



Deliverable D7.4

3rd Project Meeting and Status Report

Report Status: FINAL

Report Date: 05 March 2021

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Confidentiality Level: PU – Public

Acknowledgement

This 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, Hydrogen Europe and Hydrogen Europe Research.



R E P O R T

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Note: The 3rd Project Meeting had to be held as a web conference due to the Covid-19 pandemic. It took place on 17 December 2020.

Enclosed is an overview in the form of presentation slides of the meeting, the list of participants and excerpts of the Minutes of Meeting (MoM), adapted for publication.



PRHYDE consortium, Kick-off meeting, 5 December 2020, Paris

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ACRONYMS AND ABBREVIATIONS

CFD	Computational Fluid Dynamics
HD	Heavy-Duty (vehicle)
WP	Work Package

1 3RD PROJECT MEETING

Project PRHYDE – Protocol for heavy duty hydrogen refuelling
Subject 3rd General Assembly, 17 December 2020 3-6 pm CET
/Place Web Conference
Date: 17 December 2021

1.1 List of Participants

Participants (PRHYDE consortium):

Martin Zerta / LBST, Christopher Kutz / LBST (Project Coordinator)

Alexander Kvasnicka / ZBT, Fouad Ammouri / Air Liquide; Elena Vyazmina / Air Liquide, Quentin Nouvelot / ENGIE, Vincent Mattelaer / Toyota, Spencer Quong / Toyota, Nick Hart / ITM, Claus Due Sinding / Nel, Paul Karzel / Shell, Morgane Fouque / CEA, Antonio Ruiz / Nikola

Participants (others):

Pietro Caloprisco / FCHJU (Project Officer) → participation not possible

1.2 Agenda

Time	Topic	Responsible person
15:00 – 15:10	Welcome of the coordinator Approval of agenda, meeting goals, brief summary of project activities	LBST (Martin Zerta)
15:10 – 15:30	Mid-term review by coordinator Milestones, Timeline, status of work	LBST (Martin Zerta)
15:30 – 15:50	Status report: WP2 – State-of-the-art & specifications Deliverables, Current activities; upcoming workplan, Q&A / discussion	Shell (Paul Karzel)
15:50 – 16:10	Status report: WP3 – Protocol development Deliverables, Current activities (e.g. 3 rd Workshop) upcoming workplan, Q&A / discussion	Nel (Claus due Sinding)
16:10 – 16:30	Status report: WP4 – Simulations Deliverables, Current activities; upcoming workplan and timeline for experiments, Q&A / discussion	Air Liquide (Fouad Ammouri)
Break	10 Minutes	

Time	Topic	Responsible person
16:40 – 17:00	Status report: WP5 – Experimental validation Current activities; upcoming workplan and timeline for experiments, Q&A / discussion	Nikola (Antonio Ruiz)
17:00 – 17:20	Status report: WP6 – Recommendation and dissemination 3 rd workshop; Q&A / discussion	ITM (Nick Hart)
17:20 – 17:30	Status report: WP7 – Project management, coordination and administration organizational (contract amendments); timeline	LBST (Martin Zerta)
17:30 – 18:00	Other topics Info patent issues; planning of regular WP webcons '21, external experts, other topics? Next / To Do's	All

1.3 Meeting goals

Meeting goals (3rd GA)

- Mid-term review of project's progress (after 12 of 24 months)
- Review of PRHYDE activities
(completed / implemented / delayed / postponed / adjusted...)
- Identification of (potential) bottlenecks and discuss solutions internally
- Outlook for the next 12 months

2 PROJECT OVERVIEW

The PRHYDE (Protocol for Heavy Duty Hydrogen Refuelling) project (<https://prhyde.eu/>) has started in January 2020 with an overall project lifetime of two years.

With funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (FCH 2 JU), the project is aiming to develop recommendations for a non-proprietary heavy-duty refuelling protocol used for future standardization activities for trucks and other heavy-duty transport systems applying hydrogen technologies.

To do so, the PRHYDE partners will investigate refuelling protocol requirements, and provide data for compressed (gaseous) hydrogen refuelling protocols developed for the 35, 50 and 70 MPa nominal working pressures. A broad industry perspective shall be taken into account via appropriate external stakeholder participation throughout the project.

The work will enable the widespread deployment of hydrogen for heavy-duty applications in road, train, and maritime transport. The results will be valuable guidance for station design but also the prerequisite for the deployment of a standardized, cost effective hydrogen infrastructure.

The project is carried out by 10 project partners from 6 countries and two linked third-parties, as listed in Figure 1. Figure 2 shows the seven work packages and the contribution of the different partners.



Figure 1: Overview of the project partners.

