Developments for sustainable dredging equipment

WODCON XXI, Miami
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Royal IHC

The technology innovator.

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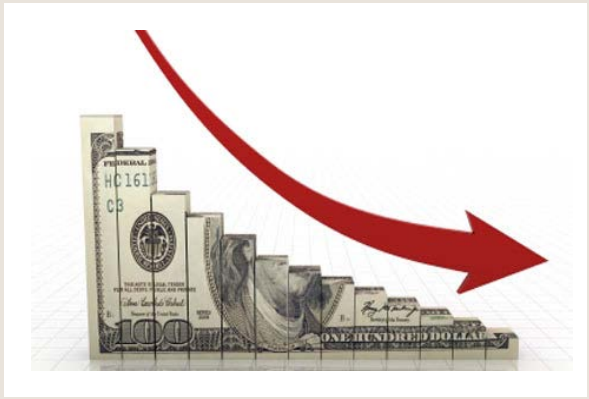
Innovation at Royal IHC

Innovation drivers:

Higher performance



Lower costs

Sustainability

Sustainable innovations

Emission regulations

Fuel saving

CO_2 reduction

Sustainability

Underwater sound

Turbidity reduction

Sustainable innovations

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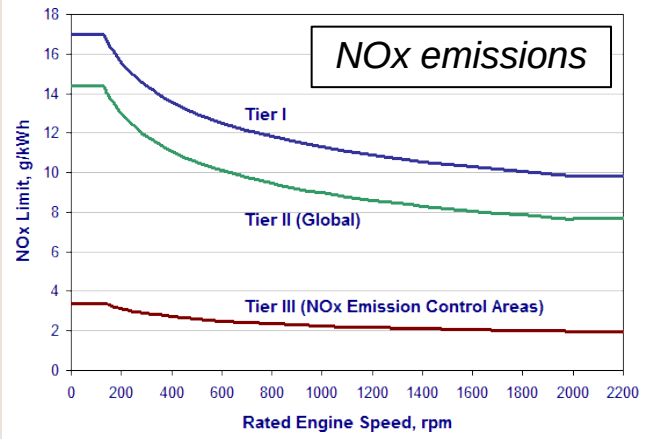
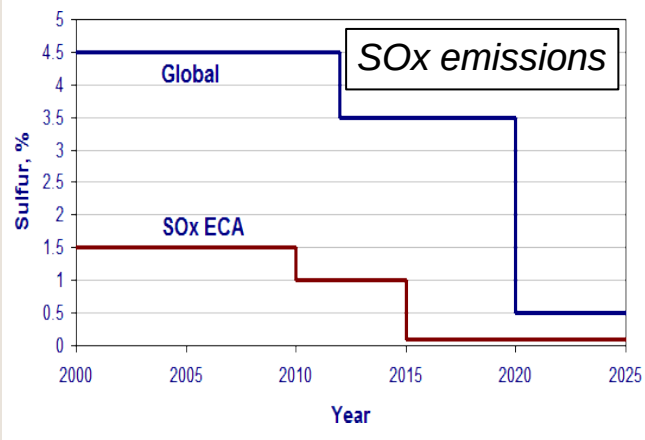
Emission reduction

- Exhaust gas emission regulations (SO_x, NO_x)
- Energy Efficiency Design Index (CO_2)
- Sustainability ambitions





Emission reduction

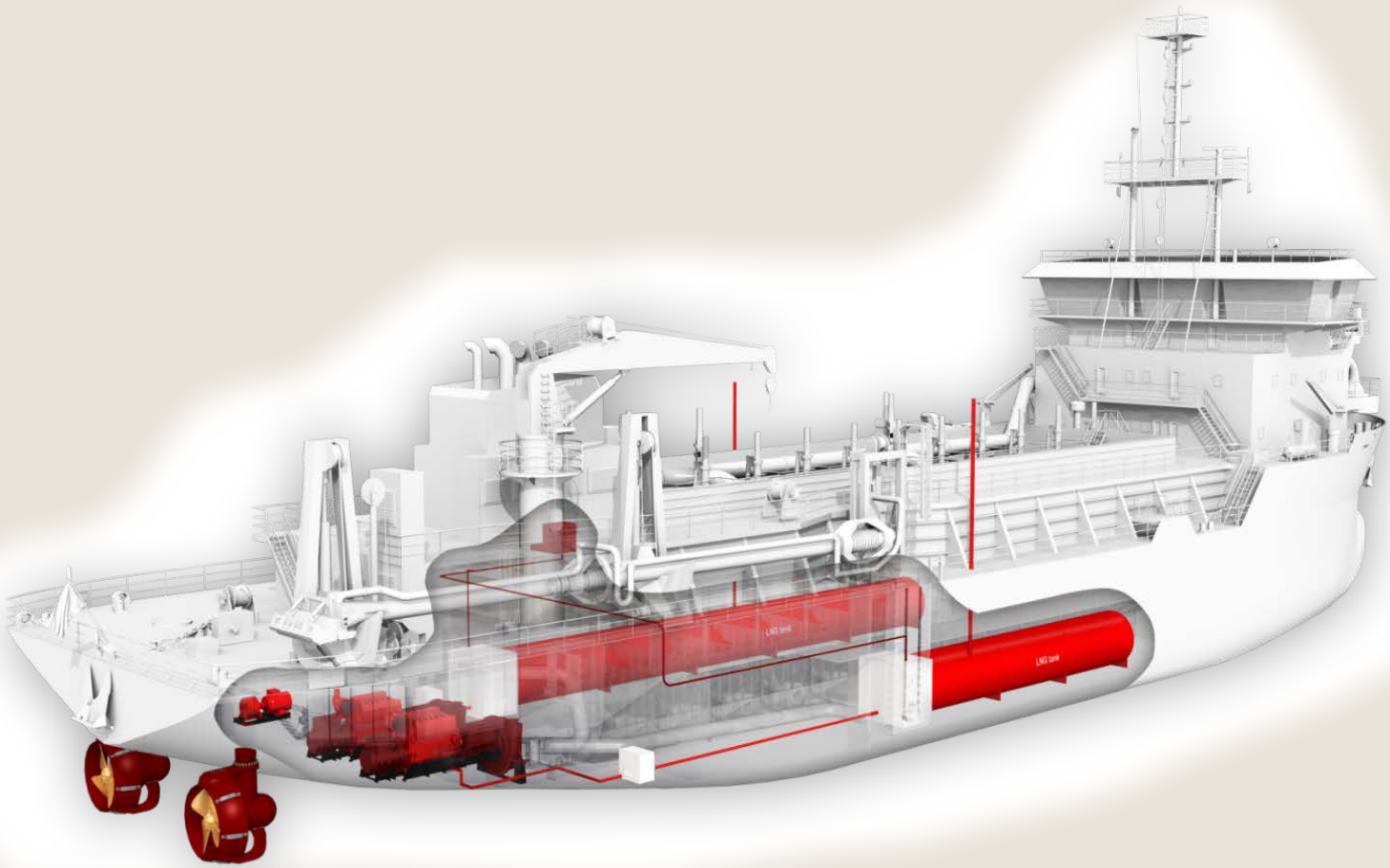
How to comply to emission regulations:

- Switch to Marine Diesel Oil:
  ⇒ 30-50% more expensive than HFO
- Switch to Low Sulphur Heavy Fuel Oil:
  ⇒ limited availability
  ⇒ higher cost price
- Use Heavy Fuel Oil:
  ⇒ after treatment of exhaust gasses necessary
  ⇒ high investment costs
  ⇒ poor earn back potential
- Use LNG

LNG

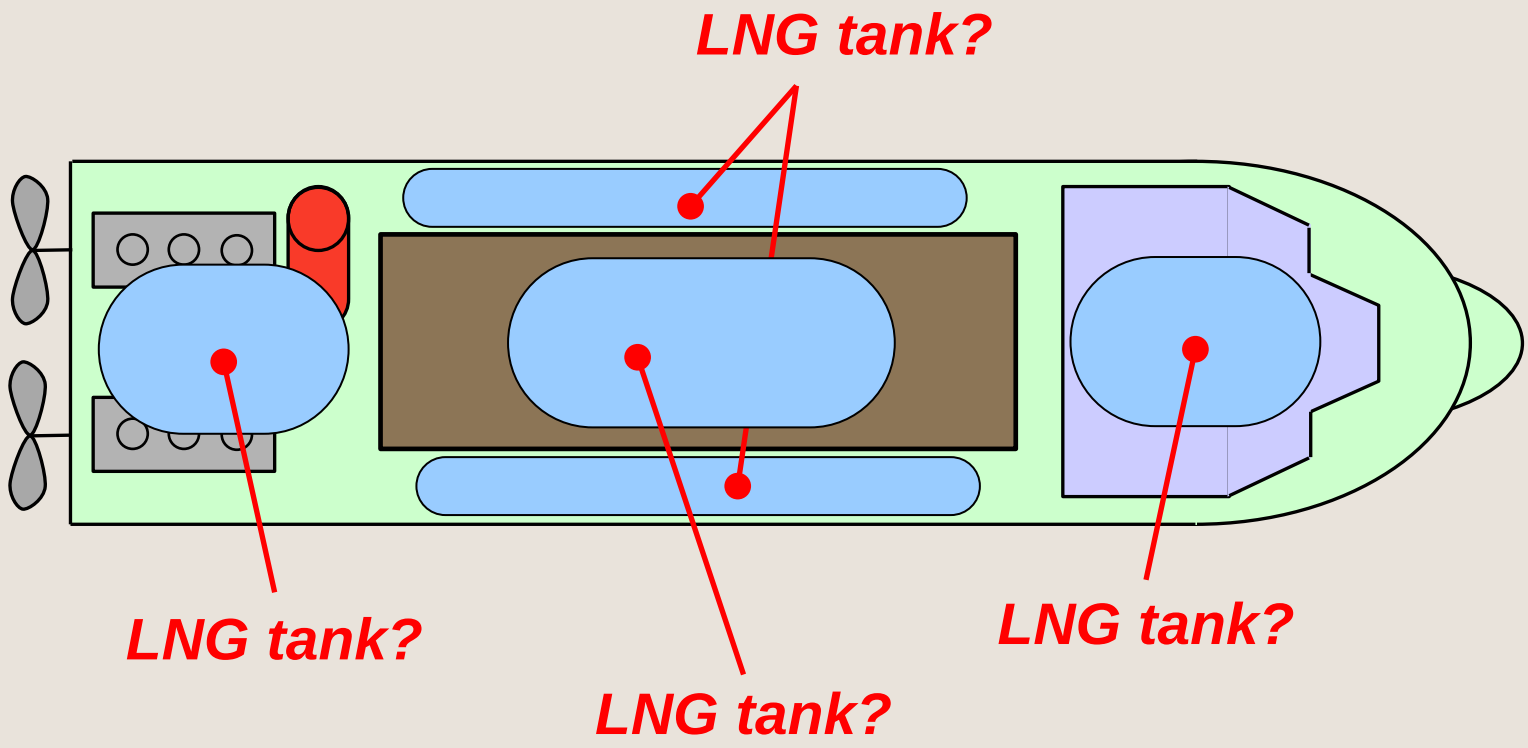
- Compared to heavy fuel oil LNG reduces:
  - SO_x emission by 99%
  - NO_x emission by 85%
  - CO_2 emission by 25%
  - Particulate Matter by 99%
- Compliant to SO_x, NO_x and EEDI regulation
- More sustainable than other emission reduction measures
- Earn back potential due to lower price

LNG hopper



Challenges

LNG storage:



Challenges

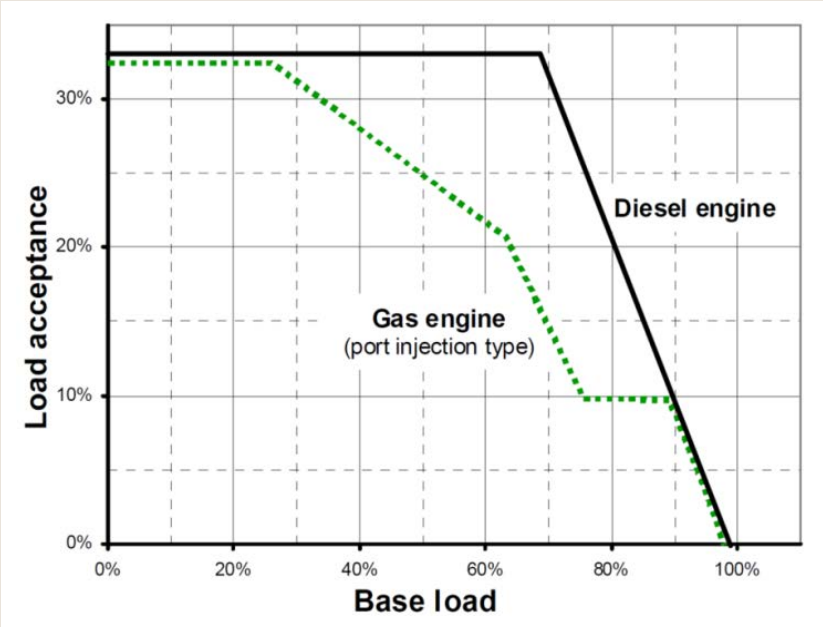
LNG storage:

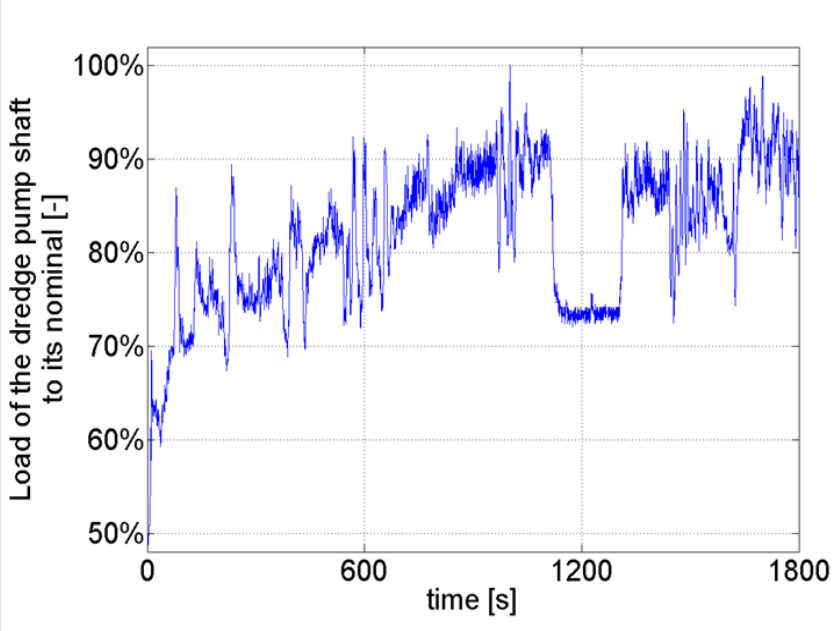
- LNG storage needs 2-3x more space than diesel storage
- Tank volume vs. autonomy vs. bunkering frequency
- Position and type of LNG tank:
  - Below / above deck
  - Single / double walled
  - Safety zones
- Large impact on vessel lay out

Challenges

Load step capability:

- Diesel engines have better load step capability than LNG engines

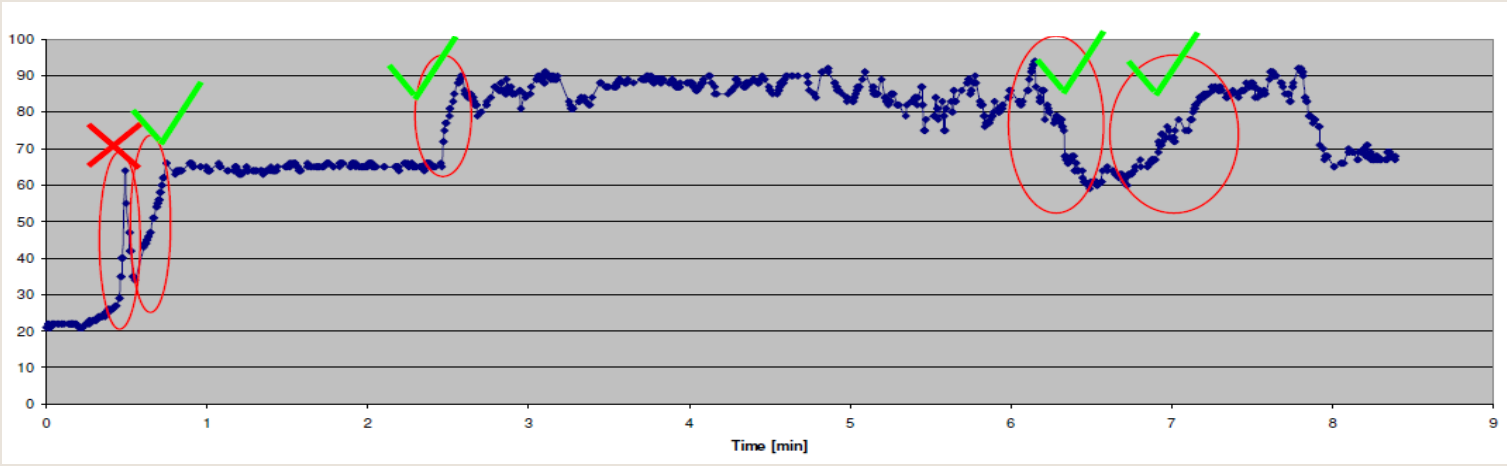




Challenges

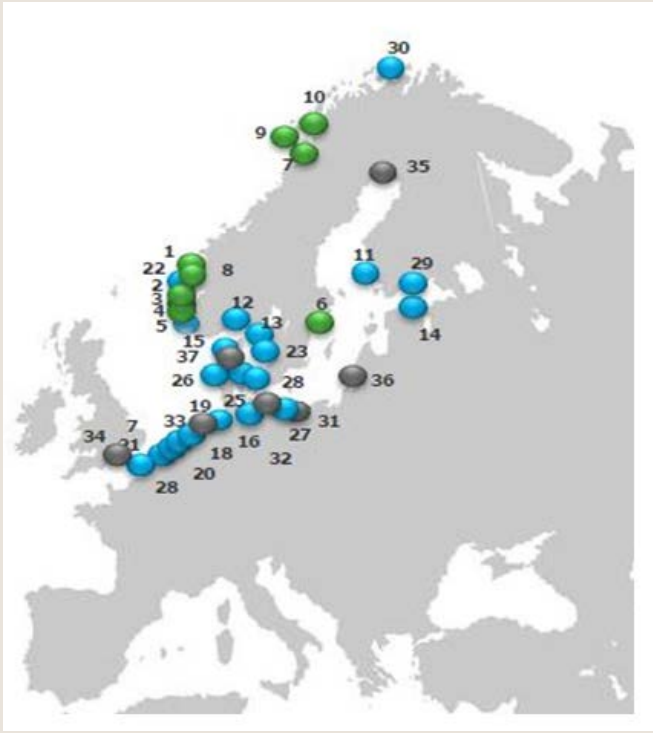
Load step capability:

- Diesel engines have better load step capability than LNG engines
- Additional measures might be needed (e.g. temporary energy storage)
- Load step capability dependent on engine type
- IHC performed load step tests on several DF engines:
  - Wärtsilä 6L20DF + 6L34DF
  - ABC DF 16 DZD



Challenges

- LNG storage
- Load step capability
- Ship design and configuration
- Safety regulations and certification
- Availability of LNG
- Bunkering
- Maintenance and operational use



LNG hopper dredgers

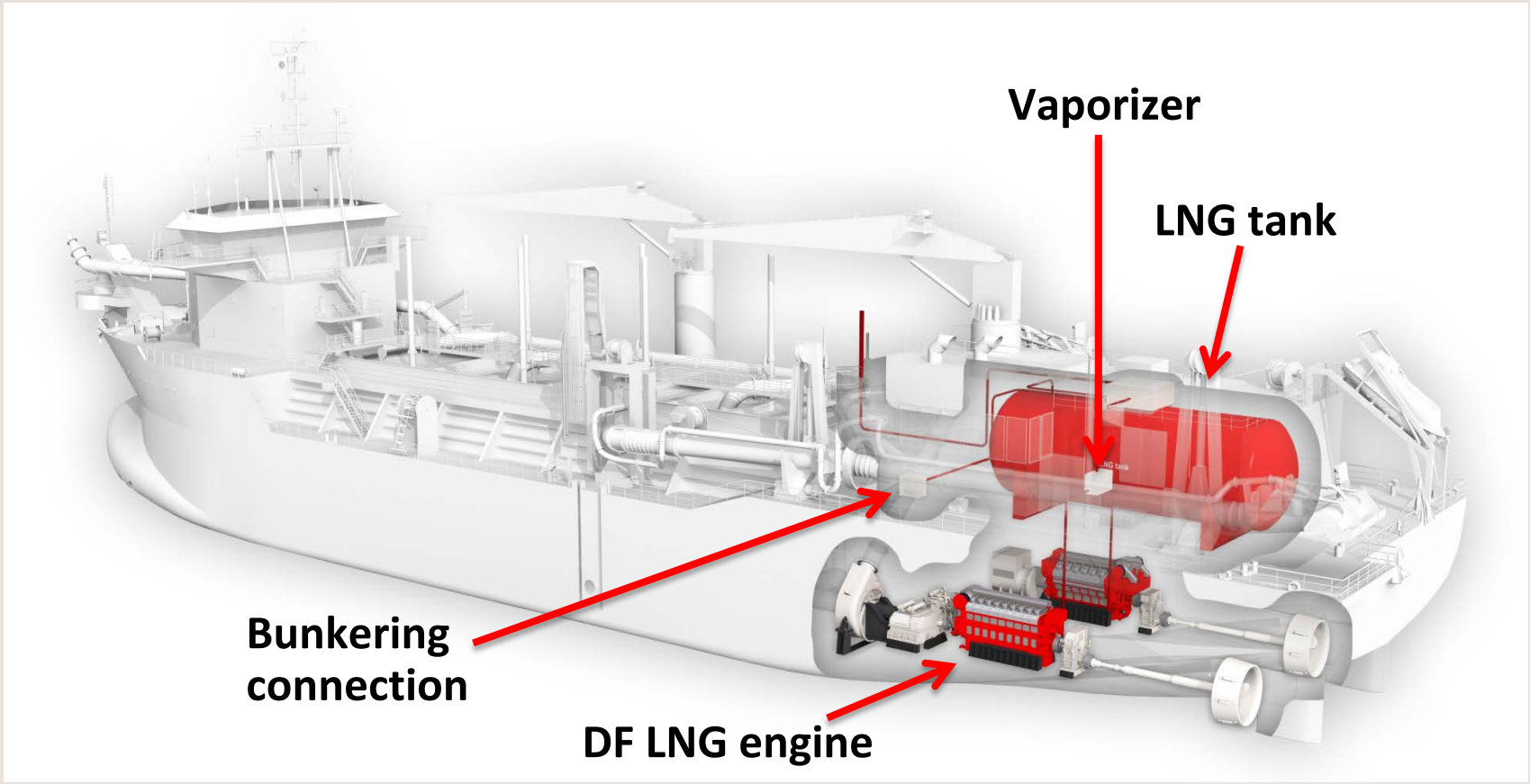
World's first LNG powered hopper dredgers…

15.000 m³
(LNG ready)

3.500 m³

8.000 m³

LNG hopper dredgers



Sustainable innovations

Emission regulations

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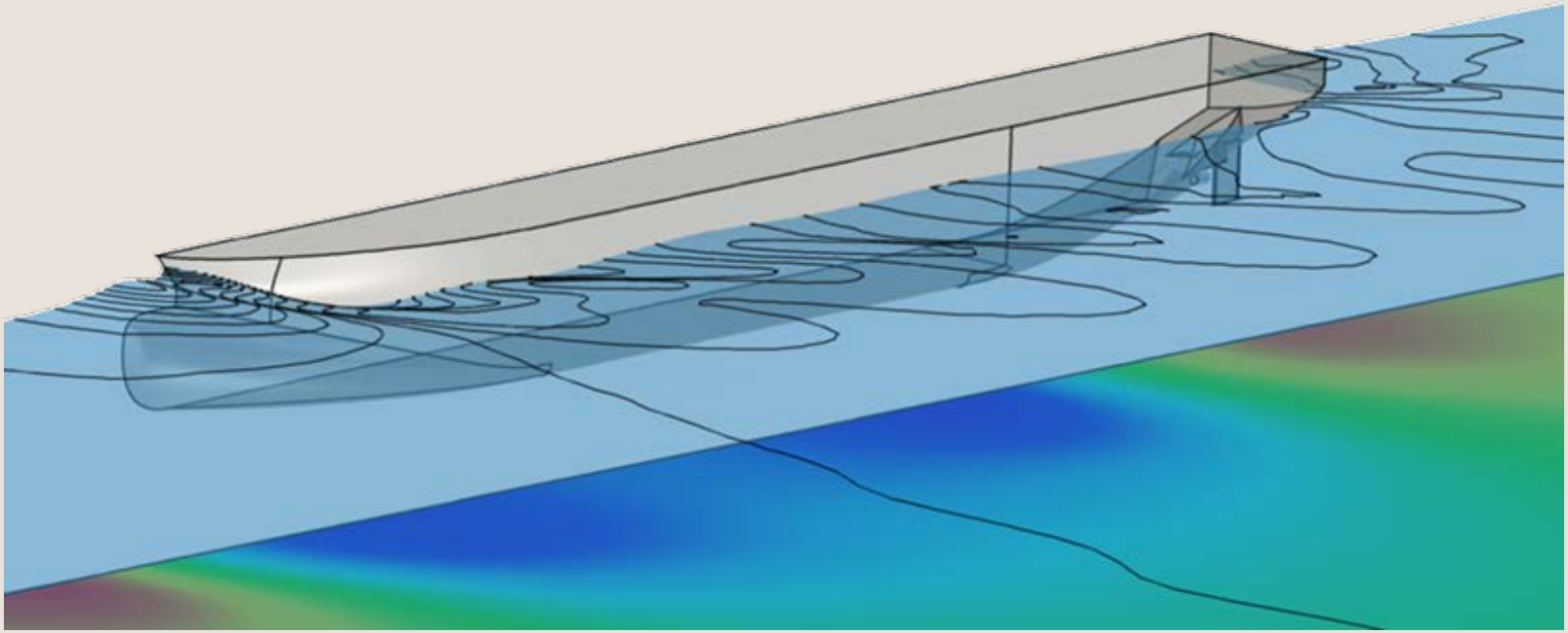
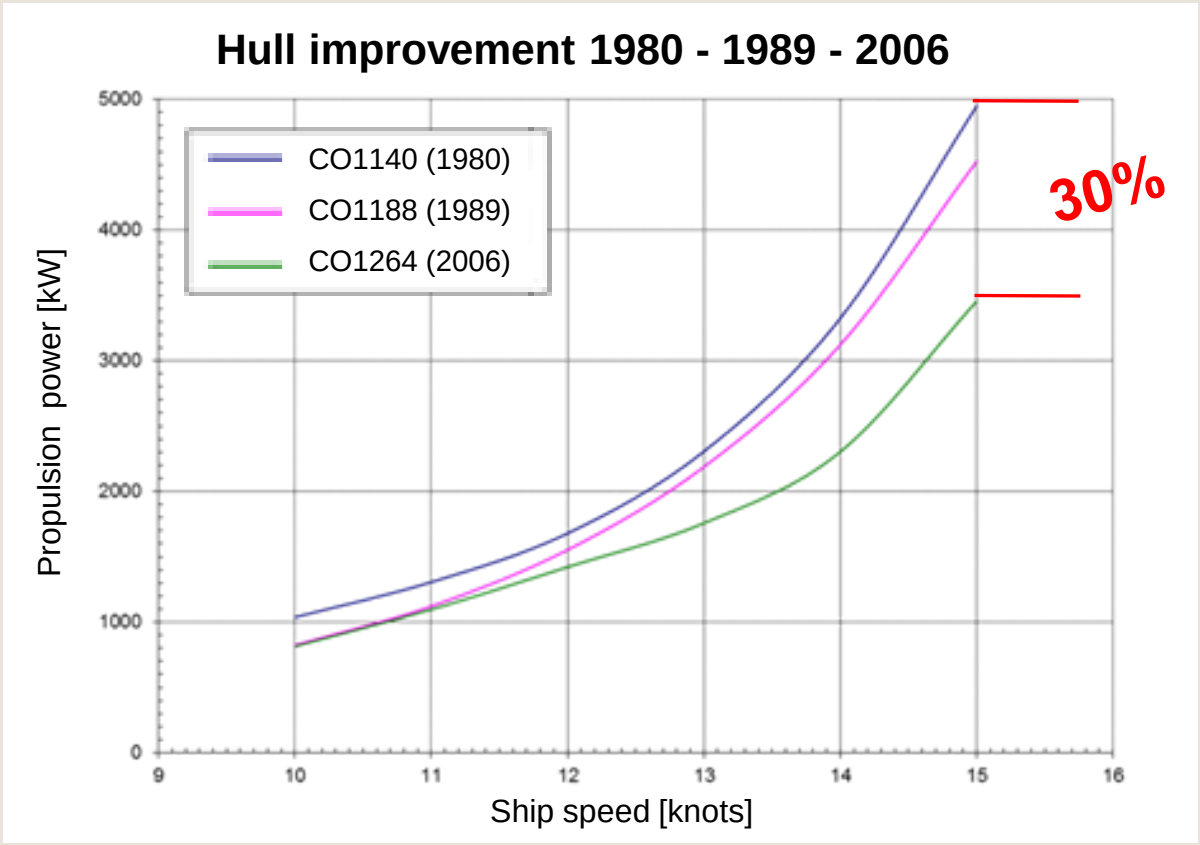
Hull shape optimization

- Fuel costs are approx. 30% of total operational costs
- Long term focus on hull resistance reduction



