GA 303457

pure

auxiliary power unit for recreational yachts

Dick Lieftink
HyGear Fuel Cell Systems
www.PURE-project.eu

PROJECT OVERVIEW (1)

- Development of Auxiliary Power Unit for Recreational yachts
- SP1-JTI-FCH.2011.4.4 (Research, development and demonstration of new portable Fuel cell systems
- Runs from 1-1-2013 to 31-12-2015
- Total budget:€2.884.875 with a FCH JU contribution of €1.642.194
- Status: 63% of project time is used

PROJECT OVERVIEW (2)

- Purpose: Develop small, light FC system for maritime applications

DTU

aptL AEROSOL & PARTICLE TECHNOLOGY LABORATORY

HYGEAR FUEL CELL SYSTEMS

European Commission

DAMEN

PROJECT TARGETS AND ACHIEVEMENTS

Status before project	AIP target	Project Target	Current status/achievements	Expected final achievement
250We	Stack power max. 50-500 We net	500We	500We	500We
	Proof-of-Concept unit	2 systems built and tested	On target	2 systems tested in Environmental lab and on board of a ship

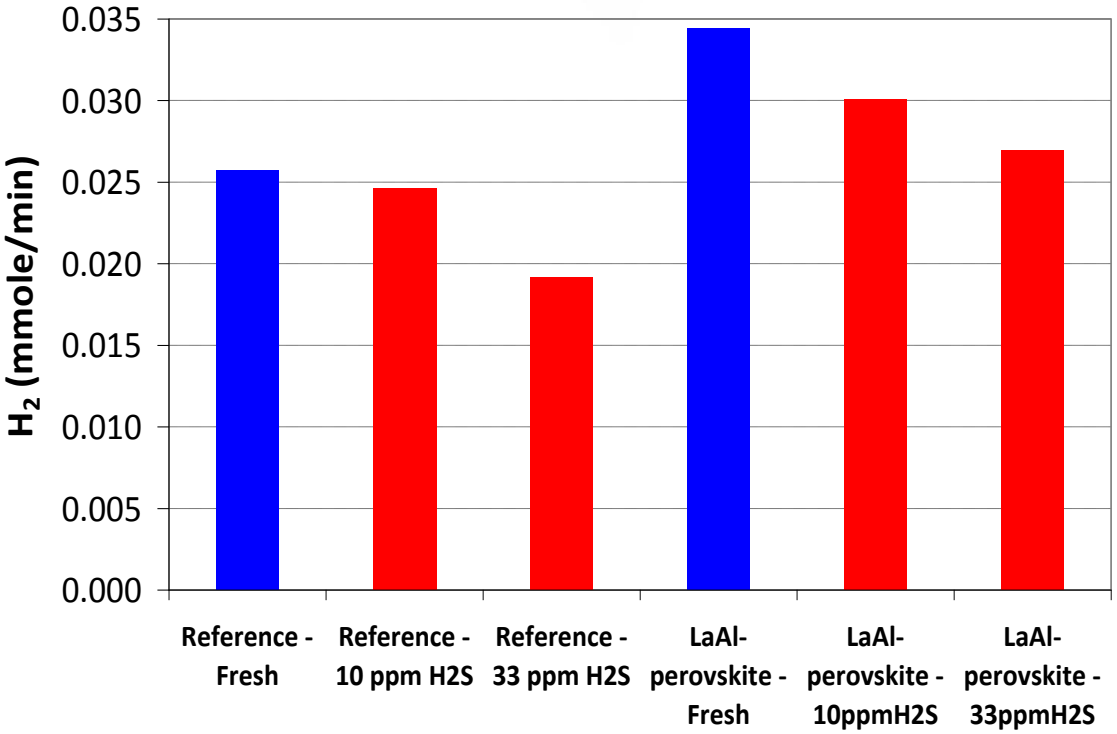
PROJECT TARGETS AND ACHIEVEMENTS

Status before project	AIP target	Project Target	Current status/achievements	Expected final achievement
160 kg/kW 384 l/kW	Development of miniaturized BoP for specific devices	35 kg/kW 50 l/kW	52 kg/kW 80 l/kW	52 kg/kW* 80 l/kW*
No standards for maritime sector and fuel cells	Pre-normative research on safety, emissions etc.	Evaluation of PURE design by maritime certification agency	Design frozen	List of recommendations by agency

