MARANDA

FLAGSHIPS

San Francisco
11th of September 2018

From Maranda to Flagships

RCS Learnings

WP Leader: Persee

FCH FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

VTT

POWERCELL

ABB

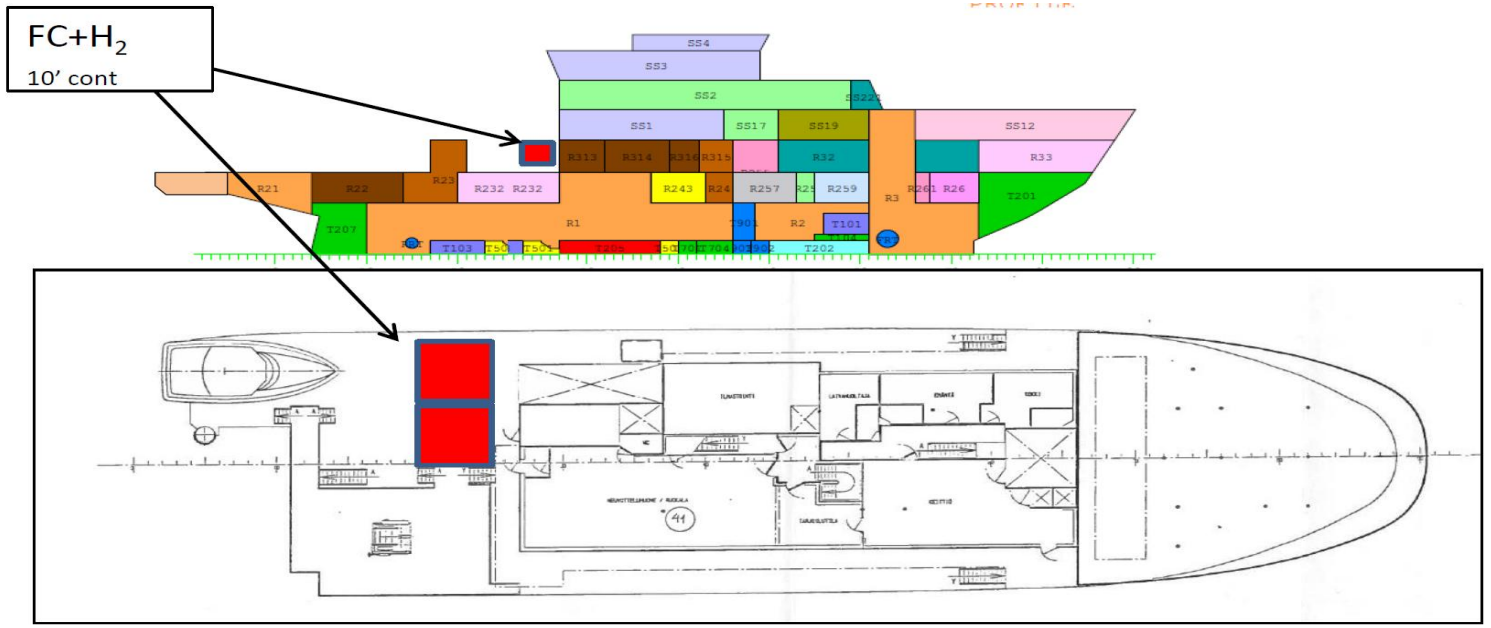
OMB

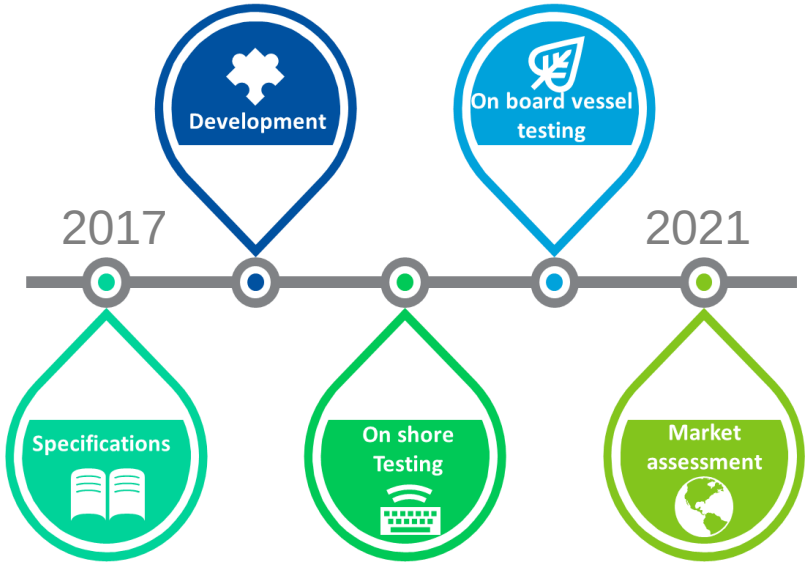
Persee

SYKE

SWISS HYDROGEN

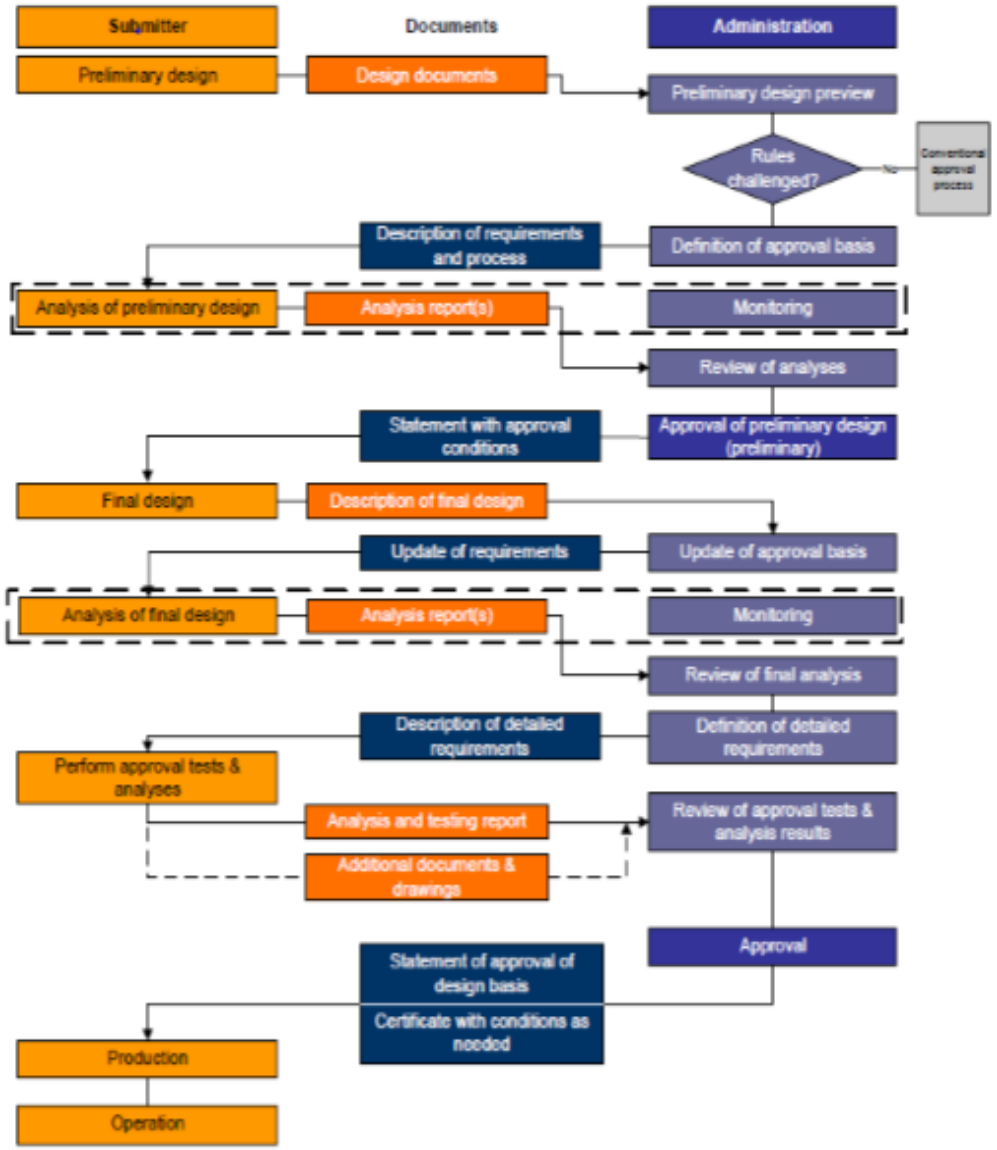
MARANDA: first HFC deepsea going vessel funded by FCH JU





