origin: Luka Koper - Timescale: Ongoing - Bodies involved/implementation: Luka Koper, Piloti Koper-Maritime pilotage, **Slovenian Maritime Administration.** - Process and detailed content of the practice: the speed reduction plan is already implemented in the Bay of Koper also due to marine safety. The future plan is to implement the voluntary speed reduction program for the Slovenian sea waters that means vessels entering or leaving Slovenian sea should observe a 12-15 knot speed limit in a zone that extends 20 nautical miles seaward. The goal of the program will be to have 100% of ships participation. - Legal framework: none - Financial framework: none
6	Evaluation	- Possible demonstrated results (e.g. through indicators: the power needed to move a ship varies with the cube of its speed. For example, for a ship with a 70,000 kilowatt (kW) main engine that powers the ship to 25 knots, reducing the ship's speed to 20 knots requires only 36,000 kW (about half); slowing further to 12 knots reduces the power demand even more to about 8,000 kW (just over a tenth). - Possible success factors: For main engines, the energy required for vessel propulsion varies with the vessel speed; the faster the speed, the greater the energy requirements to maintain that speed. Conversely, as speed is decreased, energy requirements are also significantly reduced. Since the energy required to operate a ship's main engine is directly related to emissions, actions that reduce energy consumption typically reduce emissions from these main engines. - Difficulties encountered: Options for implementation in Slovenian sea– Assure compliance through tariff reduction incentives, lease requirements for renewed lease agreements, or voluntary programs. Create a memorandum of understanding with shipping companies, ports and regulatory agencies. The first is that main engines are somewhat less efficient at slower speeds. It is important to note that this reduced efficiency is more than offset by the benefits of reduced energy consumption (and therefore associated emissions reduction) that result from slower transit speeds. The second is that reducing ship speed means that the ship takes longer to move from point A to point B, and

		therefore spends more time transiting. However, the emission reduction benefits resulting from decreased main engine energy consumption significantly outweigh the increased emissions from increased auxiliary engine operation at slower speeds. This reduction in main engine energy consumption provides for reduced emissions overall of NOx, particulate matter (PM), and sulfur oxides (SOx). In addition, reduction in fossil fuel consumption results in a reduction of greenhouse gas emissions. - Investment/ Economic return if exists: no investment needed: Technical Consideration – No operational changes are required of the engine. Technical considerations may include updating existing radars and communication devices to communicate with local navigation and communication centers. Vessel speed at which emissions are lowest is based on limited data and likely to vary with engine. - Estimation CO2 emissions reduction: 10 % reduction of CO2 produced by ship.
7	Lessons learnt from the practice	Voluntary programs such as vessel speed reduction program require a lot of effort, time, and energy for the implementation.
8	Contact information	Luka Koper
9	Other possible interesting information	

3.2.7 Clean Fuel Usage for Port Mechanisation

	Section	Indication of the content
1	Title of the practice	**CLEAN FUELS USAGE FOR PORT MECHANISATION**
2	Precise theme/issue tackled by the practice	- Reduction of air pollution - Lowering the port carbon footprint
3	Objectives of the practice	Implement the use of cleaner fuels for port mechanization. Cleaner fuels include; low sulfur diesel fuel (max. 10 ppm of S), oxygenated fuel, and biodiesel (max. 7 % of bio-components).
4	Location	- Luka Koper
5	Detailed description of the	- Origin: low sulfur diesel fuel (max. 10 ppm of S) is used in the port

	practice	according to the Slovenian regulation. - Timescale: ongoing, from 1.1.2009 - Bodies involved/implementation: Government of Slovenia, Port of Koper - Process and detailed content of the practice: the port is using low sulfur diesel fuel (max. 10 ppm of S) for its mechanization. - Legal framework: Decree on the physical and chemical properties of liquid fuels (Slovenian Gazette, n. 63/06, 92/06), DIRECTIVE 2005/33/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 6 July 2005 amending Directive 1999/32/EC as regards the sulphur content of marine fuels - Financial framework: none
6	Evaluation	- Possible demonstrated results (e.g. through indicators: Positive emission reduction benefits for NOx, PM and GHGs. The use of biodiesel may present a slight increase in NOx. - Possible success factors: the use of low S content was implemented as it was the national regulation for the quality of diesel fuel. - Difficulties encountered: Cleaner fuels tend to be more costly. - Investment/ Economic return if exists: 10 % higher costs for fuel - Estimation CO2 emissions reduction: no CO2 reduction is related to low S fuel
7	Lessons learnt from the practice	Slow harmonisation of the regulation in the field of marine fuels.
8	Contact information	
9	Other possible interesting information	

3.2.8 Active Front End Technology (AFE) for Port Cranes

	Section	Indication of the content
1	Title of the practice	**ACTIVE FRONT END TECNOLOGY (AFE) FOR PORT CRANES**
2	Precise theme/issue tackled by the practice	- Energy efficiency and savings

3	Objectives of the practice	A.F.E OpenDrive is a pulsed rectifier-regenerative feedback unit comprising an inverter with IGBT modules, admirably suited for regenerating the power back into the line in the form of sinusoidal current. Thanks to an intelligent conversion system based on IGBT technology, A.F.E OpenDrive guarantees extremely low harmonics: the power drawn from the line supply or fed back into the line supply is in the form of sinusoidal current. Advantages in comparison to conventional braking systems: • Energy saving, • DC link voltage control that allows to parameterize the drives connected to the same DC bus in the best way, by compensating possible line voltage fluctuations, • Sinusoidal line current (low harmonics) Compact sizes and low heat release Inductive and capacitive load compensation, • increase system efficiency, • minimize maintenance cost, • maximize production rate, • maximize reliability.
4	Location	Luka Koper-port cranes
5	Detailed description of the practice	- Origin: the action was implemented by the producer of cranes (Konecranes, Liebherr) - Timescale: ongoing (implementation where possible) - Bodies involved/implementation: Luka Koper - Process and detailed content of the practice: the drive system stores energy generated during load-lowering and braking, then releases it during hoisting or accelerating. The efficient design allows most of the energy stored during lowering to be available for use. - Legal framework: none - Financial framework: none
6	Evaluation	- Possible demonstrated results (e.g. through indicators: the effect of AFE system is difficult to measure, we assume 10 % of energy saved per crane. - Possible success factors: port is a very energy consuming body, so its strategy is to save energy where the possibility exists. - Difficulties encountered: difficult to measure energy saving. - Investment/ Economic return if exists: the costs for a AFE system is about 60.000 € per crane. - Estimation CO2 emissions reduction: 5 % (650 t/year)
7	Lessons learnt from the practice	

8	Contact information	Luka Koper
9	Other possible interesting information	

3.2.9 On-Shore Power Supply (OPS) for Tug Boats

	Section	Indication of the content
1	Title of the practice	**ONSHORE POWER SUPPLY (OPS) FOR TUG BOATS**
2	Precise theme/issue tackled by the practice	- Reduction of CO2 emission - Reduction of noice near the residential
3	Objectives of the practice	Onshore power supply offers the possibility of tug boats to plug in and thus reducing fuel consumption and carbon dioxide emissions. Onshore power supply (OPS) provides a source of electrical power as an alternative to the ship's service electrical power system. This can lessen engine emissions in the port area since the ship no longer has main or auxiliary engines operating.
4	Location	Luka Koper- Onshore power supply (OPS) for tug boats 
5	Detailed description of the practice	- Origin: Luka Koper - Timescale: ongoing (implementation where possible) - Bodies involved/implementation: Luka Koper - Process and detailed content of the practice: Towards a thematic

		strategy for air quality, re-examined the contribution of shipping to the concentration of air pollutants in ambient air and found it to be significant, particularly in port areas. In some port areas, the attainment of air quality standards may be jeopardised by ship emissions. Most ship pollutant emissions at berth can only be reduced through engine and after-treatment measures or through the use of shore-side electricity. The installation of shore-side electricity for use by ships at berth in ports; particularly in ports where air quality limit values are exceeded or where public concern is expressed about high levels of noise nuisance, and especially in berths situated near residential areas. Shore-side electricity is a tool that can be used to achieve local air quality improvements. The benefits from its use vary greatly depending on a range of factors. - Legal framework: COMMISSION RECOMMENDATION of 8 May 2006 - on the promotion of shore-side electricity for use by ships at berth in Community ports - Financial framework: none
6	Evaluation	- Possible demonstrated results (e.g. through indicators: OPS is one among other measures to cut emissions from ships - Possible success factors: The main driving force for implementing the OPS for tug boats is the close vicinity of mooring to the residential area. - Difficulties encountered: ***Cost.*** The cost of infrastructure, including electrical equipment such as transformers, switchgear, power cables, cable handling equipment, and associated support structures on the piers, is significant. Obviously, as the distance from the shore utility to the ships on the piers increases, the cost multiplies. Similarly, the cost increases as the number of onshore power supply locations increases. ***Compatibility.*** The ship and shore frequencies must match within limits for OPS to even be considered. It generally requires a frequency converter for a 50-Hertz supply (shore) to work with 60-Hertz loads (ship), or vice versa. Frequency converters at the power levels required are an expensive addition to an already significant infrastructure. ***Safety and quality of power.*** Standards must be agreed upon between ship operators and shore personnel as to safety procedures at a particular installation. Additionally, the minimum quality of electrical power required needs to be defined by the ship, such that safe disconnection of shore

		power can be initiated if the power quality deteriorates to a level where ship equipment may be damaged. ***Standardization.*** Efforts to formally develop an international standard for OPS installations have been underway within the International Organization for Standardization since 2006 -Investment/ Economic return if exists: In economic terms, shore-side electricity should generate savings compared to low sulphur fuel for new-build ships regularly visiting the same ports, especially, but not only, if electricity tax reductions are offered as allowed under Directive 2003/96/EC. The cost of supplying high voltage electricity to the port and then to the berth can differ significantly from one port to another. This is mainly because of variations in the distance to the nearest high voltage supply, and more importantly, the number of transformer stations/connections that require upgrading. Other costs that differ include the need of additional overhead electricity lines, poles and cables underground. In addition, the cost of retrofitting cables into a terminal is usually significantly higher than installing cables in a new build terminal. -Estimation CO_2 emissions reduction: Switching to shore-side electricity will also result in other benefits: the reduction of carbon dioxide (CO_2) emissions by over 50 %, carbon monoxide (CO) emissions by about 99 %, and nitrous oxide emissions (N_20) by over 50 %. It will eliminate vibrations and noise from auxiliary engines, which has been measured at 90-120 dB in close proximity and improve maintenance conditions for the ships' engineers.
7	Lessons learnt from the practice	The benefits and costs of shore-side electricity vary significantly depending on the existing configuration and location of the port, berth and ship. This means that its cost-effectiveness needs to be studied on a case-by-case basis, and that direct reduction of marine engine emissions should continue to be pursued. In environmental terms, shore-side electricity achieves emission reductions well beyond those achieved from switching to 0,1 % sulphur fuel at berth (as Directive 2005/33/EC requires from 2010), particularly for NOx and PM. It therefore merits particular consideration in ports where ship NOx and PM emissions are contributing to local air quality problems, such as exceedances of ambient air quality limit values for ozone and particles.

8	Contact information	Luka Koper
9	Other possible interesting information	

3.2.10 Movement of Employees with Bikes and Organized Port Bus

	Section	Indication of the content
1	Title of the practice	**MOVEMENT OF EMPLOYES WITH BIKES AND WITH ORGANIZED PORT BUS**
2	Precise theme/issue tackled by the practice	- Energy efficiency and savings.
3	Objectives of the practice	The program started in order to reduce emissions to the air, encouraging employees to move (biking), to increase the security when moving in the port (organized bus services, covered bike path), restriction of traffic within the port.
4	Location	Luka Koper
5	Detailed description of the practice	- Timescale: ongoing - Bodies involved/implementation: Luka Koper - Process and detailed content of the practice: the port of Koper has organized and implemented an energy saving system for employees entering each day in port; that is bus transportation or bikes. Each day about 1000 employees enter the port. Port has about 100 bikes. - Legal framework: none - Financial framework: none
6	Evaluation	- Possible demonstrated results (e.g. through indicators): each employee thus save fuel (20 l/month/employee) - Possible success factors: the main driving force to implement this system was the better organization of transport system in the port and to improve safety in the port. - Investment/ Economic return if exists: the total investment for the port was estimated to 80.000 €. Each month about 15.000 l less fuel is consumed. CO2 emissions reduction: 600 tonnes/year
7	Lessons learnt from the practice	-
8	Contact information	Luka Koper
9	Other possible interesting information	-

3.3 Port Authority of Livorno

3.3.1 Port Community Involvement

	Section	Indication of the content
1	Title of the practice	**PORT COMMUNITY INVOLVEMENT**
2	Precise theme/issue tackled by the practice	• Energy efficiency and savings. • Renewable energy in ports. • Waste reduction.
3	Objectives of the practice	Port community's environmental awareness improvement.
4	Location	Italy, Tuscany, Port of Livorno
5	Detailed description of the practice	Most part of the port services are provided in Livorno by private enterprises and relevant is the number of port tenants within the port. Therefore, the port environment is strictly related to the environmental care of each port actor. According to one of the most important aim of an environmental management system, along a ten-year period the port of Livorno has been interacting with the whole port community in order to improve the environmental awareness and promote environmental friendly actions. The relationships with the port community are carried out with regular informative booklets issues about the "state of environment in port", the dissemination of the Port Authority's environmental declaration complying with EMAS regulation. In order to make the whole thing dynamic and interacting, meetings between representatives of Port Authority and the port tenants are performed on regular basis. The fulfilment of this tasks is a commitment of the Port Authority structured in the environmental management system by a specific procedure regarding "dissemination and improvement of environmental consciousness". Another relevant action Livorno Port Authority id carrying out is the "Green Port Esteso", a policy framework and a plan of activities to develop where the port tenants and other port actors have an important role.
6	Evaluation	Possible demonstrate results - The effectiveness of the actions described in point 5 are now monitored by the number of port activities with a ISO 14001 or EMAS compliant management system.

