SKILLSEA

Power Production

Conversion of Energy

Prof. J. B. Jensen

Source: MAN Energy solutions – Marine Engines and Systems, *Basic Principles of Propulsion*

Co-funded by the
Erasmus+ Programme
of the European Union

Learning outcome

- By the end of this session, you should be able to:
  - Demonstrate basic knowledge of the diesel engine
  - Demonstrate knowledge of how to produce power effectively.
  - Understand the production side of power management systems
  - Discuss common challenges leading to inefficient power production

- The above criteria must be fulfilled along with criteria in Power consumption and Energy efficiency awareness lessons to:

- *Operate vessels commercially and energy efficiently, in accordance with environmental regulations.*

Co-funded by the
Erasmus+ Programme
of the European Union

Content

- Diesel engines
  - Diesel engine efficiency
  - Specific fuel oil consumption
- Electric generators
- ESS batteries

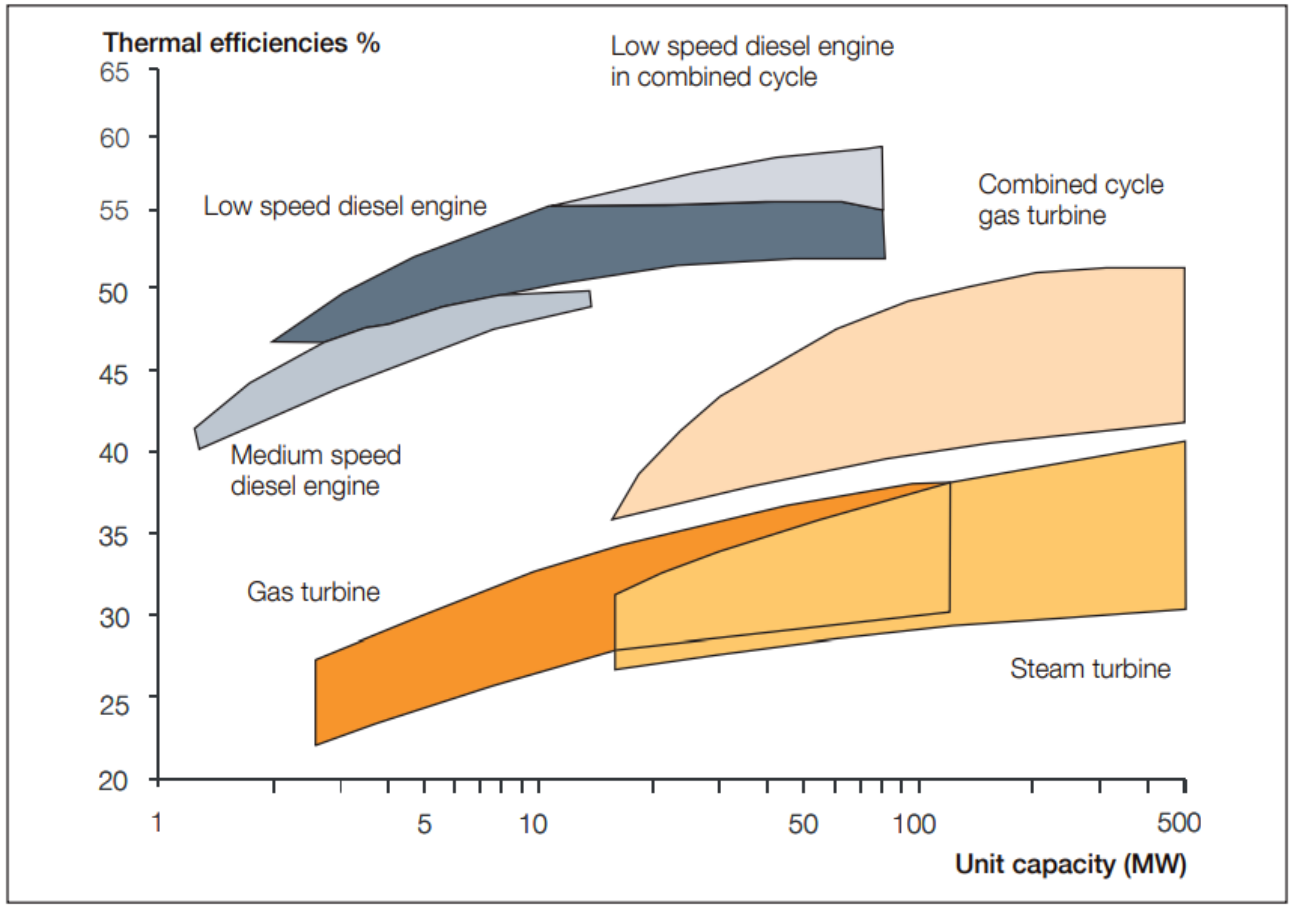
Co-funded by the
Erasmus+ Programme
of the European Union

Diesel Engines

- Why are diesel engines so common in ships?

