Integral Assessment of Alternatives at the Port of Koper

Boštjan Pavlič (Luka Koper - Port of Koper)

VI Port Cluster Innovation Congress & GreenCranes Intermediate Information Days, Session: Assessment of Energy Efficiency Alternatives at Port Container Terminals

Valencia | 29.05.2013
Content

- Introduction – Port of Koper (key facts and strategic position)
- Container terminal machinery
- Container terminal energy balance
- Role of the energy efficiency - systematic approach, how to exploit the full potential of the energy efficiency measures in the Port of Koper
- Alternative fuels and scenarios
- Conclusion and future challenges
Introduction – Port of Koper

- the only cargo port in Slovenia
- port founded in year 1957
- 280 ha of port area
- multi-purpose port (containers, cars, general cargo, light perishable goods, timber, dry bulks, liquid bulks)
- transit oriented port (only 30% for national market)
- main foreign markets: Austria, Italy, Hungary, Slovakia, Czech Republic, Southern Germany etc.
- maritime throughput 17,88 million tonnes in year 201
- most of the area reclaimed from the sea
- port located next to the old city center of Koper
- on the crossroad of Baltic-Adriatic corridor and Mediterranean corridor,
- recognized as a core EU port (within TEN-T regulations).
Introduction – Port of Koper/ Container Terminal, key facts

- Quayside 596 m
- Max. allowed draft – 11.4 m
- Berths: 3
- Railway tracks: 2x 671 m, 1x 647 m, 2x 270 m
- Total terminal area: 270,000 m²
- Storage capacity: 26,500 TEUs (full & empty)
- Est. total annual capacity: 750,000 TEUs
Green Technologies and Eco-efficient Alternatives for Cranes and Operations at Port Container Terminals

**Container terminal machinery**

- **Lift capacity (in tonnes)**
  - 4x STS panamax cranes 40/45 under spreader
  - 4x STS post-panamax cranes (outreach 51m) 51/65 under spreader
  - 16x rubber-tyred G/C (storage area) 40
  - 2x rubber-tyred G/C (railway tracks) 40
  - 11x reach stackers 42 - 45
  - 7x ECH – empty container handler 7 - 9
  - 46x yard trucks and 49x trailers
  - 3x tugmaster (tractor) 25 (on 5<sup>th</sup> wheel)
Energy balance

Energy in 2012; Port of Koper: Fuel and Electricity

Consumption on the Container Terminal
Despite huge EU policy efforts, the EU is far from reaching its 2020 energy savings target. Projected gap in Mediterranean countries is even bigger (having in mind consequences of the economic and financial crisis). There is a need for new, innovative, efficient and effective instruments and measures. Respond on the local level – Luka Koper systematically and continuously analyzes all possibilities for the optimization of port activities and related costs reduction.

- Emisions CO$_2$, Year 2011 – 24.172 t
Systematic approach at Luka Koper – every energy efficiency measure is accompanied with the implementation follow-up program and the clear definition of responsibilities of the management bodies on the Port and Terminal level.

Goal is to trigger overall *greenification of Luka Koper*

There is need for Integrated Performance Measurement System – *Energy and Environmental Management System* (EEMS)
Port of Koper sees **EEMS** as a tool for achieving targets and objectives related with the overall competitiveness through the **system of metering, monitoring, and evaluation of energy and environmental performance**.

Implementation in phases, bottom – up approach, in the first phase EEMS will be implemented on the Container Terminal.
Luka Koper systematically examines availability of alternative fuels in order to test and develop solutions for the successful and sustainable transformation of all port operations including innovative business models, financial support and incentives.

The first step – greeinification of heating system and elimination of extra lighting fuel oil.

On-going project – around 160,000 liters of extra light fuel oil per year will be replaced with the energy from the biomass (wooden leftovers – own energy source) and solar energy.

Accordingly, CO₂ emissions will be reduced for 434 tonnes annually.
Another alternative – fuel switch, use of the compressed natural gas instead of diesel fuel

Currently, there is no natural gas network in the vicinity of the Port of Koper

According to the new Slovenian energy program proposal and official plans of the national natural gas transmission system operator it cannot be expected that the natural gas will be available for use in the Port of Koper before 2020!
Natural gas network in the Obalno-Kraška (Coastal-Karst) region - current situation, no natural gas network (left) and expected future situation in 2020, new connection M6* (right)

* Source: Geoplin plinovodi, Družba za upravljanje s prenosnim omrežjem d.o.o. Razvojni načrt prenosnega plinovodnega omrežja za obdobje 2011 – 2020 (Razširjeni povzetek)
Another alternative – **Electrification of all operation at the Container Terminal**

- Excellent potential for the energy and environmental improvements
- In comparison with the current situation electrification can bring **energy savings** and **emission reductions** for up to 80%
- Significant noise level reduction
- Problem - Connection on the 110 kV grid:
  - High costs
  - Insufficient spatial planning – slow procedures
Alternative fuels and scenarios (5)

Future opportunities: electrification

- Two possibilities for the connection on the 110 kV grid
  - RTP Dekani and/or RTP Koper

- It is estimated (according to the initial consultation with system operator) that this connection can be realized in next 5 to 7 years (up to 2020)
Evaluation of the **flywheel technology** in the process of energy recovery and storage in a mobile gantry cranes

- Investigation of the energy recovery and storage technologies for electric power applications in ports – flywheel biggest potential for applicability on RTG cranes
- Already some implementations in transport/ports
- main advantages of flywheel storage systems are the high charge and discharge rates for many cycles

Main components of the flywheel storage system
When flywheels are used with an RTG crane, two units are employed; a single unit provides isolated energy storage to an individual hoist motor drive. The two units are packaged together and installed underneath a crane support beam.
Alternative fuels and scenarios (8)

Case study: flywheel technology

Flywheels store energy when the RTG works during the lowering operation. The maximum amount of energy stored is produced when the RTG lowers a full loaded container.

Experiences with flywheels installed in RTGs have been conducted in recent years at ports of the USA and show significant energy consumption reductions with percentages of 20-25% of reduction and reaching 35% in some cases.

Source: Vycon Energy
Alternative fuels and scenarios (9)

Case study: flywheel technology

- RTG cranes – main consumers of diesel fuel and major contributor of diesel emissions at the Port of Koper

- Cost benefit analysis:
  - Without genset change - not commercially justifiable
  - with genset downsizing – payback period 7 – 10 years

The fuel consumption distribution per type of machinery used on the Container Terminal of the Port of Koper (year 2011)
Conclusion and future challenges

- **Energy efficiency** and utilization of **renewable energy sources** are recognized as key instruments for reaching set goals.
- However, **large scale** implementation of energy efficiency measures and utilization of renewable energy sources in the Port of Koper may prove to be quite **challenging introduction of change** in a very **complex environment**.
- There is a need for **harmonization of interests** between the State, Municipality of Koper and Port of Koper.
Port of Koper started with the transformation in sustainable and low carbon port!

EEMS has been recognized as the first and necessary step in the development of sustainable port infrastructure.

EEMS will enable exploitation of the full potential of the Port of Koper, especially in the field of competitiveness and economic growth and reduction of negative environmental impacts.

Performance measurement will provide means for tracking position and maintaining discipline and control over energy use and environmental impacts.
Questions?
Thank you for your attention

bostjan.pavlic@luka-kp.si

VI Port Cluster Innovation Congress & GreenCranes Intermediate Information Days,
Session: Assessment of Energy Efficiency Alternatives at Port Container Terminals

Valencia| 29.05.2013