		Possible success factors – A clear goal sharing between PA and port tenants is a primary success factor. A real and pragmatic involvement of port tenants in the environmental port issues is another success reason as the search for funding the actions shared. A further factor of success is the Port Authority ability of synchronize the environmental need of the port with the business goals of the port tenants. Investments - In order to make real this commitment, The Port Authority reserve 5.000 € every year to develop end/or update booklets and 90 hours of their own personnel for meetings and management of the action. Difficulties encountered – The most difficult issue to face is to really involve and made the port tenants aware of the environmental issues of the area.
7	Lessons learnt from the practice	No real environmental management can be achieved in port without the port tenants' active support.
8	Contact information	Port of Livorno, Security-Safety and environmental monitoring Department.
9	Other possible interesting information	Booklets and environmental declaration can be provided on request by Livorno Port Authority. "Green Port Esteso" documentation.

3.3.2 Green Public Procurement

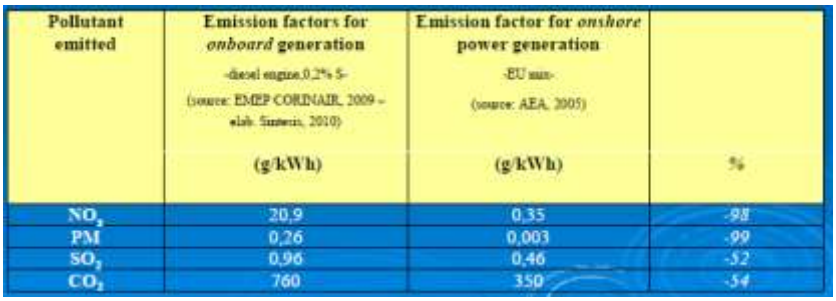
	Section	Indication of the content
1	Title of the practice	**ECO PUBLIC PROCUREMENT**
2	Precise theme/issue tackled by the practice	Energy efficiency and savings.
3	Objectives of the practice	Energy efficiency and air quality improvement
4	Location	Italy, Tuscany, Port of Livorno
5	Detailed description of the practice	The Livorno Port Authority personnel carry out a daily monitoring of the whole port area. Their mobility is assured by common cars and vans. In order to renewal and make modern and more efficient the vehicle fleet, the Port Authority put in place a new vehicle purchase plan. In order to comply with the PA policy and the Italian regulation regarding the "green" public procurement, the Authority purchased 3 new EURO 5 cars with hybrid feed (gasoline-LPG). A new purchase of 3 cars is expected within 2010.
6	Evaluation	Possible demonstrate results – The use of hybrid vehicles has a positive impact upon the quality of the exhaust gas emitted by vehicles. As a result of the use of LPG fuel the following pollutant abatement are expected: CO +26%, NOx –68%, VOC –19%, PM -99%, CO2 -11% Investment – The typology of vehicles used by LPA personnel for monitoring the port require an investment equal to about 10 k€ per vehicle purchased. In Italy there are incentives for the purchasing of hybrid vehicles equal to about 700 € per vehicle.
7	Lessons learnt from the practice	Public procurement should be "green" in order to actively contribute to relief the environmental impacts and give pragmatic examples to community.
8	Contact information	Security-Safety and environmental monitoring Dep.
9	Other possible interesting information	NIL

3.3.3 Energy Production by Renewable Sources

	Section	Indication of the content
1	Title of the practice	**ENERGY PRODUCTION BY RENEWABLE PRODUCTION IN PORT**
2	Precise theme/issue tackled by the practice	• Energy efficiency and savings. • Renewable energy in ports.
3	Objectives of the practice	Energy efficiency and air quality improvement
4	Location	Italy, Tuscany, Port of Livorno
5	Detailed description of the practice	Two port tenants are designing and ready to build up two power plants by the use of vegetal oils. The overall power production is near to 100 MW. This plants will provide the power to the national electric grid. The combustion of vegetal oils is carried out by endothermic engines performing a co-generation (electric energy and heat) The reference Italian legislative framework requires this plant to be entitled by a public body (Province administration) after an environmental assessment. Both plants have been already entitled and the building start up is expected soon.
6	Evaluation	Two port tenants are designing and ready to build up two power plants by the use of vegetal oils. The overall power production is near to 100 MW. This plants will provide the power to the national electric grid. The combustion of vegetal oils is carried out by endothermic engines performing a co-generation (electric energy and heat) The reference Italian legislative framework requires this plant to be entitled by a public body (Province administration) after an environmental assessment. Both plants have been already entitled and the building start up is expected soon.
7	Lessons learnt from the practice	The use of the port area for the energy production by renewable sources.
8	Contact information	Port of Livorno, Security-Safety and environmental monitoring Department.
9	Other possible interesting	NIL

	information	

3.3.4 On Shore Power Supply to Ships

	Section	Indication of the content
1	Title of the practice	**ON SHORE POWER SUPPLY TO SHIPS**
2	Precise theme/issue tackled by the practice	• Energy efficiency and savings. • Renewable energy in ports.
3	Objectives of the practice	Energy efficiency and air quality improvement.
4	Location	Italy, Tuscany, Port of Livorno
5	Detailed description of the practice	The energy audit carried out by Livorno Port Authority shows how the most important energy user in post are the berthed ships. In fact, the total amount of energy required by the ships is about 78% of the total port energy need. The energy required by passenger ships for their support when berthed is about the 22% of the total energy required by all ships in port. The energetic weight of the passenger ships (cruise and ferries) is enough to be taken into account for a mitigation measure like onshore power supply (OPS). The main advantage coming from the use of OPS is provide support energy to a ship with less polluting energy compared with the one produced on board. The Livorno Port Authority is designing a first OPS system able to provide energy up to two ships at the same time with a max power used equal to 6 MW. The energy will be provided by the national grid. If will not be used renewable energy (in this case low or no pollution will be produced for the energy provided) but it will be furnished by the energy national mix, the pollution abatement expected is the following:  Along the air pollution mitigation, the OPS plant will provide a significant noise abatement, particularly in the night time. At the moment, OPS plant have not any reference in the Italian legislation. This project will be partly funded by the Italian Ministry of Environment.
6	Evaluation	Possible demonstrate results – The use of the plant should provide a local better air quality and a significant noise abatement. A specific monitoring plan for air quality and noise will be part of the plant

		project. Possible success factor & Difficulties – One of the main reasons hampering the diffusion of OPS plants is the need for ship to be refitted to link onboard electric panels to the OPS plant. For this reason, the Livorno Port Authority is promoting a specific agreement with some shipping company in order to arrange with them the best solution for the two parts. Investment – The designed plant have an estimated cost equal to about 5 M€.
7	Lessons learnt from the practice	No real environmental management can be achieved in port without the port tenants' and shipping company active support.
8	Contact information	Port of Livorno, Security-Safety and environmental monitoring Department.
9	Other possible interesting information	Design of an Onshore Power Supply to ships in Livorno Port – Preliminary report.

3.3.5 Environmental R&D in Port

	Section	Indication of the content
1	Title of the practice	**ENVIRONMENTAL R&D IN PORT**
2	Precise theme/issue tackled by the practice	• Energy efficiency and savings. • Renewable energy in ports. Waste reduction.
3	Objectives of the practice	Collecting, developing and elaboration of data in order to provide studies for a more better environmental care in the port area
4	Location	Italy, Tuscany, Port of Livorno
5	Detailed description of the practice	The port is a complex environment where all the environmental matrices can be found and their protection often has deeply social implications. For this reason port planning, mitigation measures development can't be effective without the complete knowledge of the cause-effect mechanism for the various phenomena involved in the port area. This know how ca be achieved and improved only with specific studies. For this reason, the Livorno Port Authority since ten years ago has invested in R&D project (e.g. BOFOPoli, EMASPoli, NoMePorts, Simpyc, CLimeports and more) mainly funded by UE developing by them a even more clear environmental framework of the port area and about the complex relationship between port and city.
6	Evaluation	Possible demonstrate results – The results of this project are used in time to correctly plan port activities. In most cases, these results can be useful even for port tenants environmental issues. Possible success factor & Difficulties – The studies with success have been the ones carried out in order to investigate and solve a specific need. Investment – In most cases, the R&D project can be funded with a contribution of PA limited to the sole hours of the personnel involved.
7	Lessons learnt from the practice	The best effectiveness and efficiency of the environmental response that a Port Authority is hardly affected by the degree of knowledge of the phenomenon involved.
8	Contact information	Security-Safety and environmental monitoring Department.
9	Other possible	Documentation about the project in which the Livorno Port Authority was and is involved.

	interesting information	

3.4 Port Authority of Marseille

3.4.1 Recycling of Hydrocarbon Residues

	Section	Indication of the content
1	Title of the practice	**RECYCLING OF HYDROCARBON RESIDUES**
2	Precise theme/issue tackled by the practice	Waste Reduction
3	Objectives of the practice	Get back the hydrocarbon fraction of the waters of oil dumping of tankers to recover it in fuel
4	Location	France / Provence Alpes Côte d'Azur / Port of Marseille / crude oil terminal
5	Detailed description of the practice	Origin : This action was conceived by the Port Authority and R.T.D.H. company - Timescale : The project is possible only if the volume of effluents (20 000 tons here) allows the recovering company to reach an economic balance. This balance determines the duration of the realization. - Bodies involved/implementation : + Port Authority + recovering company + truck farmer + industrial plant. - Process and detailed content of the practice : Technical and economic feasibility study, study of definition, assessment study, works of connecting quays to the process plant. - Legal framework MARPOL Convention 2000/59/CE Directive Building permit Assessment and dangers study. - Financial framework : 5 M€ for the plant of oil's segregation with a volume of 5 000 m3.

		About the same expenditure for distillation plant. The sale price is indexed to the price of noble fuels.
6	Evaluation	Possible demonstrated results (e.g. through indicators : + tonnage of recycled products, + surface of warmed greenhouse + energy provided - Possible success factors : accessibility, price purchase, effluent quality, maritime oil traffic. Difficulties encountered : Reduction of the volumes unloaded in ports because of the modernization of the fleet requiring external contributions by trucks - Investment/ Economic return if exists. - Estimation CO2 emissions reduction : no estimation has done
7	Lessons learnt from the practice	Magali DEVEZE – GPMM - Béatrice BERBIEC RTDH (13) Port Pétrolier de Fos Tour Vigie 13270 FOS SUR MER Tél. : 04 42 05 11 90
8	Contact information	
9	Other possible interesting information	

3.4.2 Building Integrated Photovoltaic

	Section	Indication of the content
1	Title of the practice	**BUILDING INTEGRATED PHOTOVOLTAIC**
2	Precise theme/issue tackled by the practice	Renewable energy in ports
3	Objectives of the practice	The objective is to create a self-sufficient area in production / consumption of electricity. Port areas consumes a lot of electricity (industrial area, gantry, ships repair installation), and providing electricity to develop ports activities is complex within urban area. The expected results are a reduction of energy dependence in the medium term, and decreased dependence related to the extension of high voltage grid.
4	Location	France / Provence Alpes Côte d'Azur / Port of Marseille / city of Marseille
5	Detailed description of the practice	Origin : This action was conceived and implemented by the Port Authority. - Timescale : several steps : + Selection of appropriated buildings (1 month), + Writing the tender's specification (3 months), + call for tenders and adjustment to choice operator (s) (5 months), + Negociation and contracting (2 months), + Administrative step (6 months) + Construction and connection (12 à 24 months-depends on the number of buildings and the number of operators), optimal duration about 29 to 41 months. - Bodies involved/implementation : 3 actors + Port Authority, the owner of involved buildings, leads the project. This project can be also introduced by a port's tenant, owner of buildings. + Operator who builds and operates the photovoltaic plant. It is either about important producing companies of electricity or about trade association (usually a financial institution, an electrical equipment manufacturer, a specialist in photovoltaic and construction company). Some candidates are financial developers who aim to finalize the best deal and resell it to a company specialized in building and operating photovoltaic plants.

		+ French government intervenes indirectly: French regulation guarantees a repurchase price of this energy to encourage this type of implantation. - Process and detailed content of the practice : These photovoltaic plants are realized on warehouses, on workshop and on harbor station. The potential of public and private buildings in the port area represents 800.00 square meters for 95 MWp installed. This project allows at the same time the renovation of industrial heritage buildings. - Legal framework + Planning permission : Request for preliminary work or construction permit + Connection Authorization + The French legal purchase rate and conditions (different rates exit if the plant is built on the ground or integrated in a building) are detailed in several decrees. - Financial framework : The applicable purchase price for the French building integrated power is 37 cents € / kWp since September 1st of 2010.
6	Evaluation	Possible demonstrated results (e.g. through indicators : + Installed capacity, + equipped surface + annual production + self sufficiency rate - Possible success factors: they are emerging technologies in a French regulatory context relatively unstable. This requires responsiveness and ability to handle fast. Difficulties encountered : A lot of countries (France, Germany, Spain...) have chosen to help development of solar power plants. However the instability of context in the short term (regulatory changes each year last 3 years) on projects complicates achievements. - Investment/ Economic return if exists. The amounts invested depend on the technology used. Currently, this type of project is scheduled on 20-year business plan for returns of 15%. The lifetime of power plants with technology polycrystalline modules is estimated in 30 years.

