

Wednesday, 22 November 2023

2nd Exploitation Workshop

EUROPEAN HYDROGEN WEEK

16:00 – 17:00



Co-funded by
the European Union

Outline

16.00 – 16.10: **Welcome and introduction to the StasHH project**

Federico Zenith, SINTEF, coordinator

16.10 – 16.25: **The StasHH standard explained**

Federico Zenith, SINTEF, coordinator

16.25 – 16.40: **Practical experience with implementing the StasHH standard**

Jan Bochinger, Proton Motor Fuel Cell GmbH, FC module supplier

16.40 – 16.50: **Exploitation and impact creation**

Michel Honselaar, WaterstofNet, Exploitation & dissemination

16.50 – 17.00: **Q&A**

All

16.00 – 16.25

**Welcome and introduction to the StasHH project
and the StasHH standard explained**

Federico Zenith

SINTEF

Coordinator



Co-funded by
the European Union

Motivation

Heavy vs. Light Duty Fuel Cells

Why we are so interested in heavy duty

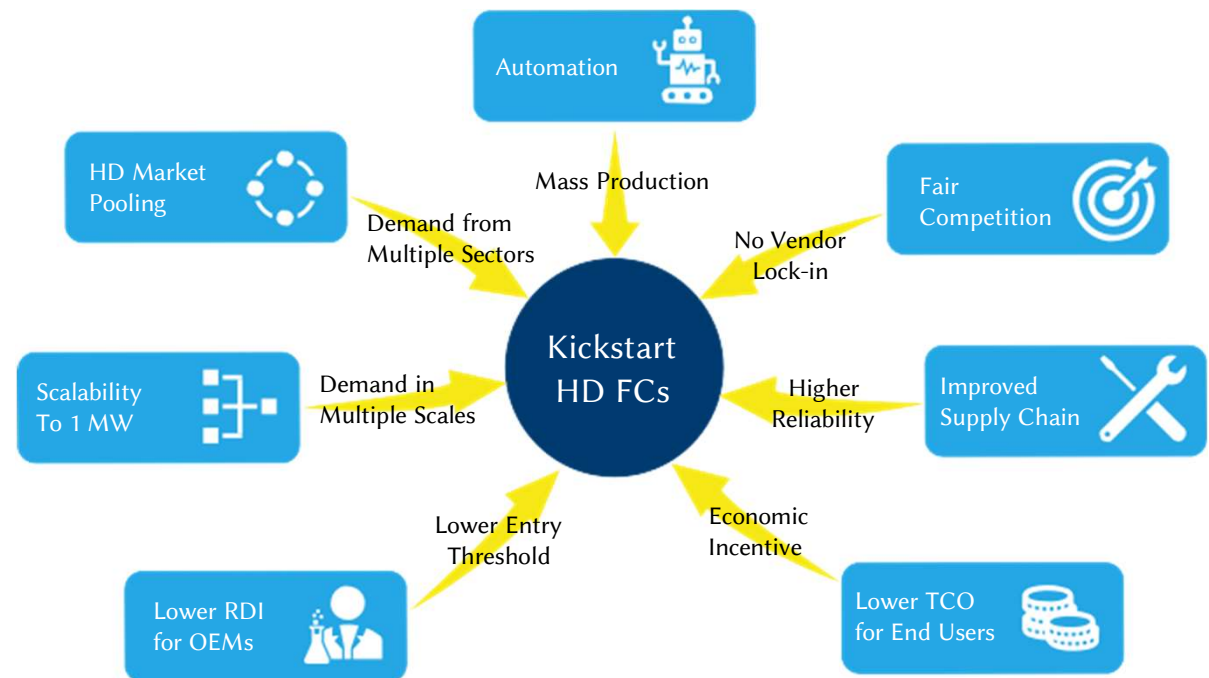
- Increasing interest in hydrogen for HD applications
- There are also batteries, what is the case for hydrogen?
- Batteries have established an advantage in the car sector
- Cars vs. heavy-duty vehicles:
 - 95 % parked vs. maximised operation time
 - Distributed vs. focused/dedicated infrastructure
 - Disposable income vs. cost minimisation
 - Free time vs. salaried time
- All these factors push towards hydrogen

What are the Barriers?