- 165 kW fuel cell powertrain (hybridized with a battery) to fuel dynamic positioning activities of Aranda, a Finnish Research Vessel
- Gaseous mobile hydrogen storage container, refillable in any 350 bar hydrogen refueling station
- Special emphasis placed on air filtration and development of hydrogen ejector solutions, for both efficiency and durability reasons.
- Liquid hydrogen considered in go-to-market strategy
- Project cost: 3,704,757.50 €
- Participants: **VTT (FI);** POWERCELL SWEDEN AB (SE); ABB OY (FI), OMB SALERI SPA (IT); PERSEE (FR); SUOMEN YMPARISTOKESKUS (FI); The Finnish Environment Institute; SWISS HYDROGEN SA (CH°

Alternative design, the must have route to ship approval



Current Option for HFC on board a ship – ALTERNATIVE DESIGN

Alternative Design option may lead to:

1. Innevitably **Lengthy** process
2. Increased initial **costs**
3. **Lack of Harmonized approach** (due to innevitable variety in evaluation instruments/criteria)

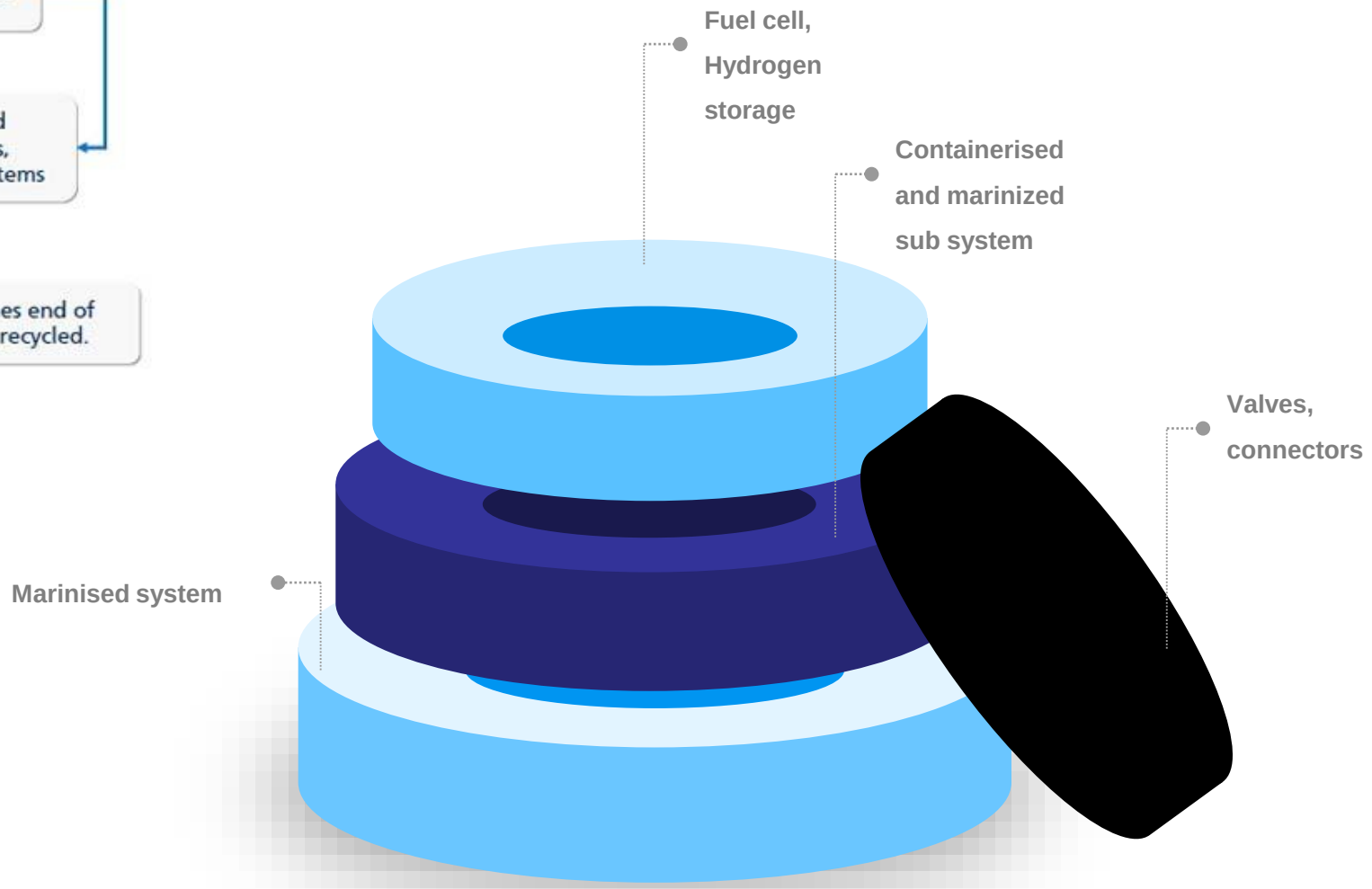
Though not anticipated RCS proved a real challenge