		- Estimation CO2 emissions reduction : Low in consideration with French energy policy
7	Lessons learnt from the practice	
8	Contact information	Michaël PARRA
9	Other possible interesting information	Website Various documents (reports, presentations)

3.4.3 Electric Consumption Monitoring

	Section	Indication of the content
1	Title of the practice	**ELECTRIC CONSUMPTION MONITORING**
2	Precise theme/issue tackled by the practice	Energy efficiency and saving
3	Objectives of the practice	Objectives are : - to know precisely electric consumptions by builds (Office, harbor station) - to establish a monitoring committee to analyze data - to determine solutions to reduce consumptions
4	Location	France / Provence Alpes Côte d'Azur / Port of Marseille / city of Marseille
5	Detailed description of the practice	Origin : This action was conceived and implemented by the Port Authority - Timescale : + Inventory of electric plugs (12 months) + installation of electric meter for all plugs (12 months) + electric meters read twice a year + Consumptions analysis from the 2nd year - Bodies involved/implementation: Marseilles Port Authority. - process and detailed content of the practice : timescale - Legal framework : no legal obligation - Financial framework : 1 500€ for each electric meter
6	Evaluation	Possible demonstrated results (e.g. through indicators : Tracking chart global, by builds - Possible success factors : a sustainable policy, implementation and monitoring by efficiency indicators - Difficulties encountered : no one - Investment/ Economic return if exists : 1 kWh costs 0.11 €.

		- Estimation CO2 emissions reduction :
7	Lessons learnt from the practice	
8	Contact information	Michaël PARRA
9	Other possible interesting information	Website Various documents (reports, presentations)

3.4.4 Promotion of the Setting-Up of Wind Farms

	Section	Indication of the content
1	Title of the practice	**PROMOTION OF THE SETTING-UP OF WIND FARMS**
2	Precise theme/issue tackled by the practice	Renewable energy in ports
3	Objectives of the practice	The port aimed to take advantage of weather conditions of the industrial area by facilating the setting-up of wind turbines
4	Location	France / Provence Alpes Côte d'Azur / Port of Marseille / industrial area of Fos
5	Detailed description of the practice	Origin : This action was conceived by the Port Authority - Timescale : four years. - Bodies involved/implementation : + Port Authority, property owner + investors + administrative departments + associations, local authorities. - Process and detailed content of the practice : Selection of the sites of setting-up which takes into account the master plan of development and environmental stakes, dialogue with associations not really in favour of wind turbines, call for projects including sustainable development criteria, selection of the offers, assessment studies, public inquiry, building permits, works, electrical connection. Today, 27 wind turbines were installed, which represents a power

		of 36 MW. - Legal framework + In France, development areas of the ground wind energy frames are imposed by the law. They are defined by the prefect and by a decree. The law plans several conditions (of power, zoning, of number of wind turbines by project, height of matt, estrangement of houses, etc.). The wind turbines which are installed there, benefit – on certain conditions - from a contract for the purchase of the electricity, and the right to be connected for the minimal deadline fixed by the law to the public network of distribution of the electricity. + The situation of the industrial area of Fos imposes the systematic realization of note of incidence on the Natura 2000 network. - Financial framework : The investment is about 1 M€ by MW installed.
6	Evaluation	Possible demonstrated results (e.g. through indicators : Installed capacity, number of wind turbines, annual production, electric power. - Possible success factors: price purchase, landscaped insertion, social acceptability, low impact on bird's population. Difficulties encountered : Aeronautical constraints, social acceptability, potential impacts on birds. - Investment/ Economic return if exists. The price purchase is calculated to pay off the investment at the end of ten years. Not determinant in consideration with French energy policy
7	Lessons learnt from the practice	
8	Contact information	Magali DEVEZE
9	Other possible interesting information	

3.4.5 On Shore Power Supply

	Section	Indication of the content
1	Title of the practice	**ON-SHORE POWER SUPPLY**
2	Precise theme/issue tackled by the practice	Energy efficiency
3	Objectives of the practice	The objective is to remove atmospheric emissions from vessels which stay at berth for a long period and reduce thus air pollution and greenhouse gas emissions generated by auxiliary engines of vessels.
4	Location	France / Provence Alpes Côte d'Azur / Port of Marseille / city of Marseille
5	Detailed description of the practice	Origin : This action was conceived and implemented by the Port Authority - Timescale : several steps : + Study of electrical network capacity (1 month), + check port's traffic in order to choose vessels which stay at berth for the longest time and regularly (1 month), + Pilot feasibility study (3 months), + Development of solutions with ship-owners (3 months), + Negotiation and contracting (3 months), + Construction (12 months). It's the same time for the port and for the ship owner in France because the port is a public institution which must comply with the rules of public procurement. - Bodies involved/implementation : 3 actors : + Port Authority: Pilot of the project. The Port Authority of Marseille owns the shore electrical network within the harbour area and is able to realize the first connection without the intervention of national electric network provider. + Ship owner: at the moment there is no standard to connect ship to shore network. Therefore, it's essential to have a close collaboration between the port and the ship owner. + National electric network provider: raising the capacity of electrical network takes a long time (5 years). In our case, it is necessary to consider the strengthening of the network in the prospect of connecting more than 3 vessels.

		- process and detailed content of the practice : Simple plug-in connection from the shore side with interlocking to prevent the plug-in connection to be opened during operation. Personal safety is assured by a safe interlocking system. Connection is automated, so that trained person can operate it safely. The mooring personal must be able to carry out the connection. Automatic start-up of the on-shore power supply released by the ship operators when the plug-in connection is ready. The ship operators keep the authority over the shore side power supply and control start, stop and synchronization. The connection between the on-board network and the on-shore power supply is realized with an industrial plug-in connection that is proven for many years in other industrial applications. The plug-in connection is a key function and should be generally standardized, in order to ensure the same preconditions for the onshore connection of the ships in all ports. The system is designed to allow the on-board personnel to take the necessary actions by themselves and without interruption of power supply when the load is taken over by the onshore connection. - Legal framework : + The European Commission recommends the promotion by Member States of the use of shoreside electricity by ships at berth. (Recommendation of May 8, 2006) + Directive 2005/33/EG : Low sulphur + Early Implementation of the Sulphur Emission Control Area (SECA) for the North Sea. Soon applied for Mediterranean sea? - Financial framework : In case of frequency's concordance between vessel and shore network (50hz) : + Budget for the ship owner is about 750k€ by vessel + Budget for the port is 1.5 M€ by berth If the frequency is different (60hz for the vessel and 50hz for the shore network), it's 1 M€ more for the port.
6	Evaluation	Possible demonstrated results (e.g. through indicators : + number of hours of use, + pollution avoided + CO2 prevented

		- Possible success factors : oil prices, will of ship owner, term contract, regular traffic, political will, legal obligation. Necessity of customized solutions in the lack of standardization • High cost of investment • No government incentives (like in Sweden) • Long payback • Difference of frequencies between the ashore grid and the ship's one • Equipment supply in high voltage (power between 0.5MW to 15MW for ferries) • Strict regulation in case of ship's modification • gap limited on board and on quays • Not universal measure - Investment/ Economic return if exists. Depends on many parameters : + frequency at berth + duration at berth + oil prices compared with electricity prices + grant - Estimation CO2 emissions reduction by year : + 100 tons nitrogen oxide, + 90 tons sulphur dioxide + 6 tons solid matter emissions
7	Lessons learnt from the practice	
8	Contact information	Michaël PARRA
9	Other possible interesting information	Website : OPS http://www.ops.wpci.nl/ Various documents (reports, presentations)

3.5 Port Autority of Piraeus

3.5.1 Reduction of Emissions from Diesel Equipment Engines

	Section	Indication of the content
1	Title of the practice	**REDUCTION OF EMISSIONS FROM DIESEL EQUIPMENT ENGINES**
2	Precise theme/issue tackled by the practice	This good practice provides savings in fuel consumption and emissions reductions in the sector of container stowage equipment
3	Objectives of the practice	About 50% reduction of fuel consumption and relative reduction of emissions.
4	Location	Port of Piraeus- Container terminal
5	Detailed description of the practice	In the new Container terminal (Pier I) about 49 diesel engine Straddle Carriers were replaced of 8 electric engine RMGs (Rail Mounted Gantry Cranes) in order to be applied the dense stowage model. The new system of dense container stowage is implemented since 01-06-2010 The new system is implemented 100% from Piraeus Port Authority
6	Evaluation	The reduction of fuel consumption is calculated as follows: According to the PPA's data the 60% of total diesel consumption in container terminal is corresponded to the straddle Carriers. Taking into consideration that in the new operational model of the container are used 49 less Straddle Carriers that is corresponding to a reduction of 83% According to the results of CO2eq emissions inventory study of PPA (C 3.1) the percentage of 95% of the direct total emissions from diesel engines is corresponding to the Container terminal activities. The percentage of the total CO2 eq emissions that is corresponding to the straddle carriers is calculated as follows: 95%*60%= 57% of the total CO2eq emissions in the container terminal related with the straddle carriers The estimated reduction of the total CO2eq emissions in the container terminal of the decreased usage of straddle carriers is

		calculated as follows: 83%*57%=47% less CO2eq emissions due to the use of the straddle carriers & 83%*60%=49,8% less fuel consumption in the container terminal activities
7	Lessons learnt from the practice	The replacement of diesel engine straddle carriers affects to the reduction of fuel consumption and to the CO2 emissions reduction.
8	Contact information	Piraeus Port Authority SA
9	Other possible interesting information	

3.5.2 Improvement of Buildings Energy Efficiency

	Section	Indication of the content
1	Title of the practice	**IMPROVEMENT OF BUILDINGS ENERGY EFFICIENCY**
2	Precise theme/issue tackled by the practice	This good practice is resulted partial capture of CO2 emissions, limitation of energy losses of the building and improvement of thermal isolation of the building.
3	Objectives of the practice	Reduction of energy consumption, both the electricity and stationary fuel consumption
4	Location	Port of Piraeus- Administration building of Container terminal
5	Detailed description of the practice	A green roof project was implemented in the roof of main administration building of Container terminal. A surface of 900 sqm was planted with ten different species of Greek fauna. Most of them are bushes that are more resistant to the weather conditions and are chosen in order to be limited the needs in irrigation, drainage and maintenance.  

		  The roof was planted in the June of 2010 and is implemented 100% from Piraeus Port Authority
6	Evaluation	Ten different species of plants, most of them bushes, representative of the Greek fauna, have been used in roof plantation such us: -Oregon -Mint -Lavender -Resemary -Thyme -Peppermint etc The works of construction of the insulated roof, took place in the following order: 1. Complete cleaning of the concrete slab. 2. Spread asphalt emulsion in two layers and a ratio 1.5 kg. per sq.m to create vapor barrier. 3. Laying cellular cement for casting purposes, weighing 350-400 kg per 330 kg m3. minimum cement thickness of 5 cm. 4. Smoothing cement coating of 450 kg. cement thickness of 2 cm. 5. Spread base with bituminous paint (primer). 6. Waterproof coating asphalt type with fiberglass mesh of 4 kg. per m2. 7. Thermal plates with free placement of closed-cell extruded polystyrene with serif type Fibran RF, 10 cm thick 8. Free sheet laying invasive non-woven geotextile felts filament polypropylene minimum weight of 90 g/m2, type Polyfelt. 9. Free floating with a diameter of 30-80 mm pebbles at an average thickness of 5 m. The support membrane on the barriers will be done with press bent aluminum sheet thickness 2 mm, fixed on the UPAT per 50 cm 10. Drainage Layer Below installation of laminated film drainage. The multilayer film drainage that is used, is suitable for green roofs. The film drainage consists of a polystyrene sheet (PS) with pineal projections thickness 11 mm, bilaterally and pasted with glue, two non-woven polypropylene geotextiles, the 125gr/m2 each. The pineal core is perforated so that, on one hand to pump the excess water of watering the garden, on the other hand to hold the cone in a significant amount of water required for the vegetable soil moisture, ensuring thus irrigation scheme and excellent function

		of the garden. 11. Confinement Layer Moisture Above the drainage membranes where extensive planting is proposed to fit the specific moisture retention layer, used as an additional water tanks, namely. These materials retain moisture during watering and store the mass gradually giving the garden. 12. Planting Substrate Then spread out the planting medium. The substrate consists of mixtures of inorganic and organic substances and has different qualities depending on the type of planting for the intended (extensive or semi-intensive). Details The green roof offers the following advantages for the building: - Thermal isolation - The thermal efficiency of the building is estimated that will be improved through the shading and the isolation. It is estimated that the internal temperature of the building will be decreased in a percentage up to 75% - Improvement of the internal microclimate of the building (temperature, humidity, flying solid particular matters etc) - Contribution to the noise up to 8 db according to the results of studies - Contribution to the rain water retention with relative reduction of the civil drainage network
7	Lessons learnt from the practice	Through the green roof project is achieved the enhancement of the plantation and in addition is achieved CO2 emissions & PM capture, the noise absorption, the microclimate improvement and the aesthetic view of the commercial port and of the building.
8	Contact information	Piraeus Port Authority SA
9	Other possible interesting information	

3.5.3 Limitation of Waste Disposal in Landfill

	Section	Indication of the content
1	Title of the practice	**LIMITATION OF WASTE DISPOSAL IN LANDFILL**
2	Precise theme/issue tackled by the practice	This good practice provides savings in fuel consumption and emissions reductions in the sector of container stowage equipment
3	Objectives of the practice	Limitation of indirect emissions: Limitation of GHG from landfill disposal\reduction of fuel consumption emissions from the waste transportation
4	Location	Port of Piraeus
5	Detailed description of the practice	Enhancement of waste recycle Implementation of a programme for the alternative management of the special waste stream generated from port activities Separate collection and treatment(recycle, re-use and evaluation) of : -paper -aluminium packages -Waste of electrical and electronic equipment -Electrical accumulators and batteries -waste of lubricants etc The system of the alternative treatment of recyclable waste is implemented since year 2009 This system is implemented from Piraeus Port Authority in collaboration with the authorised companies in the waste recycle sector
6	Evaluation	Through the implementation of the waste recycle we achieve: -Reduction of the landfill disposal waste - limitation of the waste transport to the landfills - reduction of GHG emissions from disposal -reduction of the CO2 emission from waste transport - Enhancement of the waste evaluation Reduction of waste amount:

		Estimation of 5,5 tn less waste for final disposal to the landfill Reduction of CO2 eq emissions Estimated reduction of 5,32 t CO2 eq emissions from waste disposal sector emanating from port activities
7	Lessons learnt from the practice	The enhancement of the waste recycle has as a result the limitation of GHG emissions from disposal in landfills and the CO2 eq emissions from the transport of waste
8	Contact information	Piraeus Port Authority SA in collaboration with authorised companies in waste 8 information recycle and evaluation sector
9	Other possible interesting information	

3.5.4 Enhancement of Microclimate

	Section	Indication of the content
1	Title of the practice	**ENHANCEMENT OF MICROCLIMATE**
2	Precise theme/issue tackled by the practice	Indirect emissions: Partial capture of CO2 emissions
3	Objectives of the practice	Increase capture and sequestration of CO2 emissions
4	Location	Passenger Central Port & Commercial Port & Container terminal
5	Detailed description of the practice	Increase of the existing plant covered with new species at the Central Passenger Port and at the Commercial Port A specific plantation study for the whole port area has been implemented in collaboration with the Agriculture University of Athens The framework of the study was: Increase of existed plant cover with new forestation Identification of the best plants and tree species in relation with the local environment Improvement of the microclimate: sequestration of CO2 emissions, noise absorption, PM capture Selection of the suitable areas for new forestation Enhancement of the existing fauna Proposals for best available solution for sufficient irrigation Improvement of the aesthetical aspect of the port area and of the nearby civil area The proposals of the study have been implementing partially (for passenger Port and in a part of Commercial Port) in the year 2010. This good practice is implemented 100% from Piraeus Port Authority 

ΔΙΑΜΟΡΦΩΣΗ ΠΥΛΗΣ Ε1

ΔΙΑΜΟΡΦΩΣΗ ΑΝΑΜΟΝΗΣ ΕΠΙΒΑΤΩΝ

ΔΙΑΜΟΡΦΩΣΗ ΠΑΡΤΕΡΙΟΥ Υ.Ε.Ν.