  - Prime mover
  - Auxiliary engines

  Where does the “rest” of the energy go?



Source: MAN (https://www.mandieselturbo.com/docs/default-source/shopwaredocumentsarchive/two-stroke-low-speed-diesel-engines.p)

Co-funded by the
Erasmus+ Programme
of the European Union

When is a diesel engine most effective?

Specific fuel consumption

This is the mass of fuel consumed per energy unit. It is normally indicated in

grams per kilowatt hour. [g/kWh]

The unit is tricky but: g = 0.001 kg and kWh = 3,600,000 J

Co-funded by the
Erasmus+ Programme
of the European Union

SFC

$$sfc = \frac{\dot{m}_f}{P_B} = \frac{m_f}{W_e} = \frac{1}{\eta_e \cdot h^L} \ (kg/Ws) \longrightarrow sfc = \frac{3600000 \cdot \dot{m}_f}{P_B} = \frac{3600000}{\eta_e \cdot h^L} [g/kWh]$$

$\dot{m}_f$ = mass flow of fuel (kg/s)

m_f = mass of fuel per cycle (kg)

P_B = brake power (W)

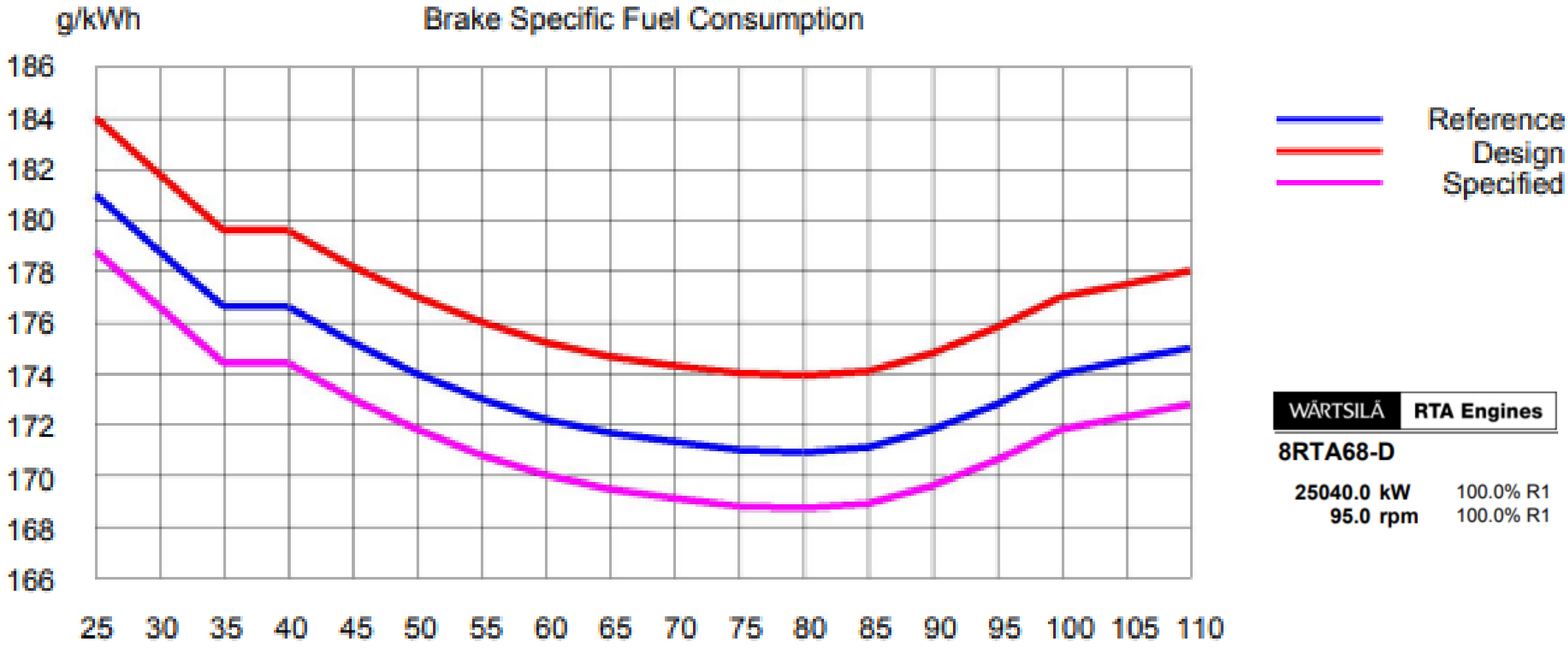
W_e = effective work per cycle(J)

