

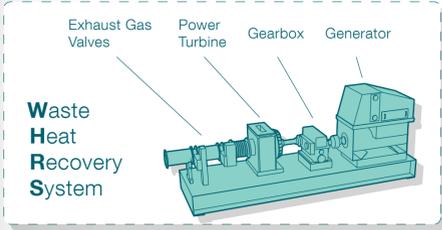
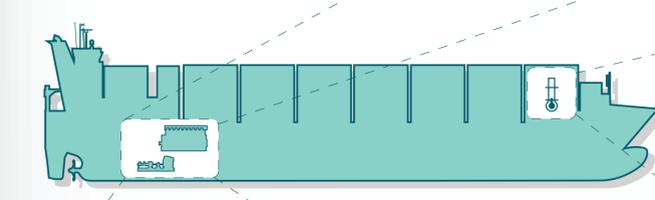
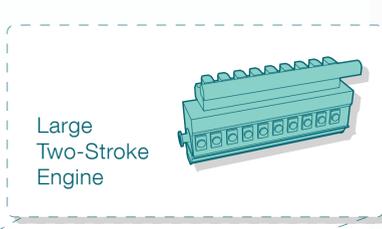
Decreasing energy consumption with ABB Waste Heat Recovery System

Interest by shipbuilding industry towards ABB Waste Heat Recovery System (WHRS) with ABB Power Turbine Generator (PTG) for container vessels demonstrates how the merchant vessel segment is rapidly waking up to the way technology can be harnessed to minimize both emissions and fuel costs across a range of ship sizes.

The Waste Heat Recovery System?

Large two-stroke engines are commonly used in today's large **container vessels of 8,000 TEU** and above. A significant proportion of **fuel energy** is lost through **dissipation of exhaust gases**. This **loss** can be **as high as 25%**, greatly diminishing the overall efficiency levels.

Container vessel with WHRS



Modern container ships also have a significant number of slots for **refrigerated containers**, which create a **high demand for electric power**.

All this power is usually produced by **three or four** powerful **diesel generator sets**.

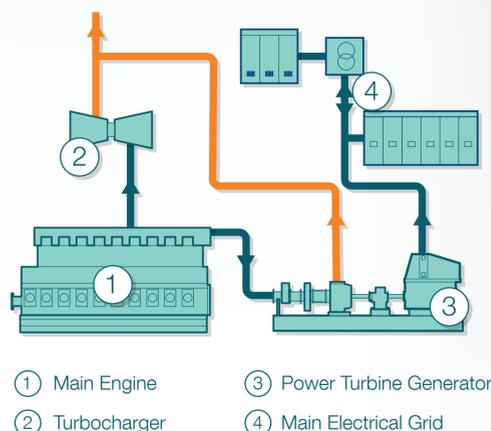
This combination of **large main engine size** and **high onboard electricity requirement** makes container vessels particularly well suited for WHRS technology.

As a result, while WHRS can be used, for example, on tankers and bulk carriers, technology take-up to date has been centered primarily on larger size box ships.

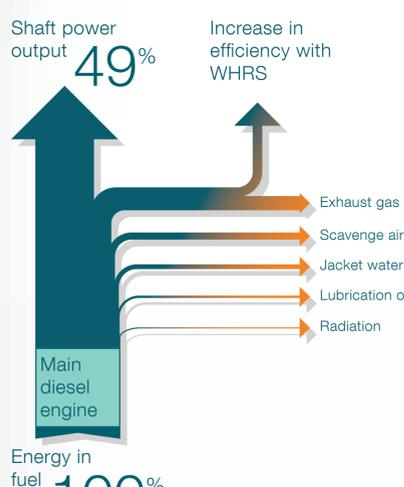
How does the Waste Heat Recovery System work?

The **Main engine's exhaust gases** are channelled to a **turbo generator**, where the power for the vessel is produced. **WHRS uses the heat, flow and pressure** from the **excess** exhaust gas, which rotates the generator and feeds the **main electrical grid** onboard the vessel.

WHRS schematics



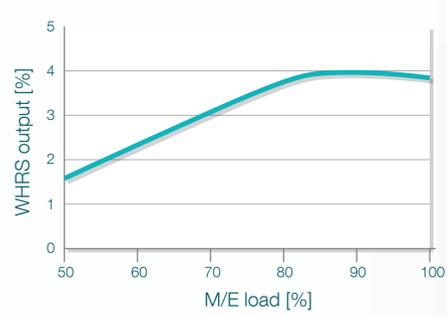
Savings



- ① Main Engine
- ② Turbocharger
- ③ Power Turbine Generator
- ④ Main Electrical Grid

The **recovered energy**, which is typically up to **4%** of the **main propulsion shaft's power output**, is converted for electricity through the PTG WHRS.

Output balance as a function of the main engine load

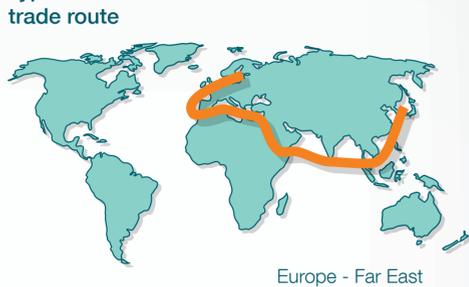


Essentially, the WHRS allows a vessel to produce more power at a very low cost, simply, by harnessing the excess power provided by the vessel's main engine.

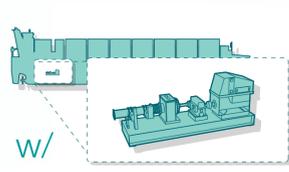
What are the advantages of WHRS in a typical operation?

In **slow steaming operation** on a **typical container vessel route**, considerable **savings** are obtained by reducing **CO₂ emissions** and **fuel consumption**.

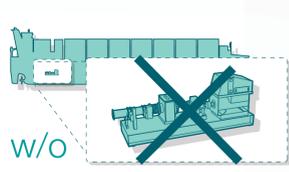
Typical container trade route



Annual emissions with and without WHRS



28848 t **/year**
91880 t **CO₂**



29200 t **/year**
93000 t **CO₂**

Annual savings with WHRS = 352 t /year
1121 t CO₂

Estimated average 2015



Savings with WHRS when compared to estimated average **CO₂ emissions** and **fuel consumption** from **passenger cars in Europe** in 2015.

Annual savings with WHRS equivalent to annual emissions of 392 European cars

WHRS reaches higher levels of efficiency, increasing fuel savings and reducing energy loss. WHRS greatly reduces a vessel's environmental impact.

Sources:

Container vessels' operation profiles. ABB Marine internal, confidential report. ABB Oy Marine & Cranes, Helsinki, Finland, 2013.

European Commission - Road transport: Reducing CO₂ emissions from vehicles http://ec.europa.eu/clima/policies/transport/vehicles/cars/index_en.htm.

European Automobile Manufacturers' Association - Latest Report on vehicles in use in 2010 published in 2012 by ANFAC <http://www.acea.be/collection/statistics>