ΔΙΑΜΟΡΦΩΣΗ ΠΕΡΙΟΧΗΣ ΥΠΕΡΥΨΩΜΕΝΟΥ ΔΡΟΜΟΥ

ΔΙΑΜΟΡΦΩΣΗ ΠΑΡΤΕΡΙΟΥ ΤΕΛΩΝΕΙΟΥ

ΔΙΑΜΟΡΦΩΣΗ ΠΥΛΗΣ Ε2

		 ΔΙΑΜΟΡΦΩΣΗ ΤΟΙΧΩΝ SILO  ΔΙΑΜΟΡΦΩΣΗ ΕΠΙΒΑΤΙΚΟΥ ΣΤΑΘΜΟΥ ΕΞΩΤΕΡΙΚΟΥ  
6	Evaluation	In the commercial port near to the container terminal was planting a surface of 3.765 m2. Five different species of plants, representative of the Greek fauna, have been used: Nerium oleander (199 pieces), Spartum junceum (1.389 pieces), Myrtus communis (270 pieces) , Rosmarinus officinalis (3.333 pecies) & Lavandula angustifolia (2.782 pecies). The budget of the

		project is about 70.000 €. In the central passenger port planting works are in progress. Nine different species of trees, four different species of bushes and 3 different species of climbing plants have been planting. The following species of plants are used: Trees: Cu.s. Cupressus sempervirens v. Pyramidalis: 44 C.sl. Cercis siliquastrum: 24 C.s. Ceratonia siliqua: 5 P.c. Phoenix canariensis: 19 E.g. Eucalyptus globulus: 29 A.j. Albizia julbrissin 26 P.h Pinus halepensis 9 E.a Elaeagnus angustifolius 20 M.a. Morus alba 2 Bushes V.t. Viburnum tinus 85 R.o. Rosmarinus officiinallis 119 L.c. Lantana camara 282 N.o Nerium oleander 140 Climbing plants B Bougainvillea 98 H.h. Hedera helix ‘’Elegantissima’’ 49 P.q. Parthenocissus quinqefolia 45 The estimation of the budget is 110.000 €
7	Lessons learnt from the practice	The enhancement of the plantation in the port area will affected to: CO2 emissions & PM capture, the noise absorption, the microclimate improvement and the aesthetic view of the passenger port.

8	Contact information	Piraeus Port Authority SA
9	Other possible interesting information	

3.5.5 Use of Renewable Energy

	Section	Indication of the content
1	Title of the practice	**USE OF RENEWABLE ENERGY**
2	Precise theme/issue tackled by the practice	This good practice provides reduction of electricity consumption and limitation of CO2 emissions
3	Objectives of the practice	Construction of photovoltaic park in the Central Passenger port area
4	Location	Port of Piraeus- Central Passenger Port
5	Detailed description of the practice	 Study and implementation of a "Photovoltaic Energy Park ' in Central Port of Piraeus. These installations will be the basis for the establishment of an electric field that could be used in shore side electricity supply to the berthed ships. This is one of the most important environmental intervention in the Port area The total area to be covered with photovoltaic plants is estimated at 12.869 m2 The cost of the average efficiency of the investment is about 24% to 45% depending on the financial scenario that will be implemented. In any case the average repayment of capital is estimated from 2.6 to 3.8 years. The project will be gradually implemented to 21 buildings, starting from the main administration building of Piraeus

		Port Authority. The implementation of the project of the photovoltaic park is planned to start in the year 2011. Spots of photovoltaic plants. This project will be funding both from Piraeus port and from private investors
6	Evaluation	The project involves the first phase of the installation of photovoltaic plants on 9 roofs of the existing buildings in the port area. The total electric plated power of the installation is estimated on 1,138 MW The main environmental benefit of the project is the reduction of CO2 eq emissions which is estimated to be in average 1249 tonnes / year The estimated cost of the investment is about 3.749.187 €.
7	Lessons learnt from the practice	The construction of the photovoltaic park will be affected in a positive way the CO2 emissions.
8	Contact information	Piraeus Port Authority SA
9	Other possible interesting information	

3.6 Port Authority of Valencia

3.6.1 Best Energy Practices in Port Environments

3.6.1.1 Vessels (46% GHG Emissions)

ID	Best Practices: Vessels	Complete information YES/NO
1	Energetic classification of vessels (Certification/Cataloging of vessels). - Incentive system.	NO
2	Declaration and quality of fuel consumption in berthing and mooring	NO
3	Energetic classification of tugs: Management study of consumptions and operations	NO
4	Time reduction in the clearance of goods (on-line) - Streamline paperwork. - Optimizing waiting time	NO
5	Analysis and control of smoke of vessels (indirect emissions)	NO
6	Power supply to vessels “Cold Ironing”.	NO

3.6.1.2 Direct Emissions: Fuel (29% GHG Emissions)

ID	Best Practices: Direct emissions	Complete information YES/NO
1	Electric trucks.	NO
2	Biofuel for machinery	NO
3	Natural gas for processes	NO
4	Efficient driving course of machinery.	NO
5	Management and control of fuel consumption per employee and machine.	YES
6	Automatic shutdown in case of stand-by	YES

3.6.1.3 Mobility (15% GHG Emissions)

ID	Best practices: Transport (80%)	Complete information YES/NO	Best practices: Employees (20%)	Complete information YES/NO
1	Electric/hybrid industrial vehicles	YES	Fomentation of car sharing (through the social networks). Eg: facebook "I go to work to port. Do you come?"	NO
2	Biofuels: install bio gas station to encourage is use.	NO	Improvement in the schedule: Full working schedule instead of split shift, for reduction the average of number of travels (At present: 2-3 diary travels per employee)	NO
3	Efficient driving: course of industrial vehicles.	NO		
4	Common norhern Access.	NO		
5	Fomentation of train	NO		

3.6.1.4 Indirect Emissions : Electricity (10% GHG Emissions)

ID		Best Practices: Indirect emissions	Complete information YES/NO
1	Offices	Promotion of "off" instead of "stand-by (PC, photocopiers, printers…) - Procedures for on / off.	NO
		Promotion of natural light / Promotion of LED technology.	NO
		Automatic shutdown and optimum performance of air conditioning.(Eg: setting the minimum temperature at 21ºC and maximum 25ºC)	NO
		Review tightness in the offices and quality of enclosures: - Promotion of thermography.	NO
2	Lighting CAMPAS	Flow reductions during the night.	YES
		Promotion the incorporation or replacement of equipment of high efficiency (Eg: fluorescent).	YES
		Access of each company to zoned lit by exhaustive control	NO
		"Evening twilight on" in concessionaire fields. (APV already have it)	NO
3	Efficient consumption course of cranes RTG's (see energy operations)		NO
4	Management and control of consumption per worker/machine.		NO
5	Maintenance	Review of maintenance plans (Eg: reducing leaks in compressors, optimal performance of a/conditioning…)	YES
		Verification sizing of the equipment (oversized and undersized)	NO
		Fixed: verification of losses in electrical wiring for overloaded lines (reactive compensation)	YES
6	Promotion renewable energy /cogeneration.		NO
7	Promotion the management of electricity demand: - Analysis of quarter hours, alarms overruns, load test. - Establishment of consumption patterns		YES

3.6.1.5 General

ID	Best practices: Generals	Complete information YES/NO
1	Promotion implementation of energy management systems.	YES

3.6.2 Identification of Action Areas and Good Practices

The best practices identified to be developed in light of the information and results obtained relating with the area of application of the same, as shown in the accompanying table below:

Action area	Actions	Impact	Nº Best Practice
Improvement in the consumption of exterior lighting of roads, yards and docks.	Flow reductions in night time. Promotion the incorporation or replacement of equipment of high efficiency	Indirect emissions: Electrical consumption	1
Reduction of machinery fuel consumption.	Automatic shutdown in case of stand-by Management and control of fuel consumption per employee-machine.	Direct emissions: Fuel consumption	2
Promotion the management of electric demand	Analysis of quarter hours, alarms overruns, load test. Establishment of consumption patterns	Indirect emissions: Electrical consumption	3
Improvements in facilities maintenance processes	Fixed: verification of losses in electrical wiring for overloaded lines (reactive compensation)	Indirect emissions: Electrical consumption	4
Improvements in facilities maintenance processes	Review of maintenance plans (Eg: reducing leaks in compressors, optimal performance of a/conditioning)	Indirect emissions: Electrical consumption	5
Improvements in energy management of the concessionary companies	Promotion implementation of energy management systems.	Direct and indirect emissions	6
Reduction of emissions in park of vehicles	Industrial hybrid vehicles.	Mobility	7

3.6.3 Development of Best Energy Practices in Port Environments

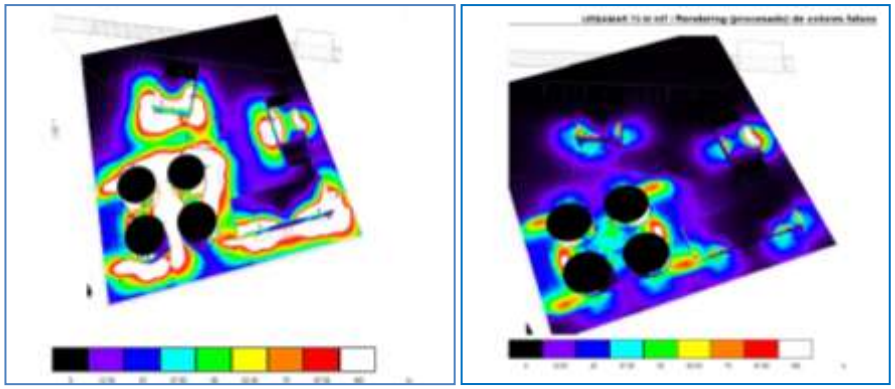
<table>
<tr><th></th><th>Section</th><th>Indication of the Content</th></tr>
<tr><td>1</td><td>Title of the best practice</td><td>IMPROVEMENT IN THE CONSUMPTION OF EXTERIOR LIGHTING OF ROADS, YARDS AND DOCKS.</td></tr>
<tr><td>2</td><td>Precise theme/issue tackled by the practice</td><td>This good practice provides savings in fuel consumption and emissions reductions in outside lighting, by installing flow reducers and energy-efficient equipment.</td></tr>
<tr><td>3</td><td>Objectives of the practice</td><td>About 3% of savings in fuel consumption and emissions.</td></tr>
<tr><td>4</td><td>Location</td><td>Port of Valencia</td></tr>
<tr><td>5</td><td>Detailed description of the practice</td><td>As a case of application of best practice has been improved the nocturnal electric consumption of a concessionaire company.
14 units de 250 w. Lampposts with Philips lamp of mercury vapor HPL-N 250W E40.
7 projectors 400w, brand FREPI LO/S class 1 E40.
To the limits of the study is considered optimal environment illumination of 30 lux , proper data set for road lighting

The energy improvement proposed is the replacement of the 14 team 250w lamps per 70 w:
Projector JOLLY 1 / A with electronic ballast
Metal halide lamp 70 w</td></tr>
<tr><td>6</td><td>Evaluation</td><td>Savings have been evaluated with this change in 750 € per year.