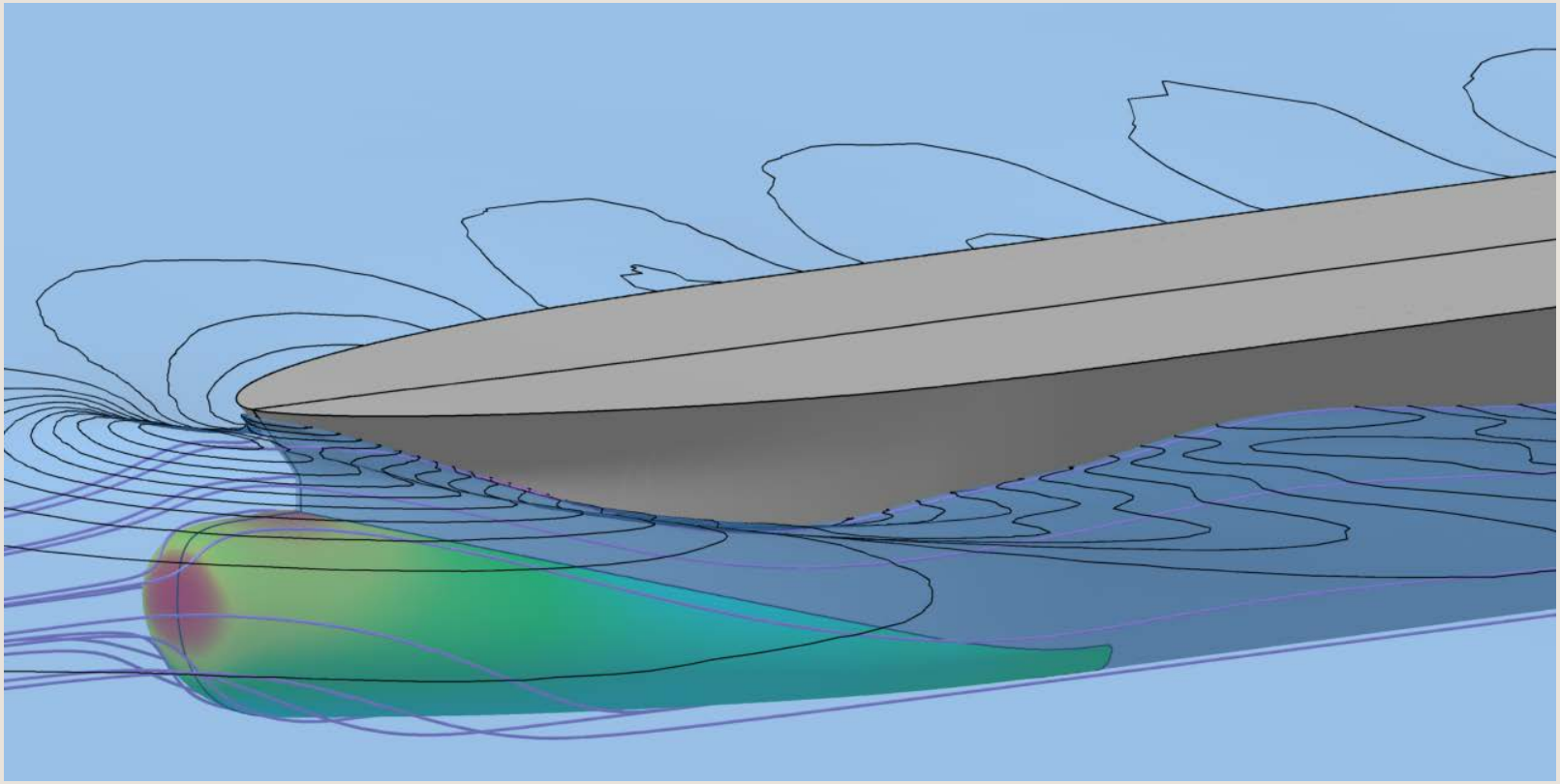
Hull shape optimization

- Fuel costs are approx. 30% of total operational costs
- Long term focus on hull resistance reduction
- Hull resistance vs. transport capacity vs. cost price