- Experience at VDL: 3 generations of fuel cells, 3 re-engineerings
 - ... (and that was with the same supplier!)
- Re-engineering is expensive and demotivating
- Unique design gives difficult support and maintenance
- Multiple, fragmented heavy-duty markets
- Each segment much smaller in numbers than car sector
- Different power requirements, from 100 kW to multi-MW
- OEM and FC supplier must agree to long-term relationship

How a Standard Helps

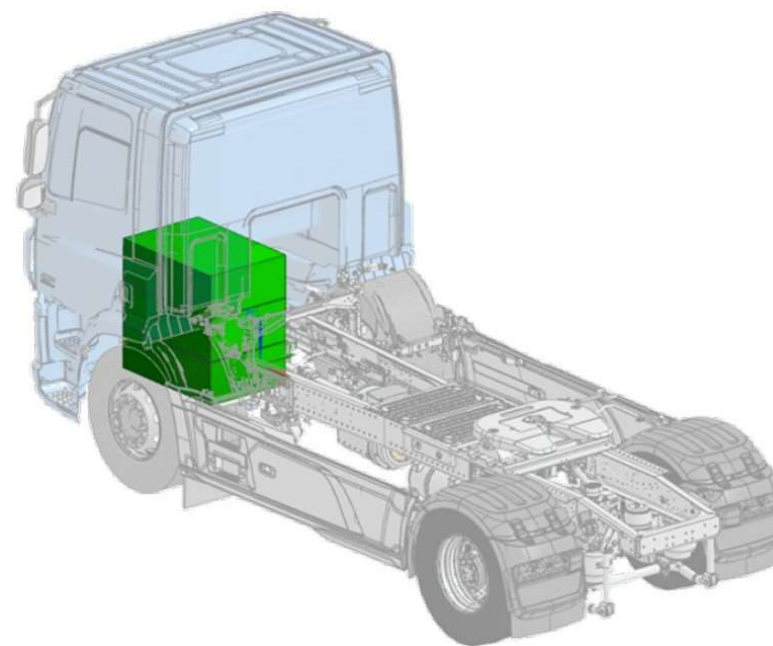
- Join multiple markets
- Increase production volumes
- Enable automation
- OEMs can change FC vendor
- Composable modules
- Easier (re)placement



StasHH project

StasHH' Core Concept

- Standards for size, interface and communications
- Construction of prototypes from multiple suppliers
- Rigorous module testing, respecting IP
- Field demonstration
- Regulations, codes, standards and safety
- Dissemination and standard adoption by industry



StasHH Partners

More than 25 involved companies and 14 million € in budget

Coordinator	SINTEF
FCM Suppliers	Ballard, Plastic Omnium, FCP†, Freudenberg, Hydrogenics†, Hyundai†, Intelligent Energy, Nedstack†, Nuvera, Proton Motor, Symbio†, Toyota.
OEMs	Alstom (trains), AVL (powertrains), CETENA (ships), Damen (ships), Future Proof Shipping (inland ships), Solaris (buses), VDL ETS (trucks, buses etc.), VDL Energy Systems (generators), Volvo (construction equipment).
Institutes	CEA, FEV, TNO, WaterstofNet.

Additional entities:

- Advisory Board
- Exploitation Group



StasHH' Timeline

2021 Development of the StasHH standard

- Detailed RCS overview
- Update at project end
- Submission to standard bodies
- OEM “Best Practices” manual (2023)

