Sustainable Commitment of the Port of Barcelona

3rd November 2015
1. Objectives of environmental sustainability of the Port
2. The improvement of Air Quality
3. The improvement of Water Quality
4. The contribution to the sustainability of the supply chain
5. Promotion goods transportation by train and SSS
6. Climate change strategy
7. LNG as a fuel for the future
1. Objectives of the Environmental Sustainability of the Port

**The reduction of the environmental impact of the port activity in the Port and its vicinity**
- Improving air quality
- Improving the quality of port waters
- Efficient use of resources

**The contribution to the sustainability of the supply chains that use the port**
- To promote more sustainable ways of transport
- To reduce the carbon footprint of port activities
- The promotion of the use of alternative fuels for the different ways of transport
1. Objectives of environmental sustainability of the Port
2. The improvement of Air Quality
3. The improvement of Water Quality
4. The contribution to the sustainability of the supply chain
5. Promotion goods transportation by train and SSS
6. Climate change strategy
7. LNG as a fuel for the future
2. The improvement of Air Quality

Port activity emissions:

- **Ships approach, manoeuvres and stay in the Port**
  - NOx: 5,134 t/y
  - PM-10: 491 t/y

- **Ground Transportation of Goods**
  - NOx: 114 t/y
  - PM-10: 6 t/y

- **Terminal Equipment**
  - NOx: 80,6 t/y
  - PM-10: 5 t/y

- **Solid bulk handling and infrastructure in construction**
  - NOx: ? t/y
  - PM-10: ? t/y
2. The improvement of Air Quality

Emissions by type of ship (2014)

Distribution of total emissions of NOx in the Port area (2013)
2. The improvement of Air Quality

Air Quality in Barcelona city: source of the pollution
2. The improvement of Air Quality

Network of complete weather stations
(main network)

Network of auxiliary weather stations
(complementary network)
2. The improvement of Air Quality

Automatic and manual network of stations for measuring air quality
2. The improvement of Air Quality

- New road and rail access to the Port
- In preparation for 2013: PLAN FOR IMPROVING THE PORT AIR QUALITY
- From 2000 all port projects with Environmental Monitoring
- From 1996, control and improvement of bulk solid handling operations on dock
- From 2011 Bonus to solid bulk terminals if they adopt good environmental practices and technical improvements
- Bonus to ships with reduced gaseous and particulate emissions
2. The improvement of Air Quality

Entry into force of European Directive 2005/33/EC that restricts the content of Sulphur in marine fuel to ships moored in Port.
2. The improvement of Air Quality

Nitrogen oxides
(ug/m3)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>89</td>
<td>55</td>
<td>63</td>
<td>67</td>
<td>71</td>
<td>55</td>
<td>67</td>
<td>72</td>
<td>48</td>
<td>37</td>
<td>39</td>
<td>42</td>
<td>41</td>
<td>45</td>
</tr>
</tbody>
</table>
2. The improvement of Air Quality

Air concentrations of particulate matter in Dàrsena sud ("South Inner Harbour") and in Moll de Pescadors ("Fishermen's Dock") (ug/m3)
1. Objectives of environmental sustainability of the Port
2. The improvement of Air Quality
3. The improvement of Water Quality
4. The contribution to the sustainability of the supply chain
5. Promotion goods transportation by train and SSS
6. Climate change strategy
7. LNG as a fuel for the future
## 4. The improvement of Water Quality