* Maybe improved depending on MEA development

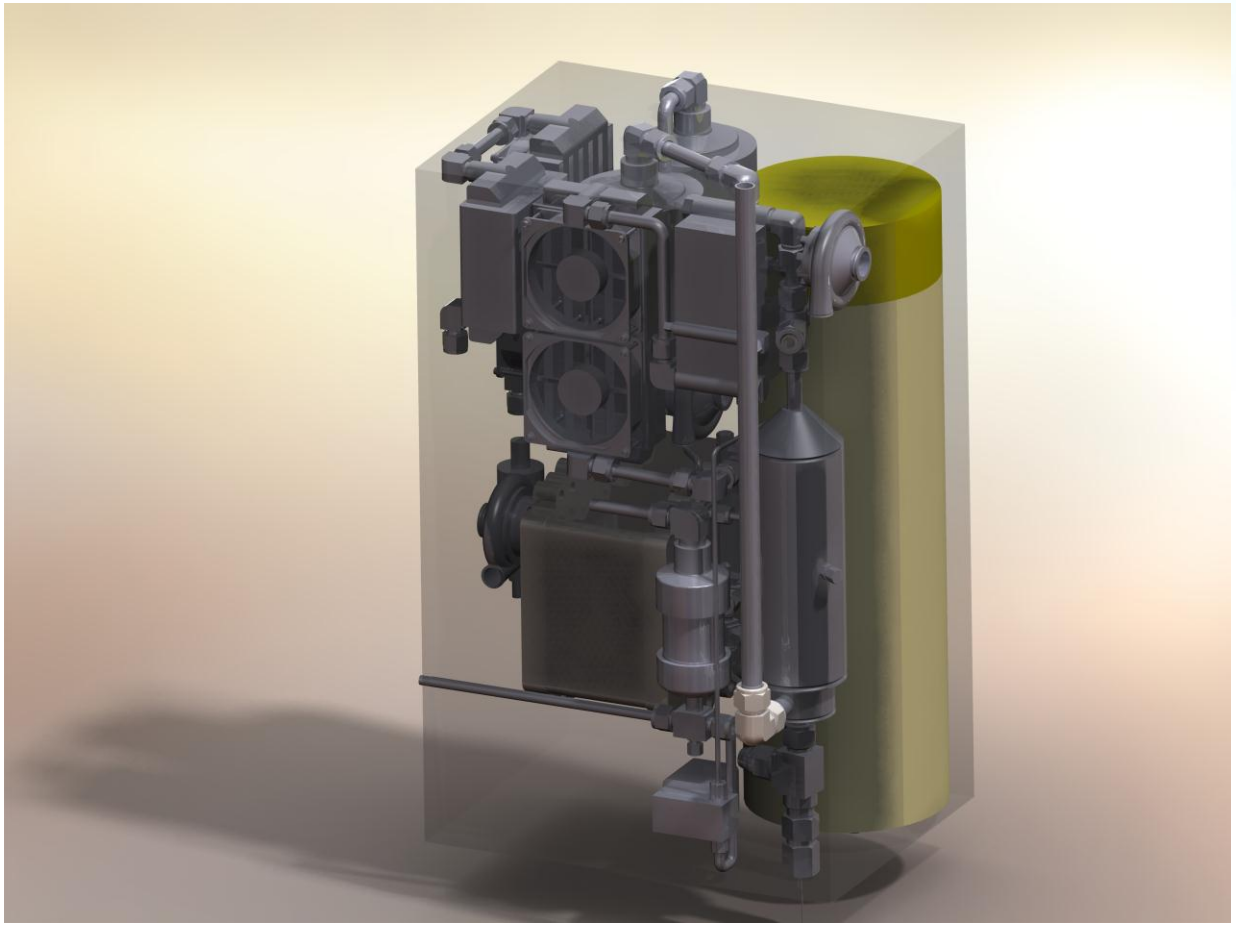
PROJECT TARGETS AND ACHIEVEMENTS

- DTU: Development of binderless membrane for MEA: improved production method
- APTL/ CERTH: improved ATR catalysts: active and Sulphur tolerant



PROJECT TARGETS AND ACHIEVEMENTS

- System volume is 40 liters with outlook to smaller when MEA become better.

