



Deliverable D7.2

2nd Project Meeting and Status Report

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Confidentiality Level: PU – Public

Acknowledgement

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R E P O R T

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Note: The 2nd Project meeting was held on 25th and 26th June 2020 as a web conference due to the Covid-19 pandemic.

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.

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ACRONYMS AND ABBREVIATIONS

WP Work Package

1 2ND PROJECT MEETING

Project PRHYDE – Protocol for heavy duty hydrogen refuelling
Subject 2nd General Assembly, 25/26 June 2020
/Place Web Conference
Date 30 June 2020

1.1 List of Participants:

1st session: 25th June 2020 3-6 pm (CEST)

Participants (PRHYDE consortium):

Martin Zerta / LBST, Christopher Kutz / LBST, Susanne Goeritz / LBST, Christian Spitta / ZBT, Alexander Kvasnicka / ZBT, Elena Vyazmina / Air Liquide, Aaron Harris / Air Liquide, Fouad Ammouri / Air Liquide, Arnaud Charolais / Air Liquide, Quentin Nouvelot / ENGIE, Pierre Olivier / ENGIE, Thomas Guewouo / ENGIE, Vincent Mattelaer / Toyota, Spencer Quong / Toyota, Nick Hart / ITM, Claus Due Sinding / Nel, Paul Karzel / Shell, Shadi Darvish / Shell, Morgane Fouque / CEA, Joel Toulchoat / CEA, Antonio Ruiz / Nikola, Livio Gambone / Nikola

Participants (others):

Johannes Seuffert / DAIMLER

2nd session: 26th June 2020 3-6 pm (CEST)

Participants (PRHYDE consortium):

Martin Zerta / LBST, Christopher Kutz / LBST, Susanne Goeritz / LBST, Christian Spitta / ZBT, Alexander Kvasnicka / ZBT, Elena Vyazmina / Air Liquide, Aaron Harris / Air Liquide, Fouad Ammouri / Air Liquide, Quentin Nouvelot / ENGIE, Pierre Olivier / ENGIE, , Vincent Mattelaer / Toyota, Spencer Quong / Toyota, Nick Hart / ITM, Claus Due Sinding / Nel, Paul Karzel / Shell, Shadi Darvish / Shell, Morgane Fouque / CEA, Joel Toulchoat / CEA, Antonio Ruiz / Nikola, Livio Gambone / Nikola

Participants (others): -

1.2 Agenda

Day 1: 25th June 2020 – Working progress

Time	Topic	Responsible person
15:00 – 15:15	Welcome of the coordinator Approval of agenda, meeting goals, brief introduction and summary of project activities	LBST (Martin Zerta)
15:15 – 15:45	Status report: WP2 – State-of-the-art & specifications Status quo on deliverables D2.1 – D2.6; incl. stakeholders' feedback; Q&A/discussion	Shell (Paul Karzel)
15:45 – 16:15	Status report: WP3 – Protocol development Status quo on deliverable D3.1 (incl. stakeholders' feedback); upcoming activities; Q&A/discussion	Nel (Claus due Sinding)
Break		
16:25 – 16:55	Status report: WP4 – Simulations Status quo on preliminary simulations (D4.1); upcoming activities / timeline; Q&A/discussion	Air Liquide (Fouad Ammouri)
16:55 – 17:25	Status report: WP5 – Experimental validation Current activities (e.g. tank selection, test sites, planning of experiments); upcoming workplan and timeline for experiments, Q&A / discussion	Nikola (Antonio Ruiz)
17:25 – 18:00	Discussions on working progress Interaction/dependencies/data flow between WPs; Q&A / discussion; summary; outlook for day 2	All

Day 2: 26th June 2020 – Stakeholder interaction and organisational aspects

Time	Topic	Responsible person
15:00 – 15:20	Welcome of the coordinator Approval of agenda; meeting goals; Report of Communications with Pietro	LBST (Martin Zerta)
15:20 – 16:00	Status report: WP6 – Recommendation and dissemination Activities on stakeholder interaction: website (D6.1), dissemination plan (D6.2), webinars/workshops (D6.3 & D6.4), further activities; Q&A / discussion	ITM (Nick Hart)
16:00 – 16:30	Status report: WP7 – Project management, coordination and administration Deliverables: 2 nd GA & Status report (D7.2) and annual data reporting (D7.3); organization aspects	LBST (Martin Zerta)
Break		
16:40 – 17:10	Other topics Expert group; upcoming events	LBST (Martin Zerta)
17:10 – 17:45	Discussion General project outcome	All
17:45 – 18:00	Summary	All