<table>
<thead>
<tr>
<th>Main pressures</th>
<th>Improvement actions</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Direct discharge</strong> from Port activities at the docks, estimated volume: 600.000 m3</td>
<td>2000 &amp; 2001. Construction of the Port sewage network. Investment of 30 M€</td>
<td>No direct discharges to docks since 2002</td>
</tr>
<tr>
<td></td>
<td>36 km of network and 16 pumping stations</td>
<td></td>
</tr>
<tr>
<td><strong>Downloads from the sanitation unitary system of the city</strong> in case of rain through 10 spillways. Estimated volume: 8 M m3</td>
<td>1999. Improvements anti-flooding PECLAB 97</td>
<td>75% reduction of contribution during raining times</td>
</tr>
<tr>
<td></td>
<td>2001. Improvements anti-DSU PECLAB 97</td>
<td></td>
</tr>
<tr>
<td><strong>Mouth of the Llobregat river and collectors outside the port. Non-measurable volume</strong></td>
<td>2002 Start up EDAR Llobregat</td>
<td>Improvement of coast water quality and reduction of external contributions</td>
</tr>
<tr>
<td></td>
<td>2004 Diversion of Llobregat</td>
<td></td>
</tr>
<tr>
<td><strong>Drop the rate of renewal of inner waters</strong> (about 17 days)</td>
<td>2003. Opening of Nova Bocana Nord <em>(North New Mouth)</em></td>
<td>Improvement of inner water renewal time from 17 to 7 days</td>
</tr>
<tr>
<td><strong>Accidental discharge</strong> of wastewater from ship and shore</td>
<td>Contingency Plan against accidental marine pollution</td>
<td>Reduction of accidental discharge on docks</td>
</tr>
<tr>
<td></td>
<td>Liquid waste collection service from ships</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Floating waste collection service on water’s surface</td>
<td></td>
</tr>
</tbody>
</table>
3. The improvement of Water Quality

- **Contingency Plan** against accidental marine pollution
- **Liquid waste collection service from ships**
- **2000 & 2001. Construction of the Port sewage network.** Investment of 30 M€
  - 36 km of network and 16 pumping stations
- **1999. Anti-flooding improvements** PECLAB 97
- **2001. Anti-DSU improvements** PECLAB 97
- **2002. Begin to operate Waste Water Treatment Plant** EDAR Llobregat
- **2004. Diversion of Llobregat**
- **2003. Opening of Nova Bocana Nord (North New Mouth)**
3. The improvement of Water Quality

With the new Mouth the renewal time of the Port Vell water decreased from 17 days to 7 days.
3. The improvement of Water Quality

**Dissolved oxygen expressed in % of saturation** (Annual average Port Vell (Old Port) station, bottom water)

**Benthic Communities on sediments** (Specific diversity in summer season, Port Vell station)
3. The improvement of **Water Quality**

**Organic matter as DBO$_5$ (in mg/l)**
(on surface water from Port Vell inner station, summer season)

![Graph showing organic matter levels from 1993 to 2010](image-url)

- 1993: 3.18 mg/l
- 2000: 2.84 mg/l
- 2010: 1.00 mg/l

---

[Image of Port Vell with a star marking the inner station location]
1. Objectives of environmental sustainability of the Port
2. The improvement of Air Quality
3. The improvement of Water Quality
4. The contribution to the sustainability of the supply chain
5. Promotion goods transportation by train and SSS
6. Climate change strategy
7. LNG as a fuel for the future
4. The contribution to the sustainability of the supply chain

The Port sustainable commitment extends beyond the port and also beyond the multimodal supply chains in order to:

- Minimize the impact related to goods
- Contribute to the improvement of the European logistic system

Promote and make easier the change of the supply chain into a more sustainable transport scheme

Commitment to becoming a Carbon neutral Port for goods in 3 years

Encourage and promote cleaner alternative fuels for all means of transport
1. Objectives of environmental sustainability of the Port
2. The improvement of Air Quality
3. The improvement of Water Quality
4. The contribution to the sustainability of the supply chain
5. Promotion goods transportation by train and SSS
6. Climate change strategy
7. LNG as a fuel for the future
5. Promotion of goods transportation by train and SSS

To promote and make easier the change of the supply chain into a more sustainable transport scheme

The expansion of the hinterland & the activity and traffic increase are done EXCLUSIVELY with the most sustainable means of transport: railway and short sea shipping

Cost of externalities in €/t Km

<table>
<thead>
<tr>
<th>Mode</th>
<th>Cost in €/t Km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portacarrier</td>
<td>0.009</td>
</tr>
<tr>
<td>Rail</td>
<td>0.015</td>
</tr>
<tr>
<td>Road</td>
<td>0.035</td>
</tr>
</tbody>
</table>

Emissions en g CO2/TEU Km

<table>
<thead>
<tr>
<th>Mode</th>
<th>Emissions in g CO2/TEU Km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portacarrier (gran)</td>
<td>186</td>
</tr>
<tr>
<td>Ferrocarril elèctric (emissions indirectes)</td>
<td>115</td>
</tr>
<tr>
<td>Camió EURO-V</td>
<td>462</td>
</tr>
</tbody>
</table>
To promote and make easier the change of the supply chain into a more sustainable transport scheme.

WHITE BOOK OF TRANSPORT 2050: 60% reduction of GHG emissions from transport in 2050, which now represent 25% of total IN EU.

Objectives of the White Book:

- Achieve modal shift of 50% of the burden of road transport to train and SSS (30% in 2030)
- Basic Transport Network TEN-T to ensure this transfer between means of transport
- Connecting the main ports to the rail network
5. Promotion of goods transportation by train and SSS

Intermodal supply chain of the Port of Barcelona
Rail services and Short Sea Shipping

Number of services per week in each direction

- **Container rail services**
  Services from port terminals and from Morrot and Le Boulou terminals

- **Short Sea Shipping services**
  Ro-Ro and Ro-Pax

Much of the new Port traffic increase in recent years has been achieved through rail transport or SSS. The expansion of the hinterland has been done through connections with trains and SSS (Zaragoza, Madrid, France, Italy).

**September 2013**
5. Promotion of goods transportation by train and SSS

Number of TEU transported by rail

<table>
<thead>
<tr>
<th>Year</th>
<th>TEU</th>
<th>% of total TEU</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>41.770</td>
<td>2,6%</td>
</tr>
<tr>
<td>2008</td>
<td>52.562</td>
<td>3%</td>
</tr>
<tr>
<td>2009</td>
<td>59.544</td>
<td>5%</td>
</tr>
<tr>
<td>2010</td>
<td>103.898</td>
<td>8%</td>
</tr>
<tr>
<td>2011</td>
<td>146.685</td>
<td>11%</td>
</tr>
<tr>
<td>2012</td>
<td>148.926</td>
<td>11,3%</td>
</tr>
</tbody>
</table>

Number of vehicles transported by rail

<table>
<thead>
<tr>
<th>Year</th>
<th>Vehicles</th>
<th>% of total vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>116.704</td>
<td>14,5</td>
</tr>
<tr>
<td>2008</td>
<td>156.188</td>
<td>21,8</td>
</tr>
<tr>
<td>2009</td>
<td>105.021</td>
<td>23,9</td>
</tr>
<tr>
<td>2010</td>
<td>128.153</td>
<td>27,5</td>
</tr>
<tr>
<td>2011</td>
<td>165.247</td>
<td>30</td>
</tr>
<tr>
<td>2012</td>
<td>179.563</td>
<td>32,5</td>
</tr>
</tbody>
</table>
5. Promotion of goods transportation by train and SSS

Saved externalities from the load transported by rail when using the road (in M€)

Externalities attributable to the load transported by rail (in M€)

<table>
<thead>
<tr>
<th>Year</th>
<th>Saved Externalities</th>
<th>Total Externalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>5,19 M€</td>
<td>8,08 M€</td>
</tr>
<tr>
<td>2009</td>
<td>4,59 M€</td>
<td>7,48 M€</td>
</tr>
<tr>
<td>2010</td>
<td>5,61 M€</td>
<td>11,11 M€</td>
</tr>
<tr>
<td>2011</td>
<td>7,52 M€</td>
<td>17,53 M€</td>
</tr>
<tr>
<td>2012</td>
<td>7,18 M€</td>
<td>16,73 M€</td>
</tr>
</tbody>
</table>
5. Promotion of goods transportation by train and SSS

- 3,1 Mt transported
- 92,185 UTI (Trucks, trailers....)
- Less trucks by road: **80 M€** saved in externalities of the transported load (air pollution, CO2, noise, accidents, congestion...)

