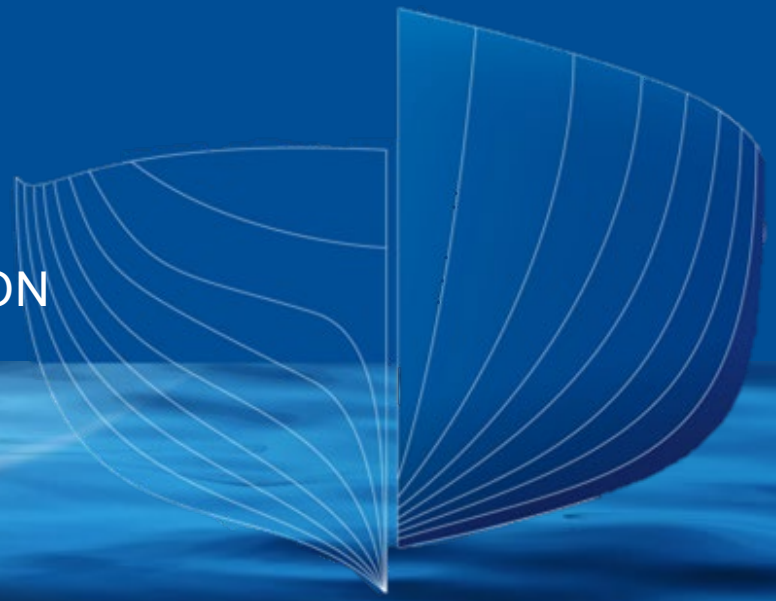
HYBRID ENERGY- AND PROPULSION SYSTEMS FOR VESSELS IN TIMETABLE OPERATION

SCHIFFBAU
ENGINEERING
SERVICE

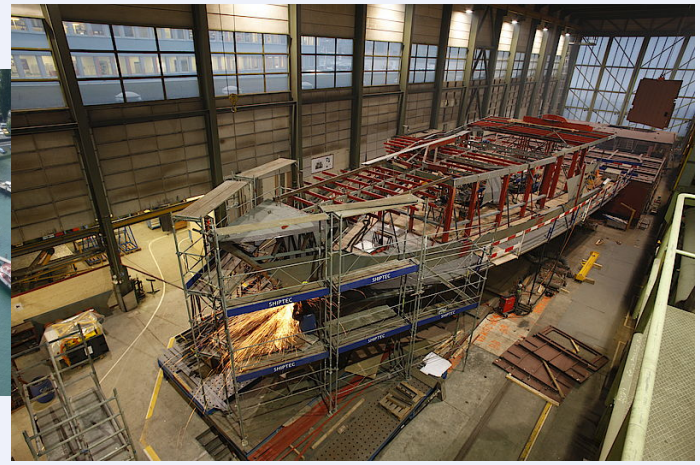


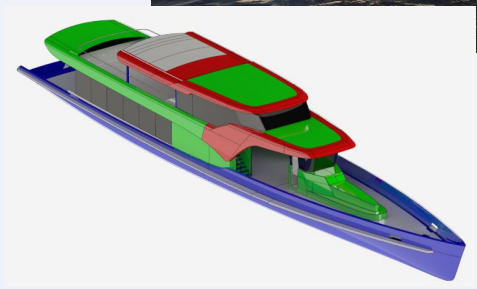
ZKR-WORKSHOP 20.04.2021:
ALTERNATIVE ENERGY SOURCES FOR ELECTRICAL PROPULSION SYSTEMS IN INLAND NAVIGATION

SHIPTEC

Shiptec AG

- Engineering and shipbuilding since 1931 in Lucerne/Switzerland
- Type of Ships:
  - Passenger and commuter ships
  - Car Ferries
  - Old-timers / Steamships
  - Yachts
  - Work boats





Shiptec – Vessel

- Modern, nautical styling
- Highly efficient hull design, weight optimized
- Highly efficient energy and propulsion systems
- Individual optimized for the specific operation
- Remote monitoring of most important operation parameters
- Optimized for low life-cycle-cost

What can we do to make our costumer (more) successful?