- Although Hydrogen and Fuel cell only support the dynamic positioning activities of the Aranda ship, various issues have been already raised by the project related to the approval process:
  - Safety compliance :
    - ✓ Fire protection system should prevent and detect leakage although we believe protection against leakage by ventilation is a more appropriate measure
  - Material fitness :
    - ✓ Plastics should be limited as flammable mass, but PEMFCs are made of plastic
  - Marine/Road Code compatibility:
    - ✓ Swapable tanks which is the more convenient approach to the state of infrastructure imposes to meet both on road rules and marine rules which is incompatible with some technologies

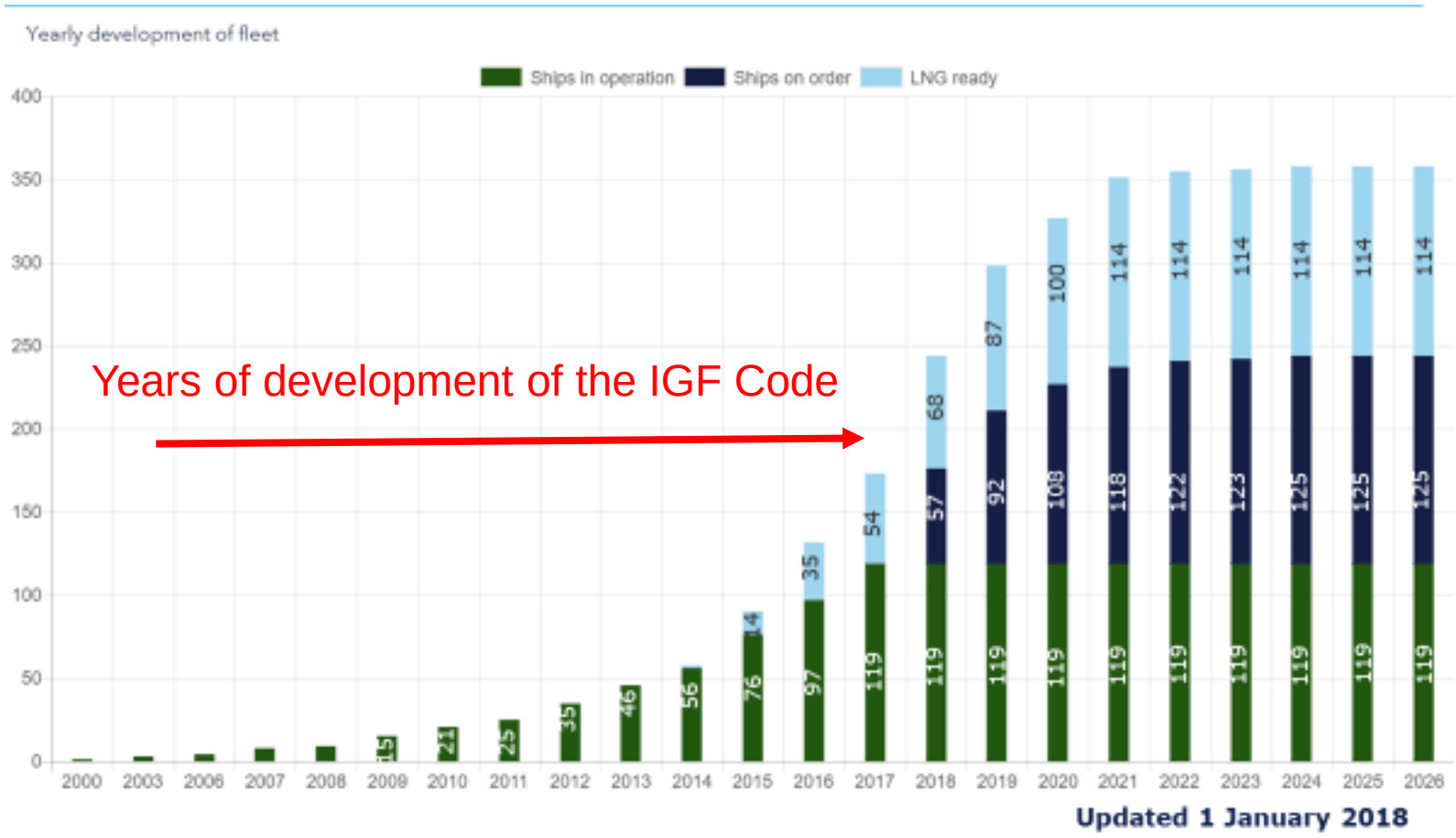
- These issues led the consortium to realise how difficult it would be get approval of a ship propelled essentially by Hydrogen & Fuel cells

Lack of RCS is a common hurdle across value chains

Lack of common references opens up to individual and sometimes personnal interpretation