---

**Number of layovers of SSS**

- 2008: 1,702
- 2009: 1,612
- 2010: 1,724
- 2011: 1,839
- 2012: 1,862
5. Promotion of goods transportation by train and SSS

- Saved externalities from the load transported by SSS when using the road (in M€)
- Externalities attributable to the load transported by rail (in M€)

<table>
<thead>
<tr>
<th>Year</th>
<th>Saved Externalities (M€)</th>
<th>Externalities Attributable (M€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>93.16</td>
<td>20.74</td>
</tr>
<tr>
<td>2009</td>
<td>92.54</td>
<td>20.00</td>
</tr>
<tr>
<td>2010</td>
<td>100.57</td>
<td>21.77</td>
</tr>
<tr>
<td>2011</td>
<td>104.34</td>
<td>22.63</td>
</tr>
<tr>
<td>2012</td>
<td>80.58</td>
<td>17.35</td>
</tr>
</tbody>
</table>
1. Objectives of environmental sustainability of the Port
2. The improvement of Air Quality
3. The improvement of Water Quality
4. The contribution to the sustainability of the supply chain
5. Promotion goods transportation by train and SSS
6. Climate change strategy
7. LNG as a fuel for the future
GHG emissions are:

- GLOBAL: their effect is global regardless of the place where they are generated
- UNIVERSAL OR GENERAL: the majority of industrial activities, services and transport produce GHG emissions

The carbon footprint is a good indicator of an organisation environmental activity related to climate change:

- It can be compared in different activities of the same sector or in different sectors.
- Its scope can be established in each specific case according to different needs and objectives
- It has an overall acceptance
6. Climate change strategy

Third study about GHG by the IMO (2014)

- Rail: 0.5%
- Other Transport (Road): 21.3%
- Domestic Shipping and Fishing: 0.6%
- International Aviation: 1.9%
- International Shipping: 2.7%
- Manufacturing Industries and Construction: 18.2%
- Other: 15.3%
- Other Energy Industries: 4.6%
- Electricity and Heat Production: 35.0%

- 1.016 Millions tons CO2eq
- 2.7% CO2eq
- +48% 1990 - 2007
6. Climate change strategy

EU Regulation 2015/757 of the European Parliament and Council of 29/04/2015 on the monitoring, reporting and verification of carbon dioxide emissions from maritime transport

2030: - 40%
Producers consider sustainability as

- A differentiating factor that attracts customers
- Energy and Efficiency savings

The supply or distribution transport chains are involved in the responsibility: incentive to modal change
6. Climate change strategy

FRANCE: from 2013 the 85,000 logistic operators must inform about the carbon footprint of their services

UK: pressure on the stock-listed companies to inform about their carbon footprint
6. Climate change strategy

Ports: Adoption of strategies to reduce their GHG emissions

**Connection Points** of the majority of logistic chains of goods and they contribute to extend the carbon footprint of transport.

**Network nodes** where it is possible to influence on the choice of the means of transport: modal change.
6. Climate change strategy

Ports: strategies to measure and reduce the GHG emissions

Territorial approach: Inventory of all the GEI emissions of the port activities

Logistic chain approach: Inventory of the activities related to the transportation of goods through the port
Port of Barcelona: triple approach to reduce the GEI emissions related to its activities
The Barcelona Port Authority has signed the Optional Agreements Programme to reduce the GEI emissions.
The EcoCalculator of the Port of Barcelona is a tool that allows to calculate CO2 emissions related to the route and means of transport.
The BCN ZERO CARBON Programme:

- Cooperation Project with the port terminals
- The goal is the neutrality in the CO2 emissions produced by the transportation of goods in different ways through the port
6. Climate change strategy

Definition of “carbon-neutral”

“Carbon neutral means that – through a transparent process of calculating emissions, reducing those emissions and offsetting residual emissions – net carbon emissions equal zero.”