Initial Starting Points, Motivation

- Environment protection => to meet strict (future) regulations CO_2 reduction => first step to the carbon neutral, timetable operating passenger vessel in Switzerland (2022)
- Considering multiple, dynamic requirements concerning energy supply and energy distribution in passenger vessels in timetable operation (knowing the operational profile as a base => system simulation as a base)
- Reduce the total installed power (downsizing) at a lowest possible risk concerning, cost, dimensioning and functionality (nominal operation speed 25-38 km/h)
- Reduction of operating costs thanks to a holistic projection (propulsion and hotel load)
- High level of availability and high level of safety

Hybrid and E-Ships (CH until now)

- Different purposes:
  - Touristic Applications
  - Public Transport
  - New Vessels, Revamp

MS Waldstätter


MS Jungfrau


MS Diamant


MS Bürgenstock

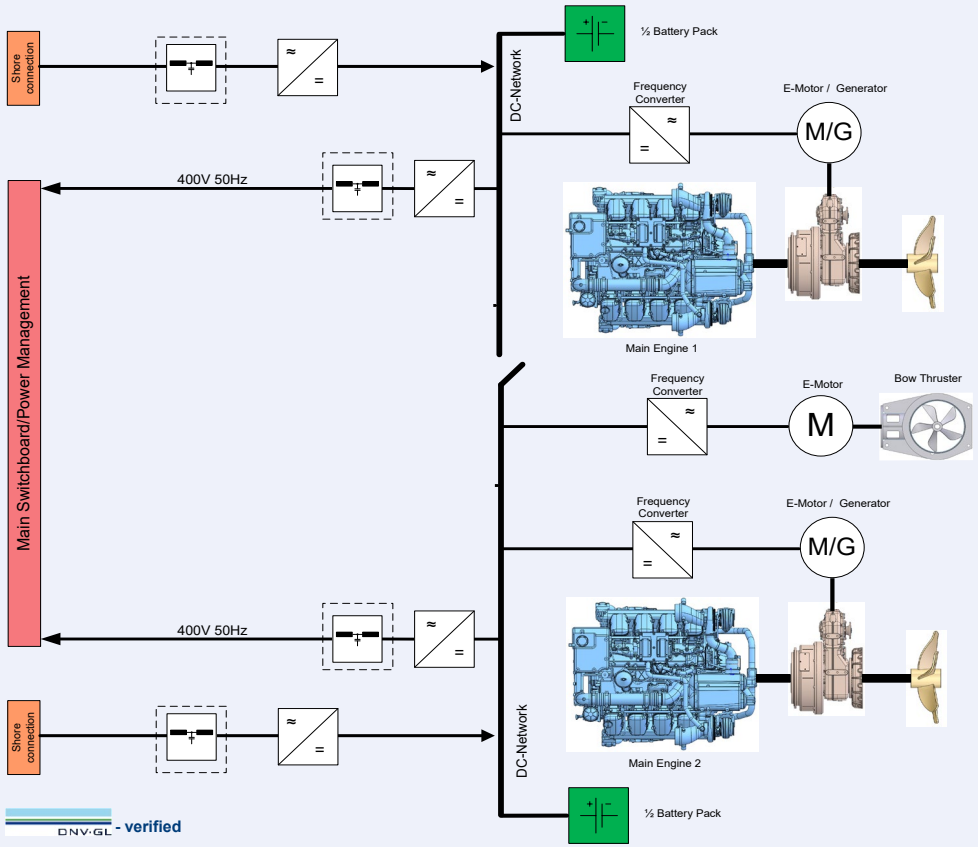