Overview and Meeting Goals

Day 1	<ul style="list-style-type: none"> – Presentation and discussions of different WPs by WP leaders (WP2-5): <ul style="list-style-type: none"> ○ Status quo deliverables and activities, challenges, upcoming activities / timeline; Q&A discussion – Participants: PRHYDE partners + Daimler → Goal: achieve uniform understanding of current project status and challenges between all PRHYDE partners and discuss open issues → For Daimler: to receive overview over project activities to facilitate further process to become a partner
Day 2	<ul style="list-style-type: none"> – Dissemination/communication/stakeholder interaction (WP6) – Organizational aspects (WP7, on-going contract amendment(s)) – General discussion to achieve uniform understanding of the outcome of the project – Participants: PRHYDE partners

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 (Status: 07/2020). 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)

25/26th June 2020 – 2nd project meeting

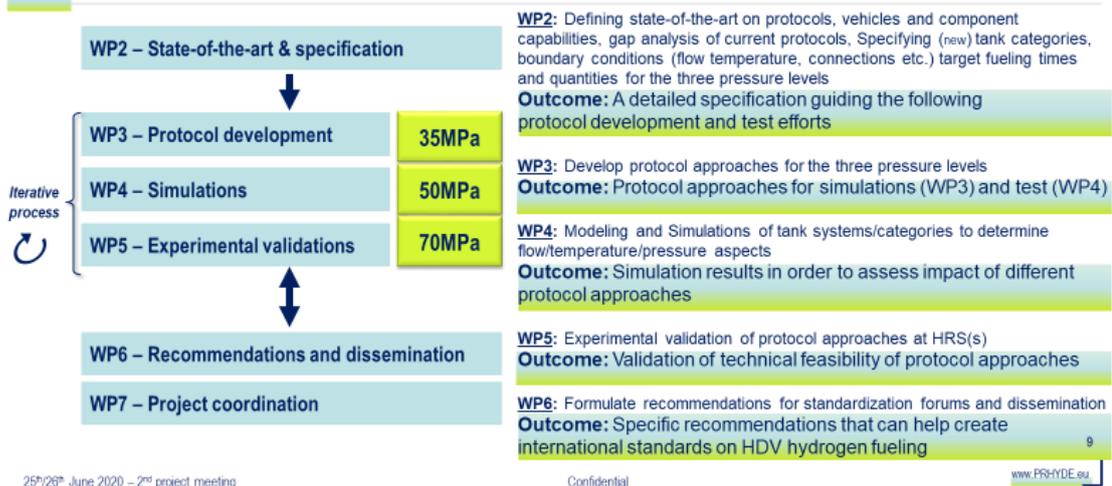
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Figure 2: Responsibilities and participation in the work packages.

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



25/26th June 2020 – 2nd project meeting

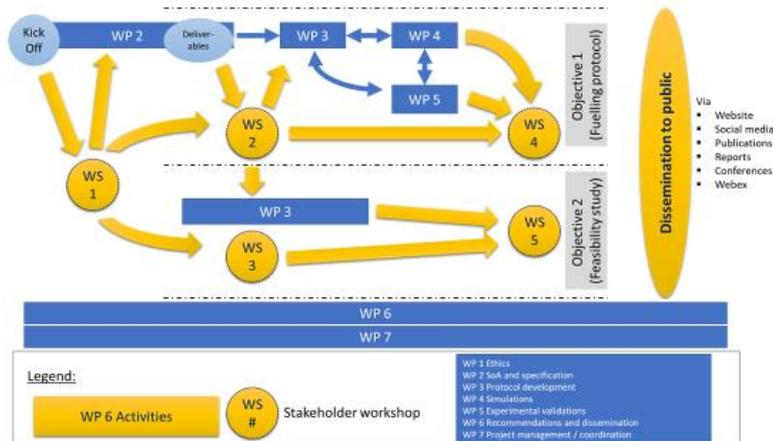
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Figure 3: Work Plan of the PRHYDE project.

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



25/7/20th June 2020 – 2nd project meeting

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- gap analysis of existing gaseous refuelling protocols;
- gap analysis of existing gaseous refuelling components;
- analysis of non-gaseous onboard storage & filling;
- target for new refuelling protocols.

To the date of this report, four of the six deliverables are in the finalization stage and being prepared for publication on the project’s website.

To cover the expertise of external project partners with regards to non-gaseous hydrogen refuelling, 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 develop protocols based on the validation test results.

Within the first six 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 specifications have been presented in the second stakeholders webinar on 23rd April 2020. After taking the feedback of different stakeholders into account, the results were forwarded to WP4, to perform preliminary simulations based on this set of assumptions (see Table 1).

