Activity 1: Mapping of Port Container Terminal Energy Profile

GREENCRANES

GREEN Technologies and Eco-Efficient Alternatives for CRANES and Operations at Port Container Terminals

Project code: 2011-EU-92151-S
TEN-T Annual Call 2011

Intermediate InfoDay – Valencia, 29th May 2013
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Introduction

Port Container Terminals have been studied with the aim of obtaining their energy profiles and the global carbon footprint produced, taking into account the activities carried out by the whole group of machinery and equipment involved.

The aim is to characterise PCTs energy profiles by means of the evaluation of the energy performance of their activities and processes, thus quantifying their impact in terms of GHG emissions.

How much energy is consumed? Where is the energy consumed?
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Methodology

• Study developed taking as a reference the years 2011 and 2012
• Classification of port machinery and equipment considering technical specifications
• Electrical consumption by type of machine and equipment
• Fuel consumption by type of machine and equipment
• Calculation of associated Green-House Gas Emissions (GHG) derived from electrical and fuel consumption expressed in CO$_{2}$eq
Methodology

Container Terminal Machinery and Equipment

- Ship-to-Shore Crane
- Reefer Containers
- Offices
- Lightning
- Rubber Tyred Gantry Crane (RTG)
- Terminal Tractor
- Reach Stacker
- Empty Forklift
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How Much Energy? Electrical Consumption

**NCTV Electrical Consumption 2012 (kWh)**
- 12,522,629 kWh (43%)
- 11,006,280 kWh (37%)
- 4,801,013 kWh (15%)
- 1,815,477 kWh (5%)

**Livorno TDT Electrical Consumption 2012 (kWh)**
- 30,145,399 kWh (30.1 GWh)

\[ \times 3,000 \text{ (10,000 kWh/ year)} \]
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How Much Energy? Fuel Consumption

**NCTV Yard Machinery. Total Fuel Consumption 2012**
- 4,049,138 L (58%)
- 2,245,147 L (32%)
- 611,460 L (9%)
- 80,819 L (1%)

**Livorno TDT Yard Machinery. Total Fuel Consumption 2012**
- 6,986,564 L

90% of total fuel consumption is used for RTGs.

X 4,000 (1,300 L / year)
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How does energy efficiency affects costs in port operations?

Energy efficiency criteria can be considered as one more decision-making instrument within the general operative model of TPCs.
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Where is the Energy?
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Where is the Energy?

\[ FC_{RTG}(L/mov) = \sum_{j} \text{mov}_{RTGj}(\%) \times f_{RTGj}(L/mov) \]

- > 700,000 KWh
- 500,000 – 700,000 KWh
- < 500,000 KWh
Where is the Energy?

- > 700,000 KWh
- 500,000 – 700,000 KWh
- < 500,000 KWh

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Carbon Footprint

Carbon Footprint is a useful indicator for all kinds of organizations to measure their environmental impact in terms of Greenhouse Gas Emissions (GHG)

<table>
<thead>
<tr>
<th>Port (Country)</th>
<th>Electricity (g. CO2 / KWh)</th>
<th>Fuel (Tonne CO2 / Tep)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Koper (Slovenia)</td>
<td>550</td>
<td>3.07</td>
</tr>
<tr>
<td>Livorno (Italy)</td>
<td>634</td>
<td>2.96</td>
</tr>
<tr>
<td>Valencia (Spain)</td>
<td>335</td>
<td>3.06</td>
</tr>
</tbody>
</table>
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Carbon Footprint Calculation. Results

Koper CT Carbon Footprint Distribution. Year 2012

Carbon Footprint Electricity and Fuel Kg. CO₂eq / TEU

TOTALS NCTV, TDT AND KOPER

RTGs 35%
Terminal Tractors 22%
Reefer Containers 13%

Carbon Footprint (Electricity) 4.15 Kg CO₂eq / TEU
Carbon Footprint (Fuel) 7.57 Kg CO₂eq / TEU

11.7 Kg CO₂eq / TEU
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Conclusions

- **Port Container Terminals** are huge energy consumers, especially on those energy sources based on fossil fuels. Average values show a yearly fuel consumption of nearly 7 million fuel litres (in form of diesel oil) and 30 GWh of electricity consumption including the three participant terminals.

- From the economic point of view, the general increase of energy prices is affecting port installations, representing every day more a significant cost which reduces their competitiveness.

- In terms of environmental impact, the use of the current fuels in a non-stop operative model generates a great amount of GHG emissions, with an estimation of nearly 25,000 CO$_{2eq}$ tonnes derived from the use of diesel oil at the three participant PCTs in 2012.

- Concerning social impact, port installations are usually located near populated cities and urban areas, especially in the Mediterranean. Port operations affects nearby population as direct GHG emissions (derived from diesel oil) are locally deployed, not only CO$_{2}$, but also other pollutant and toxic gases like N$_{2}$O, Sulphur compounds and suspension particles.

- Efforts to reduce fuel consumption and GHG emissions produced by RTGs, yard tractors and reach stackers are strongly recommended.
THANKS FOR YOUR ATTENTION!

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