British Standard Association

Carbon Neutrality ≠ Compensation
6. Climate change strategy

- Actions to reduce emissions
- Compensation of non-reduced emissions

- GOODS IN CONTAINERS
- VEHICLES
- ACTIVITIES OF CRUISE SHIPS
Measurement of emissions of goods in containers (2013 data):

<table>
<thead>
<tr>
<th>Emissions (tCO2 eq)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>PILOTS</td>
<td>1.002,2 3,06%</td>
</tr>
<tr>
<td>MOORERS</td>
<td>115,6 0,35%</td>
</tr>
<tr>
<td>TUG-OPERATORS</td>
<td>2.918,4 8,91%</td>
</tr>
<tr>
<td>TRAINS</td>
<td>162,3 0,50%</td>
</tr>
<tr>
<td>TRUCKS</td>
<td>6.094,2 18,61%</td>
</tr>
<tr>
<td>TERMINALS</td>
<td>15.615,4 47,68%</td>
</tr>
<tr>
<td>VESSELS</td>
<td>6.844,3 20,90%</td>
</tr>
<tr>
<td>Totals</td>
<td>32.752,59 100,00%</td>
</tr>
</tbody>
</table>
6. Climate change strategy

Emissions by unit of TEU handled, considering three scenarios: mix truck/train, train only and truck only.
6. Climate change strategy

Reduction Plans involving the different actors and agents:
6. Climate change strategy

Compensation of non-reduced emissions

**Regulated Market** (used by governments and companies that, mandated by law, must manage their GEI emissions).

- Clean Development Mechanism (CDM).
- Joint Implementation (JI).
- Emissions Trading Scheme.

**Optional Market** (it facilitates people and organizations to participate in the objectives of emission reductions).

- Wide range of projects
- Wide range of standards
6. Climate change strategy

**Clean Development Mechanism (CDM)**
- Led by the United Nations – it defines the tools and procedures needed to ensure the registering, verification and monitoring of the projects about reduction of GEI emissions in the framework of the Kyoto Protocol.

**Verified Carbon Standard (VCS)**
- Verification standard of optional projects of GEI reduction launched in 2006 with the aim of standardizing the validation rules and provide credibility to them (it is accepted for CDM methodologies and Climate Action Reserve).

**Gold Standard**
- Non-profit organization created in 2014 and supported by a total of 60 NGOs that has designed a certification scheme to guarantee the credibility of the GEI reduction projects (energy efficiency, renewable energies, wastes, water and forests).
- It verifies not only effective GEI reductions but also real and effective contributions to environmental sustainability.
6. Climate change strategy

**Project typologies**

The highest percentage of projects corresponds to forest activities, cooking stoves and wind energy.


Ecosystem marketplace.
### 6. Climate change strategy

#### Location
- Asia: 2.4 U$S /tCO2eq
- Latin America: 5 U$S /tCO2eq
- Africa: 5.6 U$S /tCO2eq
- North America: 6 U$S /tCO2eq
- Europe: 8.1 U$S /tCO2eq

#### Standard
- Verified Carbon Standard: 2 U$S /tCO2eq
- Climate Action Reserve: 4 U$S /tCO2eq
- Certified Emission Reduction/ERU: 4.5 U$S /tCO2eq
- Gold Standard: 8.5 U$S /tCO2eq

#### Technology
- Renewables (wind): 2.1 U$S /tCO2eq
- Methane in dumping sites: 4.5 U$S /tCO2eq
- Cooking stoves: 9.2 U$S /tCO2eq
- Renewables (hydro): 0.7 U$S /tCO2eq
- Forest Activity: 9.4 U$S /tCO2eq

6. Climate change strategy

- Transportation is intensive in CO2 emissions
- Ports are key actors to reduce the carbon footprint of transport
- Customers of goods demand a low carbon footprint
1. Objectives of environmental sustainability of the Port
2. The improvement of Air Quality
3. The improvement of Water Quality
4. The contribution to the sustainability of the supply chain
5. Promotion goods transportation by train and SSS
6. Climate change strategy
7. LNG as a fuel for the future
7. LNG as a fuel for the future: General bunkering in the Mediterranean

