



SEAterminals

SMART, ENERGY EFFICIENT AND ADAPTIVE PORT TERMINALS



Co-financed by the European Union
Trans-European Transport Network (TEN-T)

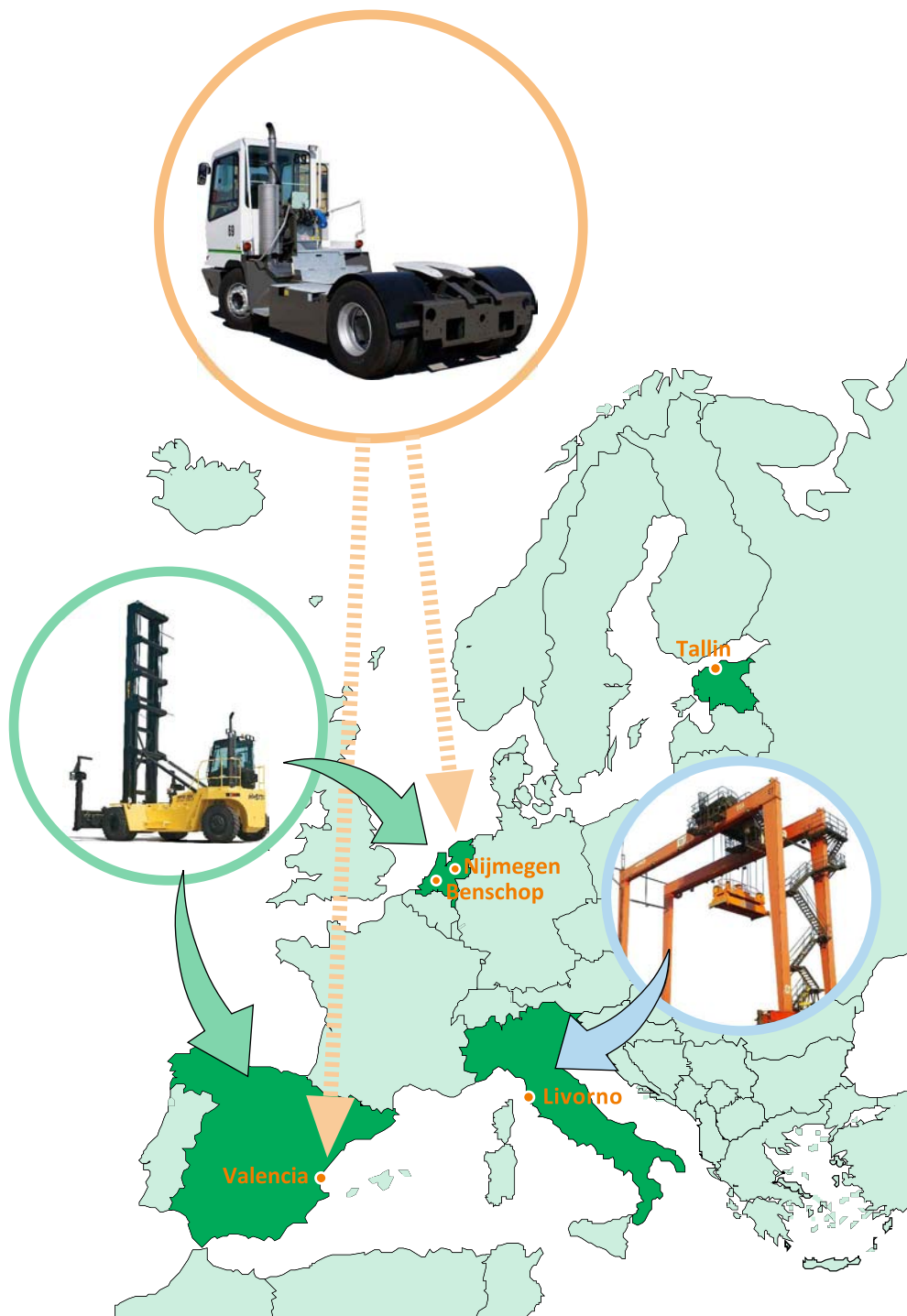
MOTIVATION ■ ■ ■

SEA TERMINALS aims to encourage a new culture in the current operative model of the port industry by introducing eco-efficiency as a key variable in order to improve activities and processes linked to Port Container Terminals (PCT's). The study is oriented to PCT's as these facilities are remarkable energy consumption centers within the European port sector.