Table 1: Selected characteristic cases for preliminary simulations

Description	H35	H50	H70	Unit
CHSS Tank Type	III IV	III IV	III IV	
CHSS Volume	1400.0	1400.0	1400.0	[L]
Single Vessel (28 vessels)	50.0	50.0	50.0	[L]
Unit (4 vessels)	350.0	350.0	350.0	
Ambient Temperature	15.0	15.0	15.0	[°C]
Initial Pressure	6.0	8.0	10.0	[MPa]
Ref. Pressure Drop	20.0	20.0	20.0	[MPa]
Fuel Delivery Temperature	+15.0 - 20.0	+15.0 - 20.0	+15.0 - 20.0	[°C]
APRR (10 min. fuelling time)	3.78	5.45	7.75	[MPa min ⁻¹]
(15 min. fuelling time)	2.52	3.63	5.17	
Stop criteria	100.0	100.0	100.0	[%]

CHSS = compress hydrogen storage system
APRR = average pressure ramp rate

The specification for preliminary simulations have been published as Deliverable D3.1 on the PRHYDE website¹.

3.3 Work Package 4: Simulations

WP leader: Air Liquide

Preliminary simulations with two different simulation models have been conducted covering in total 48 simulations (16 for each pressure level) defined in WP3. Furthermore, 6 additional cases were selected. In months 5 and 6, these first simulations have been prepared and performed. The simulations were based on the stop criteria of either the dispenser reaching the maximum pressure permitted, of 125% NWP (following a fuelling time of 10 or 15 minutes, respectively for the 2 average pressure ramp rates chosen), or reaching the final state of charge of 100%.

Aim is to understand the impact of the different parameters (e.g. Type III or Type IV tank, amount of pre-cooling, and pressure ramp rate) on the refuelling process.

The details and results of the preliminary simulations will be published as Deliverable D4.1 on the project website and serve as basis for further refinement in the protocol development process of WP3 as well as the experimental campaign planning for WP5.

3.4 Work Package 5: Experimental validation

WP leader: LBST / Nikola Corporation

The work in WP5 so far was focused on the selection and purchasing of the hydrogen tank, which are to be tested on the different pressure levels. At the time of this report, the selection process of the tanks has been completed. The work will cover single tank testing as well as tank system testing. So far, three different test sites have been identified and first experiments shall start end of 2020. In addition to that, mechanical strain testing will take place, both in the EU and the US.

Works on the report on the test specifications, details on the experimental campaign and the protocol to be tested are ongoing and it will be published by the consortium in Q3/2020.

3.5 Work Package 6: Recommendations and dissemination

WP leader: ITM Power

WP6 covers the interaction between the PRHYDE consortium and the outside world. An important milestone was the launch of the PRHYDE website in May 2020 (see <https://prhyde.eu/>).

Additionally, two workshops covering the preparatory stage and confirmatory stage for specifications of a future HD refuelling protocol had originally been planned in the

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

The 2nd workshop took place on 23rd April 2020, 3-5 pm (CEST) with 110 participants covering details of the first deliverables D2.1 – D2.5 and D3.1. The presentation slides have been published on the PRHYDE website.

Time (CET)	Subject
14:45	<i>Join webinar</i>
15:00	Introduction to project
15:10	Summary of first webinar
15:20	PRHYDE deliverable D2.1: Performance targets for refuelling protocols for heavy duty hydrogen vehicles
15:35	PRHYDE deliverable D2.2: Requirements for safe heavy duty gaseous hydrogen vehicle refuelling
15:50	PRHYDE deliverable D2.3: Gap analysis of existing heavy duty gaseous hydrogen vehicle refuelling protocols

23 APRIL 2020

2nd Workshop - WEBCON

2
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Time (CET)	Subject
16:15	PRHYDE deliverable D2.4: Gap analysis of existing hardware used for heavy duty gaseous hydrogen vehicle refuelling
16:30	PRHYDE deliverable D2.5: Analysis of existing non-gaseous hydrogen refuelling protocols or applications
16:35	PRHYDE deliverable D3.1: Report on the characteristics of the cases to be simulated in the preliminary simulations
16:50	Next steps / Plans for smaller web meetings (anticipated in May)
17:00	<i>End</i>

23 APRIL 2020

2nd Workshop - WEBCON

3
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Figure 7: Agenda of the 2nd PRHYDE workshop on 23rd April 2020.

The results of the online webinars and surveys will be published as deliverables in Q3/2020.

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 (see Chapter 0)



Figure 8: 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.

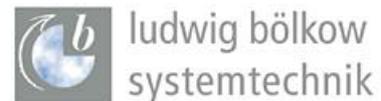
Based on existing fuelling protocols and current state of the art for compressed (gaseous) hydrogen fuelling, different hydrogen fuelling protocols are to be developed for large tank systems with 35, 50, and 70 MPa nominal working pressures using simulations as well as experimental verification. A broad 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:

