

LNG – One Option for the Green Revolutionary Ferry Design



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Project Engineer
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AGENDA

- Ferry markets overall
- Why Lng?
- How Lng Influence To Ferry Design
- State Of Art Green Solutions
- Future direction
- Conclusion

FERRY MARKETS

- Many different alternative solutions to use fuel
 - LS HFO
 - MGO
 - Battery
 - LNG
- Marine fuel distribution in Europe
 - LNG has strong position in North
 - Battery ferries solution with MGO increase in North
 - HFO with scrubbers in English channel and Mediterrian area
- European Ferry operators who use already LNG
 - Viking Line
 - Tallink Silja
 - Fjord
 - Fjordline
- Brittany Ferries will join to club 2019.

FERRY MARKETS

- NB Ferries
 - 90% new building vessels from China are HFO solutions
 - Half of that are LNG ready.
 - Major of English channel ferries are HFO with scrubber technologies
 - Irish Ferries, DFDS, P&O
 - Baltic sea area is LNG operation.
- NB LNG Ferries
 - Brittany Ferries (English channel)
 - Viking Line (Baltic Sea)
 - Balleria (Mediterranean sea)
 - Fjord1 (Norway domestic)
 - Gåtlandsbolaget (Baltic sea)

FERRY MARKETS

MGO + Battery or Battery



LS HFO + LNG (MGO)



LNG



MGO + Battery

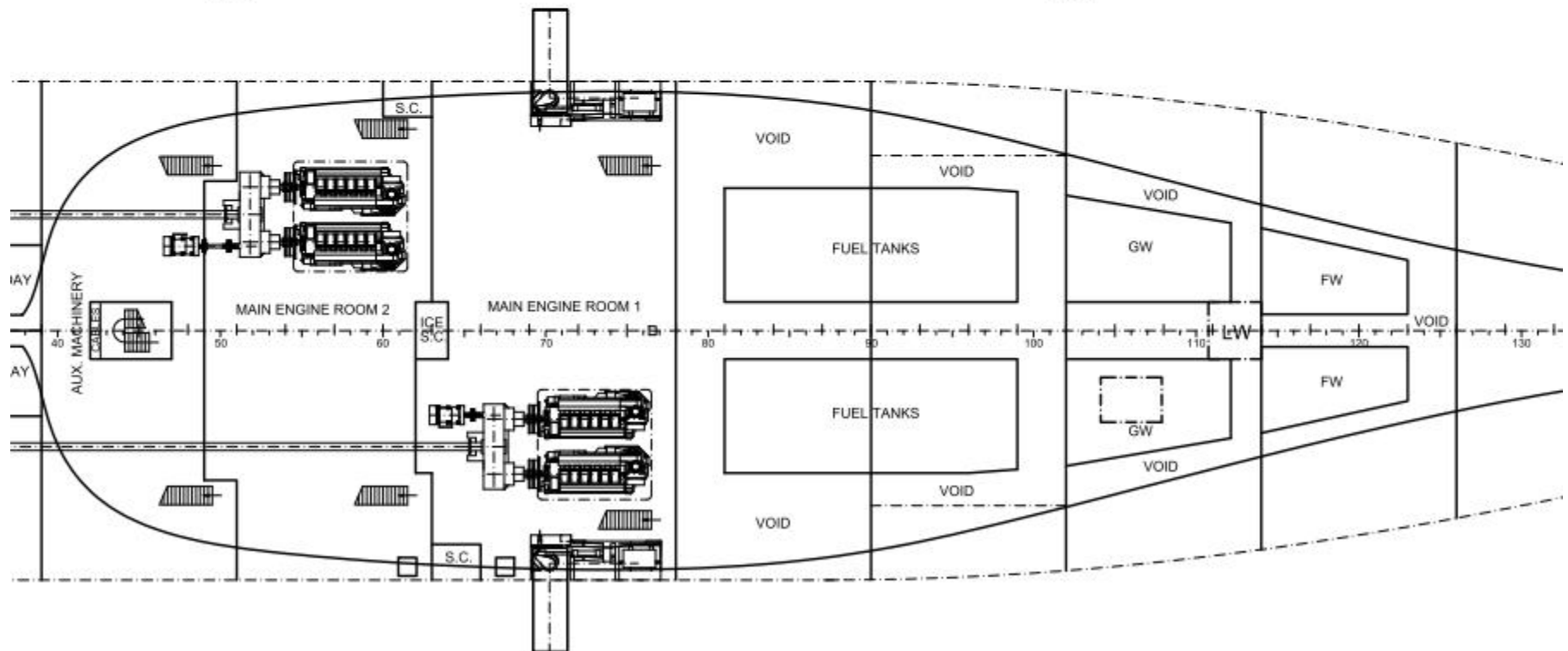
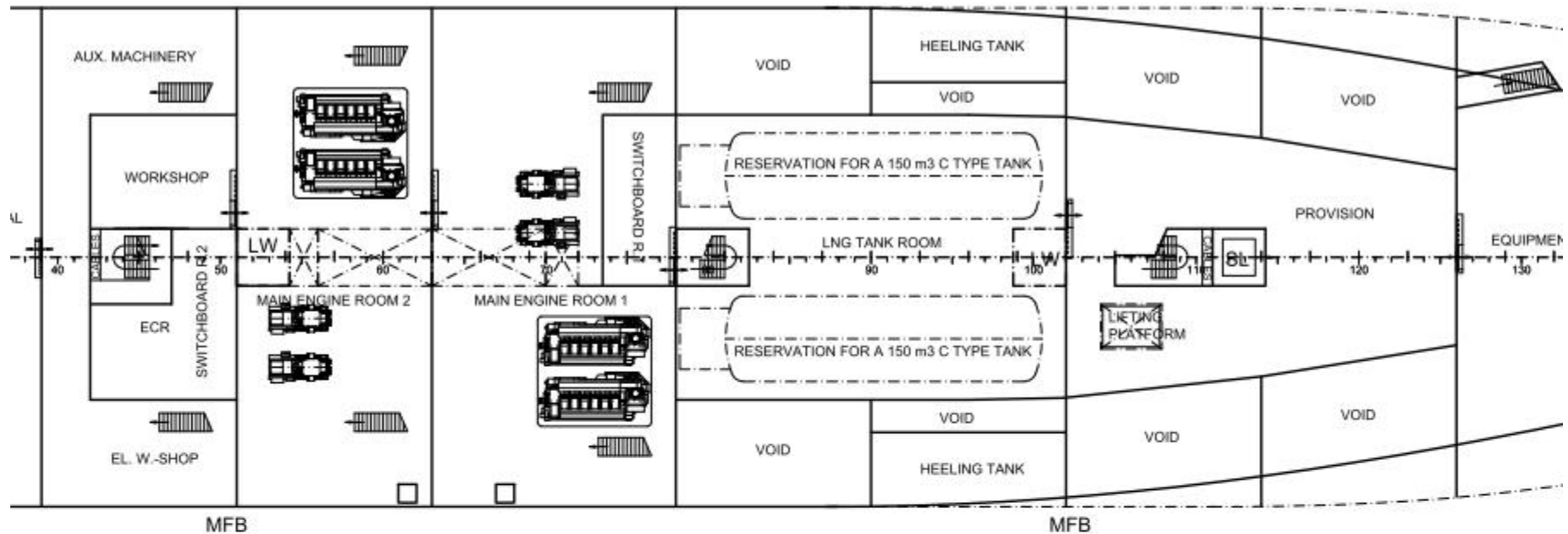