PCT's are responsible for a major share of GHG and pollutant emissions generated by the intensive use of diesel powered heavy-duty machinery in non-stop cycles (24 hours) during the whole year. In consequence, this not only produces a medium-long term impact due to the contribution of these emissions to global climate change, but also a short-term effect on the population and the environment due to the continuous exhaust of compounds like SOX, NOX and particulate matter responsible for causing respiratory illnesses.

The integration of energy efficiency into the PCT operating model will cause a significant reduction of GHG emissions, which will benefit both from the economic and environmental points of view.

SEA TERMINALS seeks to follow the path opened up by **GREENCRANES**, but taking a step beyond in testing real sustainability in ports. The project will continue developing innovative concepts based onto the adaptation of port machinery, as well as incorporating state-of-the-art technologies capable to be implemented at PCT's in the short term after being prototyped and tested (being the last mentioned to be developed at the project). Hence the developing of eco-efficient measures at the port industry is being encouraged by the SEA TERMINALS project.



OBJECTIVES

Smart, Energy Efficient and Adaptive Port Terminals - SEA TERMINALS aims to boost the evolution of the port industry towards a progressive and effective low-carbon emission operative model, integrating smart and energy-efficient technologies (hybrid machinery concepts, LNG as a fuel, electrical heavy-duty vehicles) through innovative business and energy-efficient solutions, focused on heavy-duty handling machinery and equipment. SEA TERMINALS takes as point of departure the lessons learned from the successful TEN-T GREENCRANES co-funded project, which has demonstrated that alternative fuels and smart energy management can produce remarkable positive effects on energy consumption and GHG emissions reduction.

SEA TERMINALS will demonstrate by means of **real life trials in the ports of Valencia (Spain) and Livorno (Italy)** an integrated and comprehensive set of **prototypes based on low-carbon emission technologies** implemented in last-generation port machinery and equipment. All the prototypes tested and piloted will be business and market-sided oriented, thus being demonstrated their investment feasibility. The expected successful results in the pilot actions would provide valuable information and contribute decisively to many existing PCTs' decision-making as they would have relevant proofs of how these technologies decrease their GHG emissions whilst reducing their energy bill and increasing their productivity.

One of the reasons whereby port container terminals are not investing in these technologies nowadays is precisely the lack of real life experiments and results from real trials and implementations. There are several reasons for the above mentioned situation, confirmed during the execution of GREENCRANES as well:

- It is expensive for heavy-duty machinery and equipment manufacturers to carry out tests in real life scenarios due to several costs: adaptation of the prototypes to the terminals' operative model, training of terminal staff, etc.
- In the same manner, container terminal operators are usually reluctant to test new machinery and technologies within real life operations due to the risk of failures, operative losses or accidents.
- Purchase criteria are highly driven by corporate-cultural reasons (for example, a long tradition on using a specific model or machine) more than by technical and investment profitability criteria.
- There is not effective communication among port operators due to the strong market competence. Successful stories are not properly communicated and shared with the objective of keeping the competitive advantage.

As a consequence, a situation of “chicken and egg” dilemma arises, thus introducing barriers for the swift investments of new technologies and innovative concepts within an industry with a significant intensity on energy consumption and great environmental impact.

From the end-user perspective, the ports of Valencia and Livorno will become a real test field for eco-efficient solutions based on alternative fuels (electrical/hybrid, LNG and dual-fuel technologies) and smart energy efficiency management (SEAMS), thus leading port container innovation in Europe.

The specific objectives of SEA TERMINALS are:

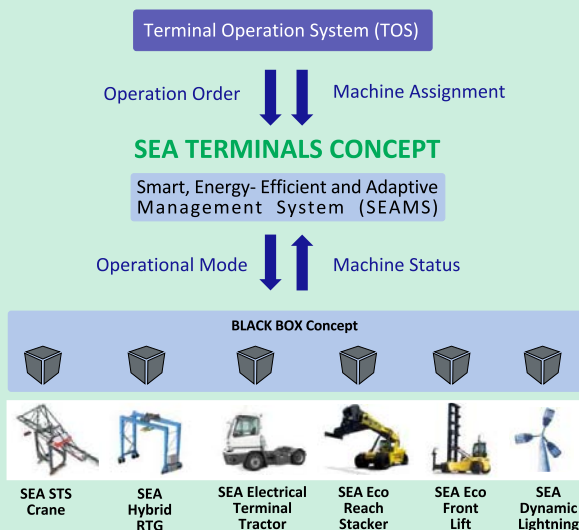
- 1.- Develop and deploy to the market a comprehensive set of **low carbon and eco-efficient alternatives for European PCTs**.
- 2.- Design, prototyping and deployment of a **Smart, Efficient and Adaptive Energy Management System (SEAMS)**.
- 3.- Design and prototyping of eco-efficient, **LNG powered, hybrid and full electric port container machinery**.
- 4.- Develop **real life trials** involving last generation SEA TERMINALS prototypes.
- 5.- **Definition of Standards and Policies Based on the Project Results** to Ensure the Adoption of These Technologies by a Critical Mass of PCTs in the EU.

PILOTS AND DEMONSTRATIONS

SEAMS Platform & Black Box

Smart, Energy-Efficient and Adaptive Management Platform (SEAMS). The SEAMS system will connect the operational and energy dimensions of container terminal operations, being able to assign the most efficient working mode to any machine according to its specific working conditions in real time.

Integration of the SEAMS and Black Box concepts. The entire container terminal will participate in a real life test field as all existing terminal machines, vehicles and lighting will be connected to the SEAMS Platform by means of “Black Boxes” able to transmit real time energy and operative status.



Eco-Efficient Adaptive Equipment

Four types of eco-efficient adaptive equipment will be tested in real life trials in Valencia:

- * Smart, Energy Efficient and Adaptive Electrical Terminal Tractor (SEA-eTractor): A fully electric terminal tractor prototype will be designed, prototyped and piloted

- * Smart, Energy Efficient and Adaptive ECO-RTG crane (SEA-EcoRTG): The SEA-EcoRTG is an optimised RTG able to work at the minimum cost point (sum of operative and energy cost)

- * Smart, Energy Efficient and Adaptive Reach Stacker (SEA-EcoRS) with Stage IV drive-train developments (Diesel, LPG or LNG fuelled)

- * Empty Container Handler (SEA-ECH): This prototype will allow fuel efficiency while increasing productivity for port container operators



Terminal Dynamic Lighting (SEA-Lighting)

The SEA-Lighting prototype and pilot will reduce electrical illumination consumption by selecting and adapting the intensity of lighting needed depending on the operations being carried out in real time. The project's goal is to reduce energy consumption using dynamic lighting by 30%.

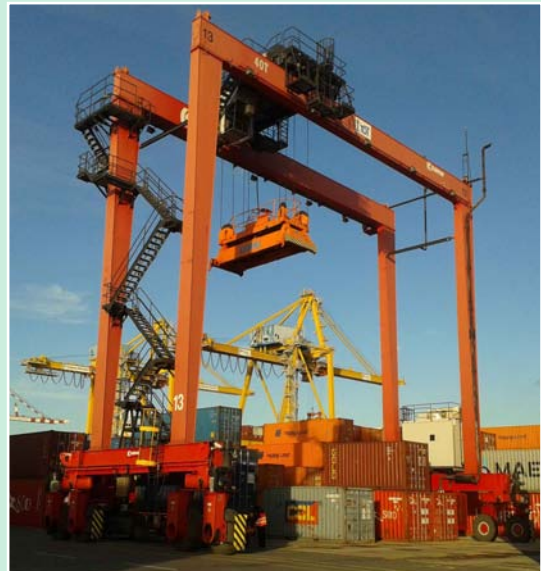


LNG Supply and Equipment

At the port of Livorno, LNG supply and Dual Fuel LNG powered machinery will be prototyped and piloted. The objective of this pilot project will be to overcome the current lack of LNG supply availability in the area of Livorno and to develop LNG usage. The Port of Livorno will test two innovative concepts:

*LNG dual-fuel rubber tyred gantry crane (SEA-Dual Fuel RTG)

*An LNG supply mobile station specifically designed for refuelling port gantry cranes

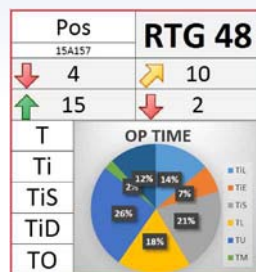


TECHNOLOGIES

Technology 1: Integral Port Equipment Monitoring

Different terminal machinery and equipment will be monitored in real time through the “Black Box”, regarding operational and energy status. The Black Box is a complete data logger with a very capable database system that allows information transfer of selected machine signals and meters like working mode status, engine regime (rpm), instant fuel consumption, position, etc.