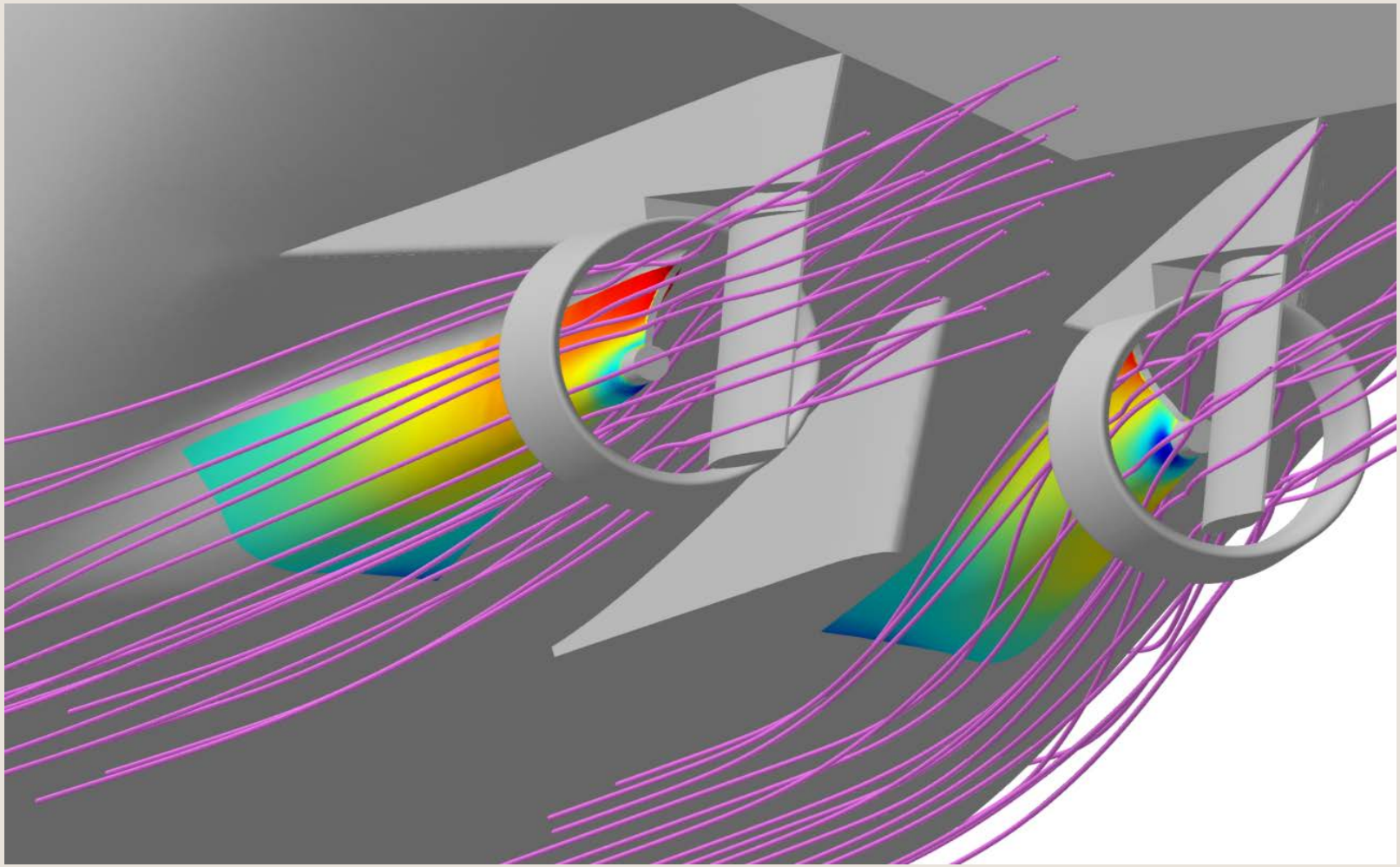
Hull shape optimization

Resistance reduction with bulbous bow



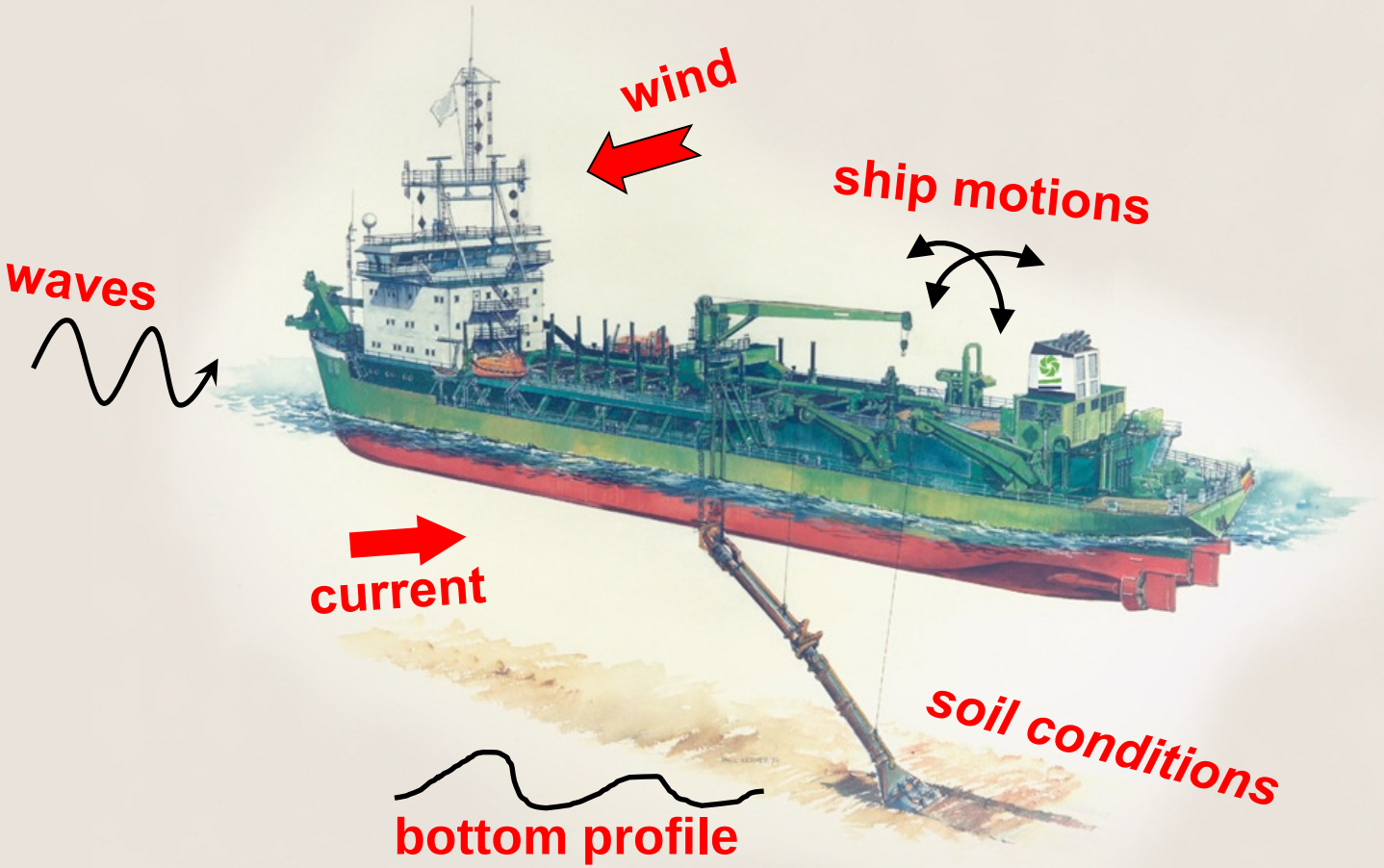
Hull shape optimization

Resistance reduction on aft ship



Dredging automation

The need for dredging automation…



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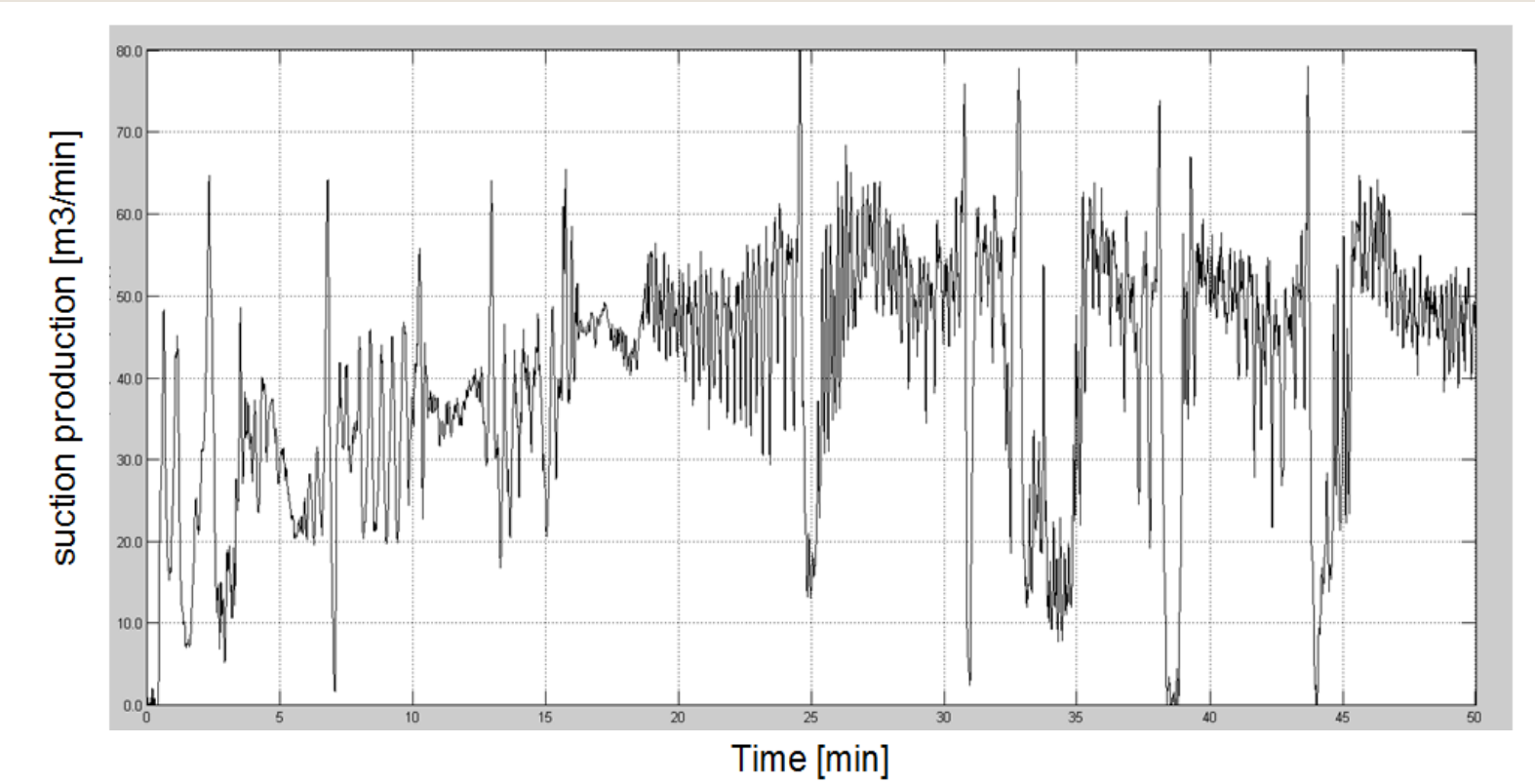
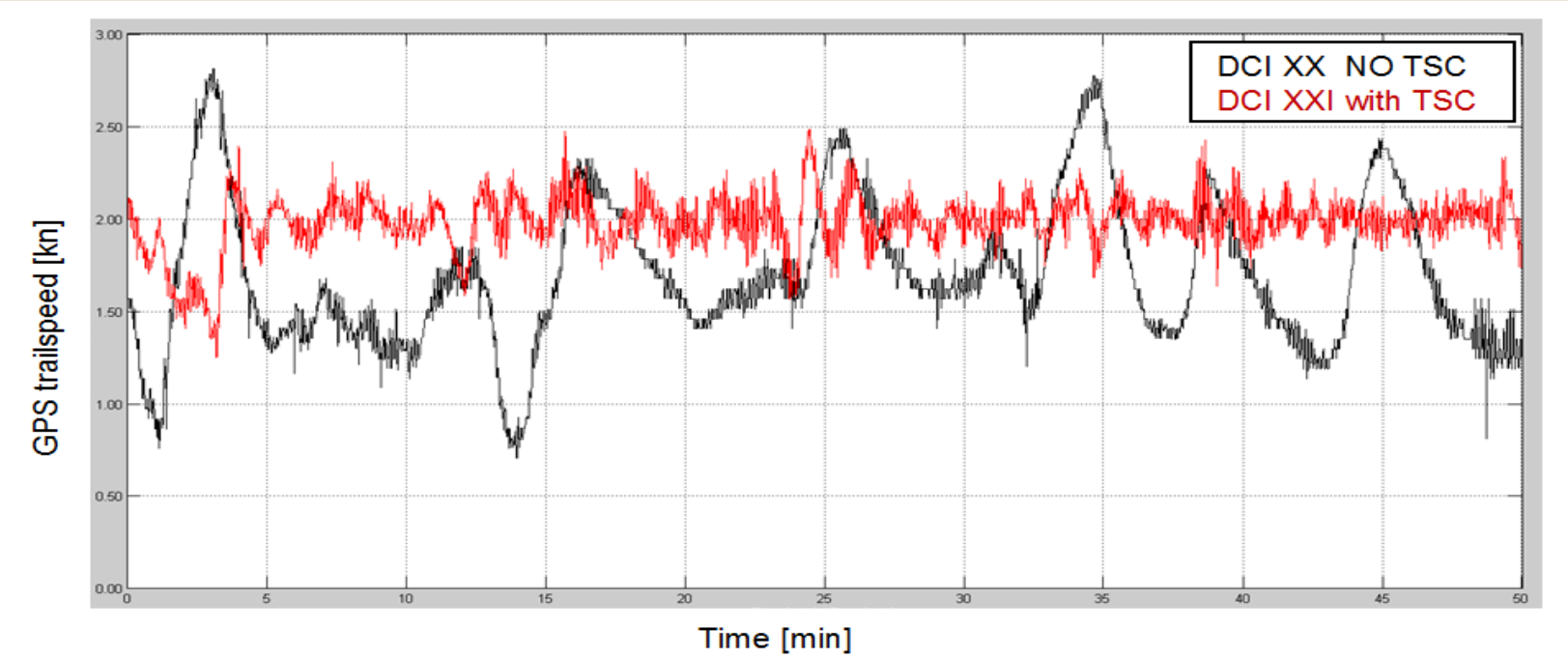