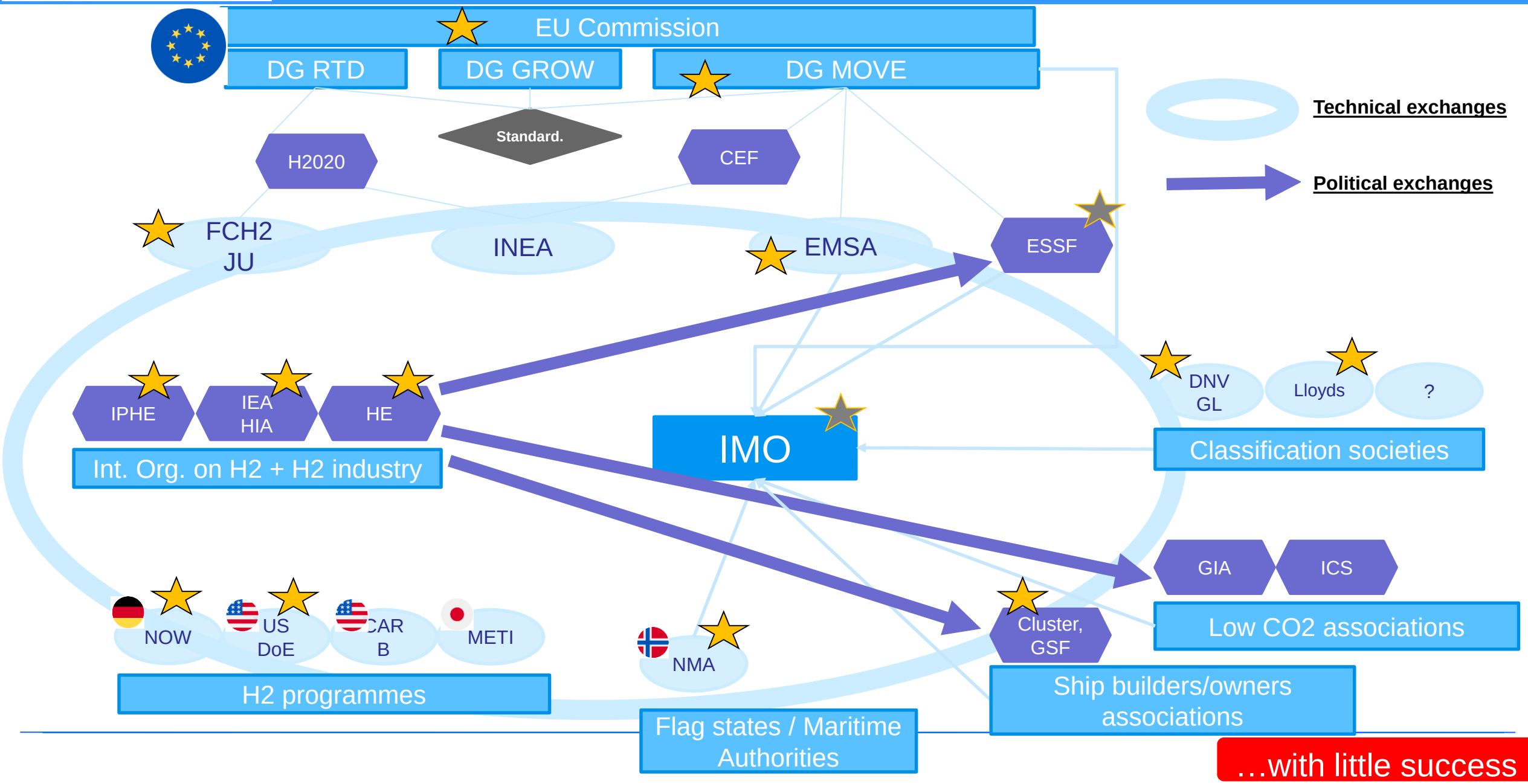


The road to proper RCS is long



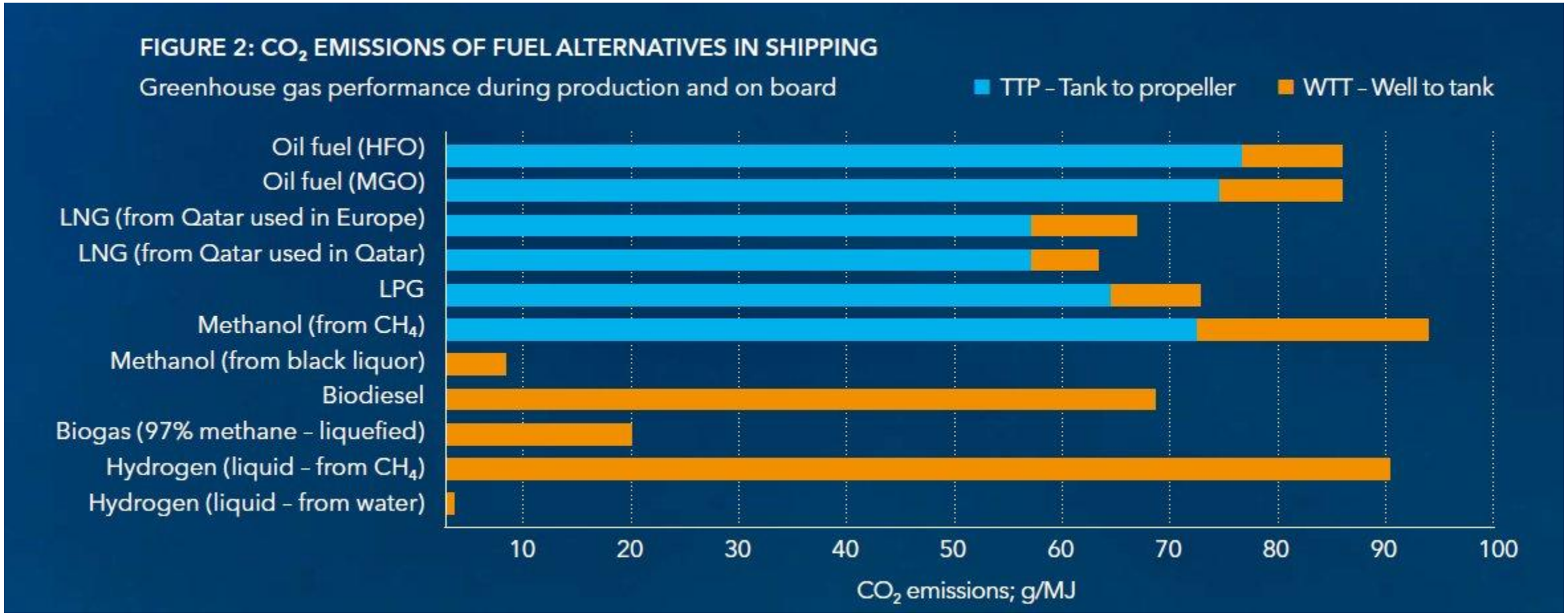
Unfortunatly, not much has been happening for FCH, at code level certainly, elsewhere as well

Numerous contacts have been established (directly/indirectly)



…with little success

But alternative fuels are competing… for RCS too



Source DNV GL

Why not further build on experience from road application?

International Energy Agency

Remove critical barriers to hydrogen deployment

Some barriers relate to regulatory obstacles and uncertain standards.

Areas for close attention include:

- hydrogen refuelling standards
- refuelling station permitting processes
- natural gas grid blending limits
- demonstration of safety measure effectiveness in new applications.

The European Commission's HYLAW project is an example of multilateral progress that could be expanded beyond Europe's borders.

Why not further bring synergies across vessels?