Introduction – Works packages and directly involved project partners

WP No.	WP Title	Leader	Participants
WP1	Ethics requirements	LBST	
WP2	State-of-the-art & specification	SHELL	AL, ENGIE, TOYOTA*, ITM, NEL, NIKOLA, MAN**
WP3	Protocol development	NEL	AL, ENGIE, TOYOTA*, ITM, SHELL, NIKOLA, MAN**
WP4	Simulations	AL	ENGIE, TOYOTA*, ITM, NEL, SHELL, NIKOLA, MAN**
WP5	Experimental validations	NIKOLA	ZBT, AL, ENGIE, TOYOTA*, ITM, NEL, CEA
WP6	Recommendations and dissemination	ITM	ZBT, AL, ENGIE, TOYOTA*, NEL, SHELL, CEA, NIKOLA, MAN**
WP7	Project coordination	LBST	

* Toyota = TME + TMNA (linked third party)
** MAN (third party linked to SHELL)

25/1/2020 June 2020 – 2nd project meeting

Confidential

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Figure 2: Responsibilities and participation in the work packages.

A brief overview of the different work packages, a brief description as well as their interdependencies can be found in Figure 3. Accordingly, work package (WP) 1 and WP 7 exclusively cover organizational aspect of the PRHYDE project. Details on the current progress in the different work packages can be found in Chapter 3.

Introduction – Work plan

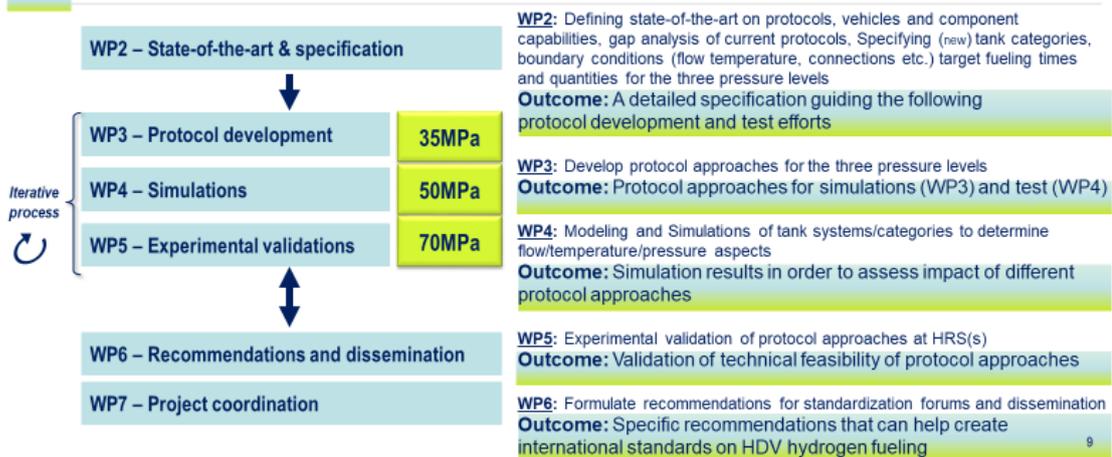


Figure 3: Work Plan of the PRHYDE project.

During the whole project lifetime, interaction with key stakeholders is an important aspect of WP 6 – Recommendation and dissemination. Originally, five stakeholder workshops were planned to integrate the perspective from outside the consortium and disseminate results from the different WPs. Although the workshops were meant to cover two different objectives of the project, namely the refuelling protocol and a feasibility study for future protocols, the whole stakeholder process had to be adapted to the Covid-19 situation and the following travel restrictions. Details can be found in Chapter 3.5.

Introduction – Work plan – workshops

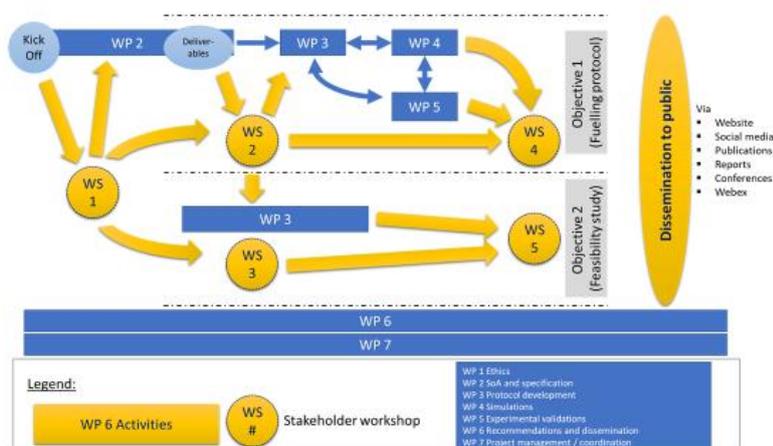


Figure 4: Work plan of PRHYDE workshops.

3 STATUS REPORT

Status: 17 December 2020

At month twelve of the PRHYDE project, all work packages are in a progressing state. In 2020, 14 Deliverables have been submitted to the FCHJU.

In work package (WP) 2 (State-of-the-art) three Deliverables have been outstanding at the date of the 3rd Project meeting. The main reason for the delay was limited discussion with and delayed feedback from stakeholders due to the COVID-19 conditions as no face-to-face workshops were possible in the first 12 months. Stakeholders' input from the first three webinar / web conferences¹ (with the last one taking place between 1st and 3rd of December 2020) and from e-mails & surveys have been relevant for the different deliverables of WP2 and also for the other WPs.

The WP2 analyses also served as an important basis for the further development of a HD refuelling protocol in WP 3-5. Therefore, a regular exchange between the work packages has been maintained to provide necessary knowledge, insights and information to each WP task at an early stage to ensure the continuous project progress.

Regular webcons have been organized by each WP on a weekly / bi-weekly basis and for all consortium partners on a monthly interval. Additional steering group calls with the WP leaders have been organized on demand.

In WP3, "Golden Rules" for the communication between vehicle and dispenser have been discussed and formulated. In WP4 additional simulations as requested by WP3 have been conducted. The Deliverable D4.7 has been postponed until having more progress on deliverable D5.1. In WP5, Deliverable D5.1, Report on test specification, has been delayed due to the ongoing need for discussions with the other WPs. The build-up of the test installations is expected to be delayed.

Work package 6 has successfully organized three online webinars and web conference (on 24th March 20, 23th April 20 and 1st/2nd/3rd December 20). On the webpage (see <https://prhyde.eu/progress/>) public presentations and project Deliverables have been available for review and comments by stakeholders. For stakeholder information the project has initiated regular newsletters to stakeholders and social media campaigns.

The overall overview is shown in Figure 5.

¹ Due to COVID-19 all planned in-person workshops have to be conducted as webinars or web conferences in the first 12 months.

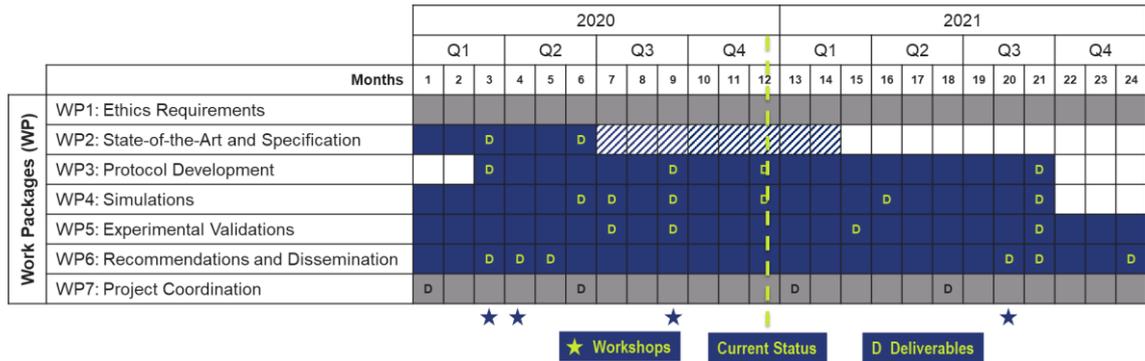


Figure 5: Timeline of the PRHYDE project (foreseen delay in WP2 is marked as hatched area).

In the following, a detailed overview of the progress in the different work packages is given.

3.1 Work Package 2: State-of-the-Art and Specifications

WP leader: Shell

WP2 has the aim to review the current State-of-the-Art in refuelling technology and existing technology and to set targets for the development of future refuelling protocols. In this WP, six public deliverables have to be created, covering the following different aspects:

- performance metrics for refuelling protocols for heavy duty hydrogen vehicles (D2.1);
- refuelling risk analysis (D2.2);
- gap analysis of existing gaseous refuelling protocols (D2.3);
- gap analysis of existing gaseous refuelling components (D2.4);
- analysis of non-gaseous onboard storage & filling (D2.5);
- target for new refuelling protocols (D2.6).

To the date of this report, three deliverables were published at the PRHYDE website, namely D2.1, D.2.3 and D2.4.

To cover the expertise of external project partners with regards to non-gaseous hydrogen refuelling as well as to include further stakeholders' input, a deviation from the original schedule is to be anticipated as indicated in Figure 5.

3.2 Work Package 3: Protocol development

WP leader: NEL

The tasks of WP3 are to develop concepts for future HD refuelling protocols, lay out specifications for the use in the simulation and experimental validation tests, to

perform a safety and risk assessment of the refuelling protocols and to further optimize the developed protocols based on the validation test results.