η_e = effective efficiency

h^L = lower heating value (J/kg)

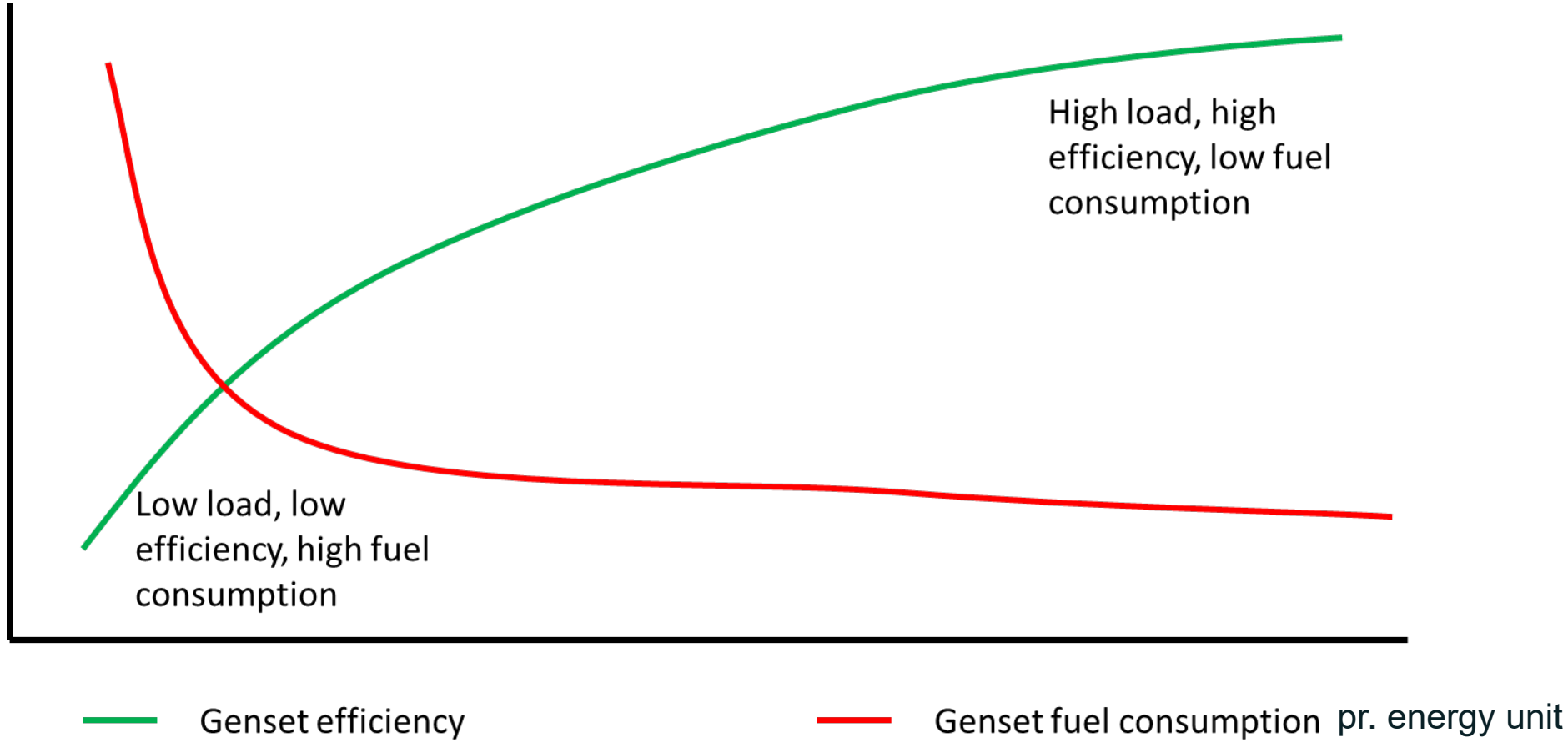
Co-funded by the
Erasmus+ Programme
of the European Union