Dredging automation

Trailspeed Controller:

- Maintains ship speed at constant level
- Constant ship speed is essential for steady dredging process
- Improves safety, steersman can concentrate on marine traffic



Dredging automation

Trailspeed Controller:

- Maintains ship speed at constant level
- Constant ship speed is essential for steady dredging process
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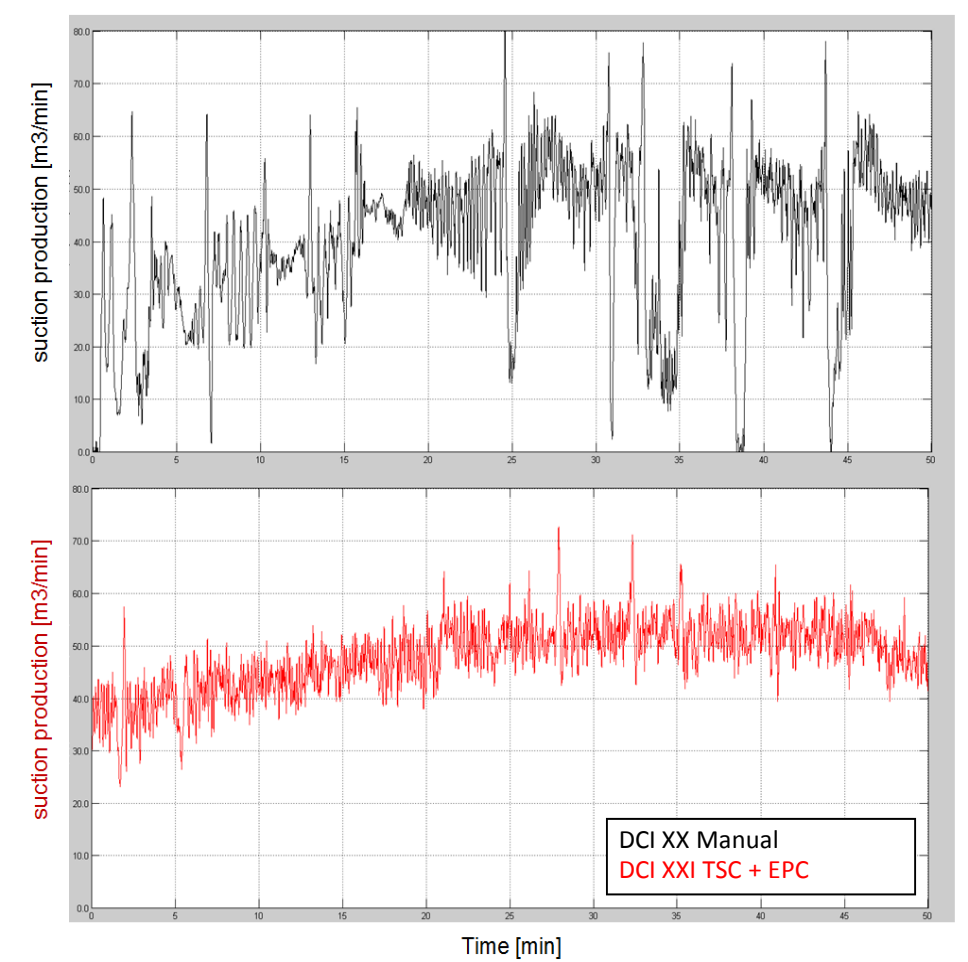
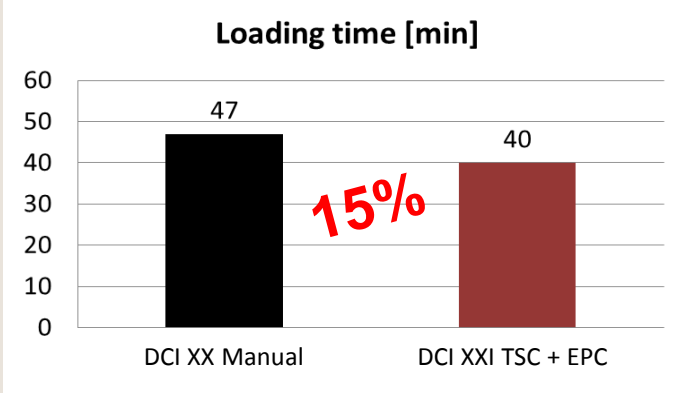
Eco Pump Controller:

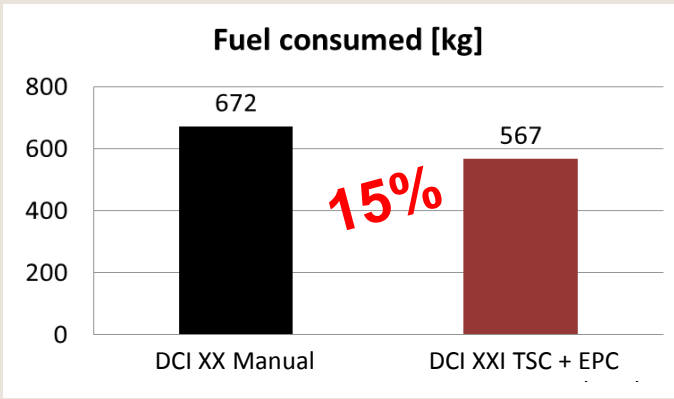
- Prevents pump from cavitation
- Actively controls pump speed to optimize production and fuel consumption

Dredging automation

The impact of dredging automation…







Sustainable innovations

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Energy prices

CO_2 reduction

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Turbidity reduction

Turbidity

The problem…

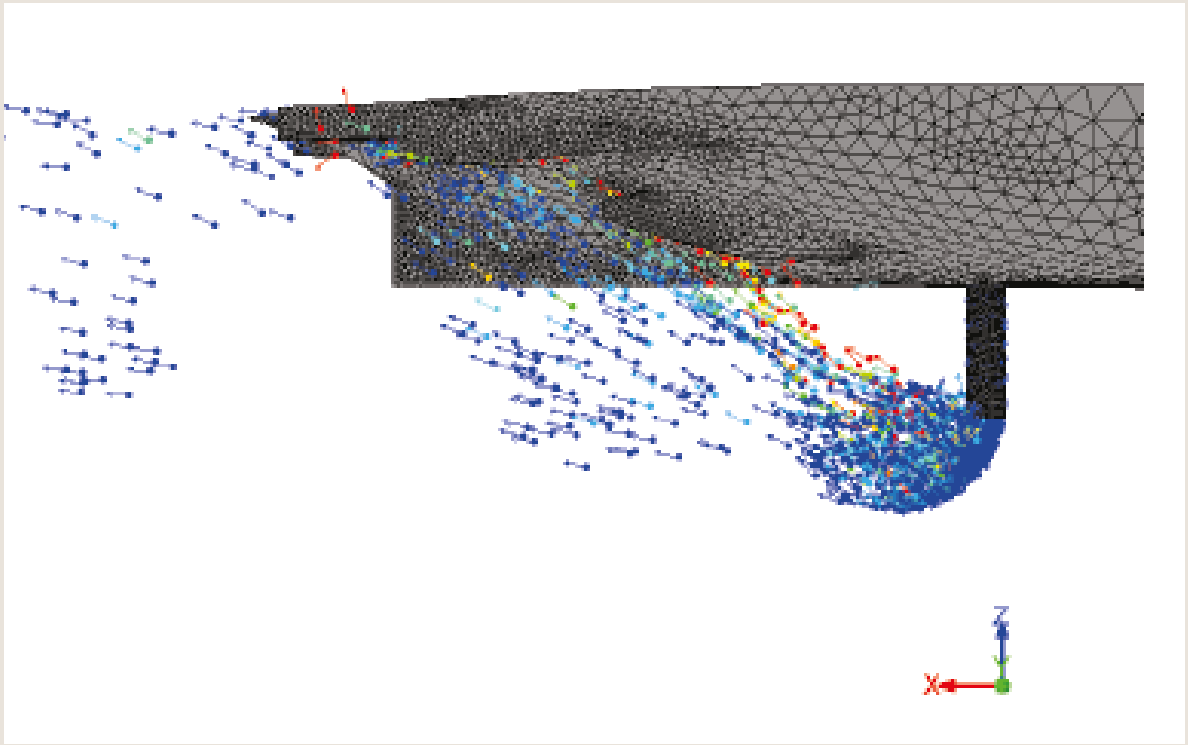
Turbidity and air

The problem…

Turbidity and air

B. Decrop, 2015:

"the presence of air bubbles in the overflow has the potential to increase the surface plume concentrations with a factor 5 to 10"



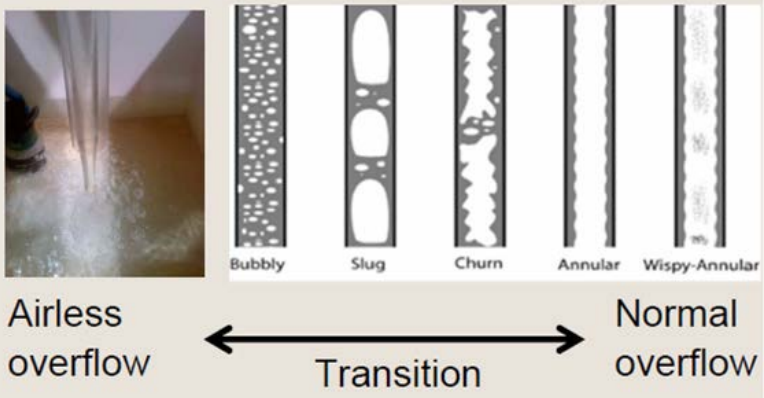
Airless Overflow

Development of Airless Overflow:

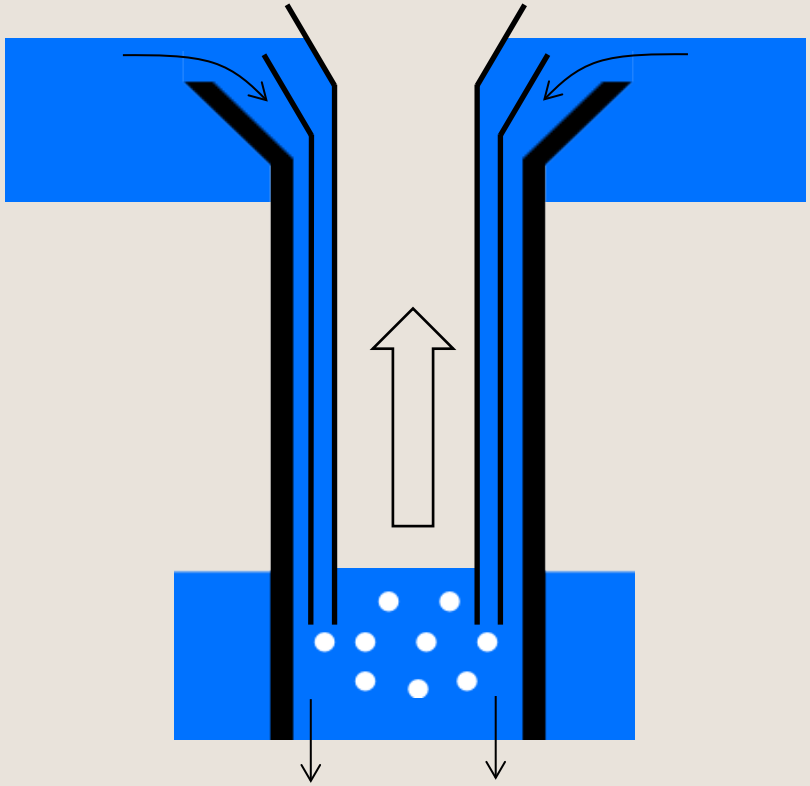
- Reduce turbidity plume by reducing air bubbles in the overflow
- Prevent possible damages resulting from air underneath the vessel

Airless Overflow

Small lab tests to identify flow regimes and understand air enclosement



Airless Overflow



- Free flow
- No moving parts
- Easily replaceable add-on

Airless Overflow

Prototype test on Easydrege 2700

Conclusions

- Sustainability is an import driver for innovation at Royal IHC
- Emission regulations will have impact on ship design
- LNG is a sustainable and feasible answer to strict emission regulations
- Hull shape optimization contributes to fuel saving and exhaust gas emission reduction
- Intelligent dredging automation contributes to both higher production and lower fuel consumption
- Airless overflow contributes to turbidity reduction

Thank you for your attention