Within the first 12 months, WP3 members have set the specifications for preliminary simulations for the three different pressure levels 35, 50 and 70 MPa and both Type III and Type IV tanks.

The specification for preliminary simulations has been published as Deliverable D3.1 on the PRHYDE website². The formulation of the “Golden Rules” have been started addressing the relationship between vehicle and dispenser and to provide input for D3.2. Currently more feedback and inputs are needed and asked from partners and stakeholders, especially with regard to refuelling concepts to be discussed. Therefore, extended WP meetings will be initiated in January 2021. Deliverable D3.3 and Deliverable D3.4 efforts start in parallel after Deliverable D3.2 will be submitted and approved (expected for January 2021).

3.3 Work Package 4: Simulations

WP leader: Air Liquide

CFD simulations for different tanks to be used in the WP5 test campaign have been prepared. Data and information from the WP5 partners have been delivered but more detailed characteristics on tank walls to be defined and described. The objective of the simulation is to understand what is happening inside the tank.

In WP4 additional simulations requested by WP3 have been conducted. The new information will be integrated in upcoming deliverables.

The Deliverable D4.7 has been postponed until having more progress on deliverable D5.1.

For Jan. 2021 a meeting is scheduled with Wenger Engineering to discuss their remarks on WP4 preliminary calculations reported in D3.1.

3.4 Work Package 5: Experimental validation

WP leader: Nikola Corporation

Deliverable D5.1, Report on test specification and D5.2, Mechanical Measurements Systems, have been delayed due to the ongoing need for discussions with the other WPs. Additional input is needed from WP3 to define the experimental campaign to calibrate models and test protocol. Finalization of D5.1 and D5.2 is expected in early Q1 2021.

The build-up of the test installations is expected to be delayed. When the test campaign was originally planned, the plan was to use installed instruments / sensors in the vessel, but now additional thermocouple trees specifically designed for the tanks are needed and have to be retrofitted.

² https://prhyde.eu/wp-content/uploads/2020/05/PRHYDE_Deliverable-D3-1_final_revised.pdf

The testing side at ZBT will be commissioned and finalized in December 2020 with only some fine-tuning actions left for January 2021.

The preparation of the testing side at Nikola is almost finalized with last modifications in Q1 2021, including initial calibration and testing with Hydrogen Station Testing apparatus.

The testing side at TMNA is available for single tank and tank system testing.

The planned bus refuelling station for the ITM testing side is to be delayed. Details have to be clarified. As an alternative, partners will check, whether planned tests at ITM testing side could be performed at ZBI site.

3.5 Work Package 6: Recommendations and dissemination

WP leader: ITM Power

Within the first 12 months, originally three face-to-face workshops with stakeholders and experts had been planned. Due to the Covid-19 virus, all physical meetings and events had to be transferred into an updated format, resulting in online webinars and web conferences (held on 24th March 20, 23th April 20 and 1st/2nd/3rd December 20). The results of the online webinars and surveys are published as deliverables D6.3 and D6.4. With D6.2 the PRHYDE Dissemination and exploration plan was prepared.

On the webpage (D6.1) (see <https://prhyde.eu/progress/>) public presentations and project Deliverables have been available for review and comments by stakeholders. For stakeholder information the project has initiated regular newsletters to stakeholders and social media campaigns.

3.6 Work Package 7: Project management, coordination, and administration

WP leader: LBST

The PRHYDE coordinator has set up a regular monthly consortium call to discuss all project-related topics between the consortium partners in addition to the individual calls, implemented on work package level. The kick-off meeting has taken place in Paris on 5th February 2020 and the 2nd project meeting was held via web conference on the 25th and 26th June 2020.



Figure 6: PRHYDE consortium at Kick-off meeting in Paris, 5th February 2020.



**FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING**

What is PRHYDE?

With funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (FCH 2 JU), the PRHYDE project is aiming to develop recommendations for a non-proprietary heavy duty refuelling protocol used for future standardization activities for trucks and other heavy duty transport systems applying hydrogen technologies.

Based on existing fuelling protocols and current state of the art for compressed (gaseous) hydrogen fuelling, different hydrogen fuelling protocols are to be developed for large tank systems with 35, 50, and 70 MPa nominal working pressures using simulations as well as experimental verification. A broad industry perspective is captured via an intense stakeholder participation process throughout the project.

The work will enable the widespread deployment of hydrogen for heavy duty applications in road, train, and maritime transport. The results will be a valuable guidance for station design but also the prerequisite for the deployment of a standardized, cost-effective hydrogen infrastructure.

Further information can be found under <https://www.prhyde.eu>. For feedback on the PRHYDE project or the published deliverables, please contact info@prhyde.eu.

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With contributions by:

