Copenhagen, June 4th 2014

Scandlines Green Agenda

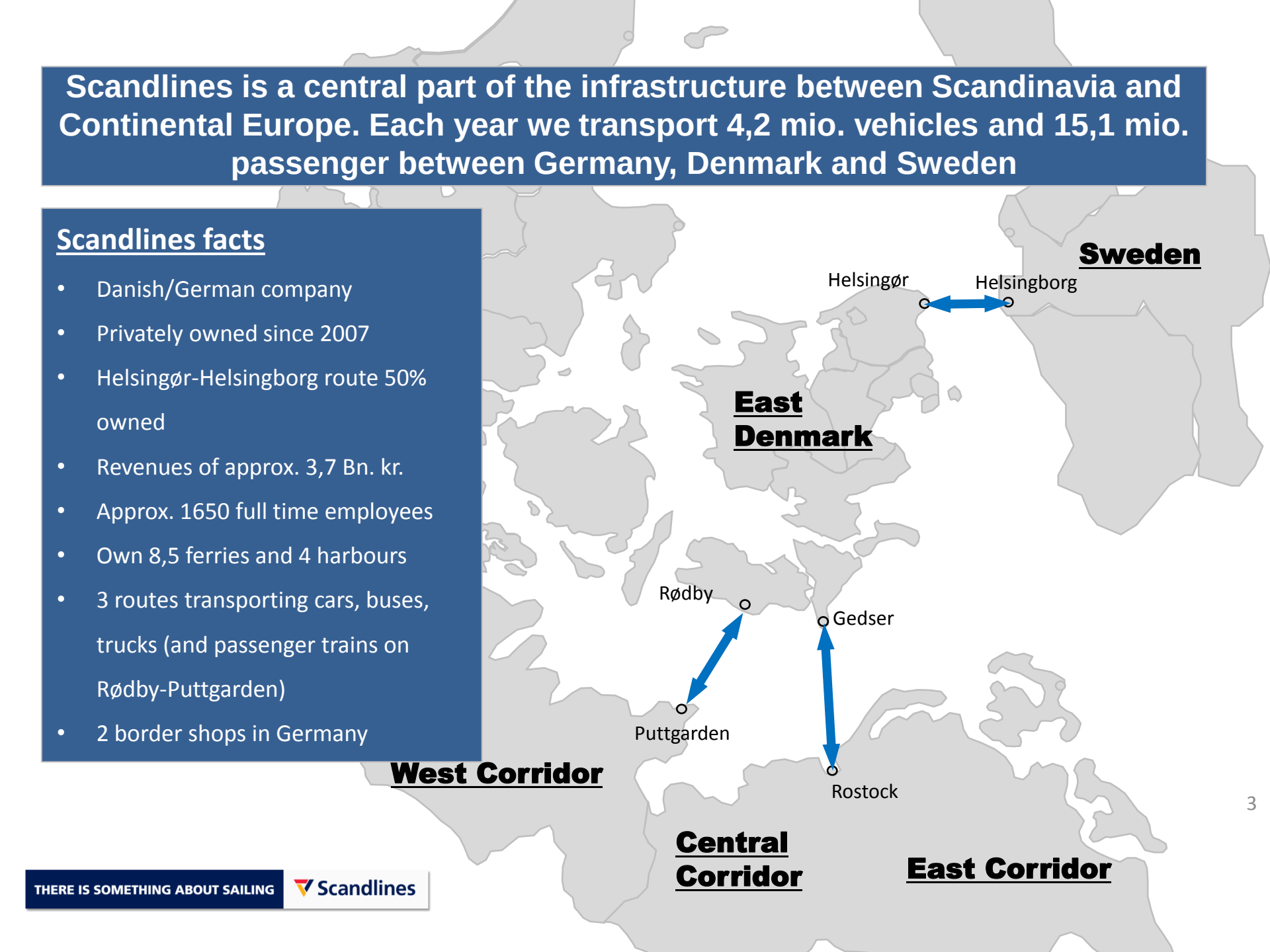
Agenda

- Introduction to Scandlines and our Green Strategy
- Scandlines Hybrid Ferries
- Scandlines Zero Emission program

