

# GREENCRANES: Testing the way to sustainability in ports

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One of the main strategic guidelines established by the European Commission about energy efficiency is related to assuring an effective transition towards the use of energy sources with lower environmental impact in terms of greenhouse gas (GHG) emissions.

Such evolution should be sustainable in the mid to long term from different points of view, including the economic-financial, environmental and social perspectives.

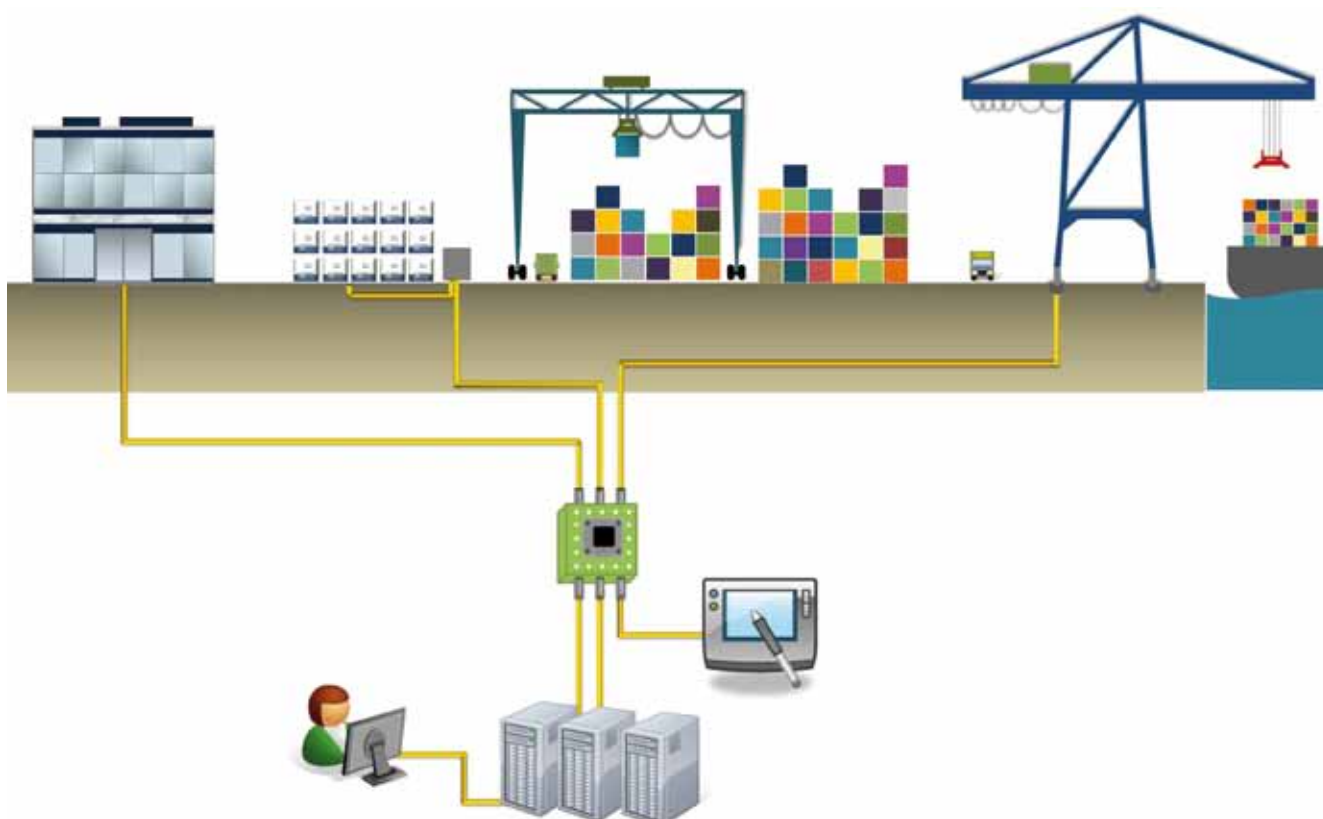
In recent years the integration of renewable energy and alternative fuels within the industrial and transport sector has been greatly encouraged. However, despite important efforts, the total share of such greener alternatives remains modest considering the production and consumption energy mix on a European level. In January 2013 the European Commission launched a communication titled: 'Clean Power for Transport: a

European Alternative Fuels Strategy' which reflects upon the important dependency of oil and its sub-products within the European transport sector. Moreover, high economic costs as well as environmental impact are addressed as significant barriers for the fulfilment of the 20/20/20 objectives established by the Commission.

The maritime transport and port-logistic sectors are strongly affected



LNG tractor and mobile supply station.



Energy consumption monitoring concept.

by this situation, due to their strategic importance as key drivers of international trade and transport of goods. However, it is worth mentioning that energy efficiency has not been considered as an important improvement field in this sector until recent years. Fortunately, this situation is changing quickly thanks to the major awareness of the industrial sector and the innovation developed by research teams and port machinery manufacturers.

### The GREENCRANES TEN-T project

Within this context, the project 'Green Technologies and Eco-Efficient Alternatives for Cranes and Operations at Port Container Terminals' (GREENCRANES) aims to be an innovative action which contributes to the improvement of energy efficiency of port container terminals. GREENCRANES was awarded European funds through the Trans-European Transport Network (TEN-T). The project started in August 2012 and will end in May 2014. The participants in the GREENCRANES project are the Valenciaport Foundation (acting as coordinator); the Port Authority of Valencia; Noatum; Konecranes; ABB; Port of Koper and the Italian Ministry of Infrastructure and

Transport. The implementing bodies are Autorità Portuale Livorno; RINA SpA; Global Service Srl; Scuola Superiore Sant'Anna - Perceptual Robotics Laboratory.