Present

Concept boats

Race for Water (2017)

Energy Observer (2017)

2019

FCH JU - Maranda

Water-Go-Round

2020

HYSEAS III

HYBRIDship

2021

NPRA

Elektra

Hydrogen Viking

2022

Demonstration of Fuel Cell applications for mid-size passenger ships and freight (2 vessels**)**

TUESDAY, APRIL 2, 2019 • 1:30 PM - 5:50 PM HILTON NEW ORLEANS RIVERSIDE NEW ORLEANS, LOUISIANA

Join us to be a part of this historic event. Building on AIChE's experience in chemical industrial process safety, and access to 60,000 members in 110 countries, the Center for Hydrogen Safety (CHS) will be the worldwide leader in coordination and promotion of hydrogen safety. The event will launch a collaboration on worldwide solutions to hydrogen safety and how this will transform the transportation and energy industries. The Launch Event will feature distinguished speakers from the U.S., Australia, Europe, and Asia, and explore your part in this growing global initiative.

European Hydrogen Safety Panel
About the initiative

The FCH 2 JU launched the European Hydrogen Safety Panel (EHSP) initiative in 2017. The mission of the EHSP is to assist the FCH 2 JU both at programme and at project level in assuring that hydrogen safety is adequately managed, and to promote and disseminate H2 safety culture within and outside of the FCH 2 JU programme. The EHSP will provide to the FCH JU a unique, practical and direct access to state-of-the-art expert judgment for all issues regarding hydrogen safety. It will improve the transfer of safety knowledge across project boundaries and establish a consistent communication about safety performance.

A final thought

MARANDA

Contact us at maranda@pers-ee.com

Acknowledments

This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking under grant agreement No 735717. This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation programme and Hydrogen Europe and N.ERGHY