MS Berna

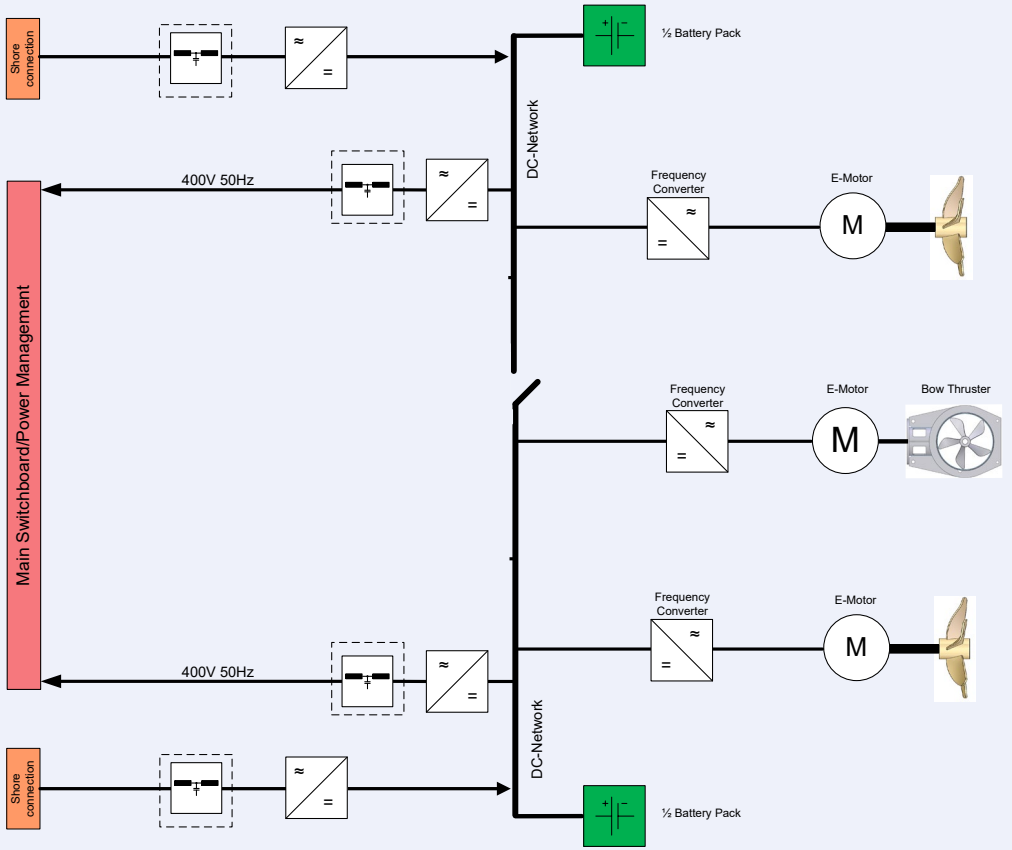
eMS MobiCat


MS Aurora

eMS Heimat

Different Architectures (holistic approach: prolusion & hotel load)





Parallel Hybrid => Bridge-Technology for high shaft power and two clear stage operation profile

(MS Diamant, MS Bürgenstock, MS Aurora, MS Waldstätter)

Serial Hybrid => base for Zero-Emission technology

(MS Jungfrau, MS Berna, eMS MobiCat, eMS Heimat,)

Operation options

Parallel-Hybrid

Typical peak shaving

- Downsizing of components, operation in best efficiency
- High dynamics
- Shaft Generator/ Booster
- See detail

Source switch under load

- Downsizing of components, operation in best efficiency
- High dynamics
- Shaft Generator/ Booster
- Full flexibility
- Operation like serial-hybrid
- See detail

Serial-Hybrid

Energy source combination

- Downsizing of components, sequential operation of sources => in best efficiency
- High dynamics
- Peak shaving
- See detail

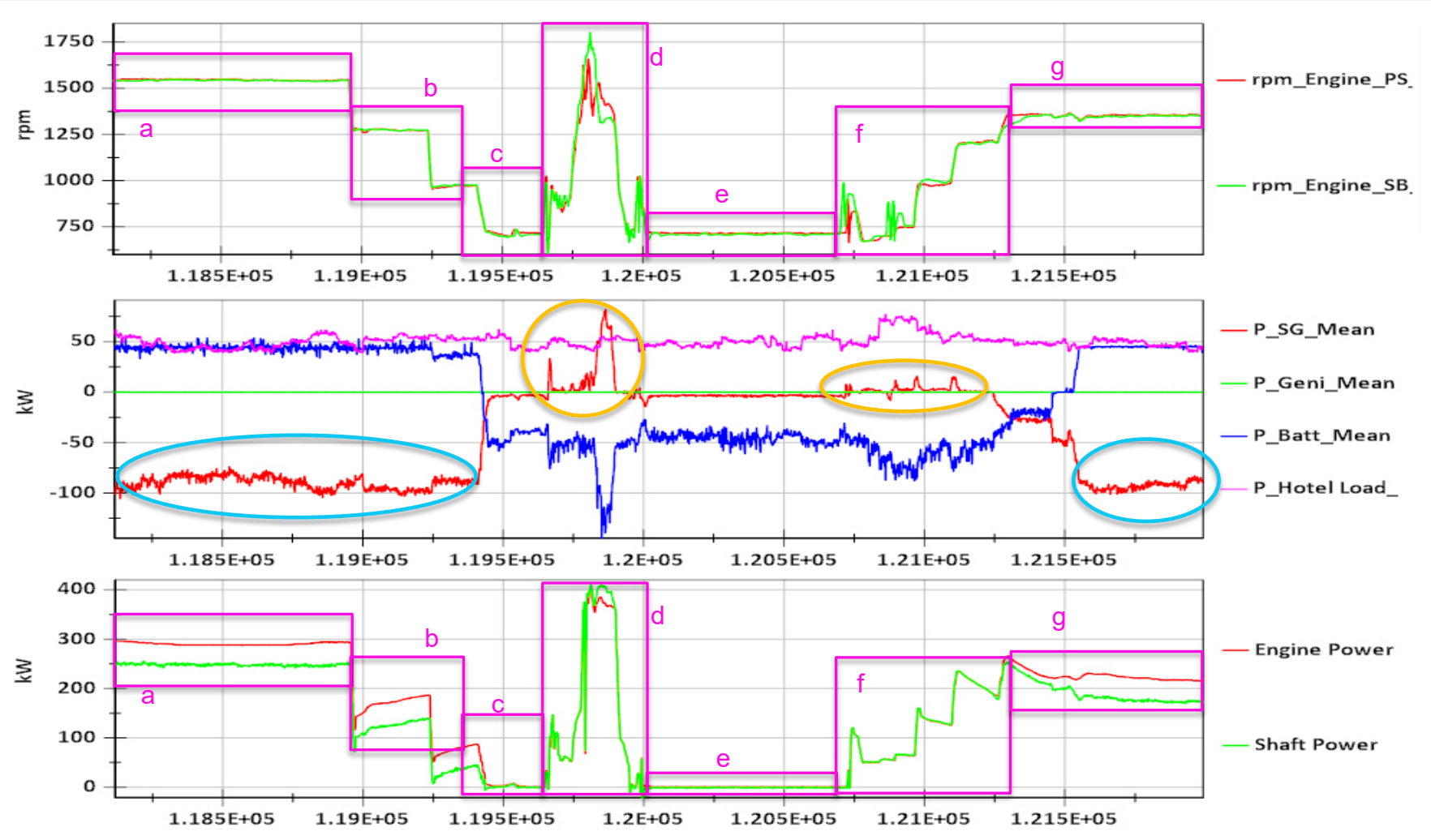
Source switch under load

- Downsizing of components, sequential operation of sources => in best efficiency
- High dynamics
- Full flexibility
- See detail

Alternative fuel and/or pure electric

- Sequential operation of sources => in best efficiency
- High dynamics
- Full flexibility
- Zero-Emission

Peak-Shaving function (touristic application, pier maneuver every 8 min)