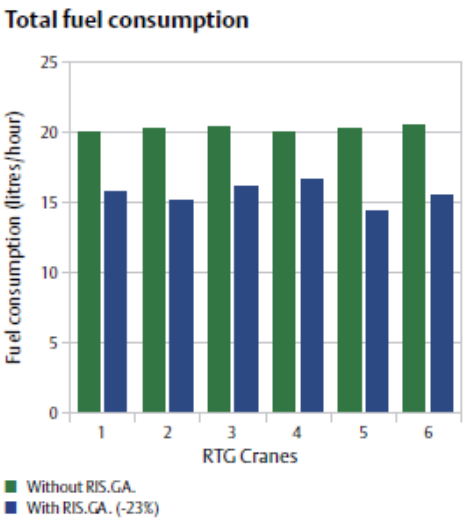
✓ With the option to install adjustable ballasts, it supposes an added energy savings estimated in 3.160 Kwh/year, that it would increment <u>the total save until 973 € / year.</u>

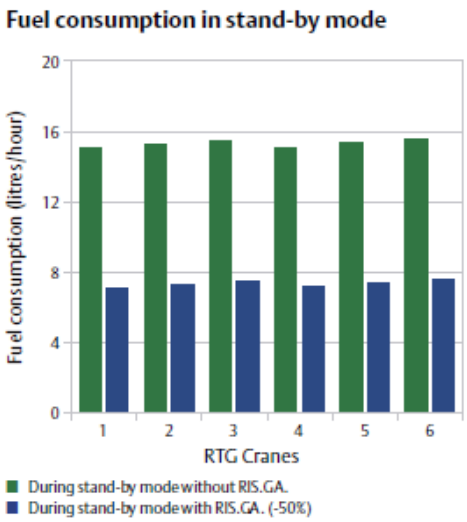
Summary of justification of savings on inventory data:*

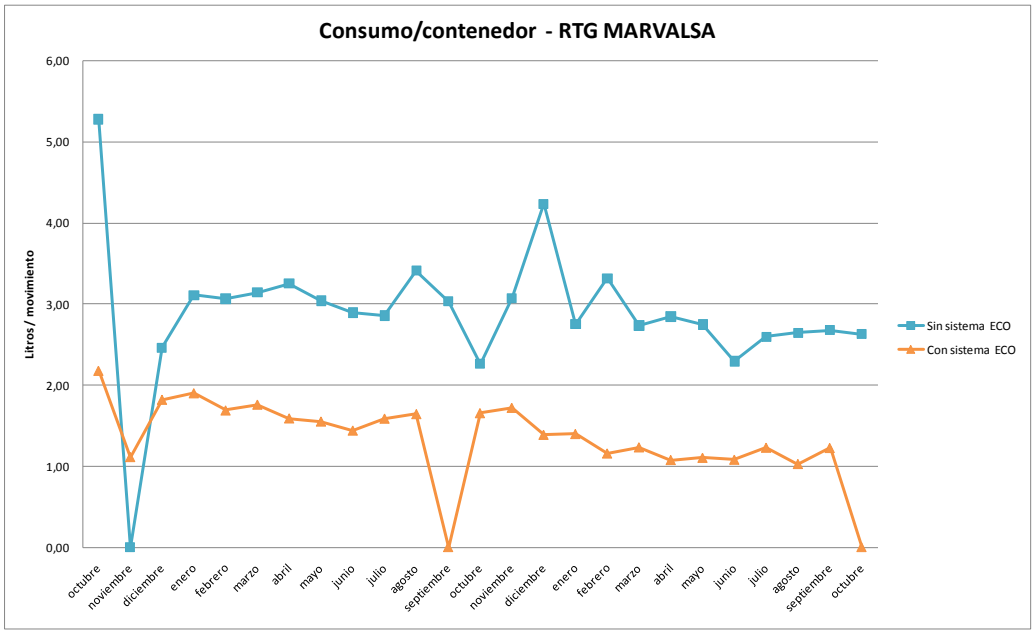
<table>
<tr><th>Descripción</th><th>Nº uds.</th><th>Pot. electrica (kw)</th><th>Horas/año</th><th>Consumo (kwh/año)</th><th>Coste actual (kw*h*€)</th><th>Propuesta (kw)</th><th>kwh/año ahorrados</th><th>Coste ahorrado</th></tr>
<tr><td>Bombillas incandescentes 250 w</td><td>14,00</td><td>0,271</td><td>2920,00</td><td>11.082,57</td><td>1.050,63 €</td><td>0,078</td><td>7.893,93</td><td>748,34 €</td></tr>
<tr><td colspan="7">Reductor de flujo: Estimado ahorro del 40% adicional</td><td>3.157,57</td><td>224,50 €</td></tr>
<tr><td colspan="7"></td><td>TOTAL ahorro</td><td>11051,50</td><td>972,85 €</td></tr>
</table></td></tr>
</table>

		AHORRO TOTAL ANUAL ALUMBRADO: 11051,50 kWh año / 7,172 Ton CO2 año Retorno: 2,52 años Inversión prevista: 14 124,86 € Proyector JOLLY 1/A con reactanc electrónica 14 50,00 € Lámpara halogenuros metálicos 2.448,04 €
7	Lessons learnt from the practice	The replacement of luminary and lamps of 250 W to 75 W and the introduction of flow reducers improve energy efficiency and CO_2 emissions reduction.
8	Contact information	Valencia Port Authority
9	Other possible interesting information	BEFORE AFTER 
	Section	**Indication of the Content**

1	Title of the best practice	**REDUCTION OF MACHINERY FUEL CONSUMPTION.**
2	Precise theme/issue tackled by the practice	Incorporating energy-saving systems of diesel on cranes RTG's
3	Objectives of the practice	Savings of 20% of total consumption to 50% of savings consumption in stand-by.
4	Location	Port of Valencia
5	Detailed description of the practice	In cranes RTG (Rubber Tyre Gantry) the power supply is made with a diesel generator. This generator provides all the cranes equipments, all the motors, PLC, lights and others auxiliary. When the crane is in "stand-by" mode, the diesel motor continues working at maxim power to provide energy to all auxiliary with a consumption of low power. This means that the generator consumes a large quantity of diesel when it really is not necessary. Maintain basic services powered in the operator cab and the crane safety, in low voltage / frequency alternator, implementing an uninterruptible power supply for these services.
6	Evaluation	The RTG cranes in stand-by. DIESEL SAVINGS = 50% Diesel consumption with the generator at 100% without load and without the RIS.GA system: 15 liters. Diesel consumption without load and the RIS.GA system: 7,1 liters. MARVALSA Valencia RTT-34 (FANTUZZI): - A/C room tables: 2300W 230V - A/C operator cab: 2300W 230V - Access lighting: 1500W 230V - PLC + I/Os (E-House + Trolley + cab) 500W 230V - Spotlights beams: 3200W 230V - Cab: Radio, Data terminal, Cameras..: 1500W 230V TOTAL: 11.300W. Potency supplied to auxiliary services by the system to half of consumption.
7	Lessons learnt from the practice	The incorporation of fuel savings systems on equipment and machinery for the movement of containers are suitable for reducing direct emissions in port areas.
8	Contact information	Valencia Port Authority.
9	Other possible interesting information	Control Techniques RIS.GA. System: Fuel saving for RTG canes and MHC







Monitoring consumption in liters / container movements of two RTG's with and without fuel saving system.

	Section	Indication of the Content
1	Title of the best practice	**USE OF THE THERMAL INERTIA IN INDUSTRIAL COOLING FACILITIES.**

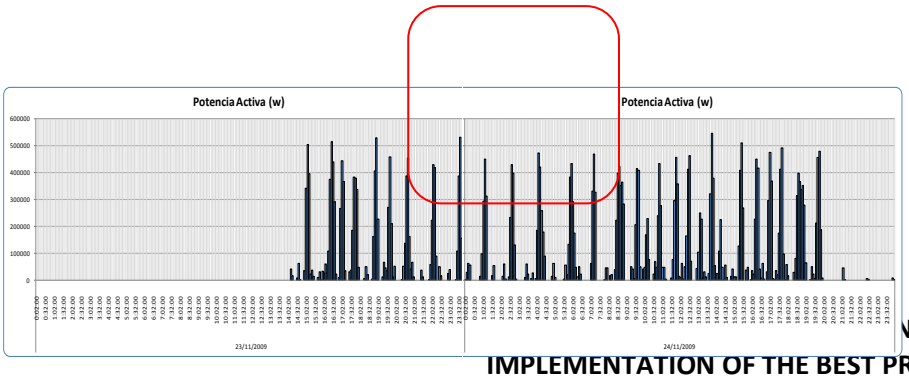
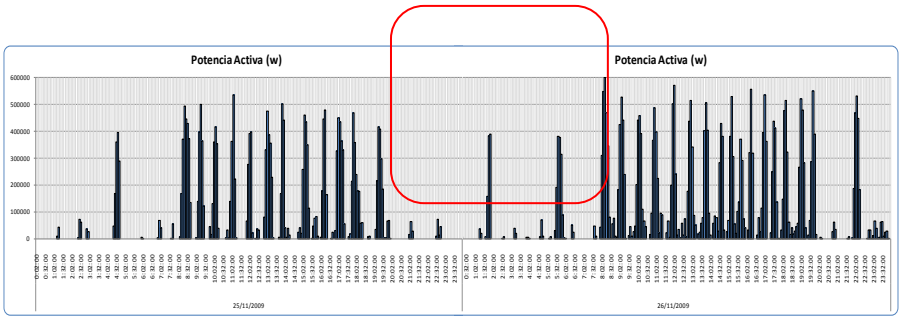
2	Precise theme/issue tackled by the practice	Changing temperatures of consignation in industrial refrigeration equipment.
3	Objectives of the practice	10% savings in fuel consumption and a 15% saving in CO_2 emissions.
4	Location	Port of Valencia.
5	Detailed description of the practice	To check if it is possible to obtain savings through better utilization of the thermal inertia, some proofs are raised during the nocturnal horary. Since the electricity tariff in this case is not affected by the schedule, we propose the use of inertia during the inactive period of the staff. Closed doors aimed at conserving energy. The options without cost of implementation are: - 20:00 hrs to 08:00 hrs → Increase 2 ºC in temperature chambers that the goods permit. Friopuerto is responsible for verifying that the storage process remains within the expected ranges during the proof. - 20:00 hrs to 08:00 hrs → Change the hysteresis of 2ºC to 3ºC in the refrigeration chambers that the goods permit.
6	Evaluation	It worked for two days at each of the options, the value of quarter-horary consumption obtained are the following summary of average power and savings (+ values) or increases in cost (- values).

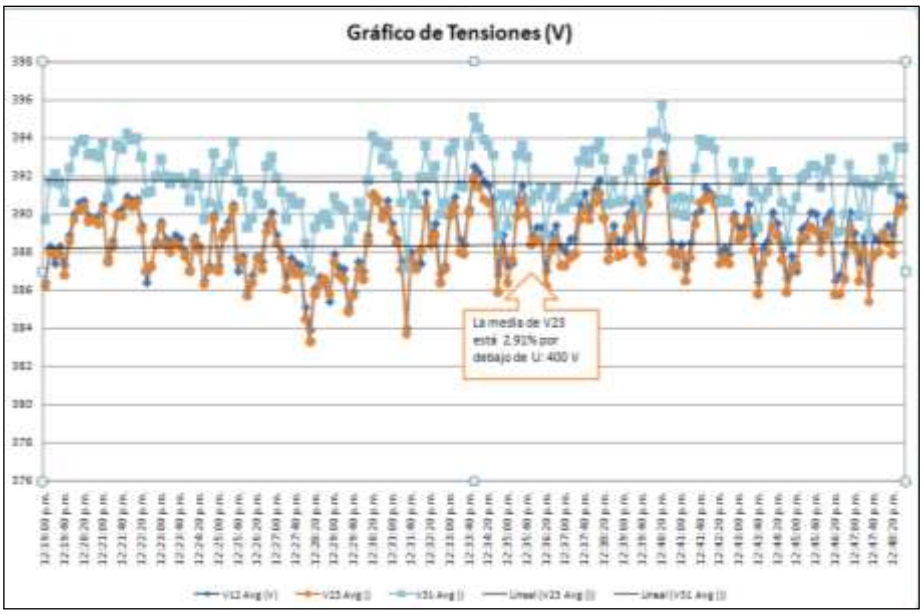
Pruebas de cambio tª:	Periodos:	Promedio kw	Tiempo (h)	Consumo kwh en 12 horas	Ahorro kwh (de base)	Dif euros/12 h	Ahorros al mes
Día 1 base estándar	23/11/2009 Comienza a las 14:12 hrs a 20:0	121,06	12	1.452,78			
	23/11/2009 De 20:00 a 08:00 hrs - BASE	78,14	12	937,64	base noches	89,83 €	Coste mes
5 -Cam 1 -18ºC ; Cam 2 -20ºC ; Cam	De 08:00 a 20:00 hrs - BASE	130,42	12	1.565,08	base día	148,37 €	7.146,03 €
3 -16ºC ; Cam 4 - 6ºC ; Sala Elab. - 7ºC	24/11/2009 De 20:00 a 08:00 hrs	12,11	12	145,27	802,32	76,06 €	
	De 08:00 a 20:00 hrs	136,08	12	1.632,95	- 67,87	- 6,43 €	
Día 3: idem	25/11/2009 De 20:00 a 08:00 hrs	21,37	12	256,49	691,10	65,52 €	17%
	De 08:00 a 20:00 hrs	176,42	12	2.116,99	- 551,91	- 52,32 €	1.242,31 €
Día 4: Cambiar histéresis 2ºC a 3ºC	26/11/2009 De 20:00 a 08:00 hrs	72,06	12	864,75	82,84	7,85 €	
en cámaras 1,2,3,4, muelle y sala	De 08:00 a 20:00 hrs	155,33	12	1.863,91	- 298,83	- 28,33 €	
	27/11/2009 De 20:00 a 08:00 hrs	98,79	12	1.185,42	- 237,83	- 22,55 €	
	De 08:00 a 20:00 hrs	90,68	12	1.088,19	476,89	45,21 €	
Dejar igual ante Fin de semana	28/11/2009 De 20:00 a 08:00 hrs	77,00	12	924,01	23,58	2,24 €	
	De 08:00 a 20:00 hrs	71,73	12	860,72	704,36	66,77 €	
	29/11/2009 De 20:00 a 08:00 hrs	81,76	12	981,12	- 33,53	- 3,18 €	
	De 08:00 a 08:47 hrs	258,37	(No significativa)			-	
Retirada aparato	30/11/2009 De 20:00 a 08:00 hrs	-				- €	

It is observed in the area marked with green, that the values of consumption are clearly lower.

