

# HIGH-EFFICIENCY WASTE HEAT RECOVERY IN SERVICE

**A NEW SERIES** of super post-panamax containerships powered by Wärtsilä RT-flex common-rail low-speed engines is leading the way in both fuel economy and low exhaust emissions by using high-efficiency Waste Heat Recovery (WHR) plants.

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**T**he first installation in M/S Gudrun Mærsk, a 7000 TEU containership belonging to the Danish shipowner A.P. Møller, entered service in June 2005 and successfully confirmed the benefits of the new WHR plant concept. During sea trials and in operation, the performance of the WHR plant exceeded expectations.

Similar WHR plants are now in normal operation in six 7000 TEU ships, the others being the M/S Grete Mærsk, M/S Gunvor Mærsk, M/S Gjertrud Mærsk, M/S Gerd Mærsk and M/S Georg Mærsk.

## Jointly developed

The concept for this plant was devised by Wärtsilä together with the builder Odense Steel Shipyard and the owners based on adapting engines for ambient air intake and the flexibility in engine setting provided by Wärtsilä RT-flex common-rail technology (see page 45). The WHR plant itself was developed in a joint effort headed and integrated by Odense Steel Shipyard Ltd in cooperation with Wärtsilä, Siemens AG, Peter Brotherhood Ltd and Aalborg Industries Ltd.

Each of the six ships is propelled by a Sulzer

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12RT-flex96C low-speed common-rail engine with a maximum continuous power output of 68,640 kW at 102 rpm. Exhaust gases pass through a dual-pressure exhaust-gas economiser supplied by Aalborg Industries A/S, and the resulting superheated steam is utilised in a 6 MWe turbogenerator set supplied by Peter Brotherhood Ltd. The turbogenerator sets incorporate both a multi-stage dual-pressure steam turbine and an exhaust-gas power turbine. The electricity generated is supplied to each ship's main switchboard and used in both a Siemens shaft motor/generator that assists in ship propulsion, and for powering shipboard services. A portion of the steam from the exhaust economiser is utilised for shipboard heating.

## Satisfactory operation

The output of the turbogenerator set was calculated using ISO standard reference conditions which include an ambient temperature of 25°C. During sea trials with the first ship, this performance was exceeded as this level of output was already achieved with ambient air at a temperature of 14°C. Following delivery, the high-efficiency Waste Heat Recovery plants have operated entirely satisfactorily.

Each of the six Mærsk vessels are also equipped with three eight-cylinder Wärtsilä 32 generating sets which have a combined electrical output of 11.2 MWe. Installation of high-efficiency WHR plant meant that the number of diesel generating sets required on each vessel was one less than it would otherwise have been. ●

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M/S Gudrun Mærsk is the first container ship to use high-efficiency WHR plants.



The turbogenerator set for M/S Gudrun Mærsk incorporates an exhaust-gas power turbine (left side), the generator (right side) and a steam turbine (centre).