SFC curves



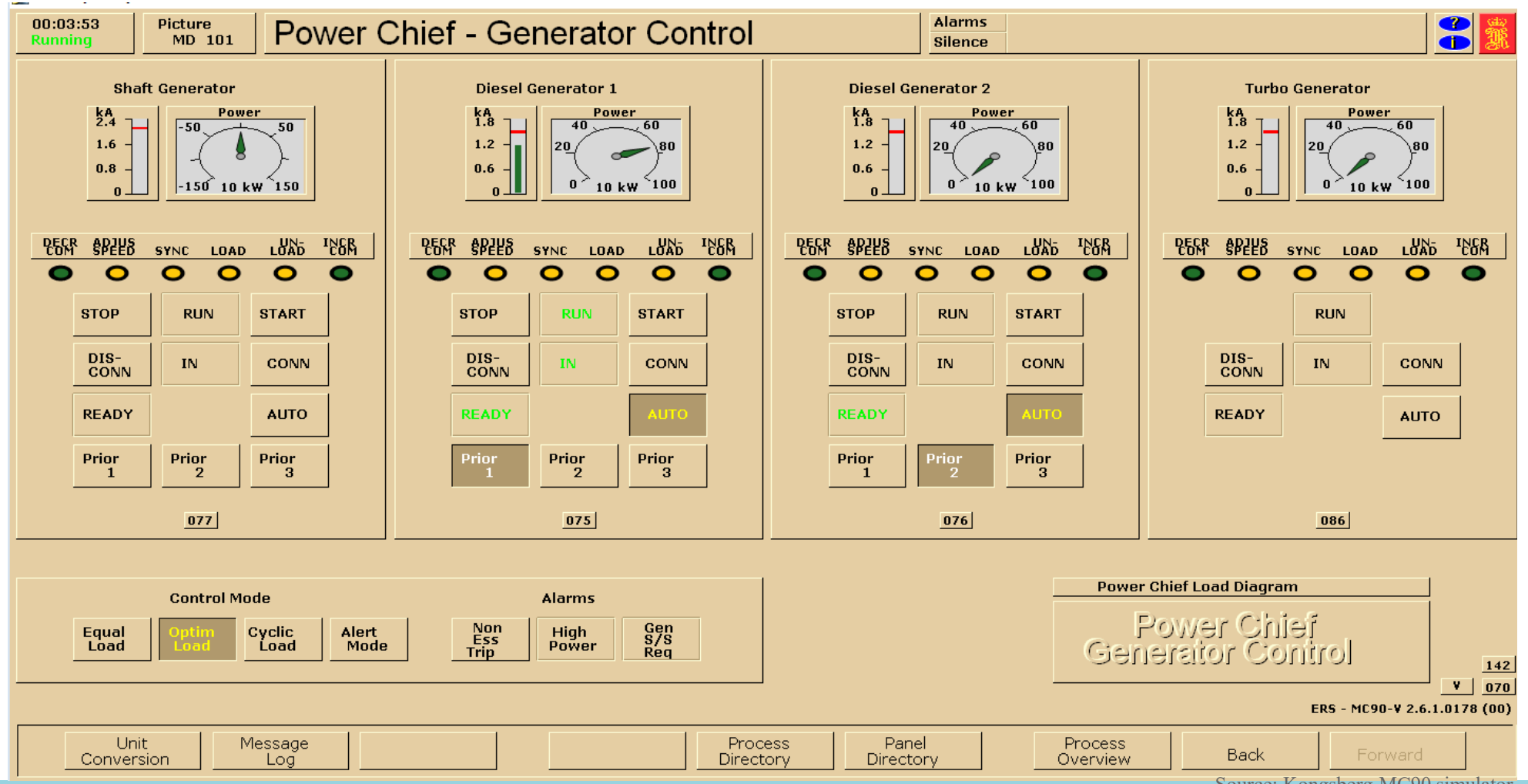
Co-funded by the
Erasmus+ Programme
of the European Union