The main mission of the project is to provide tools to port container terminal decision-makers which increase energy efficiency of equipment and machinery. GREENCRANES proposes the development of different actions including:

- To characterise the energy profiles of port container terminals, thus quantifying the amount of energy consumed and its location.
- To analyse the feasibility of several eco-efficient alternatives able to produce a significant reduction of the environmental impact of these facilities without affecting productivity.
- To develop pilot tests of those alternatives with higher implementation potential and significant reduction of GHG emissions.
- To provide recommendations and guidelines to the port industry, port container operators, public authorities, etc. derived from the results obtained in the project.
- To communicate and disseminate

these results and good practices among the European port sector and the public in general.

### Integral energy consumption diagnosis

GREENCRANES is structured into three key activities oriented towards the achievement of their described objectives. The first activity consisted of an integral energy consumption diagnosis of the participant terminals in the project: Noatum Container Terminal Valencia (Spain), Livorno Darsena Toscana (Italy) and Koper Container Terminal (Slovenia).

This study concluded that 80 percent of electrical consumption is produced by reefer containers connected at the yard (43 percent) and ship-to-shore cranes (37 percent) in charge of loading and unloading containers to and from vessels. With regard to fuel consumption, the study found that 90 percent of the total consumption is distributed between rubber-tyred gantry (RTG) cranes (58 percent) and terminal tractors in charge of the horizontal transport (32 percent). In absolute figures, in 2012, the three studied container terminals consumed more than 30 GWh of electricity, which equals to the annual consumption of 3,000 Spanish homes on average. In the same manner, the amount of fuel

consumed almost reached 7 million litres. The associated carbon footprint generated was calculated as 11.7 kilogrammes of carbon dioxide (CO<sub>2</sub>) equivalent per twenty-foot equivalent unit (TEU).

### Evaluation of eco-efficient alternatives

The second activity of GREENCRANES consisted of the development of studies focused on evaluating financial, technical and environmental feasibility of a selected group of eco-efficient alternatives which may allow the reduction of GHG emissions.

### The use of liquefied natural gas (LNG) in terminal tractors

The feasibility study for this alternative option concluded that it is affordable from the financial, technical and environmental perspectives, assuming the current gap of price between LNG and diesel fuels. The study was conducted for the Noatum Container Terminal Valencia (NCTV) business case and shows that a minimum fleet of 19 new terminal tractors would be needed to ensure the critical mass which provide an internal rate of return (IRR) of 10 percent (the minimum profitability threshold established by the company).

### Reach stacker retrofitting with dual fuel technology

This alternative was also considered as feasible, taking into account that emissions reduction would be greater considering a full LNG solution, but the high power requirements of this machine when lifting up and down containers make it more suitable as an intermediate solution in order to fulfil operative performance.

### Electrification of RTG cranes

Electrification is a viable solution for greenfield terminals, although in existing facilities a detailed study must be carried out for each specific case. It is the alternative with a higher degree of environmental local benefits, as CO<sub>2</sub> emissions reduction could reach 90 percent. Moreover it provides significant savings in energy cost due to the use of electricity instead of fossil fuels.

### Optimisation of RTG cranes by generator power adjustment

Tests carried out in GREENCRANES show that old RTG cranes are equipped with oversized generators, thus providing much more power than the needed to perform port operations. In this manner,

it is possible to adjust the real power requirements by means of substituting old systems with smaller new units able to reduce fuel consumption and emissions.

### Development of market-sided pilots

Activity three of GREENCRANES is to develop market-sided innovation by means of the demonstration of pilot projects in the ports of Valencia, Livorno and Koper.

Within the framework of the project, the first European prototype of a 100 percent LNG propelled terminal tractor has been developed. The prototype is currently being tested at NCTV, jointly with a last generation diesel (stage IV) terminal tractor in order to compare operative performances of both machines. The results of the pilot will be used as decision criteria to progressively replace the fleet of 90 terminal tractors of NCTV by new LNG units.

Another pilot consists of the dual fuel technology implementation in a reach stacker vehicle. The pilot will be conducted at the Darsena Toscana Terminal in the Port of Livorno, thus demonstrating the feasibility for the adoption of alternative fuels in heavy-duty port vehicles.

The final pilot and demonstration will be based on the implementation of a real-time energy consumption monitoring system at the Port of Koper Container Terminal, with the aim of preparing the terminal for a future certification with the ISO 50001 standard.

*It is a pleasure for us to invite readers of Port Technology International to attend the real live demonstrations taking place on December 2nd in Valencia, where the LNG powered terminal tractor and retrofitted eco-RTG will be presented. For more information and to register for these Demo Days, please visit: [www.greencranes.eu](http://www.greencranes.eu) <<http://www.greencranes.eu/>> .*

### About the author



José Andrés Giménez qualified as an industrial engineer at the Polytechnic University of Valencia in Spain. He is research and development project manager at the Valenciaport Foundation and has 10 years' experience in managing and developing innovation and research projects in the port-logistic and maritime transport sectors, with special focus on energy efficiency, security and safety. His work is focused on R&D projects financed by the European Commission through innovation, research and cooperation programmes like TEN-T and VII Framework Programme among others. He is also the technical manager for the GREENCRANES project.

### About the organisation

The Valenciaport Foundation for Research, Promotion and Commercial Studies of the Valencian region (Valenciaport Foundation) is a non-profit private entity. It has been conceived to expand the reach of the logistics-ports community by serving as a research, training and cooperation centre of excellence. The Valenciaport Foundation manifests an initiative of the Port Authority of Valencia, in collaboration with various other associations, companies and institutions. The Valenciaport Foundation is presently active in numerous cooperation and internationalisation projects in over 20 countries, principally located in Europe, the Far East and Latin America.

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