Session 1: Role of hydrogen in a low-carbon economy – long-term perspective

Views from industry ; Maritime. .

International Energy Agency
Technical Collaboration Programme

Task 39: Hydrogen in Maritime Transport, 2017-2019

Operating Agent:
Ingrid Schjolberg
Department of Marine Technology,
Norwegian University of Science and Technology, NTNU

Workshop on hydrogen production with CCS
CAMPUS EDF CHATOU
November 6, 2019

Jacques Saint-Just
H2 Plus Ltd, ask member

Why Hydrogen in Maritime transport?

Because hydrogen could be an option for maritime transport, which is a major contributor to:

- GHG emissions
  - 2.8 % of annual global emissions

- Pollutant emissions
  - SOx
  - NOx
  - VOCs
  - Particles
  - ODS, ROGs…

Regulated by IMO (Emission Controlled Area, …) + Kyoto protocol

Golden Gate « Water-go-round »

- passenger capacity of 84
- hydrogen tank capacity for two full days of operation.

Why an IEA task?

The current deployment of H2 technologies in maritime transport is poor

Objective of the task

http://ieahydrogen.org/Activities/Task-in-Definition-Hydrogen-in-Marine-Applicatio.aspx

- provide know-how on the use of hydrogen and fuel cells in the maritime
  - ship propulsion, shore-side electrical power, cargo handling
- evaluate concepts
- initiate research and demonstration projects

This is achieved by creating an exclusive network of

- suppliers of hydrogen and fuel cells
- shipping companies
- advisory and research institutions

How it is done

- Bi-annual meetings of the members of the task and invited stakeholders

- Production of a “white paper” with the conclusions of the group and time horizons

White paper

1. Logistics, H2 supply and port development
    - H2 vs other clean fuels, for propulsion & auxiliary power
    - Compressed or LH2, Green or Clean (CCS) H2
    - On-shore power (cold ironing)
    - Fuel cell port handling devices (cranes, trucks)

2. Safety (mainly on-board safety) and RCS
    - Safety issues for H2 storage options (above or below deck)
    - Global regulatory framework

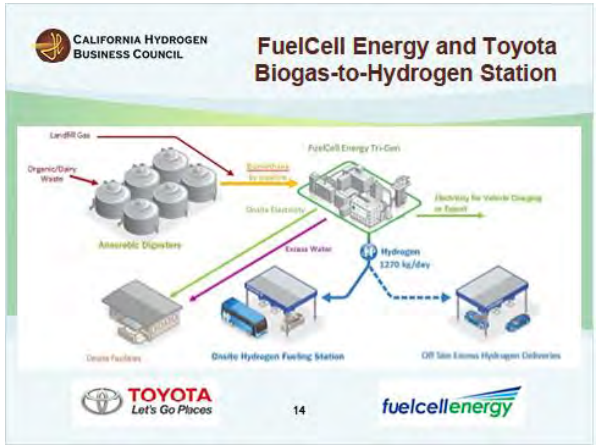
3. On-board technology – fuel cell development/hybrid solutions/energy management and ship design; retrofitting.

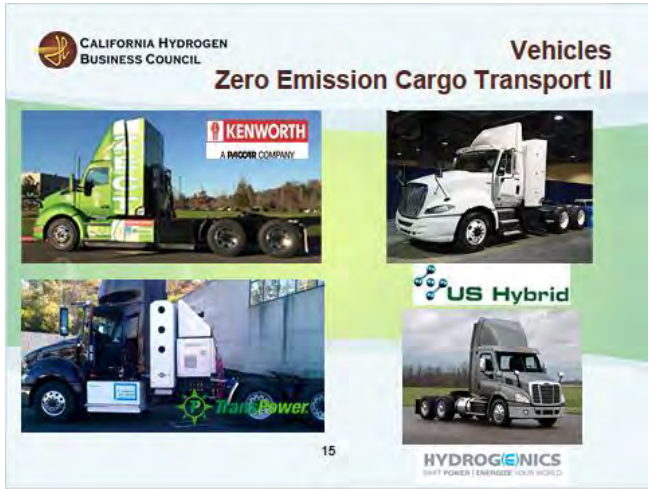
Task members (39) and invited stakeholders

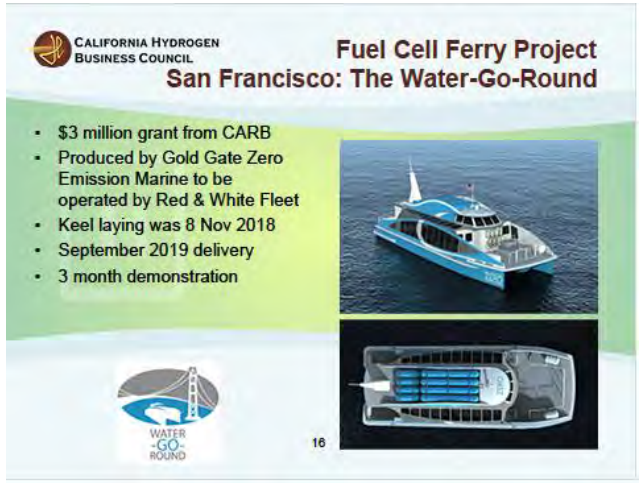
- Industry: *Fincantieri, Wartsila, Nedstack, Hydrogenics, Ballard, ITM, PowerCell, Engie, …*
- Port Authorities, shipyards: *Eastern Adriatic Sea, Damen, Holland, …*
- Registrar and classification: *Lloyd's Register, DNV GL*
- Government: *European Commission, California Hydrogen Business Council*
- Institutes: *VTT, SINTEF, INTA, …*
- Academia: *NTNU, U. Southampton, Delft, Tokyo, Trieste, Madrid, Lausanne, Genoa, …*

Information on the status of H2 in the maritime provided by the members:

Hydrogen demonstrations in the ports of Los Angeles & Long Beach







Hydrogen for maritime applications

projects supported by the European Commission

New projects – started 2019

Call for proposals – 2020 onwards

Maranda

hydrogen fuelled PEMFC based hybrid powertrain system validated on board the research vessel Aranda

2017-2021

FCH Funding: ~3M€

BIG HIT

A hydrogen territory in Scotland: hydrogen production, storage, transportation and utilization for heat, power and mobility.