Initial phase: No LNG bunkering

2020: LNG bunkering in ports with existing plants

2030: LNG bunkering in other ports with satellite plants
Ports are key players in the use and development of gasification for mobility. Ports are primary nodes in the logistics chain and handle all means of transport.
7. LNG as a fuel for the future: Ports perspective

Advantages of a fast implementation of natural gas as a fuel for mobility

- Improvement in environmental air quality
- Improvement in competitiveness of transport and logistics
- Attraction of ships with LNG
7. LNG as a fuel for the future: Ports perspective

Role of ports to develop a fuel switch in the transportation of goods

<table>
<thead>
<tr>
<th>Preparing supply infrastructures to accommodate future demand</th>
<th>Leadership and promotion of demonstrative initiatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔ Facilities available to supply trucks and terminal equipment</td>
<td>✔ Promotion of technological knowledge between operators</td>
</tr>
<tr>
<td>✔ Capability to supply ships with barges, tanker trucks and boarding pontoons</td>
<td>✔ Support and encouragement to demonstration initiatives</td>
</tr>
</tbody>
</table>
7. LNG as a fuel for the future: Bunker operator perspective

The Main factor is Demand. Close relationship with small scale

Extreme dependence on the supply chain (LNG terminal, liquefying plant)

Operational regulations clear and harmonized

Advantage of the pioneers
The most suitable ships for switching to LNG are:

- Ferry lines
- Cruise ships
- Regular container lines
- Harbor crafts (port services)
- Leisure ships
7. LNG as a fuel for the future: Bunker operator perspective

The more suitable ships for switching to LNG are:

- Ferry lines
- Cruises
- Regular container lines
- Harbor craft (port services)
- Leisure ships
7. LNG as a fuel for the future: Port of Barcelona

- **Supply infrastructure**
- **Promotion of LNG as a fuel: demonstration actions to break barriers**
- **Bonus scheme for ships using LNG as a fuel**
- **Regulation of bunkering operations TTS and STS**
## 7. LNG as a fuel for the future: Bunker operator perspective

<table>
<thead>
<tr>
<th>Bonus scheme for ships using LNG as fuel</th>
<th>Regulation of bunkering operations TTS and STS</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔ 70% reduction on vessels fee if the ship uses natural gas engines when at port</td>
<td>✔ Local rules and operational procedures for LNG supply</td>
</tr>
</tbody>
</table>
7. LNG as a fuel for the future: Bunker operator perspective

Supply Infrastructure

Modification of the existing barge to incorporate LNG tanks and supply systems to provide ships

Initiative of FLOTA SUARDIAZ (Suardiaz Fleet)

LNG berth devoted to supply small vessels and barges

Initiative of ENAGAS TRANSPORTE S.A.U.
7. LNG as a fuel for the future: Bunker operator perspective

Promotion of LNG as fuel in different segments of the port mobility

Incorporation of an auxiliary NG engine and LNG storage tank of 30 m³ on board

Initiative of BALEARIA Ferries and GAS NATURAL FENOSA

Construction and installation of NG engine on the wharf to supply electricity to the vessel

Initiative of FLOTA SUARDIAZ in collaboration with ports of Vigo, Tenerife and Barcelona
7. LNG as a fuel for the future: Bunker operator perspective

Promotion of LNG as fuel in different segments of the port mobility

Design of a tugboat powered by natural gas

Initiative of UTE REMOLCADORES BARCELONA SAR (Barcelona Tugboats SAR)

Adapting terminal equipment (Straddle Carrier) to be powered by natural gas

Initiative of IDIADA
7. LNG as a fuel for the future: Bunker operator perspective

Promotion of LNG as fuel in different segments of the port mobility

Promotion and licensing of LNG station in the Port area to supply LNG and CNG

Initiative of PORT AUTHORITY OF BARCELONA

Modification of trucks to be powered by natural gas

Initiative of IDIADA
1. Shifting to natural gas is an effective measure to reduce emissions

2. Ports are primary nodes for transport and logistic chains and therefore they are well positioned to promote gasification

3. For Ports, shifting to natural gas requires availability of supply infrastructures and promotion of actions in different segments of the goods mobility
Thank you