2022–23 Construction of prototypes and test rigs

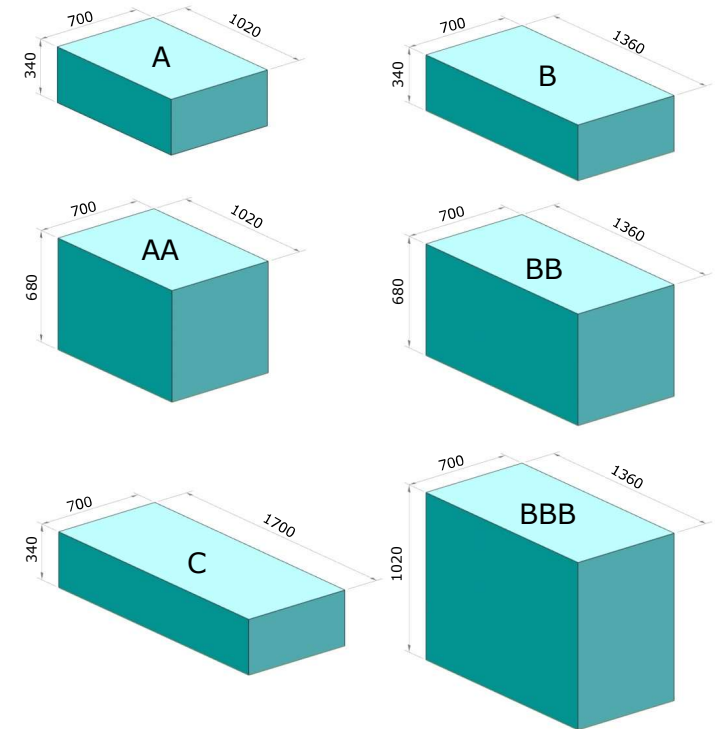
2023–24 Testing and analysis

- Recommendations for assessment
- Demonstration with multipurpose generator

The StasHH standard

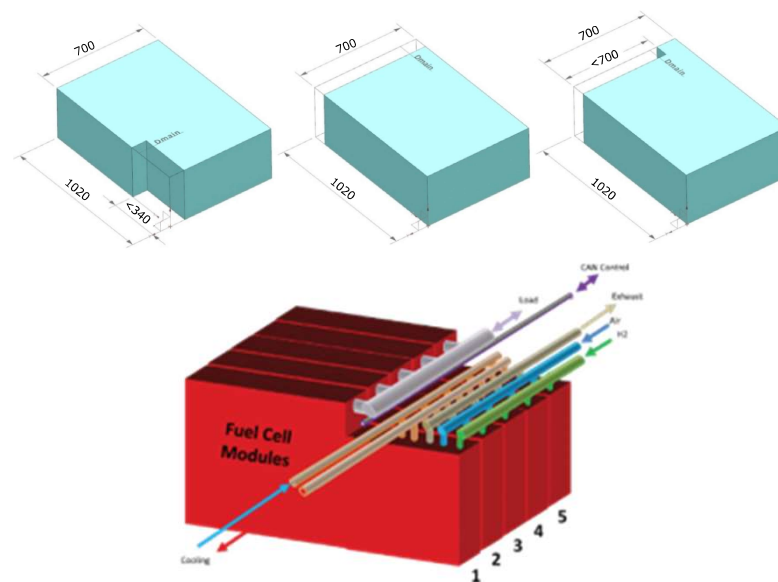
Standard Size Formats

- Three base sizes based on unit length of 340 mm:
 - 1 Height
 - 2+ Width
 - 3,4,5 Lengths A, B and C
- Numbers most influenced by measures of EU trucks
- Stackable formats by doubling the letters. Most popular:
 - AA, BB for truck side tanks
 - BBB for truck engine bays
- By default lying, but can be provided standing on side