2016-2021

FCH Funding: ~5M€

HySeas

the world's first zero emission, sea-going ferry. Demonstrate a circular economy model for the local production

2017-2021

H2020 Funding: ~9.3M€

FLAGSHIPS

- Fluvial push-boat, Lyon (FR)
- RO-PAX ferry, Stavanger (NO)

2019-2022

FCH Funding: ~5M€

H2 PORTS

FC for port/harbor container terminal:

- Reach Stacker
- Yard Tractor
- Mobile HRS

2019-2022

FCH Funding: ~4M€

H2020

- **Next Generation Propulsion for Waterborne >5MW on-board power**
- **Structuring R&I towards zero emission waterborn transport**

H2020 Funding: ~4-8M€

FCH JU

- **Scaling up and demonstration of a multi-MW Fuel Cell system for shipping**

FCH Funding: ~10 M€

MoZEES

Center for environment-friendly energy research focusing on zero-emission transport solutions. The Center is hosted by IFE, Kjeller, Norway, and has a budget of ~ 25 M€ and a duration of 8 years

(Director: Øystein Ulleberg)

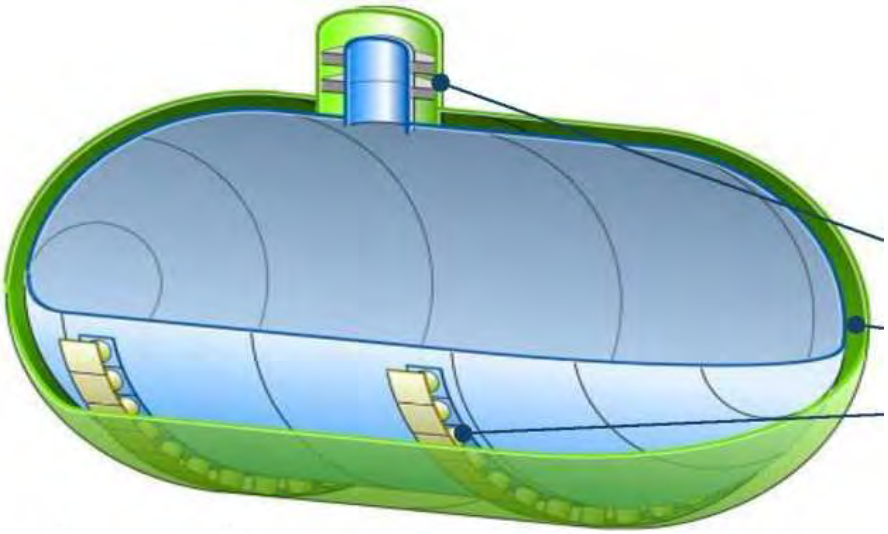
Objectives

develop battery and hydrogen materials, components, and technologies for existing and future transport applications on road, rail, and sea.

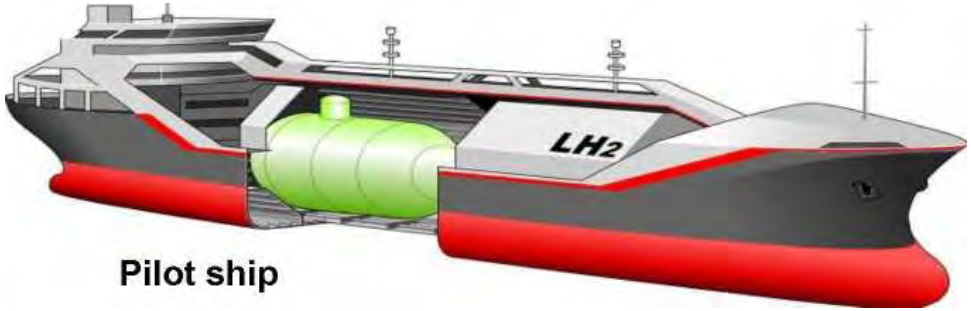
Japan

■ Kawasaki

World's first liquefied hydrogen cargo ship



Cargo tank



Pilot ship

Special dome structure for maintaining vacuum

Stainless steel vacuum thermal insulation double hull

High thermal insulation supporting structure

H2 from Australian brown coal **+ CCS**

F

Guideline to complement IGC code is being proposed to IMO by both Japan and Australia

Session 1:
Role of hydrogen in a low-carbon economy – long-term perspective.
Views from industry ; Maritime

- Short term: numerous niche opportunities for industry;
  Regulatory framework has a critical role

- Long-term perspective: hydrogen will play a major role

Thank you!

Contact for IEA-HIA Task 39

Ingrid Schjølberg, Professor

Director NTNU Oceans

Norwegian University of Science and Technology

ingrid.schjolberg@ntnu.no

http://ieahydrogen.org/Activities/Task-in-Definition-Hydrogen-in-Marine-Applicatio.aspx

IEA Hydrogen TCP Mary-Rose de Valladares <mvalladares@ieahydrogen.org>