Green Ports Initiative in Spain. Waterfront at the Port Authority of the Balearic Islands

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Green Ports Targets

1. Emissions reduction
2. Reduction of the overall energy consumption
3. Encouragement of a distributed energy generation
4. Optimization in energy management
Waterfront principles

1. Guarantee water quality
2. Develop relationship between port & city
3. Preserve Heritage
4. Promote land and sea activities
5. Guarantee access to waterfronts
6. Develop Public-private Master Plan
7. Long term projects. Non stop projects
Green Port initiative

BALEARIC ISLANDS PORT AUTHORITY
Why green on the waterfront?

- Ports need to grow to develop new activities
  - Build up new piers
  - Environmental degradation

- City pushes Old port to new piers
Port environmental and safety tasks

- Ship
- Greenhouse gases emissions
- Noise and vibration pollution
- Dangerous goods
Port ops as far as possible

Small crafts surrounding City and Port border

Cruise traffic at the Balearic Islands
  ➢ New tourism option
  ➢ Developing market
  ➢ Do not need high city infrastructures
  ➢ Medium/high expense by call
  ➢ Port Authority / City “joint venture”
Green Ports Initiative in Spain

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Ro-Ro Ramp
New Pier #4
Security and Maintenance facility in partnership
Extend Pier #1
Upgrade Pier #2
Small Crafts Berthing
Rota
Puerto de Santa María

Are there any green models?

INITIAL STATUS FINAL STATUS

BERTHING LINE
1.400 m 2.400 m

DRAFT
-12,00 m -15,00 m

UTILITIES
Electricity, potable water, fuel (for ships and aircrafts), waste water & oily water collection, fire protection

Six different locations on the waterfront.
Various works, upgrading existing piers and constructing new ones.
Different constructive solutions of Port Engineering.
Are there any proven technologies?

- **Potable water system**: To fill ships tanks.

- **Waste water collection system**: To empty ships tanks.

- **Oily water collection system**: To empty ships bilges.

- **Shore-side electricity system (60 Hz)**: For use by ships at berth in port, supplying electricity to the ships electrical distribution system. It allows to switch off their auxiliary engines.

- **50 Hz system**: For auxiliary services of the pier (lighting, outlets for welding equipment, machines, tools, etc.).
Business model for the Port Authority

Feasibility study to reduce the emissions of greenhouse gases, noise and vibration in the Port areas of Palma and Ibiza installing a shore-side electricity system:

- Estimation of annual emissions reduced (ton/year) in each port, in each berthing point and for each type of ship.
- Project design of the power supply system in ports (12 mooring points).
- Schematic design of the ships retrofits (one ship by mooring point).
- Profitability of the proposal for each ship.
- Profitability of the proposal for the Port Authority.
Business model for the Port Authority. Emissions Reductions

### ANNUAL EMISSIONS REDUCTION IN EACH PORT

CONSIDERING THE EMISSION FACTORS FOR ELECTRICITY GENERATION IN SPAIN AND AUXILIARY ENGINES OF SHIPS, TOTAL HOURS BERTHEDED AND POWER OF AUXILIARY ENGINES

<table>
<thead>
<tr>
<th></th>
<th>NO\textsubscript{x} (TON/YEAR)</th>
<th>SO\textsubscript{2} (TON/YEAR)</th>
<th>CO\textsubscript{2} (TON/YEAR)</th>
<th>CO (TON/YEAR)</th>
<th>COV (TON/YEAR)</th>
<th>PM (TON/YEAR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>83,29</td>
<td>1,04</td>
<td>3,224,84</td>
<td>6,12</td>
<td>2,78</td>
<td>2,05</td>
</tr>
<tr>
<td>% REDUCTION</td>
<td>97%</td>
<td>31%</td>
<td>64%</td>
<td>94%</td>
<td>96%</td>
<td>94%</td>
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### ANNUAL EMISSIONS REDUCTION IN EACH PORT

IN FUNCTION OF THE GLOBAL WARMING POTENTIAL

| TOTAL CO\textsubscript{2} EQ | 3.280 |
Business model for the Port Authority. Profitability study

Factors considered for the analysis:

- **Fuel price.** Current price of MGO (Marine Gas Oil) in significant Spanish ports.

- **Auxiliary engines consumption.** According to the European Commission report performed by Entec UK Limited, year 2005.

- **Auxiliary engines maintenance costs savings.** According to the European Commission report performed by Entec UK Limited, year 2005.

- **Electricity prices in port.** Purchase price and sale price of the Port Authority.

- **Future scenario:** Energy trends depending on different inflation rates.
## Business model for the Port Authority. Profitability Analysis

<table>
<thead>
<tr>
<th>INCOMES</th>
<th>EXPENSES</th>
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<tbody>
<tr>
<td><strong>PORT AUTHORITY</strong></td>
<td>• INITIAL INVESTMENT FOR THE ELECTRICAL SYSTEM IN PORT</td>
</tr>
<tr>
<td>• ELECTRICITY SELL</td>
<td>• MAINTENANCE OF THE NEW ELECTRICAL SYSTEM</td>
</tr>
<tr>
<td></td>
<td>• ELECTRICITY PURCHASE TO THE SUPPLIER</td>
</tr>
<tr>
<td><strong>SHIP COMPANIES</strong></td>
<td>• INITIAL INVESTMENT FOR THE SHIP RETROFIT</td>
</tr>
<tr>
<td>• SAVINGS IN FUEL PURCHASING</td>
<td>• MAINTENANCE OF THE NEW ELECTRICAL SYSTEM</td>
</tr>
<tr>
<td>• SAVINGS IN AUXILIARY ENGINES MAINTENANCE</td>
<td>• ELECTRICITY PURCHASE TO THE PORT AUTHORITY</td>
</tr>
</tbody>
</table>

### Profitability results

- Port Authority IRR: **5.87%**.
- Ship Companies IRR: **8.12%**.

( amortization period of 15 years)

**IRR:** Internal Rate of Return
Business model for the Port Authority.

Project design of an oily water collection and treatment system in the Ports of Palma and Ibiza:

- **Data collection** (ships storage capacity, discharge pumps, connection type and location, ships calls).
- **Project design** according to the design criteria.
  - Technical specifications.
  - Drawings.
  - Cost estimation.
- **Profitability of the proposal.**

**Conclusions**

- Auxiliary means are eliminated.
- The resulting amount of sludge diminishes. Treatment plant efficiency 95–98%.
- High profitability. Port Authority **IRR: 68%**.
  (amortization period of 10 years)

IRR: Internal Rate of Return
The application of environmental policies is the great tool for Ports to integrate in the city.

A good environmental behavior can also be a convincing commercial argument, positioning the Port and the City ahead of its competitors.

Our experience evidences that it is possible to build a business model, as profitable for the Port Authorities as for the rest of the agents involved (shipping companies, private initiative).