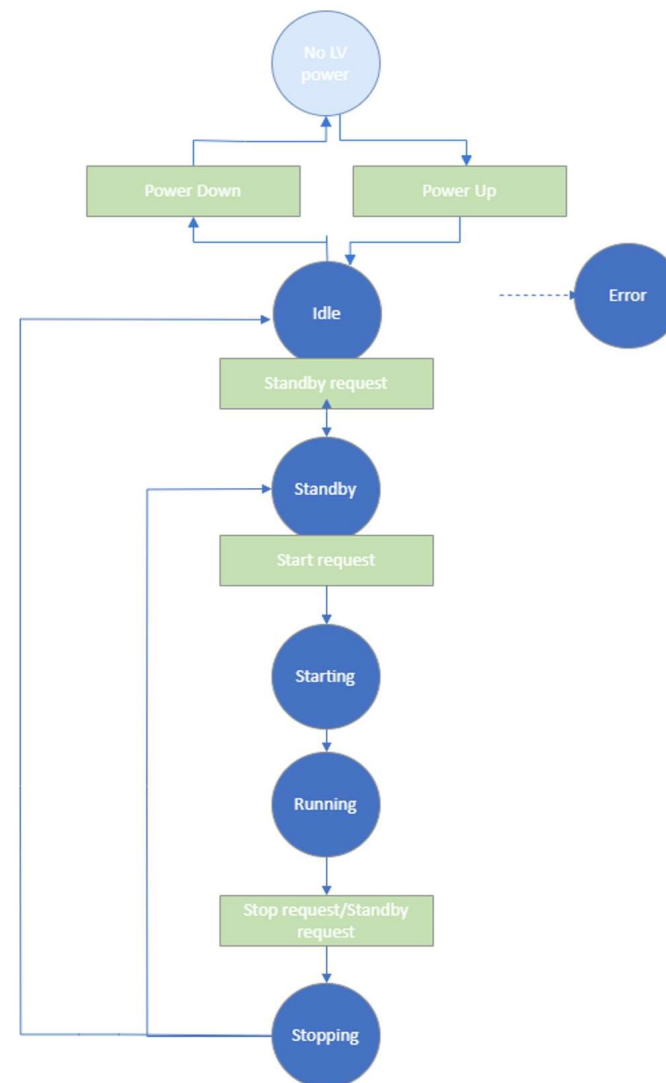
Standard Flow Interfaces

- Connections located on either or both sides of box
- If both, some connections must be redundant
- Connections must not interfere with straight manifolds
- Size of fittings/nozzles depends on power rating
 - Metric interval (includes common US sizes)
- Exceptions: drain, HV and LV power



Standard Digital Interface

- Defined on top of CAN bus
 - Ethernet implementation possible (ships)
- Signals defined according to SAE J1939
- FCM State machine
- Multiple FCMs: possibility of FCM hierarchy
- No specific connector, but 18 pins required



Prototypes

- Early deployments at VDL with Plastic Omnium units
 - A-size in truck
 - Vertical A-size in genset racks
- Test campaigns started at TNO and FEV



Conclusions

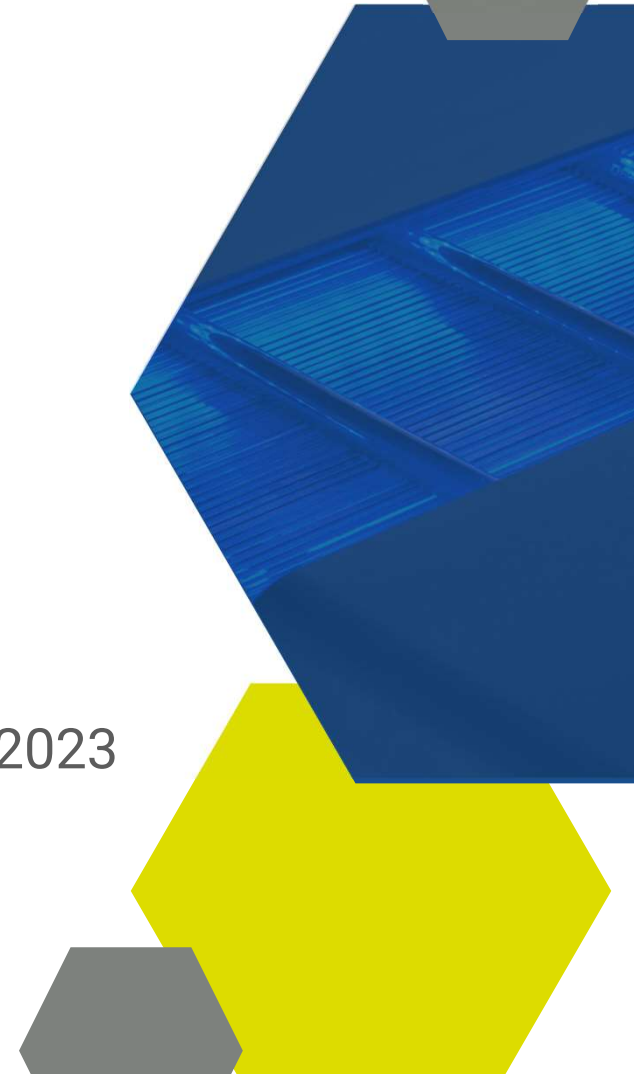
- Standard for fuel-cell modules prepared with inputs from FCM suppliers and OEMs
- Strong interest from the industry
- Future work for 2024:
 - Delivery of final FCMs
 - Complete testing and data analysis
 - Update and dissemination of the standard
- If interested, join the exploitation group!

