



Scuola Superiore  
Sant'Anna  
di Studi Universitari e di Perfezionamento



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SEAterminals

# LNG Dual-Fuel Rubber Tyred Gantry Crane

## PROTOTYPE DESCRIPTION

The LNG Dual-Fuel Rubber Tyred Gantry Crane (RTG) is a prototype within the framework of the European project SEA TERMINALS, where an existing RTG is retrofitted from diesel powered to dual-fuel (Diesel-LNG) in the Terminal Darsena Toscana at the Port of Livorno.

The RTG prototype powered by dual-fuel is tested and validated comparing the indicators of consumption, emission, power, efficiency and costs to an RTG powered by diesel during full cycles of work, under the same operating conditions.

## OBJECTIVES

The main objective is to study, design, construct and test the first RTG conversion system from diesel to dual fuel, carrying out an economic analysis of the prototype versus similar machines.

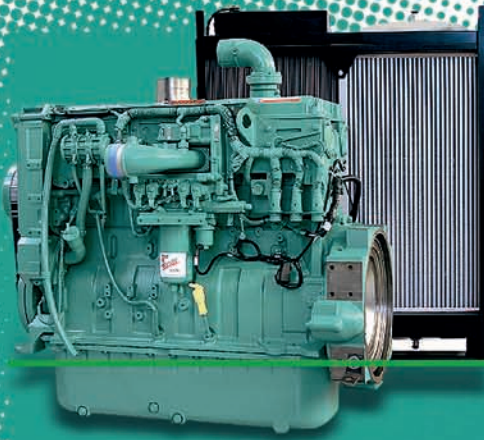
Innovation and development has been done in the improvement of the LNG tank lifetime by increasing the shell tank durability and capacity of retaining gas evaporation losses.

Moreover, a specific mobile refuelling station for supplying LNG to the dual-fuel RTG will be deployed in order to assure LNG availability for the prototype.





# ENGINEERING PROCESS



## DUAL FUEL SYSTEM

The Dual Fuel System can be fitted on a standard diesel engine, which operates unchanged. The most relevant difference is that the majority of the power is generated by the combustion of natural gas which generates less pollutant particulates and GHG emissions than diesel fuel.

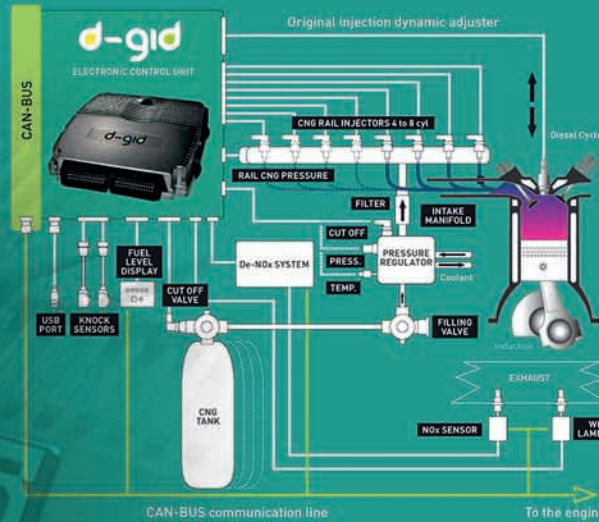
## WEATHERING TANK

Evaporation losses in the LNG supply chain are one of the key factors for LNG safety, technical and economic assessment. LNG weathering issue is focused on the cryogenic tank that is going to be installed on the RTG. In addition, it is proposed a system to recover the gas released to the atmosphere in the venting process.

## ENGINE

The dual fuel prototype is being carried out on a Kalmar RTG equipped with Cummins engine model QSX15-G6 – 1800 rpm.

In this way it will be possible to compare the performance of the dual fuel prototype with the performances of other RTGs at the port container terminal, working at the same operative conditions.

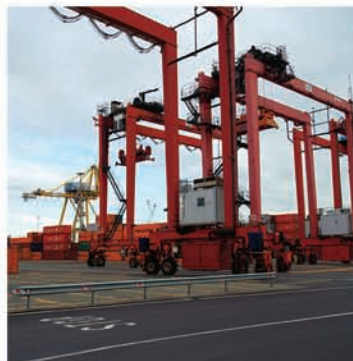
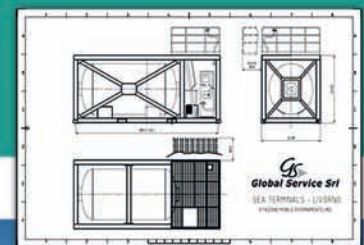
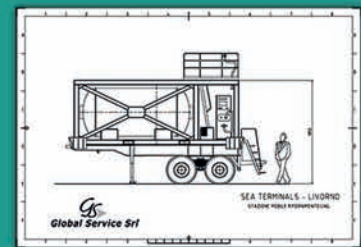


## LNG SUPPLY MODULE

An innovative mobile refuelling station is being prototyped for supplying both the tank of the LNG dual-fuel RTG crane located in elevated position and LNG fuelled trucks.

A modular system is being developed for supplying the LNG tanks in an elevated position (height of about 4 meters compared to the quay) and currently there are not similar solutions available on the market.

The system consists of a modular mobile LNG distributing station arranged in a customised tank container with the upper floor practicable, with a moving walkway to refuel in height safety.



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