Electric Generators



Co-funded by the Erasmus+ Programme of the European Union

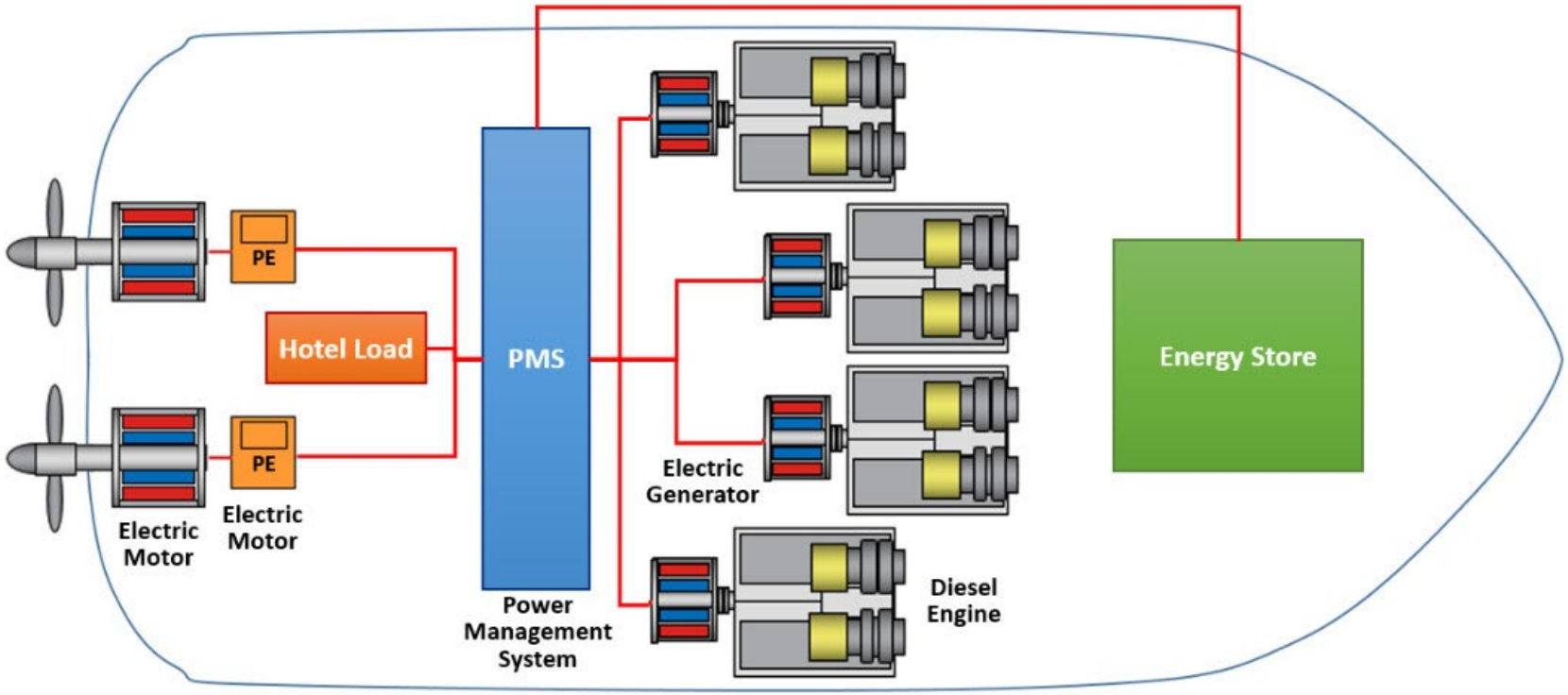
Load on generators



Source: Kongsberg MC90 simulator

Co-funded by the
Erasmus+ Programme
of the European Union

ESS – Electrical Storage Systems



Source: https://mfame.guru/improving-engine-robustness-diesel-electric-vessels/

Co-funded by the Erasmus+ Programme of the European Union

Exercise

Make a presentation of the slow steaming concept, introduced in 2007.

Let the presentation have emphasis on how it makes sense to let the ships steam well outside the optimum point and with a significantly worse SFC than possible.

Co-funded by the
Erasmus+ Programme
of the European Union

Thank you

Co-funded by the
Erasmus+ Programme
of the European Union