Legal-administrative procedures and barriers to hydrogen applications in the maritime sector

HyLAW workshop, Brüssel, 6th December 2018
Senior Research Scientist Sigrid Damman, SINTEF
-Maritime transport emits around 1000 mill tons of CO2 annually - about 2.5% of global GHG emissions (3rd IMO GHG study)

-Shipping emissions predicted to increase between 50% and 250% by 2050

-IMO to reduce CO2-emissions 50% by 2050

-0.50% Sulphur Cap on marine fuel from 2020

-Opportunity and need for new alternatives!

Promising projects, but lack of H2 specific regulations

GKP7H2 (Brødrene Aa, new construction, H2 (compressed gas) and fuel cells, 2021)

Water-Go-Round, first fuel cell / H2 gas vessel in the US (Golden Gate Zero Emission Marine, 2019)

Viking Cruises, 230 m /900 passenger cruiseship, fuel cells and liquid hydrogen

- Or ammonia, or LOHC?
• SOLAS, MARPOL
• IGF Code
  • Main part (A-1): Specific requirements for use of LNG
  • First part (A): Opens up for use of other gases or low-flashpoint liquids, through "Alternative design"
    • Safety, reliability and dependability shall be equivalent to that of new and comparable conventional systems (how to demonstrate this?)
    • 18 additional functional requirements
    • Risk and explosion studies required
  • Requirements for fuel cell installations will be added as a new part E to the Code (2024)
  • Hydrogen specific requirements are not yet on the agenda in IMO/CCC
From IMO and EU to the national level

- IGF Code, SOLAS, MARPOL implemented through EU Directives
  - Directive 2014/90/EU, on marine equipment
  - Directive 2009/45/EC, on safety rules and standards for passenger ships
  - Directive 2009/16/EC and Directive 2013/38/EU, on port State control

- National Maritime Authorities responsible, in most cases
  - Relating to international rules and standards
  - Transposed through EU- and national legislation
Reg. 55: methodology for alternative design and arrangements for machinery, electrical installations and low-flashpoint fuel storage and distribution systems

Refers to “Guidelines for the approval of alternatives and equivalents as provided for in various IMO instruments” (MSC.1/Circ.1455)

Linear, but comprehensive process

Close collaboration and dialogue required

Guidelines include

- Detailed description of the roles of the involved parties
- Description of the project phases and the parties’ responsibilities in the respective phases
- Guide for establishing evaluation-and acceptance criteria
- Suggested documentation requirements
- Operational requirements
Applicable class rules

- For fuel cell installations
  - Requirements, design principles
  - Spaces, fire safety, control and monitoring systems
  - No fuel specific requirements
- And gas fuelled ship installations
- But not specifically for HFC vessels
Remaining concerns

- **Common concerns for LH2 and CH2**
  - Relevant hazardous (EX) zones for hydrogen
  - Embrittlement
  - Risk of autoignition when burst discs are used
  - Capacity of safety relief valves
  - Inerted spaces?
  - Ignition mechanisms

- **Compressed hydrogen**
  - The high pressure is a hazard on its own

- **Liquefied hydrogen**
  - Loss of vacuum
  - Sloshing in tank
  - Inerting issues
  - Condensation and solidification of oxygen
  - Impact of extremely low temperature

- **Ammonia**
  - Impact of possible leakages on marine life?
  - Lack of safety procedures, standards as marine fuel
  - On-board reforming is challenging and energy intensive
  - Technology to utilize ammonia directly is still in very early stage
Vessels on inland waterways

- CESNI - European committee for drawings up standards for inland navigation
- ES-TRIN (European Standard for Transport on inland navigation vessels) provides general provision for low-flashpoint fuels (Ch. 30; Appendix 8)
- EU Directive 2016/1629/EU provides the possibility for CESNI to issue special permits for new technologies
- Equivalence of safety, risk assessment

'Hydroville' (CMB)
Landing and bunkering installations

- Regulated under the ATEX directives
- Directive 2012/18/EU (aka Seveso-III): Control of Major-Accident Hazards Involving Dangerous Substances
- Norway: Installations harbouring more than 5 t, and all bunkering installations for HFC passenger vessels, require special consent
- Time-consuming - normal processing time is 3 months, may take longer
- Comprehensive, quantitative risk assessment
- Function-based rather than specific requirements
- Costs depend on case, difficult to specify
- ISO 20519 – LNG standard
- Need internationally aligned norms and guidelines

Approval for landing/bunkering installations

https://www.hylaw.eu/database#/database/vehicles/boatships/approval-for-landing-bunkering-installations
Barriers and opportunities: View from Hybridship

• Car and passenger ferry, flexible hybrid, HFC and battery, rebuild, 2020
• R&D support through Pilot-E
• Develop technology AND accelerate approval process
• Industry and relevant authorities, including NMA and Directorate for Civil Protection, SINTEF, DNV GL, Standard Norway
• Ship propulsion, bunkering and storage options

• Challenge no.1: Develop regulations!*

*Presentation by K. Nerem, Fiskerstrand, Oslo 4th May 2017
Barriers and opportunities: View from NPRA

- Resolution no. 873, 13. June 2016: Parliament request, development contract for HFC ferries
- Car and passenger ferry, new construction
- Competitive innovation contract /competitive dialogue
- Public tendered service, into operation 2021
- Close dialogue with NMA and Directorate for Civil Protection

- Crucial that IMO make specific regulations for hydrogen (shipping and classification societies must push!))
- Need internationally aligned norms and guidelines for landing and bunkering installations

*Camilla Røhme, NPRA, 10.10.2018
HyLAW partners sending a clear message

As to design / type approval of hydrogen / hydrogen fuel cell vessels, there is a very clear and highly damaging regulatory gap

This map depicts the severity of this barrier across the HyLaw Partner countries.

- **Green**: No barrier
- **Yellow**: Low
- **Orange**: Medium
- **Red**: High
- **Gray**: Data not available
- **Selected countries**

Recommendations

• Develop specific rules for the type approval of Hydrogen and Hydrogen Fuel Cells vessels
  • Who: The IMO, National Maritime Authorities, EMSA, the European Commission, Class societies, CESNI (for inland navigation)

• Clarify and streamline applicable rules for the landing and bunkering of hydrogen
  • Who: The European Commission, National / Regional and Local authorities, business assurance companies, standardization bodies

• Develop and share minimum requirements for the operation and maintenance of HFC vessels
  • Who: National Maritime Authorities, EMSA, the European Commission, Class societies, the IMO, CESNI