WHY LNG?

- Increase the operators Green Value
- LNG is smart way to meet existing and upcoming requirements for emissions
 - SO_x, No_x, PM, CO₂ emissions
- Clean machinery room increase overall cleanliness

HOW LNG INFLUENCE TO FERRY DESIGN

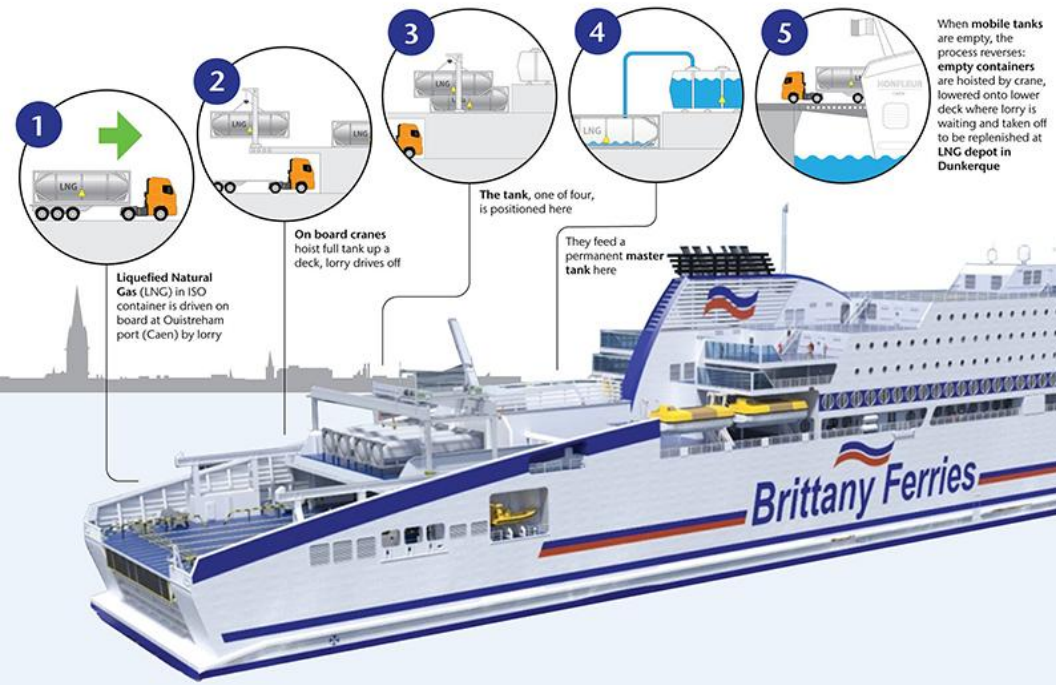
- LNG using ship
 - Increase vessel cost
 - DF engine > single fuel
 - LNG tank > MGO tank
 - Extra piping and ventilation cost
 - Typical DF solutions. Battery package option.
- Design viewpoint
 - Tank location outside vs. inside
 - LNG tank space ventilation
 - LNG bunkering station with bunkering door
 - Staircase arrangement to LNG tanks space
 - Machinery arrangement
 - DF engine and piping layout