Scandlines is a central part of the infrastructure between Scandinavia and Continental Europe. Each year we transport 4,2 mio. vehicles and 15,1 mio. passenger between Germany, Denmark and Sweden

Scandlines facts

- Danish/German company
- Privately owned since 2007
- Helsingør-Helsingborg route 50% owned
- Revenues of approx. 3,7 Bn. kr.
- Approx. 1650 full time employees
- Own 8,5 ferries and 4 harbours
- 3 routes transporting cars, buses, trucks (and passenger trains on Rødby-Puttgarden)
- 2 border shops in Germany



THERE IS SOMETHING ABOUT SAILING Scandlines

Scandlines Green Strategy

Our ambition is emission free ferries – we take One Nautical Mile at a Time. We invest responsively in tomorrows technology leading towards a greener future.

Past

Diesel/electric

Present

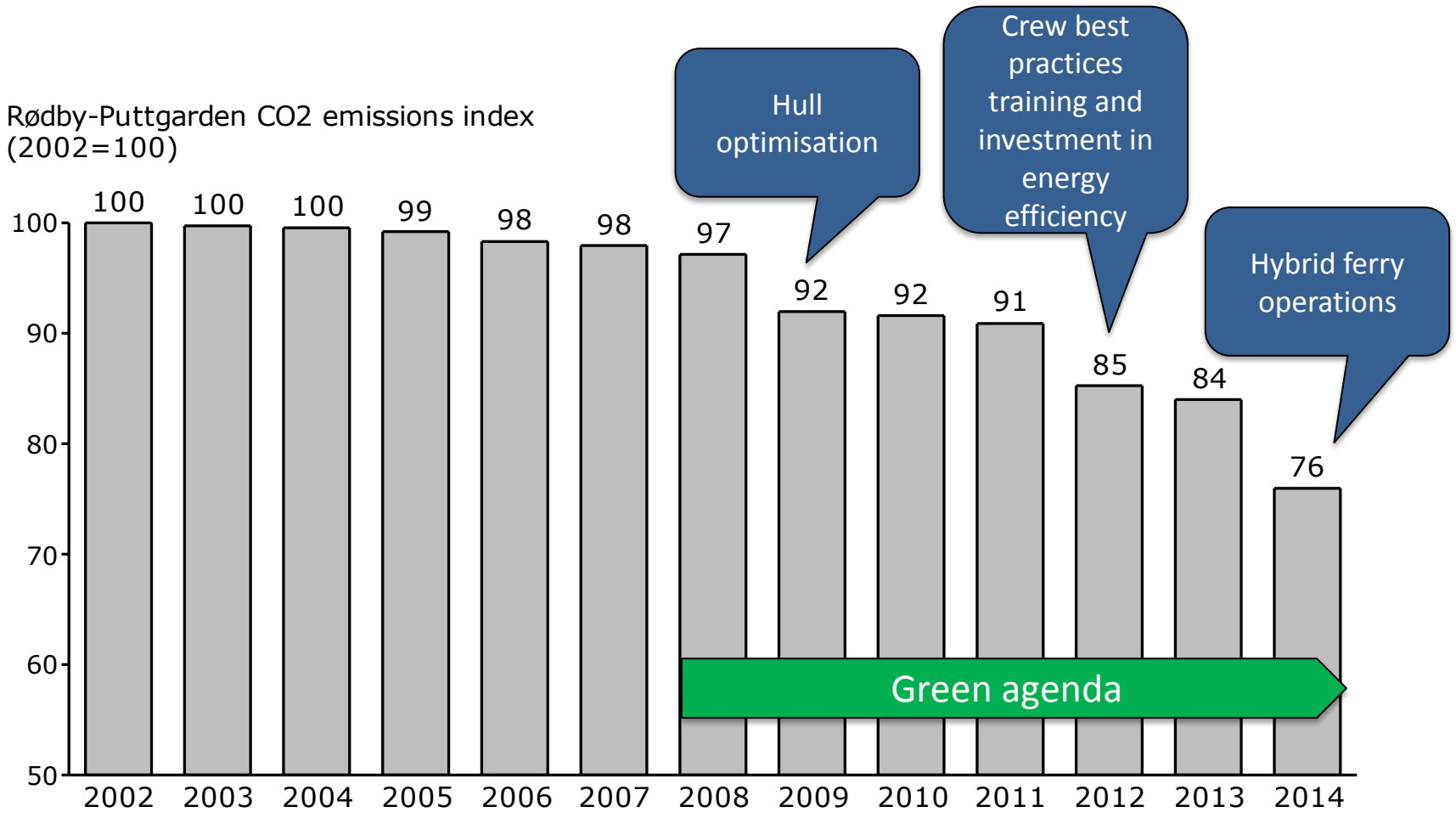
Diesel/battery/
electric hybrid

Future

Zero emission
- 100% battery
- Hydrogen/Battery hybrid

One Nautical Mile at a Time
- Further energy reduction
- Hull optimisation
- Further hybrid development

What does ”One Nautical Mile at a Time” mean? – a 24 % reduction of CO_2 since 2002



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Scandlines HYBRID FERRY

~190 million kr. investments in green technologies 2013-15 on Rødby-Puttgarden

Prinsesse Benedikte, built in 1997, hybrid since August 2013

SHIPPAXAWARD 2014

- The world's largest hybrid ferry – 2.7 MWh battery bank / capacity for 364 cars
- The system equals approx. 600 hybrid cars and can propel the 8.800 tons vessels for 30 minutes

- Reduce CO_2 emissions with up to 15 % (approx. 10,000 tons CO_2 yearly)
- Large international recognition for this industry leading concept
- Gain fundamental knowledge of use of batteries in operations

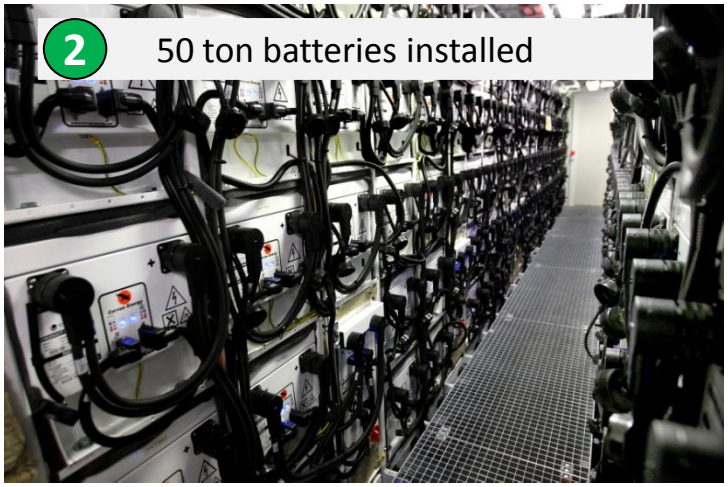
Co-financed by the European Union
Trans-European Transport Network (TEN-T)

Scandlines HYBRID FERRY

How you convert a ferry to hybrid:

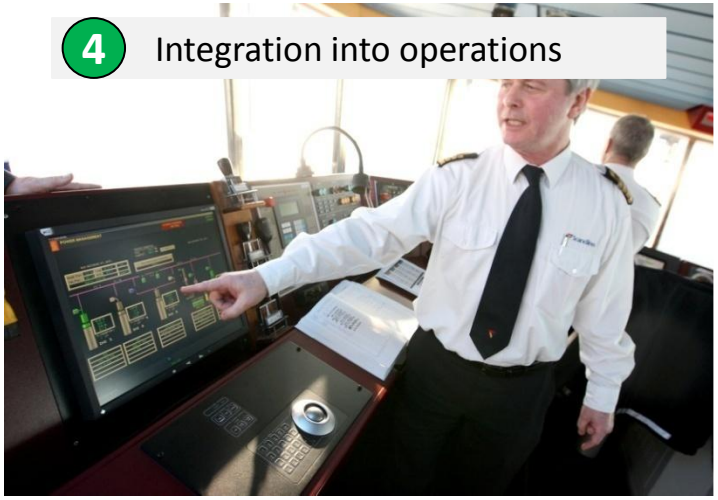
1 85 ton motor taken out

2 50 ton batteries installed



3 Control system installed

4 Integration into operations

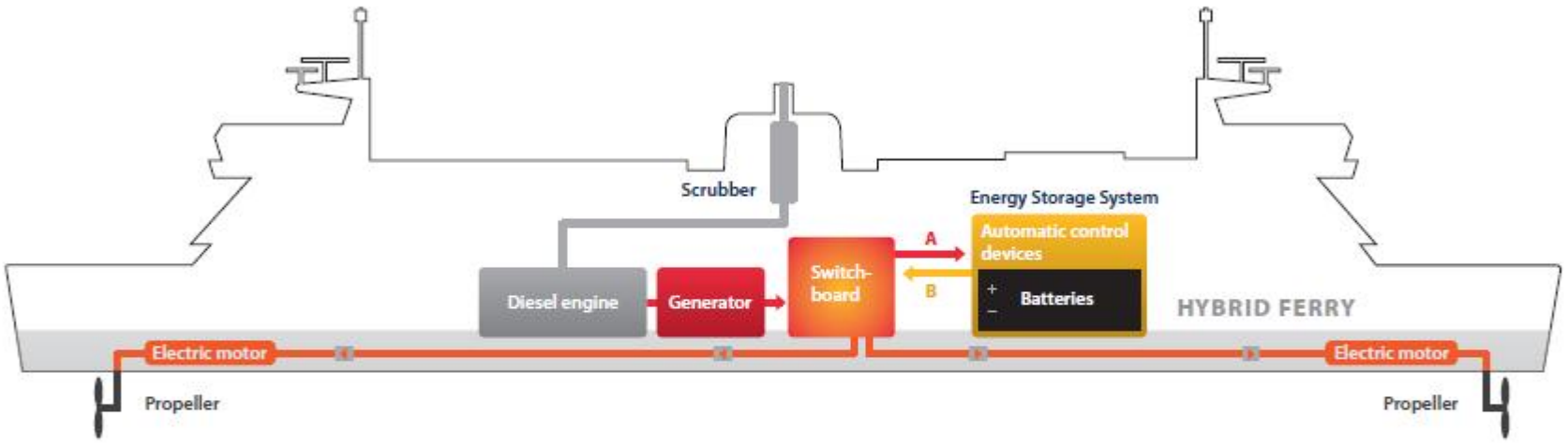


Scandlines HYBRID FERRY

Backup – how it works:

A The generator produces energy to the Energy Storage System via the switchboard.

B The Energy Storage System supplies energy to the switchboard.



Low speed

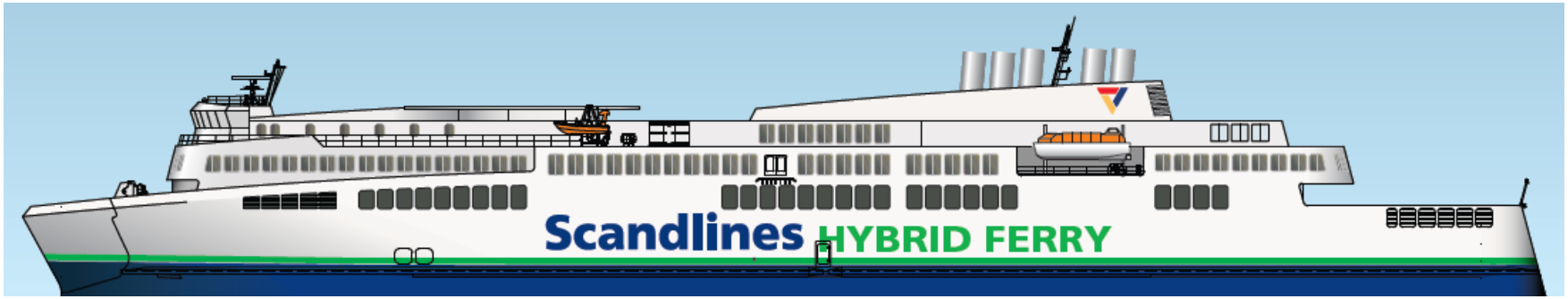
The motor is most efficient at a load of 85-90 %. Excess energy is saved in the batteries on board.

High speed

The motor is most efficient at a load of 85-90 %. Energy from the batteries on board contributes to the propulsion.

”One Nautical Mile at a Time”
– Next generation ferries on Gedser-Rostock are Hybrid Ferries

New vessels summer 2015 with hybrid system



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Our ambition is emission free ferries – this ambition can be achieved *already next year* on Helsingør-Helsingborg

A **Battery propulsion with shore side charging**

Helsingør-Helsingborg

- **100% battery operations**
- First vessel to be ready in a year, all 4 vessels zero emission within 3 years

Rødby-Puttgarden

- **100% battery operations**
- Project launch once sufficient electrical grid infrastructure is in place

B **Battery/fuel cells propulsion**

Gedser-Rostock

- **Combined battery and fuel cell** propelled vessels (hydrogen)

Helsingør-Helsingborg Zero Emission

The concept

Helsingør

Charging

8 minutes in port

20 minutes crossing running only on batteries

Charging

Helsingborg

12 minutes in port

Energy demand (estimate)

100 kWh	1050 kWh	150 kWh

Energy supply (estimate)

1150 kWh	1200 kWh

What does it take?

Conversion of vessels

- Two of the existing four diesel generators will be removed including all auxiliary equipment and systems
- Two battery banks will be installed on the existing base frames
- Two 20/0.66 kV supply transformers and two inverters for supply of a new 660 V DC bus bar and circuit breakers, sockets and cabling as necessary

New installations ashore

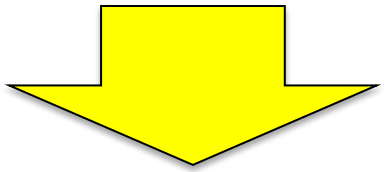
- New shore supply installation together with a new 10/20 kV transformer for supply and transmission of the shore power to the vessel
- The shore supply connection to the vessels needs to be automatically controlled by the bridge (solutions to be found!)

Any roadblocks?

- Being a first mover has its challenges
- Taxes on electricity to be lowered in Denmark (thank you for the political support!)
- Negotiations ongoing with suppliers and partners and help needed from local cities/municipalities to build planning certainty

Emission free ferries on Fehmarn could be a reality once we have the electrical infrastructure in place

Same concept as Helsingør-Helsingborg however the Puttgarden and Rødby areas today lack sufficient electrical grid infrastructure to allow charging of vessels



- We now concentrate on realising the Helsingør-Helsingborg Zero Emission project
- We engage electrical suppliers to discuss future grid expansions in the Fehmarn region
- We further optimise our hybrid setup on Rødby-Puttgarden

