

## Success Story:

# Apros

## Energy efficient ship design – case Viking Grace

A modern cruise ship contains a wide variety of interconnected mechanical, electrical, automation and thermal systems of great complexity. Meyer Turku uses Apros® since 2014 for dynamic energy flow simulations to support engineering decisions. Recently Meyer Turku delivered Viking Grace, a modern LNG powered passenger ship.



### Energy efficiency and low emissions

Energy efficiency has become increasingly important to ship owners and builders, due to fuel costs and tightening environmental regulations, but also due to public opinion and expectation for green technology.

The emission requirements of marine diesel engines primarily focus on the reduction of nitrogen oxides (NO<sub>x</sub>) and sulphur oxides (SO<sub>x</sub>). Therefore a modern ship is most likely to be powered by liquefied natural gas (LNG).

### Demanding operation profile

The operation profile of a typical cruise ship has big variations. The conditions vary from day to day and seasonally. During each cruise the ship sails at different speeds, visits ports, and daily processes are run, e.g. food preparation and laundry. This all causes big changes to the energy balance.

Improved energy efficiency and significant savings are achievable by increasing waste heat utilization and storage. Moreover attention must be paid to the smart use of different sources of cold: electric chillers, LNG evaporation and seawater.

### Apros model scope

Meyer Turku has used Apros for studying the ship's waste heat recovery system and chilled water system, including the main control loops.

- Waste heat recovery from engine cooling water (both high and low temperature)
- Steam production by exhaust gas
- Heat storage by hot water accumulator tanks
- Electric chillers
- Alaska (seawater) cooler
- LNG cold recovery

### Studies performed:

The models have enabled a variety of studies to support the energy efficiency:

- Dimensioning of the heat accumulator
- Alternative strategies of using the stored heat
- Studies of novel energy converter solutions, e.g. using hot water for electricity generation
- Dimensioning and operation of LNG cold recovery

"Apros has increased our understanding of the interconnected systems. By providing a realistic control and operation response it has helped us in the evaluation of design work and supported decision making in engineering."  
Vesa Lepistö, Meyer Turku Oy

### Contact

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