3rd Webcon | 01 DECEMBER 2020

PRHYDE-Protocol for heavy-duty hydrogen refuelling

Call Identifier FCH-04-2-2019:
Refuelling Protocols for Medium and Heavy-Duty Vehicles

Horizon 2020
European Union Funding
for Research & Innovation

FCH
FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

AGENDA, 3rd Webinar

PRHYDE
Protocol for heavy-duty Hydrogen refuelling

Time (UTC)	Subject
13:45	*Join webinar*
14:00 (15:00 CET)	Introduction • Format of webinar • Subsequent workshops • State of the Art (WP2) public deliverables available to date: see https://prhyde.eu/progress/
14:15	Goal with PRHYDE (State of the Art -> WP3 Effort)
14:30	Considerations and decisions to be made
14:50	Two viable paths • Performance-based Approach • Formula-based Approach
15:50	Closing remarks
16:00	*End*

Introduction

- *PRHYDE-Protocol for heavy-duty hydrogen refuelling*
  Refuelling Protocols for Medium and Heavy-Duty Vehicles
- 01 JAN 2020 - 31 DEC 2021
- The PRHYDE project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking under grant agreement No 874997.
  This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation programme.

PRHYDE project partners

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No.	Participant organisation name	Short name	Country
1	Ludwig-Bölkow-Systemtechnik GmbH (Coordinator)	LBST	DE
2	Zentrum für BrennstoffzellenTechnik GmbH	ZBT	DE
3	Air Liquide SA	AL	FR
4	Engie Lab CRIGEN	ENGIE	FR
5	Toyota Motor Europe NV	TME	BE
6	ITM Power (Trading) Limited	ITM	UK
7	NEL Hydrogen AS	NEL	DK
8	Shell Deutschland Oil GmbH	SHELL	DE
9	Commissariat à l'énergie atomique et aux énergies alternatives	CEA	FR
10	Nikola Motor Company	Nikola	USA

Third linked partners: MAN and Toyota North America

Work plan

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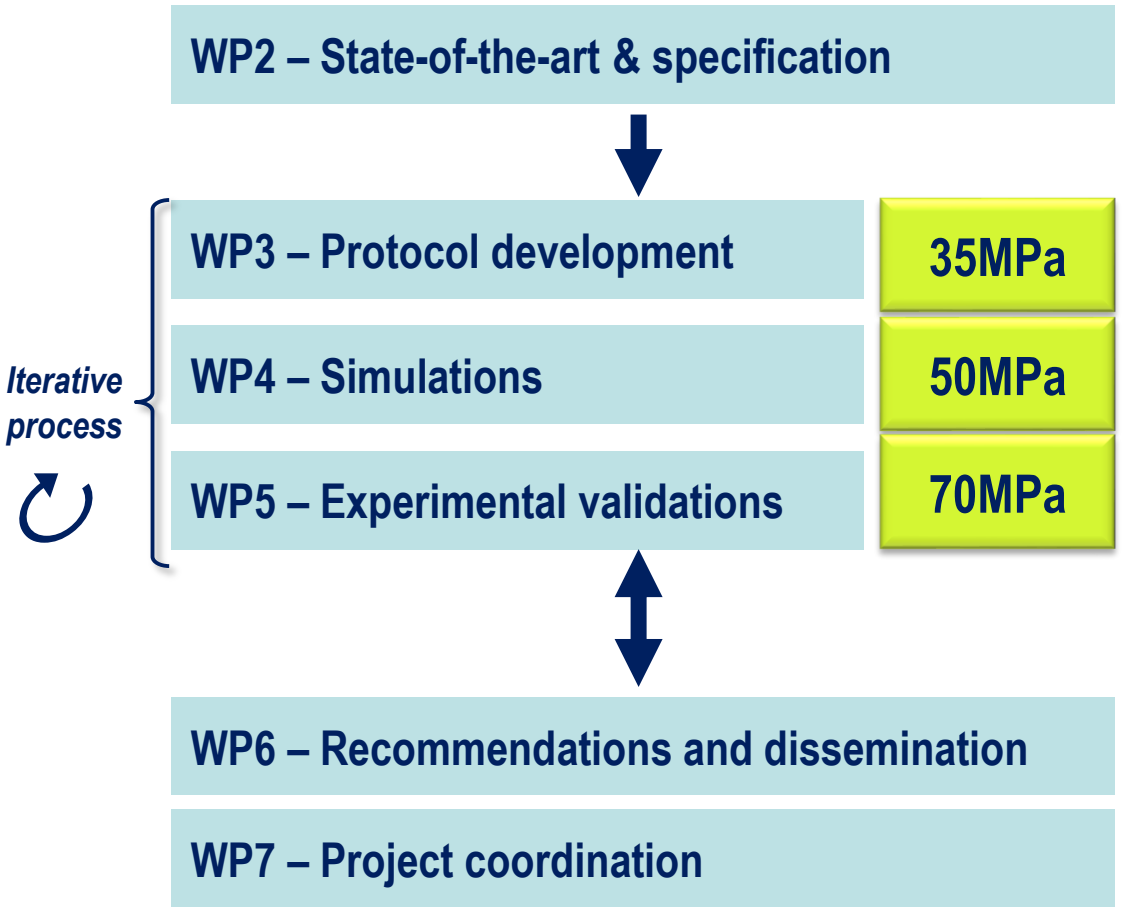

WP2: Defining state-of-the-art on protocols, vehicles and component capabilities, gap analysis of current protocols, Specifying (new) tank categories, boundary conditions (flow temperature, connections etc.) target fueling times and quantities for the three pressure levels

Outcome: A detailed specification guiding the following protocol development and test efforts

WP3: Develop protocol approaches for the three pressure levels

Outcome: Protocol approaches for simulations (WP3) and test (WP4)

WP4: Modeling and Simulations of tank systems/categories to determine flow/temperature/pressure aspects

Outcome: Simulation results in order to assess impact of different protocol approaches

WP5: Experimental validation of protocol approaches at HRS(s)

Outcome: Validation of technical feasibility of protocol approaches

WP6: Formulate recommendations for standardization forums and dissemination

Outcome: Specific recommendations that can help create international standards on HDV hydrogen fueling

Introduction: Format of webinar

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- Intended to disseminate the work in the PRHYDE project carried out to date on the developments towards a fueling protocol approach for heavy duty vehicles
- Presentations given, with a series of questions where the PRHYDE consortium would value the opinion of stakeholders from outside of the consortium
- Additional questions that you may have: please email them to info@PRHYDE.eu and/or put them in the “chat” box
- Link to questions from PRHYDE *(to be added to “chat” box as a link)*:

  https://bit.ly/3mpjL39

- **Important note:** Webinar being recorded for internal purposes (from now)

Introduction: Webinar and subsequent workshops

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- Originally (pre-Covid) planned full day sessions – however now not possible
- Instead holding a series of 2 hour meetings over the 3 days Tues-Thurs
- Webinar, on the 1st Dec, and 2 workshops (restricted numbers) on the 2nd and 3rd December:
  - Webinar: to disseminate work in the project in addition to publishing deliverables on website (allows wider reach)

    Note: welcome comment on all public deliverables – feedback to help shape final input for standards development
  - Workshop 1: to act as Q & A session following the webinar
  - Workshop 2: on non-road applications, and non-gaseous applications, supporting further deliverables
- Public deliverables to cover questions (as for previous workshops, see D6.3 & D6.4)

Introduction: State of the Art (WP2)

- State of the Art (WP2) public deliverables available to date: see https://prhyde.eu/progress/

DELIVERABLES

Document Number	Deliverable Title	Web Link
D2.1	Performance metrics for refuelling protocols for heavy duty hydrogen vehicles	Download
D2.2	Requirements for safe heavy duty gaseous hydrogen vehicle refuelling	To be added when available
D2.3	Gap analysis of existing heavy duty gaseous hydrogen vehicle refuelling protocols	Download
D2.4	Gap analysis of existing hardware used for heavy duty gaseous hydrogen vehicle refuelling	Download
D2.5	Analysis of existing non-gaseous hydrogen refuelling protocols or applications	To be added when available
D3.1	Report on the characteristics of the cases to be studied in the preliminary simulations	Download
D4.1	Report on preliminary simulations (revised)	Download
D6.3	Report on the external stakeholder engagements conducted at the start of the PRHYDE project – Surveys and Workshop 1	Download
D6.4	Report on the external stakeholder engagements conducted at the start of the PRHYDE project –Workshop 2	Download
D7.1	Kick-off-Meeting	Download
D7.2	2nd Project meeting and Status Report	Download

WP2 progress

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- Covers “State of the Art” and benchmarks in hydrogen refuelling

- Used to:
  - set metrics to evaluate outcome of project
  - Give key inputs to the development of the protocol

- 5 public deliverables
- 3 published, remaining 2 being finalized (published before year end)

D2.1 – published

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- Performance metrics for refuelling protocols for heavy duty hydrogen vehicles

- Setting benchmarks in comparing conventional refuelling to hydrogen
  - Cost, Range, Time to refuel, SoC
- Used to evaluate targets for and performance of protocol
- HD trucking applications, but also trains, transport systems, inland barges, etc. covered, various vehicle classes looked at

D2.2 – not yet published

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- Requirements for safe heavy duty gaseous hydrogen vehicle refueling

- A summary of “state of the art” risk assessments, covering
  - the refuelling process
  - Requirements around minimum technical standard of vehicle and station

- Input from audience? Please email in

D2.3 – published

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- Gap analysis of existing heavy duty gaseous hydrogen vehicle refuelling protocols

- What functionality is missing? Flow rates, CHSS size ranges, …
- What are the issues with current refuelling protocols?

- Input from previous workshops captured
- challenges and issues with current protocols – narrow control margins, stacking of tolerances, …

D2.4 – published

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- Gap analysis of existing hardware used for heavy duty gaseous hydrogen vehicle refueling

- Analysis of market situation – gap analysis to cover HD refuelling
  - Tanks, components, specifications; technical and thermodynamic properties
- What will need to be achievable to meet benchmarks?
- Outlook of anticipated development to be taken into account

D2.5 – not yet published

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- Analysis of existing non-gaseous hydrogen refuelling protocols or applications

- Alternatives to gaseous refueling – to understand competitive landscape
- LH2, CcH2, LOHC, Hydrides, Ammonia, bundle swap, on board generation, …

- Additional input will be gathered through expert workshop (3rd December)

WP3 – Protocol development

Goal with PRHYDE (State of the Art -> WP3 Effort)

Presenter: Claus Sinding

Slides: See separate slide pack

WP3 – Protocol development

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Considerations and decisions to be made

Presenter: Spencer Quong

Slides: See separate slide pack

WP3 – Protocol development

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Two viable paths:

- **Performance-based Approach**
- **Formula-based Approach**

Presenters: Spencer Quong, Steve Mathison

Slides: See separate slide pack

Next steps

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- Further feedback and inputs requested from stakeholders:
  - E-mail list for PRHYDE stakeholders
    (→ please send e-mail to info@prhyde.eu if you want to receive or not to receive info / news)
  - PRHYDE deliverables & presentation will be made available for comments / feedback
    (→ to be downloaded from the PRHYDE website)
- Further webinars / workshops towards end of 2021

→ Please provide your comments / inputs any time to info@prhyde.eu

THANK YOU!

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