Thank you for your attention!

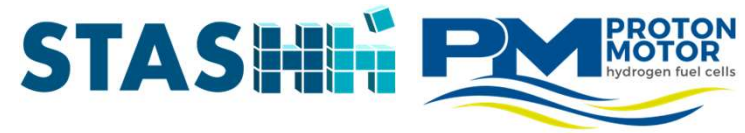


Practical experience with implementing the StasHH standard

StasHH Exploitation Workshop | European Hydrogen Week 2023
– Jan Bochinger | Proton Motor Fuel Cell GmbH –



Company Background



Focus on **Proton Exchange Membrane (PEM)** fuel cell technology

with over **25 years** experience in different market segments

Currently based near Munich

Listed on the AIM Stock market since **2006**

Two core fuel cell stack types: **HyStack® 200** and **HyStack® 400** capable of delivering 4 to 50 kW electrical power

CEO and Investor **Dr. Faiz Nahab** with his family

Approx. **120** employees

New facility plant **13.500 m²** space for production, testing, development and offices



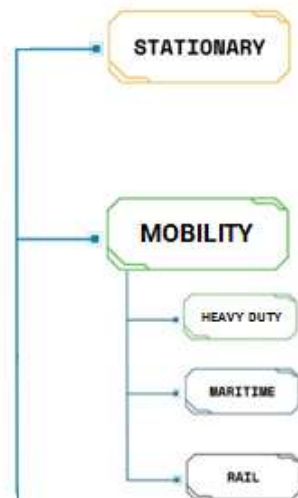
Modular FC Solutions



Fuel Cell Stack & Module
Standard Kit
Sold only in the system



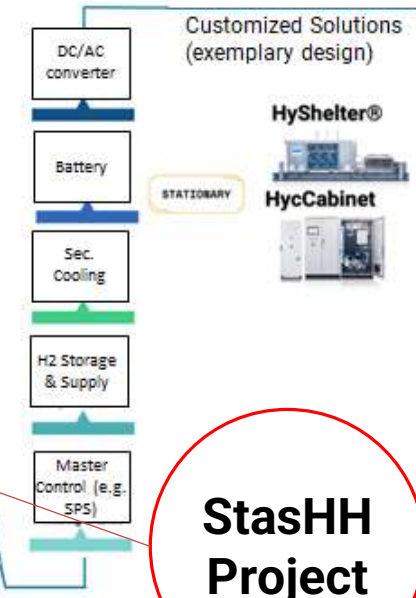
Definition of target
market & field of
application



Fuel Cell System
Standards & Solutions



Fuel Cell Plant
Turn Key Solutions



Competences along the entire Fuel Cell Value Chain

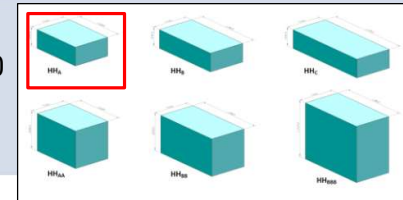


StasHH Requirements



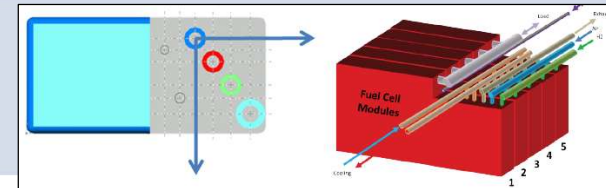
1. Size definition

- Target Application: Range Extender for Heavy Duty Application
- Target Size HH_A (~50 kW): using Proton Motor Standard Stackmodul HyStack®400
- Development of system concept & choice of suitable BOP
- Packaging study to evaluate feasibility