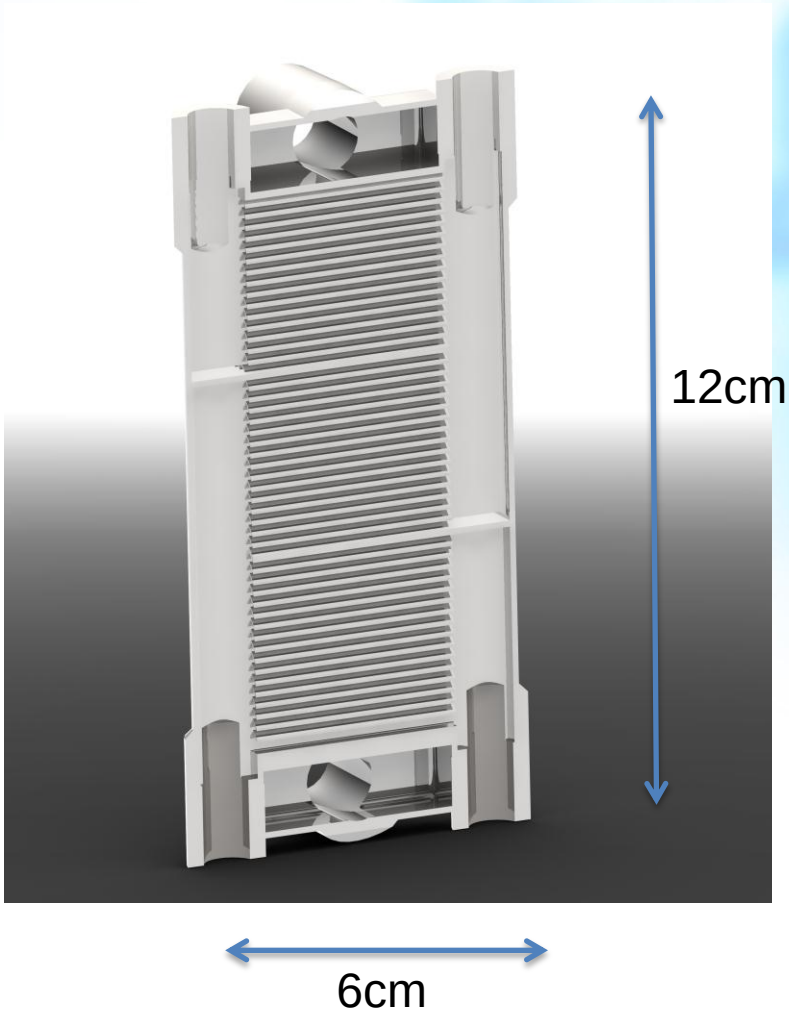


RISKS AND MITIGATION

- Risk: Size and weight requirements not met
  - MEA need high hydrogen concentration (>45%)
  - Implement reformate conditioning steps which add volume and weight
  - Develop next generation MEA's with increase performance
  - Balance MEAs cost with system size

RISKS AND MITIGATION

- Small system size requires compact heat exchangers: 3D printing
  - First time: properties of 3D printed metals are similar as conventional metal constructions



SYNERGIES WITH OTHER PROJECTS AND INITIATIVES

- PURE builds on previous FCH-JU projects: LOTUS (small μ-CHP), Furim (MEA development)
- PURE benefits from running FCH-JU projects SUAV (small system components) and Nemesis2+ (Catalyst development),
- PURE benefits from Non- FCH-JU projects: Joules (FP7) and HySeas (Dutch funding)

HORIZONTAL ACTIVITIES

- Harmonization of test procedures for HT PEM cells and stacks
- Regulations and certification of fuel cell systems in the maritime sector

DISSEMINATION ACTIVITIES

- Lieftink, D.J. (2013) PURE: APU for recreational yachts: Contribution to FCH-JU workshop Fuel Cells and Hydrogen for maritime and harbour applications: current status and future perspectives in the EU. Venice, Italy.

- Lieftink, D.J. and Huyskens, P. (2014) Hydrogen in shipping: an overview of research projects. Abstract submitted to the Electric & Hybrid Marine World Conference 2014. Amsterdam, The Netherlands

- S. Martin, Q. Li, T. Steenberg and J.O. Jensen. (2014) Binderless Electrodes for High-Temperature Polymer Electrolyte Membrane Fuel Cells. Accepted for publication in J. Power Sources

- J. O. Jensen, S. Martin and Q. Li. What is the ideal working temperature for proton conductors? Solid State Protonic Conductors (SSPC-17). Seoul, Korea, September 2014 (Invited talk)

EXPLOITATION PLAN/EXPECTED IMPACT

- The PURE project has attracted attention of the maritime industry for fuel cells, concerning technology, certification, codes and standards
- Demonstration projects:
  - Next steps are ECAT demonstration on board of a yacht.
- Cross-cutting:
  - Certification to maritime standards
  - Harmonization of HT PEM MEA's and stacks test protocols