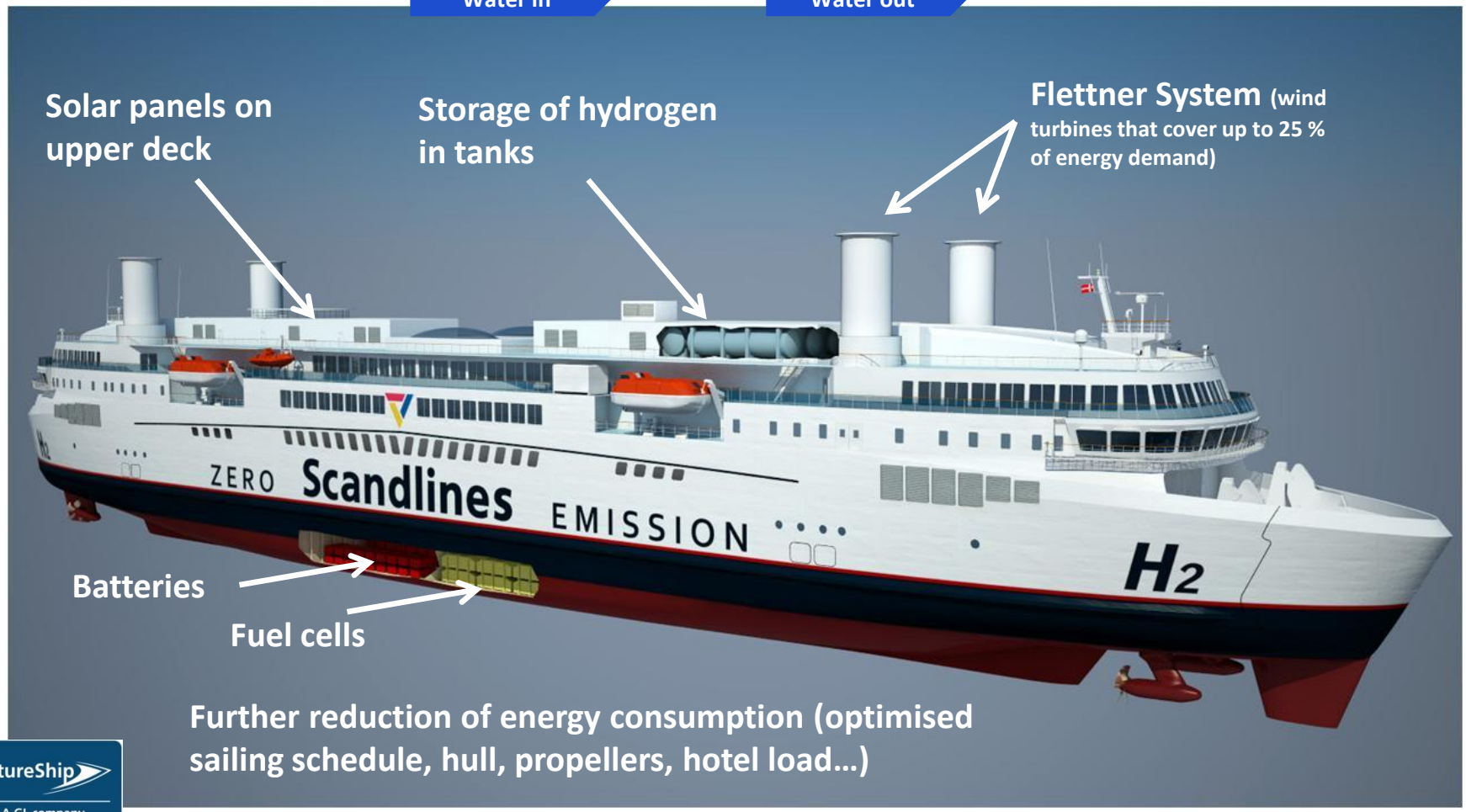
B

Gedser-Rostock Zero Emission

The concept - next generation ferries developed in cooperation with FutureShip

Storage of energy | **Energy used for propulsion**

- Electricity from windmills (surplus energy from night time production)
- Electricity used to create hydrogen (storage)
  - Water in
- Onboard: electricity generated by fuel cells burning hydrogen
  - Water out
- Electricity used for vessel propulsion and onboard facilities