For an estimated savings figure has been extrapolated action of raise the temperature 2 º C at night to the entire month to get a **17% savings, which would amount to 1,242 €/month less.**

7	Lessons learnt from the practice	Changing temperatures of consignation in industrial refrigeration equipment during the nocturnal horary: Raise the temperature 2 °C in the chamber from 20:00 to 8:00.
8	Contact information	Valencia Port Authority

9	Other possible interesting information	**QUARTER HORARY CONSUMPTION BEFORE THE IMPLEMENTATION OF THE BEST PRACTICE:**  **THE N BEFORE IMPLEMENTATION OF THE BEST PRACTICE:** 

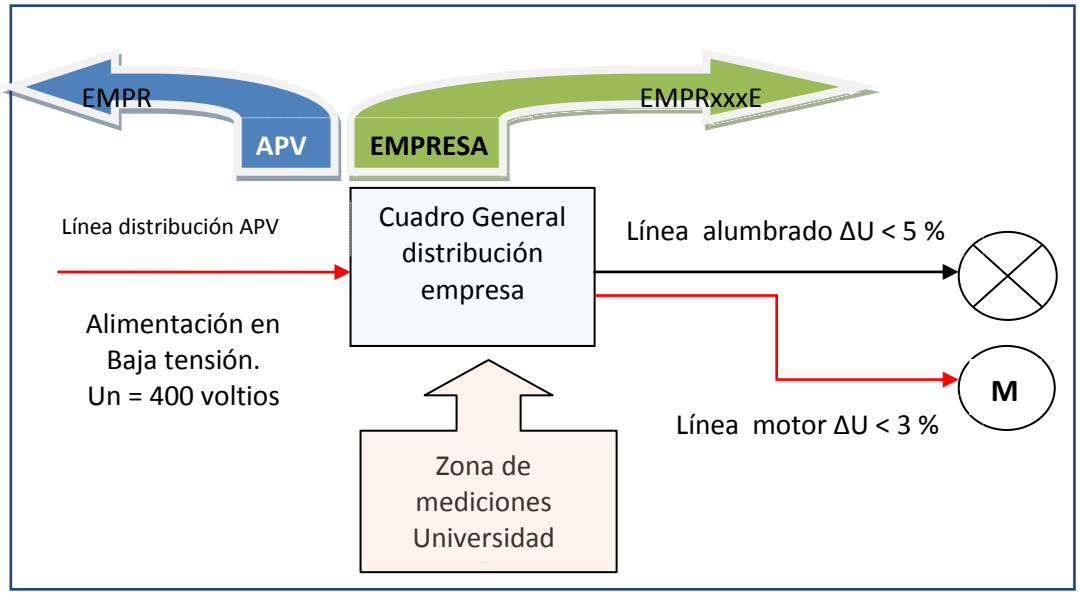
<table>
<tr><th></th><th>Section</th><th>Indication of the Content</th></tr>
<tr><td>1</td><td>Title of the best practice</td><td>IMPROVEMENTS IN THE QUALITY OF CONSUMPTION.</td></tr>
<tr><td>2</td><td>Precise theme/issue tackled by the practice</td><td>Reduction in losses of an electrical installations: Correction of reactive potency, harmonics, etc.</td></tr>
<tr><td>3</td><td>Objectives of the practice</td><td>Savings of 1,5% of consumption and emissions.</td></tr>
<tr><td>4</td><td>Location</td><td>Port of Valencia.</td></tr>
<tr><td>5</td><td>Detailed description of the practice</td><td>
QUALITY OF CONSUMPTION
The network analyzer also has allowed to see other information such as the electric tension it receives, the anomalies in the supply and cos (phi) and other:


To see possible inefficiencies of the team, it has been studied the graphic of tensions, calculating the phase lag:
1. <u>Phase imbalances between supply voltages</u>: Correct values, therefore not detected inefficiencies as a result.
<table>
<tr><th></th><th>V12 Avg (V)</th><th>V23 Avg ()</th><th>V31 Avg ()</th></tr>
<tr><td>Average 16/11/09:</td><td>388,84</td><td>388,38</td><td>391,68</td></tr>
<tr><td>Tot. Average</td><td>389,63</td><td></td><td></td></tr>
<tr><td>Phase lag:</td><td>0,20%</td><td>0,32%</td><td>-0,53%</td></tr>
</table>
</td></tr>
</table>

2. Supply voltage below the nominal: **Supply voltage below the nominal: The values deviate from 2 to 3% at the top of the installation. The tension is reaching the motor terminals, therefore exceed the maximum allowable 3%** due to an excess of potency circulating through electric lines caused by the company (line marked in red in the diagram).

   In posterior graphic is attached the cos (phi) read in the proof and circulating reactive potency, causing the overloading of the line.

	V12 Avg (V)	V23 Avg ()	V31 Avg ()
Average 16/11/09:	388,84	388,38	391,68
U Nominal:	400	400	400
Phase lag U nom:	2,79%	2,91%	2,08%



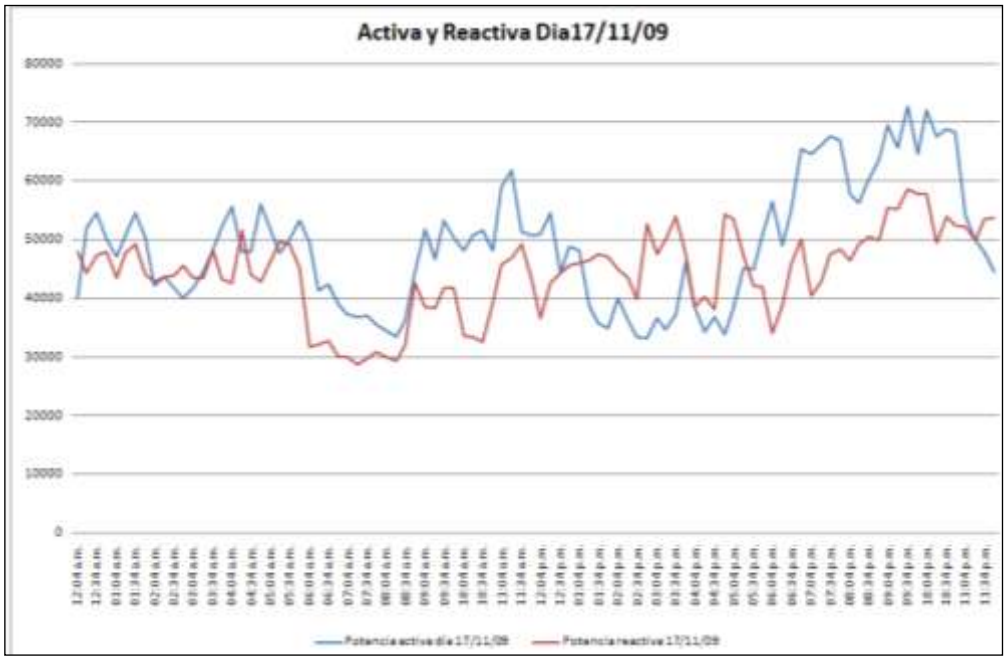
Consequences of Energy Reactive: Voltage drop losses.

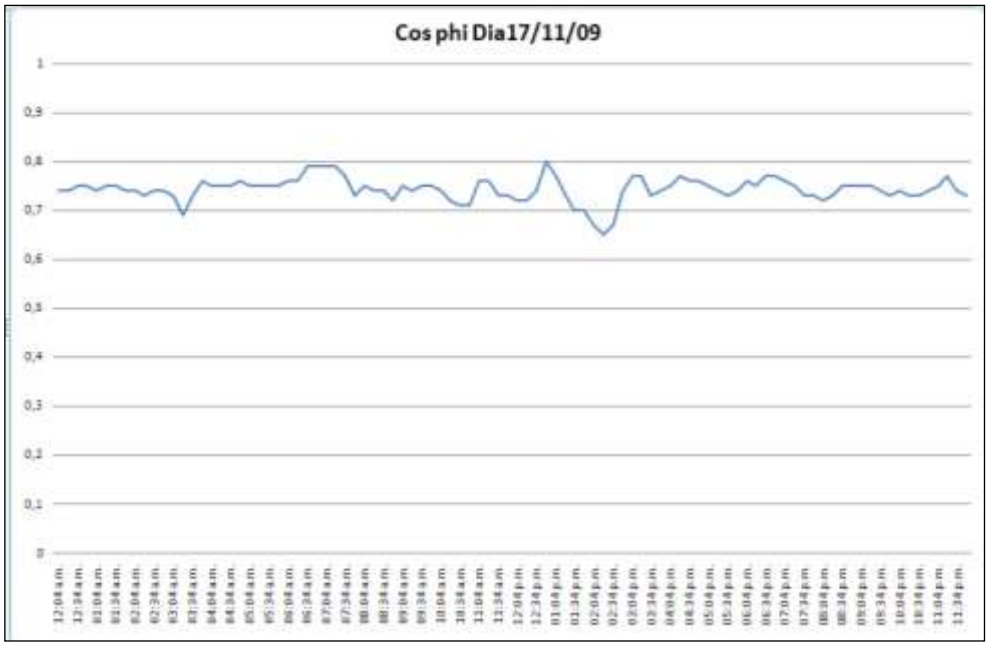
The spanish electricity legislation indicates a maximum allowable loss of 3% for the case of engines (5% max for lighting), so it would be desirable to review these voltage drops at points of consumption.

To assess the effects of voltage drops are attached documents that indicate that some may be working with a yield of 1% below the expected catalog, assuming a total voltage drop of 95%.

Graphics of reactive power and cos (phi):

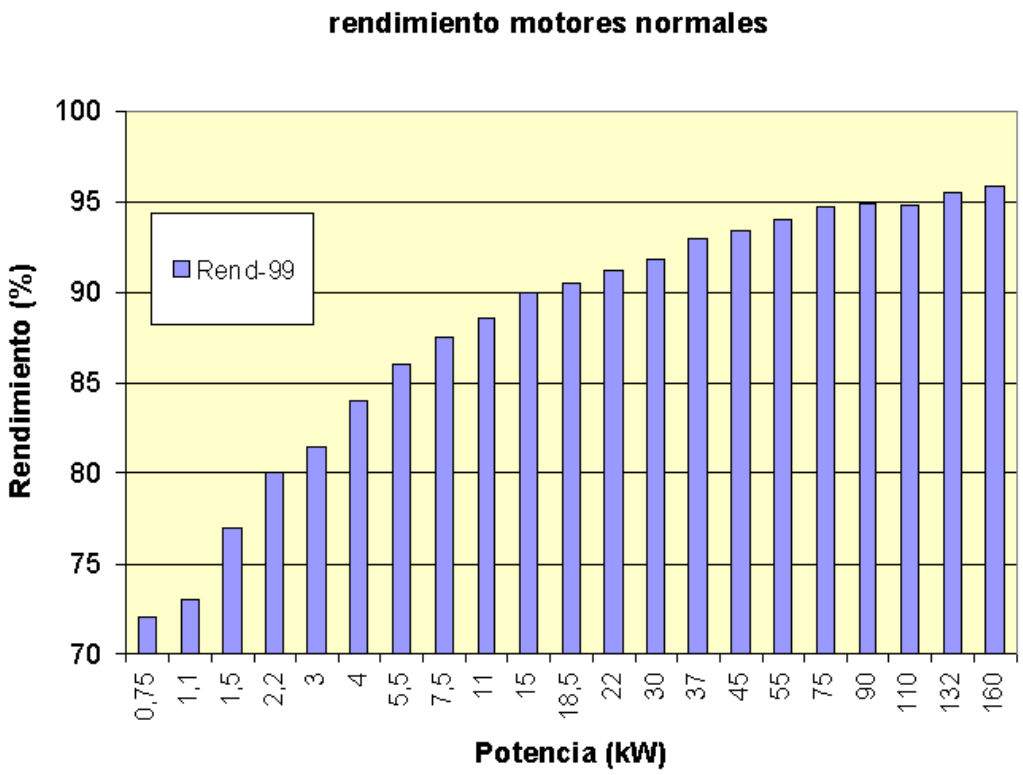
Are represented as an example the values of reactive power and cos (phi) obtained from measurements of the day 11/17/2009. The same pattern was followed throughout the week.





6	Evaluation	As discussed in the previous section, the network analyzer has registered a lower supply voltage to the nominal that it results in a decrease in the electrical performance of the engines. To assess the effects of voltage drops are attached documents that indicate that some may be working with a yield of 1% below the expected catalog, assuming a total voltage drop of 95%. The theoretical yields of the motors inventory are obtained from the following chart, in the

absence of data of specific models installed in the company. In general, electric motors are efficient equipment, between 80 and 98%



Although it must be borne in mind that there are variations depending on the load that has the motor (full load, half load, ...) found in some measurements with the network analyzer that the sizing of the engine corresponds to the load they have.

If a oversized motor was detected, it is important to assess his possible change due to the impact on yield losses.