2. Interface Definition

- Packaging/Design to enable an interface plate at only one side of the module
- Usage of defined interface dimensions & specified connectors



3. API Definition

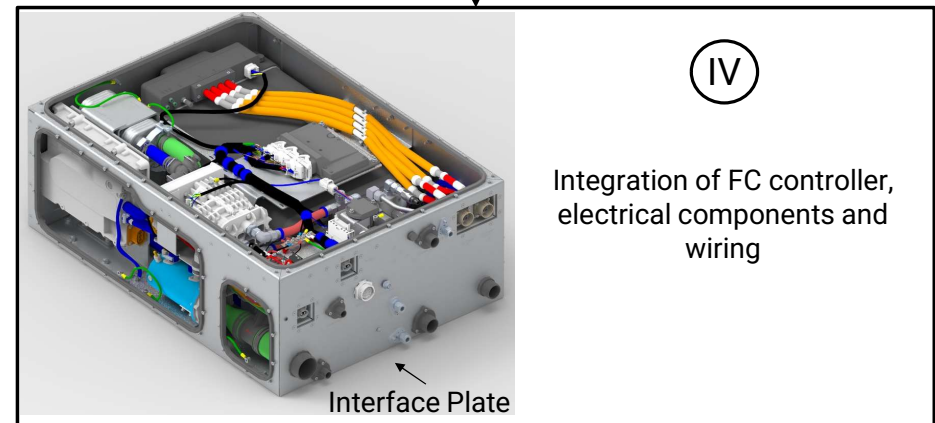
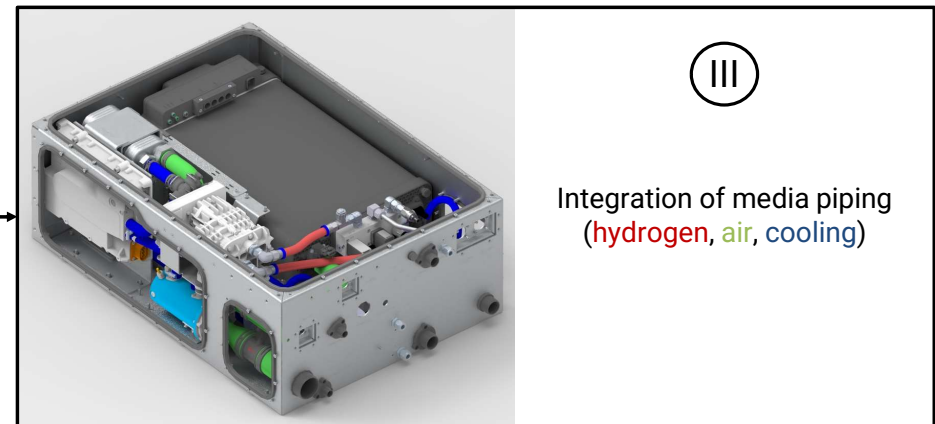
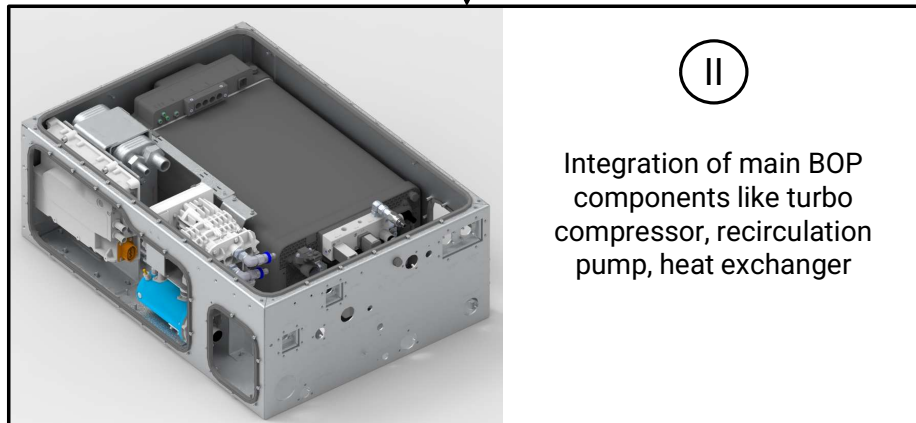
- Development of new Customer Communication Interface J1939

4. Key Performance Indicators

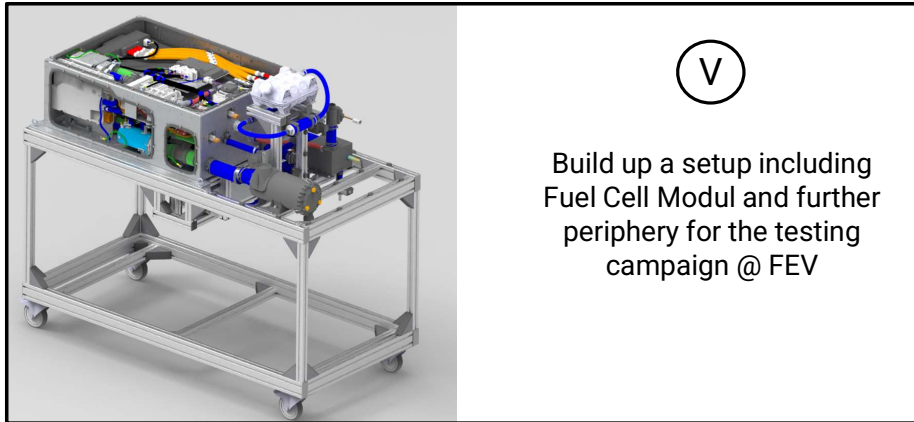
- BOL / EOL Targets
- Electrical & Media Interface Parameter
- Environmental Conditions

To be evaluated during the project test campaign

Fuel Cell Module Design



Testing Campaign Setup



- 1. Size Definition**
 - Target Application: Range Extender for Heavy Duty Application
 - Size HH₂ ~ 50 kW to use Proton Motor Standard Stackmodul HyStack®400
 - Development of system concept & choice of suitable BOP
 - Packaging study to evaluate feasibility
- 2. Interface Definition**
 - Packaging/Design to enable an interface plate at only one side of the module
 - Usage of defined interface dimensions & specified connectors
- 3. API Definition**
 - Development of new Customer Communication Interface J1939
- 4. Key Performance Indicators**
 - BOL / EOL Targets
 - Electrical & Media Interface Parameter
 - Environmental Conditions

To be evaluated during the project test campaign

Proton Motor **successfully developed** a fuel cell system which meets the requirements of the **StasHH standard**

Next steps

- Revision of communication interface according to learnings during first test campaign
- Second test campaign planned for Q1 2024
- Evaluation of market potential for this system design (potential product development)

Acknowledgements



Towards a standardised fuel cell module

<https://stashh.eu/>



The **StasHH project** has received funding from the **Fuel Cells and Hydrogen 2 Joint Undertaking** (now **Clean Hydrogen Partnership**) und Grant Agreement No. 101005934.

This Joint Undertaking receives support from the **European Union's Horizon 2020** Research and Innovation Program, **Hydrogen Europe** and Hydrogen Europe Research.

Synergies and cross-linkage with following EU funded projects:



Project Partners

Fuel cell module suppliers



Research, test, engineering and/or knowledge institutes



Original Equipment Manufacturers

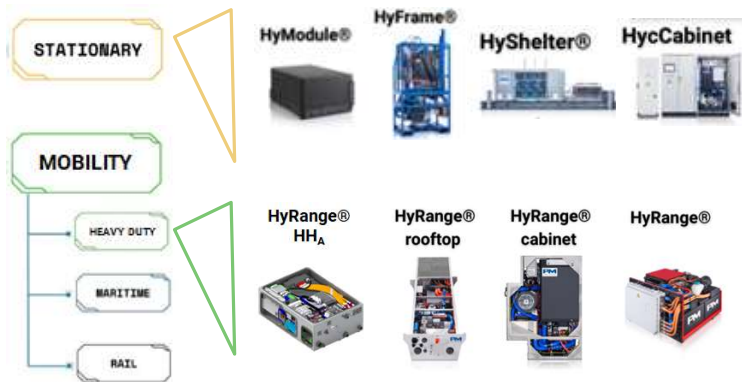
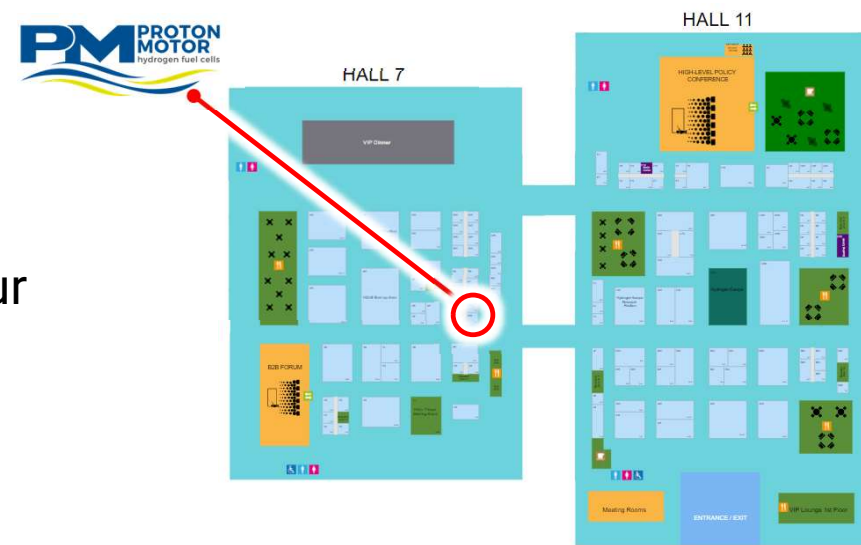


Get in contact with us



Meet us at booth **K10** in **hall 7** to discuss about your **Fuel Cell Project**

- **Standardized** fuel cell system & turn key solutions for the **stationary market**
- **Customized** fuel cell system solutions for your **specific target application** (e.g. heavy duty)



Contact our Sales Team for more information

Proton Motor Fuel Cell GmbH
Info@proton-motor.de
+49 89 127 62 65 - 0

Contact Proton Motor for your Fuel Cell Solution

16.25 – 16.40

**Practical experience with
implementing the StasHH standard**

Jan Bochinger

Proton Motor Fuel Cell GmbH

Fuel cell module supplier



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16.40 – 16.50

Exploitation and impact creation

Michel Honselaar

WaterstofNet

Exploitation & dissemination

Exploitation

Exploitation Plan targets several target groups, these include:

- Industrial stakeholders, including: fuel cell components developers/manufacturers, fuel cell stack developers/manufacturers, fuel cell module developers/manufacturers, fuel cell system developers/manufactures, fuel cell system integrators, original equipment manufacturers, end users of fuel cell applications
- Standardisation bodies
- Regulatory bodies
- Certification bodies
- Testing bodies
- Research organisations
- Policy makers
- General public

Exploitation Group

StasHH **Post-Project Exploitation Group**:

- Now open to any interested party
- Regular StasHH exploitation group meetings (online or in-person) to receive the latest insights into the project developments, discuss your perception and questions regarding the StasHH standard and discuss opportunities for exploitation
- Do you want to become a member, it is as easy as writing an email to michel.honselaar@waterstofnet.eu

Exploitation Trajectories

- We got awarded the Horizon Results Booster: a service provided by the European Commission to help projects tailor their exploitation needs, a first in-situ workshop is planned in December 2023
- Initiate the uptake of the StasHH standard in the official international or European standardisation domain in order to obtain a global standard status
- A common declaration signed by all StasHH partners (mandatory basis) and members of the Exploitation Group (voluntary basis) on the further use and uptake of the StasHH standard

STASHH

Towards a standardised fuel cell module

Standard-Sized Heavy-duty Hydrogen

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STAS

Towards a standardised fuel cell module

Partners

Original equipment manufacturers



VDL Energy Systems

Fuel cell module suppliers



Research, test, engineering and/or knowledge institutes



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16.50 – 17.00

Q&A

All

Questions

CONTACT DETAILS

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A big thanks to everyone for participating!