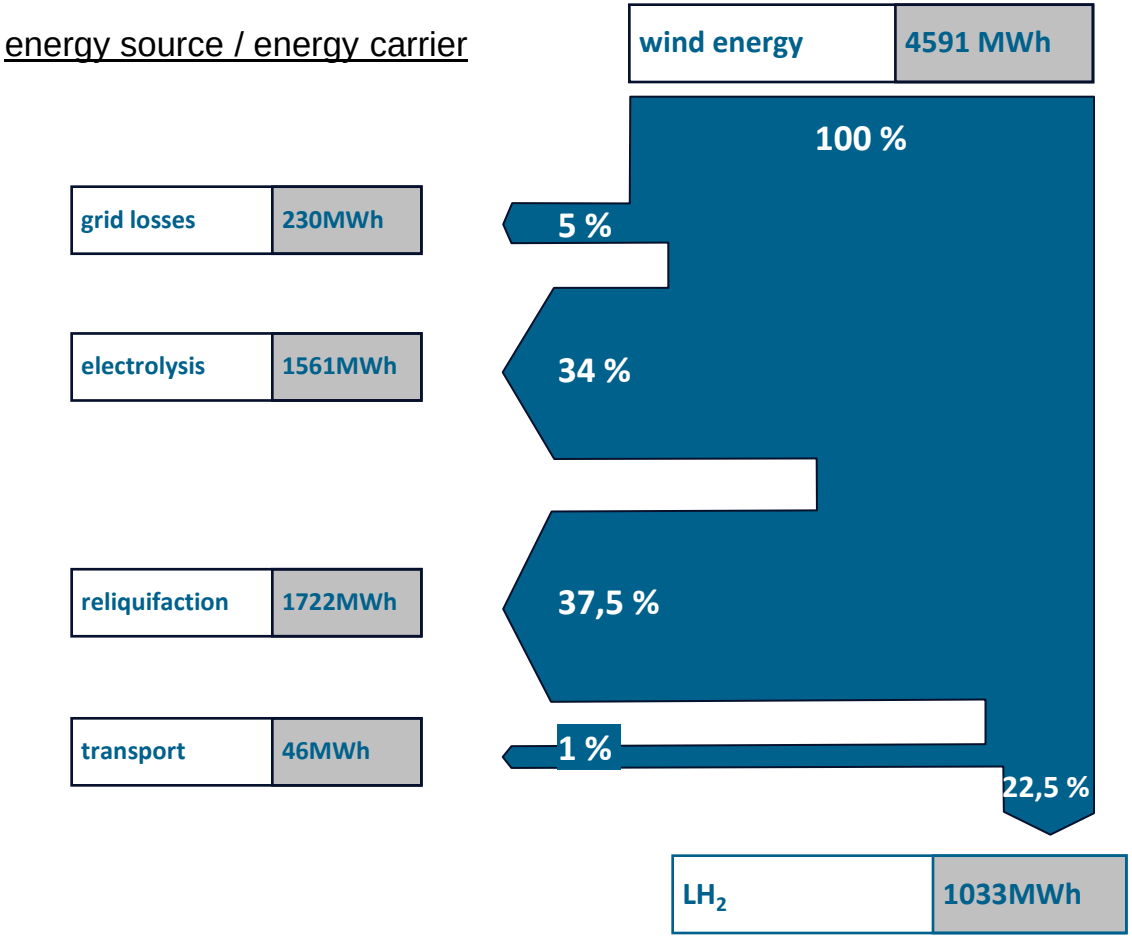


FutureShip
A GL company

B

Gedser-Rostock Zero Emission

The concept challenge – the fuel cell technology needs to develop and commercialise further



FutureShip
A GL company

Large potential for zero emission domestic ferry operations

- If we assume that full potential can be achieved domestically then the result could be CO_2 savings of 500,000 tons CO_2 yearly if not more
- Cost to operate ferries are reduced (a lot of public funding involved)
- Preliminary estimates of 3 different sizes of ferries indicate a financial payback of 4-6 years by converting to electric propulsion and shore side charging

BILFÆRGERNES REDERIFORENING

THERE IS SOMETHING ABOUT SAILING

Scandlines

Thank you for your attention

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