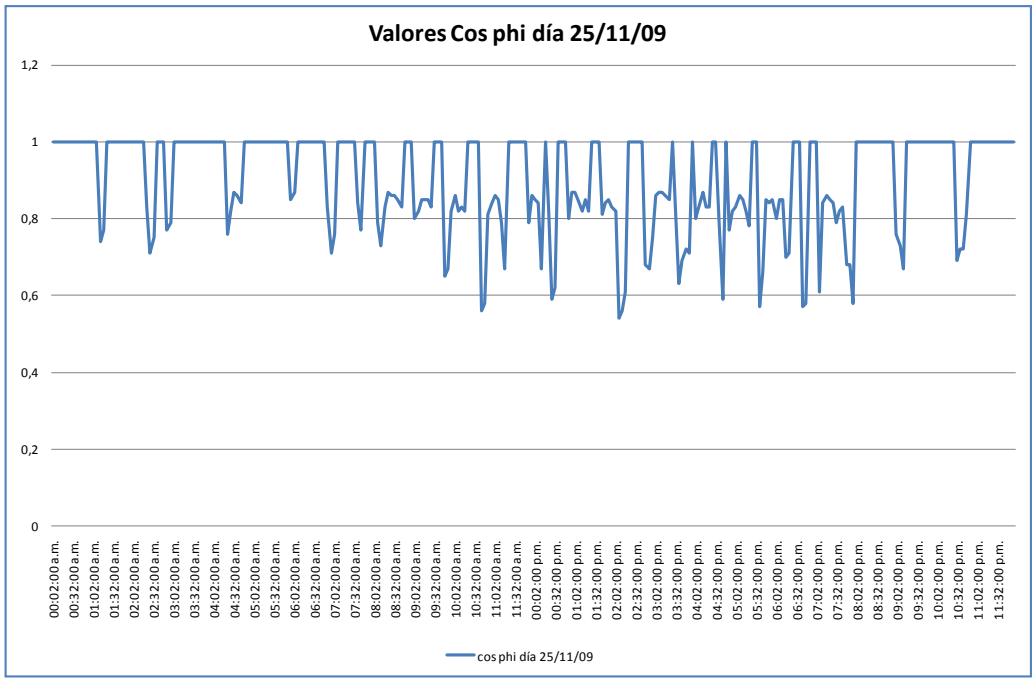
		TEORICO			REAL		Pérdidas por rendimiento - 1% (kw)		Coste extra anual (kw*h*€)
Descripción	Nº uds.	Pot. electrica (kw)	Rend. Teórico	P útil (kw)	Rend. Real	P. eléctrica(kw)		Horas/año	
Bomba descarga V	2,00	15	0,9	13,50	0,89	15,17	0,34	2920	93,31 €
Bomba de mar	1,00	7,5	0,87	6,53	0,86	7,59	0,09	8760	72,42 €
Compresor aire	1,00	15	0,9	13,50	0,89	15,17	0,17	4000	63,91 €
Bombas trasiegos	5,00	7,5	0,87	6,53	0,86	7,59	0,44	1566	64,73 €
Recirculación caldera	1,00	5,5	0,86	4,73	0,85	5,56	0,06	5000	30,67 €
Bomba de carga	1,00	11	0,88	9,68	0,87	11,13	0,13	1566	18,77 €
								TOTAL	343,82 €

Be afforded the rated voltage 400V in the inventoried engines would save the extra cost calculated 343,82 € (approximately is 1% of the total bill - 356.262 kwh/year and 33.774 €/year).

The savings figure is considerably higher since in this calculation has not been obtained the improvement of the joule's effect losses occurring in the electrical wiring installation in overloaded. Could be estimated at 40% higher, reaching 516€ of annual savings. This supose 5100 kWh / year and 3,30 tons CO2.

Return on investment:

The installation of a commercial battery of capacitors has a budget of 1.815 €. So the simple

		payback period of investment is 3 to 5 years.
7	Lessons learnt from the practice	Although in the case of the Valencia Port Authority is compensated the reactive power consumption of the entire port area, is pending that companies are exposed to electric losses due to overloading of his facilities, so is recommend their particular correction for each company energy consumer.
8	Contact information	Valencia Port Authority
9	Other possible interesting information	**Graphic of Reactive Potency and cos (phi) after the implementation of the good practice:** The values of reactive power and cos (phi) obtained from measurements of the day 11/25/1909 are represented as an example. They followed the same pattern throughout the week. Be seen that the cos (phi) corrected to the value of 1, except in specific moments startups that momentarily destabilize its value. In general there is a good compensation. 

	Section	Indication of the Content
1	Title of the best practice	**IMPROVEMENTS IN THE CONSUMPTION OF AIR CONDITIONERS BY ENERGETIC CLASSIFICATION CHANGE.**
2	Precise	Replacement for energetic classification A of air conditioning equipment amortized, obsolete

	theme/issue tackled by the practice	and/or deteriorated.
3	Objectives of the practice	Savings between 6% and 30% in fuel consumption and emissions of heat and cold equipment to be replaced by greater efficiency.
4	Location	Port of Valencia.
5	Detailed description of the practice	The analysis of consumption of air conditioning equipment of the company of the study was based on the inventory provided by the company itself. According to this inventory, where it picked up the brand and type of each appliance, the technical specifications have been searched of each of the equipments. The following table lists the technical characteristics of air conditioning equipment. Also we have proceeded to make an indication of those equipments that we have found their true values and those we have had to estimate, because those have not been possible to determination.

	Ud	Daewoo DSB 121 LH	Daewoo DSB 121 LH	Mundo Clima MUP-09-HN	Mundo Clima MUP-09-HN	THOR TA-07 *	THOR TA-12 *	Daikin FTY 24J *	Daikin FTY 35J *	Daikin FTY 40J *	Carrier *
Capacidad Refrigeración	w	3663	3663	2500	2500	2000	3500	2400	3500	4000	3318
	BTU/h	12600	12600	9000	9000	7000	12000	8256	12040	13760	11414
	Kcal/h	3150	3150	2150	2150	1750	3000	2064	3010	3440	2853
Capacidad Calefacción	w	3956	3956	3000	3000	2300	3800	700	3602	4165	4004
	BTU/h	13608	13608	9600	9600	8000	13200	2408	12389	14328	13774
	Kcal/h	3402	3402	2400	2400	2000	3300	602	3097	3582	3443
Pot Refrigeración	w	1500	1500	1200	1200	940	1620	774	1129	1290	1400
Pot Calefacción	w	1410	1410	1080	1080	1050	1820	700	1029	1190	1400
EER	-	2,44	2,44	2,08	2,08	2,13	2,16	3,10	3,10	3,10	2,37
COP	-	2,81	2,81	2,78	2,78	2,19	2,09	3,50	3,50	3,50	2,86
Clasif Refrigeración	-	E	E	G	G	G	G	B	B	B	F
Clasif Calefacción	-	D	D	E	E	G	G	B	B	B	D

True values except those marked with *.

*Estimated values for machines with similar potency.

For issues of improving energy efficiency, the change of the equipments currently have installed have not been justified due to the annual savings o f have all the equipments with classification A and B are 420 €/year, that extend enough the period of return on investment.

		Although, if that is a factor to bear in mind when having to replace any of the equipment currently in operation, since the savings of each machine, energy classification A, with respect to another installed energy classification G, would be around 30%.
6	Evaluation	The following are the values of percentage savings can be achieved, resulting from the substitution of a less efficient machine by a higher energy efficiency machine. Calculated both for use in refrigeration and heating.

Tabla de referencia de Ahorros medios en %, por cambio de equipo y mejora de su Clasificación Energética (Refrigeración)

		Clasificación Energética del Equipo que se Sustituye.						
Clasificación Energética del Nuevo Equipo	Letra	A	B	C	D	E	F	G
	A	0,0 %	6,1 %	12,1 %	18,2 %	24,2 %	30,3 %	33,3 %
	B	-	0,0 %	6,5 %	12,9 %	19,4 %	25,8 %	29,0 %
	C	-	-	0,0 %	6,9 %	13,8 %	20,7 %	24,1 %
	D	-	-	-	0,0 %	7,4 %	14,8 %	18,5 %
	E	-	-	-	-	0,0 %	8,0 %	12,0 %
	F	-	-	-	-	-	0,0 %	4,3 %
	G	-	-	-	-	-	-	0,0 %

The table above shows the average percentage savings on replacement of a machine of a certain classification of energy for another. According to the table could achieve an average energy savings of approximately 33% simply by replacing a G energy classification equipment with another of the same features with A energy classification.

Tabla de referencia de ahorros medios en %, por cambio de equipo y mejora de su Clasificación Energética (Calefacción)

Clasificación Energética del Nuevo Equipo	Clasificación Energética del Equipo que se Sustituye.							
	Letra	A	B	C	D	E	F	G
	A	0,0 %	5,4 %	10,8 %	21,6 %	27,0 %	32,4 %	35,1 %
	B	-	0,0 %	5,7 %	17,1 %	22,9 %	28,6 %	31,4 %
	C	-	-	0,0 %	12,1 %	18,2 %	24,2 %	27,3 %
	D	-	-	-	0,0 %	6,9 %	13,8 %	17,2 %
	E	-	-	-	-	0,0 %	7,4 %	11,1 %
	F	-	-	-	-	-	0,0 %	4,0 %
	G	-	-	-	-	-	-	0,0 %

To calculate these values, it was considered an average reference machine with a cooling capacity of 3.010 BTU/hour, and with a heating capacity of 4.128 calories per hour.

In the case of study in question it gives the following results:

ACCIÓN	Ahorro €/año	Inversión / Tasa de retorno	Ahorro emisiones (ton CO2)
Cambio de clasificación "E" a "G" por clasificación energética – "A".	420 €	7* 1100€ Tr > 10años	2,88 ton CO2

7	Lessons learnt from the practice	Adopt a policy of change and replacement of equipment of cold and heat by others of higher energy rating.
8	Contact information	Valencia Port Authority.
9	Other possible interesting information	

	Section	Indication of the Content
1	Title of the	**IMPROVEMENTS IN ENERGY MANAGEMENT OF CONCESSIONARIES COMPANIES.**

	best practice	
2	Precise theme/issue tackled.	Implementation of energy management systems according to UNE-EN 16001 in port facilities.
3	Objectives of the practice	· Management commitment in energetic management. · Definition of the energy policy of the company. · Establishment of measurements, controls and indicators of consumption. · Identification and assessment of the significant energy aspects. · Development of an energetic program. · Obtain values of 10% energy savings in fuel consumption and emissions. · Implementation of a quality assurance system of energy management certifiable by third parties according to UNE-EN 16001.
4	Location	Port of Valencia
5	Detailed description of the practice	Implementation of a system based on process management, which is the common axis with the guide ECOPORT of the Valencia Port Authority, as well as reference standards in both areas UNE-EN 16001 and ISO 14001. Both standards are based on the methodology known as Plan-Do-Check-Act (PDCA), which establish: - **Plan**: Establish the objectives and processes necessary to achieve results according with the energy policy of the organization. - **Do**: Implement the processes. - **Check**: To monitor and measure processes regarding energy policy, objectives, goals and legal obligations and other requirements organization subscribes, and report the results. - **Act**: Take actions to continually improve performance energetic management system. It provides a methodology for the implementation of energy management systems following the philosophy of the Guide ECOPORT, taking the long journey made by the same for the implementation of environmental management systems in order to provide customers with useful and practical tool for integrated design of both types of systems. Turn raises the assessment of energy issues for the determination of those that must be considered significant for the establishment of an energetic program of action on the part of the company, fundamental part of continuous improvement in the fight for saving, energy efficiency and the emissions reduction of GHG.
	Evaluation	Companies that have begun implementation of such systems and have developed its energy program surpass more than 10% of estimated annual savings both in € as a CO_2 emissions
7	Lessons learnt from the practice	Energetic studies performed and the results obtained have served to sensitize and train the staff of enterprises and, in order to see the benefits of investment in energy efficiency and savings, which has helped reduce resistance to implementation of the system energy management.
8	Contact information	Valencia Port Authority
9	Other possible interesting information	
	Section	**Indication of the Content**
1	Title of the best practice	Emission reductions in fleet vehicles in Valencia Port Authority.
2	Precise	Incorporation of hybrid cars in the fleet of Valencia Port Authority.

	theme/issue tackled by the practice	
3	Objectives of the practice	Reduce energy consumption and GHG emission by the fleet of vehicles of Valencia Port Authority. Evaluate the possible replacement of service vehicles by new units more efficient, both in consumption and in emissions.
4	Location	Port of Valencia
5	Detailed description of the practice	Evaluation of actual vehicles in terms of consumption and emissions. Evaluation of possible alternative models. Making a proposed schedule of replacement and purchase of new units. **Fleet evaluation:**
6	Evaluation	Estimated savings: Model to replace Ford Focus.