a) Cruising

b) Speed reduction

c) Disengage

d) Engaging and astern thrust

e) Stop

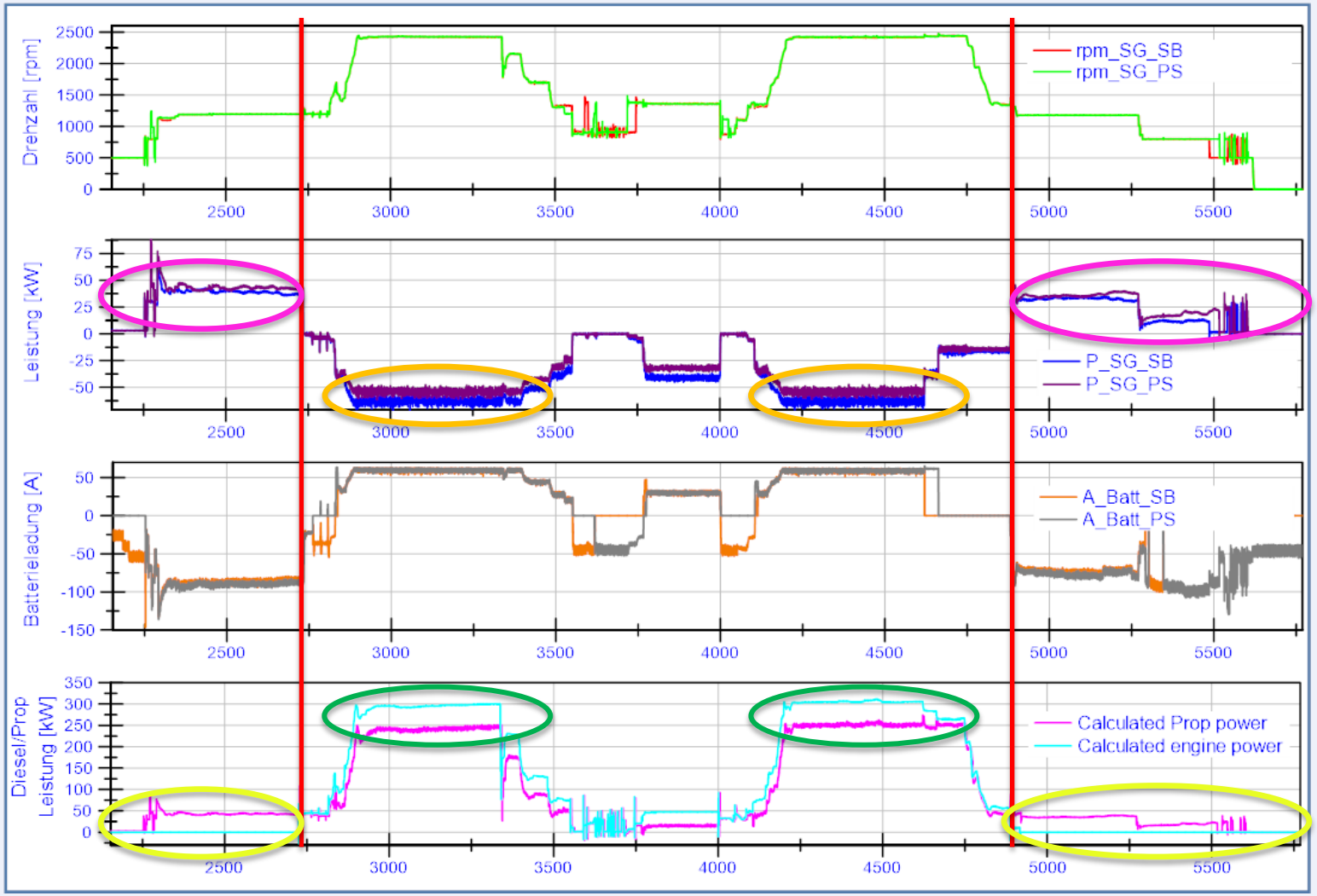
f) Acceleration

g) Cruising

Booster

Shaft generator

Combi-Operation (pure E and peak shaving) & switch under load



Electric-Mode: Pure electric drive

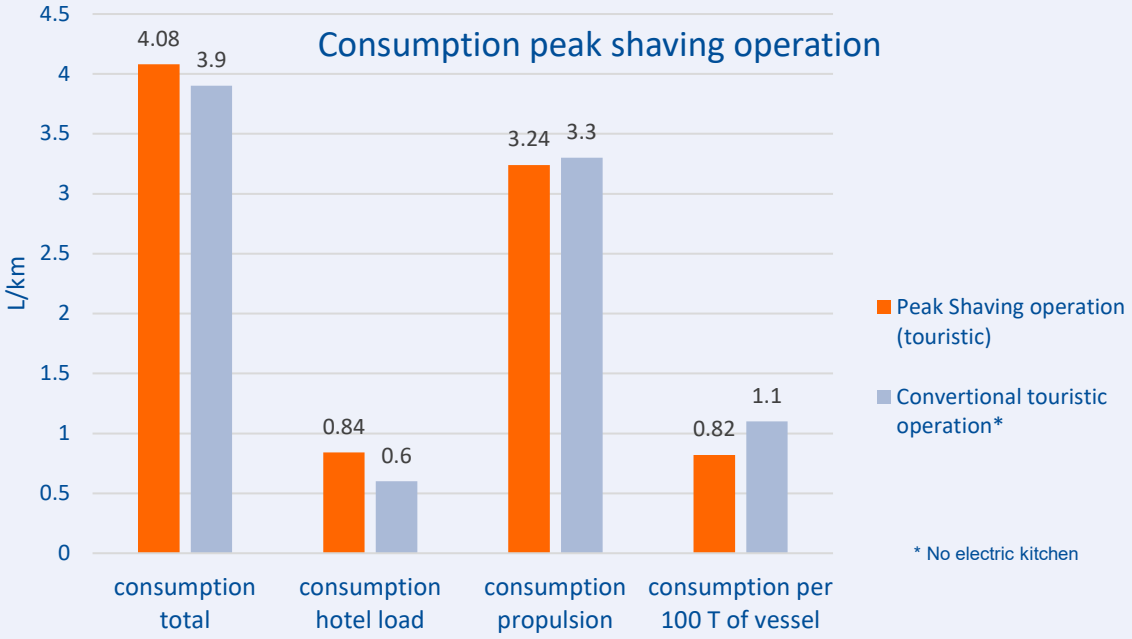
Diesel-Mode: charging the batteries

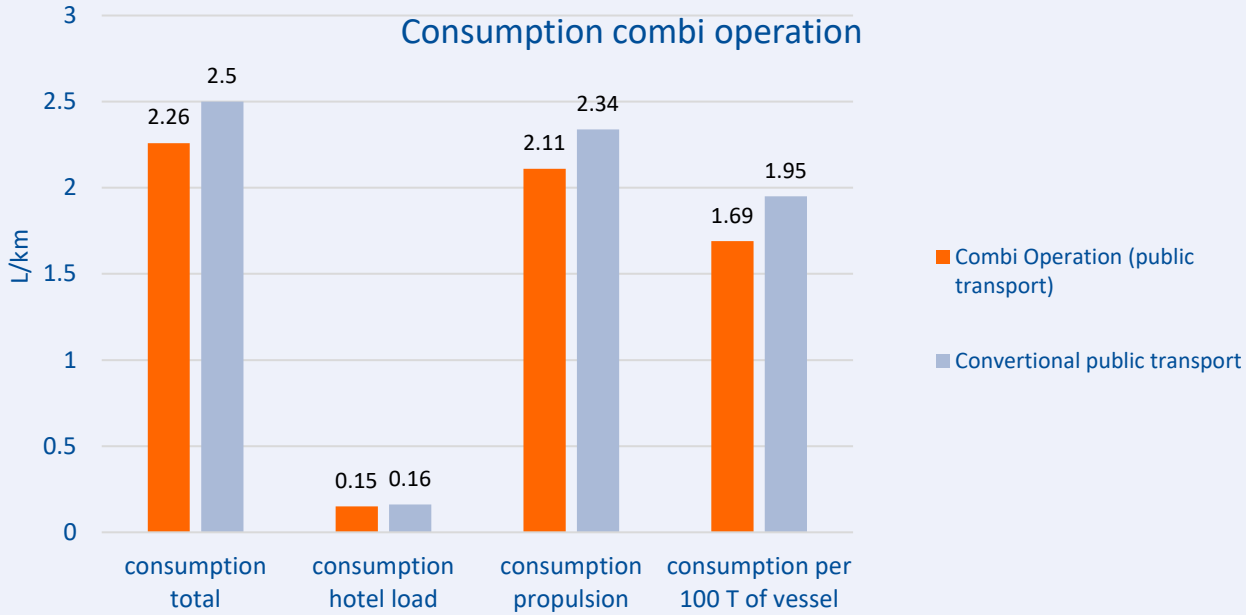
Switch under load

Engine Power > Shaft Power

Engine Power = 0; Shaft Power > 0

Operation experiences





- Fuel saving: 13 – 26 % under comparable conditions (weight compensated)
- Maintenance cost saving 30-50% on main engines (downsizing) and because of no Gensets

- With system investment costs about 27% higher than a conventional, comparable system, payback is about 3.5 years

Next steps (Hybrid => Zero-Emission)

- Pure Electric (incl. shore charging strategies)
- H2 fuel cell (incl. Logistics)

New eLimmat:
next pure electric

Quinten lebt (new):
First H_2 fuel cell vessel

New bulk carrier:
H_2 fuel cell study

Conversion MS Saphir:
Study «Helios»
H_2 fuel cell study

Challenges: Rules partial not clear, H_2 logistics (Swiss benefit ☺), charging strategies

Questions?

www.shiptec.ch