The Black Box device will serve as communication link between the physical operational dimension of the terminal (machinery and equipment) and its logical dimension (SEAMS Platform). The main purpose will be to allow the SEAMS Platform to identify operational bottlenecks, thus allowing the system to assign suitable working modes that will optimize cycle times and reduce unnecessary fuel consumption.



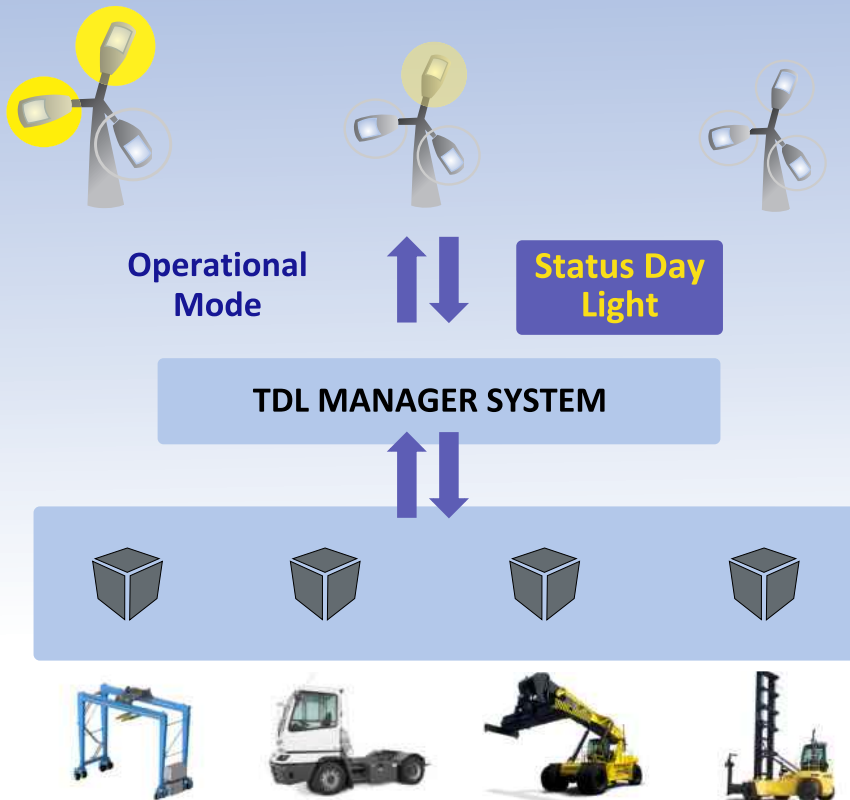
Technology 2: Low Carbon / Zero Emission Port Machinery

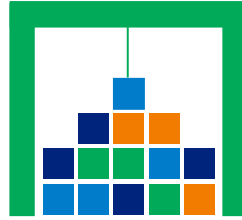
The technologies applied to the port machinery will be based on alternative fuels like Liquefied Natural Gas (LNG) and full electric equipment, thus demonstrating feasibility for the market adoption of a new generation of low carbon, efficient and adaptive machinery and equipment. The project will take advantage of current and on-going industrial prototypes that are in the last pre-commercial development stage. The equipment will be operated under a system able to optimize their working performance in a dynamic and remote way (real time) depending on the current state of the operational requirements.



Technology 3: Dynamic Lighting Management

The Dynamic Lighting Management system will be able to manage terminal lighting in an automated way, i.e. areas where there are ongoing operations will keep appropriate lighting levels and areas without operations will significantly decrease it, being this a dynamic and changing process in real time. The introduction of the Dynamic Lighting Management concept will allow port operators to adapt lighting conditions to specific operational needs in any circumstances.





SEAterminals

www.seaterminals.eu · Testing the Way to Real Sustainability in Ports

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