Fecha baja	Marca	Modelo del Vehículo o Descripción del Elemento	Combustible	KMs a fecha
02/02/1999 0:00:00	NISSAN	NISSAN DIESEL	DIESEL	33.897
29/07/2007 0:00:00	FORD	FIESTA1.3 GASOLINA5P	GASOLINA	41.046
31/07/2007 0:00:00	FORD	FIESTA 1.3 GASOLINA	GASOLINA	39.268
03/10/2007 0:00:00	FORD	FIESTA 1.3 GASOLINA BLANCO	GASOLINA	35.437
27/01/2008 0:00:00	NISSAN	CABSTAR-E1	DIESEL	30.664
17/02/2008 0:00:00	FORD	FIESTA 1.3 GASOLINA	GASOLINA	32.532
15/05/2008 0:00:00	RENAULT	KANGOO COMBI 1.9 D 65 CV	DIESEL	0
18/06/2008 0:00:00	FORD	FIESTA 1.3 GASOLINA BLANCO	GASOLINA	50.004
26/06/2008 0:00:00	FORD	FIESTA 1.4 GASOLINA	GASOLINA	32.175
08/09/2008 0:00:00	RENAULT	RENAULT KANGOO 1.9 DIESEL	DIESEL	49.039
01/02/2009 0:00:00	FORD	MONDEO 2.5I GASOLINA	GASOLINA	55.673
03/02/2009 0:00:00	FORD	FOCUS 1.8 TDCI GHIS 100 CV 4P	DIESEL	208.608
23/02/2009 0:00:00	VOLVO	S80	GASOLINA	95.960
22/03/2009 0:00:00	RENAULT	KANGOO 1.9 DIESEL COMBI	DIESEL	37.371
28/03/2009 0:00:00	RENAULT	KANGOO COMBI 1.9D 65CV DIESEL	DIESEL	77.040
23/04/2009 0:00:00	FORD	FOCUS1.6 GHIA 5P AZUL GASOLINA	GASOLINA	30.344
04/05/2009 0:00:00	FORD	TRANSIT	DIESEL	19.945
04/05/2009 0:00:00	FORD	TRANSIT	DIESEL	31.949
10/05/2009 0:00:00	FORD	FOCUS 1.6 GHIA GASOLINA	GASOLINA	55.836
21/05/2009 0:00:00	FORD	MONDEO 2.5 I V6 GIA X5 TRONIC	GASOLINA	16.632
24/05/2009 0:00:00	RENAULT	KANGOO 1.5DIESEL	DIESEL	16.819
29/07/2009 0:00:00	FORD	TRANSIT CHASIS DOBLE DIESEL	DIESEL	20.108
30/07/2009 0:00:00	FORD	TRANSIT	DIESEL	25.700
20/10/2009 0:00:00	RENAULT	KANGOO 1.5 DCI 65 CV COMBI	DIESEL	47.870
03/12/2009 0:00:00	RENAULT	KANGOO 1.5 DCI	DIESEL	58.436
14/12/2009 0:00:00	FORD	FIESTA 1.4. TREND2002 5P GASOL	GASOLINA	29.718
17/12/2009 0:00:00	VOLVO	S80	GASOLINA	116.417
28/12/2009 0:00:00	FORD	FIESTA 70CV	GASOLINA	25.889

Features of replacement vehicles:

Marca	Modelo	Consumo Unidad (l/100km)	Emisiones CO2 (g/km)
TOYOTA	PRIUS	4.3	104
HONDA	CIVIC	4.6	109

		<table><tr><th>Ahorros anuales</th><th>KM Recorridos</th><th>Consumos (l comb.)</th><th>Emisiones (Tn CO2)</th></tr><tr><td>Coche Inicial</td><td>11.167</td><td>714,70</td><td>2,35</td></tr><tr><td>Coche sustitutivo Toyota</td><td>11.167</td><td>480,18</td><td>1,16</td></tr><tr><td>Coche sustitutivo Honda</td><td>11.167</td><td>513,68</td><td>1,22</td></tr><tr><td>Ahorros Toyota</td><td></td><td>234,52 – 33%</td><td>1,19 – 51%</td></tr><tr><td>Ahorros Honda</td><td></td><td>201,02</td><td>1,13</td></tr></table>
7	Lessons learnt from the practice	The study suggests the replacement of vehicles Ford Focus by Toyota Prius, allowing a 51% estimated reduction of CO2 emissions per vehicle replaced.
8	Contact information	Valencia Port Authority
9	Other possible interesting information	

4 BENCHMARKING

ID.	TITLE	SCOPE LEVEL	PORTS IMPLEMENTED IN	CATEGORY 1. Energy Efficiency and Savings 2. CO2 Reduction 3. Renewable Resources Integration 4. Mobility/ Logistic Improvement 5. Waste Reduction 6. CO2 compensation / CO2 sinks 7. Other
1	**Improvement in the consumption of exterior lighting of roads, yards and docks.**	This good practice provides savings in fuel consumption and emissions reductions in outside lighting by installing flow reducers and energy-efficient equipment. Lowering light pollution of the port (adaptation of lighting the proportion of luminous flux). Reduction of energy consumption (replacement of existing bulbs with energy-saving using High Pressure Sodium lamps, using motion sensors at specific areas of the port-garages),etc.	Valencia, Koper	1,2
2	**Reduction of machinery fuel consumption.**	Incorporating energy-saving systems of diesel on cranes RTG's.	Valencia	1,2

ID.	TITLE	SCOPE LEVEL	PORTS IMPLEMENTED IN	CATEGORY 1. Energy Efficiency and Savings 2. CO2 Reduction 3. Renewable Resources Integration 4. Mobility/ Logistic Improvement 5. Waste Reduction 6. CO2 compensation / CO2 sinks 7. Other
3	Use of the thermal inertia in industrial cooling facilities.	Changing temperatures of consignation in industrial refrigeration equipment.	Valencia	1,2
4	**Improvements in the quality of consumption.**	Reduction in losses of an electrical installations: Correction of reactive potency, harmonics, etc.	Valencia	1

ID.	TITLE	SCOPE LEVEL	PORTS IMPLEMENTED IN	CATEGORY 1. Energy Efficiency and Savings 2. CO2 Reduction 3. Renewable Resources Integration 4. Mobility/ Logistic Improvement 5. Waste Reduction 6. CO2 compensation / CO2 sinks 7. Other
5	**Improvements in the consumption of air conditioners by energetic classification change.**	Replacement for energetic classification A of air conditioning equipment amortised, obsolete and/or deteriorated.	Valencia	1,2
6	**Improvements in energy management of concessionaries companies.**	Implementation of energy management systems according to UNE-EN 16001 in port facilities.	Valencia	1
7	**Emission reductions in fleet vehicles in Valencia Port Authority.**	Incorporation of hybrid cars in the fleet.	Valencia, Algeciras, Livorno	2,3
8	**Installation of transformers in accordance with the standard HD 428.1 S1.**	Energy saving through the use of energy-efficient electricity distribution transformer.	Algeciras	1,2

ID.	TITLE	SCOPE LEVEL	PORTS IMPLEMENTED IN	CATEGORY 1. Energy Efficiency and Savings 2. CO2 Reduction 3. Renewable Resources Integration 4. Mobility/ Logistic Improvement 5. Waste Reduction 6. CO2 compensation / CO2 sinks 7. Other
9 (also see 1)	**Optimisation of indoor lighting systems in buildings.**	Installation of lighting control systems. Replacing standard incandescent and fluorescent lamps. Replacement of magnetic ballasts with electronic ones.	Algeciras	1,2
10	**Introduction of insulation in sanitary hot water pipes.**	Minimisation of energy losses associated with the distribution of hot water which also reduces waste of water.	Algeciras	1,2,3
11	**Installation of wind energy in port facilities.**	Construction and operation of wind farms in ports installed in infrastructures that penetrate the sea.	Algeciras, Marseille	2,3
12	**Installation of photovoltaic energy in administrative buildings.**	Conversion of sunlight into electricity through the electronic device called "solar cell" by the physical phenomenon known as "photovoltaic effect". It provides electricity supply to be used in buildings of the port.	Algeciras, Koper, Piraeus, Marseille	2,3

ID.	TITLE	SCOPE LEVEL	PORTS IMPLEMENTED IN	CATEGORY 1. Energy Efficiency and Savings 2. CO2 Reduction 3. Renewable Resources Integration 4. Mobility/ Logistic Improvement 5. Waste Reduction 6. CO2 compensation / CO2 sinks 7. Other
13	**Installation of solar thermal energy in the building of the Port Police.**	Collection and application of solar radiation to obtain Sanitary Hot Water (ACS) to be used in the port.	Algeciras	3
14	**Establishment of a model of gardening for the optimisation of the capture and sequestration of CO_2 in the Green System.**	Incorporation of green areas such as CO2 sinks.	Algeciras, Piraeus	6,7 (better view of the port, noise absorption…)
15	**Port Waste Management Centre.**	A variety of waste materials are produced as a consequence of port operations and these can be sorted and collected separately for recycling and processing.	Koper	5
16	**Economy software for optimised fuel consumption for harbour mobile cranes.**	Comprehensive software enables reduced fuel consumption. New purchased cranes integrate software.	Koper	1,4

ID.	TITLE	SCOPE LEVEL	PORTS IMPLEMENTED IN	CATEGORY 1. Energy Efficiency and Savings 2. CO2 Reduction 3. Renewable Resources Integration 4. Mobility/ Logistic Improvement 5. Waste Reduction 6. CO2 compensation / CO2 sinks 7. Other
17	**Using NH_3 for cooling system instead of CFCs.**	Refrigeration system for cooling applications at low temperatures.	Koper	1,2
18	**Vessel speed reduction entering in the port.**	The speed reduction program asks that vessels entering or leaving the port to observe a maximum speed limit.	Koper	1,2
19	**Clean fuels usage for port mechanisation.**	Implement the use of cleaner fuels for port mechanisation. Cleaner fuels include; low sulphur diesel fuel (max. 10 ppm of S), oxygenated fuel, and biodiesel (max. 7 % of bio-components).	Koper	1,2
20	**Active Front End technology (AFE) for port cranes.**	A.F.E OpenDrive is a pulsed rectifier-regenerative feedback unit with an inverter and IGBT modules, suited for regenerating the power back into the line in the form of sinusoidal current.	Koper	1

ID.	TITLE	SCOPE LEVEL	PORTS IMPLEMENTED IN	CATEGORY 1. Energy Efficiency and Savings 2. CO2 Reduction 3. Renewable Resources Integration 4. Mobility/ Logistic Improvement 5. Waste Reduction 6. CO2 compensation / CO2 sinks 7. Other
21	**Onshore Power Supply (OPS)**	Onshore power supply offers the possibility of tug boats to plug in and thus reducing fuel consumption and carbon dioxide emissions. Also in ships in general.	Koper, Livorno, Marseille	1,2
22	**Movement of employees with bikes and with an organised port bus network.**	The program is to reduce emissions to the air, encouraging employees to bike, to increase the security when moving in the port (organised bus services, covered bike path), and reduce traffic within the port.	Koper	1,2,4
23	**Energy production by renewable production in port.**	Building up power plants by the use of vegetal oils. These plants provide the power to the national electric grid. The combustion of vegetal oils is carried out by endothermic engines performing a co-generation (electric energy and heat).	Livorno	3

ID.	TITLE	SCOPE LEVEL	PORTS IMPLEMENTED IN	CATEGORY 1. Energy Efficiency and Savings 2. CO2 Reduction 3. Renewable Resources Integration 4. Mobility/ Logistic Improvement 5. Waste Reduction 6. CO2 compensation / CO2 sinks 7. Other
24	**Environmental R&D in port.**	Research and development in the environmental field for the port area.	Livorno, Valencia, Algeciras, Koper, Piraeus	7
25	**Port community involvement.**	Interacting with the whole port community in order to improve the environmental awareness and promote environmental friendly actions.	Livorno, Valencia, Algeciras, Koper, Piraeus	7

ID.	TITLE	SCOPE LEVEL	PORTS IMPLEMENTED IN	CATEGORY 1. Energy Efficiency and Savings 2. CO2 Reduction 3. Renewable Resources Integration 4. Mobility/ Logistic Improvement 5. Waste Reduction 6. CO2 compensation / CO2 sinks 7. Other
26	**Reduction of the emissions from diesel engine equipment.**	Replacement of diesel engine Straddle Carriers with electric engine RMGs.	Piraeus	1,2,4
27	**Improvement of the energy efficiency of buildings.**	Implementation of green roof project. This good practice allows partial capture of CO_2 emissions, limitation of energy losses of the building and improvement of thermal insulation of the building.	Piraeus	1, 6, 7 (better view of the port, noise absorption…)
28	**Limitation of waste disposal in landfill.**	Enhancement of recycle. Implementation of a programme for the alternative management of the special waste stream generated from port activities.	Piraeus	2,5

ID.	TITLE	SCOPE LEVEL	PORTS IMPLEMENTED IN	CATEGORY 1. Energy Efficiency and Savings 2. CO2 Reduction 3. Renewable Resources Integration 4. Mobility/ Logistic Improvement 5. Waste Reduction 6. CO2 compensation / CO2 sinks 7. Other
29	**Recycling of Hydrocarbon Residues.**	Get back the hydrocarbon fraction of the waters of oil dumping of tankers to recover it in fuel	Marseille	5
30	**Electric Consumptions Monitoring.**	Objectives of this Best Practice are: - To know precisely electric consumptions by builds (Office, harbour station) - To establish a monitoring committee to analyze data - To determine solutions to reduce consumptions	Marseille	1,2

5 CONCLUSIONS

The Component 3 of CLIMEPORT has provided an accurate picture of the current state of energy consumption and GHG emissions at the Mediterranean ports of Algeciras, Koper, Livorno, Marseille, Piraeus and Valencia. The studies carried out by each port show some differences of energy consumption according to the different activities which take place in their port areas.

In this sense, container handling operations are some the most intensive activities in terms of electricity and fuel consumption. All ports show a significant level of energy consumption, being the total consumption for the six ports, 115.006.633 KWh and 27.809.336 litres, with a total amount of 152.495 CO_{2eq} tons in this category. Solid and liquid bulks are also a remarkable activity with intensive use of electricity in the case of Livorno and Marseille. Livorno reaches a consumption of 66.885.600 KWh and 1.539.850 fuel litres in solid bulk handling, whereas electrical and fuel consumption of Marseille in liquid bulk operations is 254.730.532 KWh and 1.400.464 litres. The Port of Koper has a significant energy consumption concerning general cargo handling, 9.545.184 KWh and 814.029 fuel litres, and Piraeus reaches 4.036.900 KWh in its ro-ro terminals. These figures provide the magnitude of the huge amount of energy involved in all port activities.

The calculation of the CO_{2eq} footprint in CLIMEPORT shows similar global values CO_{2eq} emissions per freight tonne. The specific nature of each port has an impact in its global carbon footprint. Some ports like Algeciras and Valencia are very focused on container traffic, whereas some others like Marseille presents important bulk traffic figures. The nature of the operations involved in the different port activities requires different levels of energy consumption.

Ports around the world have the same problems in terms of CO_2 and air pollution generation. The identification of CO_2 reduction best practices is one of the main objectives of the project, since the knowledge and experiences of the participant ports can be shared and transferred in a transnational way.

With respect to the best practices identified, CLIMEPORT addresses thirty different best practices already implemented or with plans to put them in practice in the participant ports. Best practices have been classified according to different categories which cover several aspects of CO_2 emissions reduction: energy efficiency, efficient mobility, CO_2 sinks, renewable energies, etc. Each best practice has also been described and evaluated in order to study their potential transferability among ports with the aim of developing common and specific action plans in Component 4.