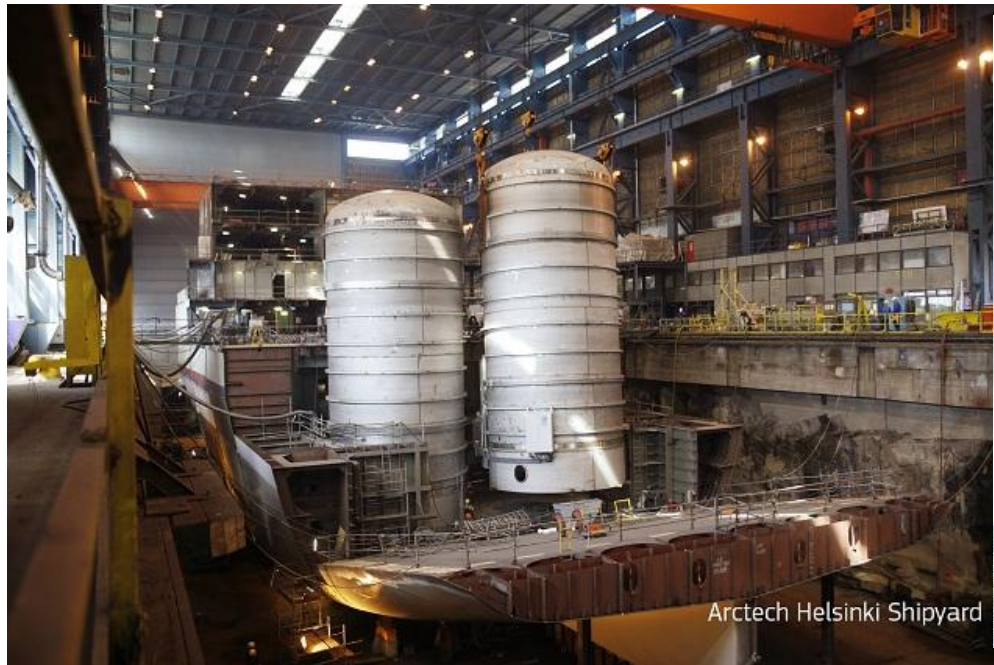
LNG TANK SOLUTION



Delivering fuel to Brittany Ferries Honfleur



LNG TANK SOLUTION



STATE OF ART GREEN SOLTUTIONS

- Battery ferries already developed
 - Good solutions for the short crossing were is charging possibilities
 - Color Line new plug-in hybrid ferry
 - Operate between Norway and Sweden
 - Fueled by MGO and Battery package
 - Color Line future direction will be battery charging
 - Plug system Color Fantasy, Magic and superspeed
 - Stena Line
 - Steps to the battery operation; Case m/s Jutlantica
 - Scandlines
 - Strong direction to operate battery.

FUTURE DIRECTION

- Hybrid solutions will be the winner in future
- What is the winning combination?
 - In north some believes LNG + Battery & other MGO + Battery or only Battery
- How the infrastructure will develop?
 - LNG terminals vs. battery charging technology
 - Mobility container system
- Fuel cells technology?
 - How fuel cells technology will influence to ferry markets?
 - First existing solutions on the Cruise market will be RCCL Icon class
- Zero emission operation will be the target level.

CONCLUSION

- LNG has green value on the marine market
- LNG used vessel increase all the time (cargo ship, containers, ferries, cruise vessel)
- Technology is already developed
 - R&D work focus on tanks design
- Costs & infrastructure
 - LNG system vs. Battery system
- Future winning combination will be hybrid solutions.

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