



**WASTE2H<sub>2</sub>**

WASTE TO HYDROGEN

## Report on Thematic Workshops (Interim Report)

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## Abstract

This report briefly describes the WASTE2H2 thematic workshop taking place at KTH Royal Institute of Technology, Dept. of Chemical Engineering, for three days November 9-11, 2021. The topic was “Technologies and methods for production of H<sub>2</sub> rich gas from thermochemical treatment of solid waste feedstocks”.

The workshop was carried out successfully as a hybrid event including presentations online as well as on campus. Totally 47 participants (21 researchers, 22 PhD students and six industrial representatives), including 21 connected to the WASTE2H2 project were present in the workshop. The hybrid event worked well but the use of a professional speaker/microphone/camera system is recommended for future workshops within the project.

## Document History

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21/12 2021	1	Klas Engvall, Eftymios Kantarelis (KTH)	First version of the document
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## 1. Introduction

For three days November 9-11, 2021, KTH Royal Institute of Technology, Dept. of Chemical Engineering hosted the first thematic workshop at the venue of KTH campus in Stockholm, Sweden. The purpose of the workshop was to bring together the senior and junior members of each partner's teams to share research experiences and networking on the thematic area specified. To facilitate a reach out to a larger audience, the workshop arranged as a hybrid meeting between a PhD "Integration of gasification technologies for decarbonized process industry" arranged as a joint venture between the WASTE2H<sub>2</sub> project (First Summer School within Task 3.2) and the SFC Gasification Academy (SFC - Swedish Gasification Centre), a national centre of excellence in Sweden.

The objectives of the workshop were as follows:

- To present and discuss participants specific research topics in view of the thematic area of the workshop.
- To promote interaction and networking on the specific thematic area.
- The workshop was attended by a diverse group of participants, including:
  - o WASTE2H<sub>2</sub> partners' executive senior researchers, senior researchers, early-stage researchers, and PhD students
  - o Executive senior researchers, senior researchers, early-stage researchers, and PhD students from other organisations,
  - o Related industries and scientific experts
  - o Other interested stakeholders.

In the first two days only around ten participants were present of the workshop, which is less than the target 20-30 participants. On the other hand, on day 3 more than 40 people participated.

## 2. Workshop programme

The workshop program consisted of a mixture of presentations by WASTE2H<sub>2</sub> and external researchers, and industrial representatives from engineering companies and equipment suppliers. A photo from one of the seminars is shown in Figure 1.

The workshop schedule and the list of R&D presentations are shown in Figure 2 and Table 1, respectively.

The workshop was arranged as a hybrid event with a major part of the presentations on campus but also some online, as indicated in the schedule in Figure 2.



Figure 1 Photo from one of the presentations

**'Technologies and Methods for production of H<sub>2</sub>-rich gas from thermochemical treatment of solid waste feedstock'**

	Tuesday 09/11		Wednesday 10/11		Thursday 11/11
8:45-9:15	Welcome coffee	8:45-9:00	Coffee	8:45-9:00	Coffee
9:15-9:30	Introduction to twinning EU and Waste2H <sub>2</sub> (Paulo Brito IPP) LOGOS Seminar Room	9:00-9:45	H <sub>2</sub> from Methane-Pyrolysis -Thomas Kolb, KIT (online)LOGOS Seminar Room	09:00-9:15	Introduction- last day of school/ workshop
9:30-10:15	High pressure gasification of biomass- Klas Engvall, KTH LOGOS Seminar Room	10:00-10:30	Air gasification of anaerobic digestate in a pilot scale rotary kiln- Cesare Freda, ENEA LOGOS Seminar Room	9:15-10:00	Experiences from starting the first industrial 6 MW WoodRoll® plant at Höganäs AB-Rolf Ljunggren Cortus Energy Room Q2
10:30-11:45	Development of low density Catalytic filter for tar reforming -Efthymios Kantarelis ,KTH LOGOS Seminar Room	10:30-11:00	3-stage biomass gasification technology - pilot plant at ENEA Research Center of Trisaia-Giovanni Stoppiello, ENEA LOGOS Seminar Room	10:15-11:00	High Temperature Gas filtration (-Erik Karlsson- Tenmat Ltd.) (online) Room Q2
11:45-13:00	Lunch	11:00-11:30	Discussion	11:00-11:45	Gas upgrading and related technologies -Klas J Andersson, Haldor Topsoe Room Q2
13:00-14:00	Potential biomass gasification markets in Portugal: The Alentejo case study- Catarina Nobre, BIOREF (online) LOGOS Seminar Room	11:45-13:00	Lunch	11:45-13:00	Lunch
14:00-14:45	Thermal gasification of agricultural wastes of the Portalegre-Portugal region, Luiz Rodrigues IPP LOGOS Seminar Room	13:00-13:45	Techno-environmental assessment for a bio-methanol integrated plant using anaerobic digestion of OFMSW and biomass gasification - Enrico Catizzone, ENEA LOGOS Seminar Room	13:15-14:30	MEVA-ongoing projects focusing on low cost production of syngas, Niclas Davidsson ,MEVA Energy (online) Room V3
14:45-15:15	Coffee break	14:00-14:30	Thermochemical upgrading and valorization of Refuse Derived Fuel. -Catarina Nobre, BIOREF (online) LOGOS Seminar Room	14:30-15:30	SFC Section-CIGB, Bio4Gasification, SFC 2.0 Room V3
15:15-16:00	Waste thermal gasification for hydrogen production-Paulo Brito, IPP LOGOS Seminar Room	14:30-15:15	Coffee break	15:30-16:00	Coffee Break
16:00-17:00	Discussion	15:15-16:00	Hydrogen for Refineries-Reinhard Rauch, KIT LOGOS Seminar Room	16:00-17:00	Discussion
		16:00-17:00	Discussion		Dinner 19:00-



**Room Address**  
 Q2 Malvinas väg 10, Q-huset, våningsplan 2, KTH Campus, Rumsnr: B:218  
 V3 Teknikringen 72, Väg och vatten, våningsplan 5, KTH Campus, Rumsnr: 203  
 LOGOS Teknikringen 42, Kemiteknik, våningsplan 6, KTH Campus, Rumsnr:694

**Room link**  
<https://www.kth.se/places/room/id/1d244f3a-c130-4909-98e2-c1590f352b2e>  
<https://www.kth.se/places/room/id/0e2af584-d1d1-40c8-83b1-e3fdb285dccc>  
<https://goo.gl/maps/JmFN7NQMqdTNGrmZ8>



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**Figure 2** Workshop schedule

**Table 1** List of R&D presentations

Name and affiliation	Title
Klas Engvall, KTH	Pressurized fluidized bed gasification: Application of dolomite as a bed material
Efthymios Kantarelis, KTH	Development of a low density catalytic filter for tar reforming
Catarina Nobre, BIOREF	Potential biomass gasification markets in Portugal: The Alentejo case study
Luiz Rodrigues, IPP	Thermal gasification of agricultural wastes of the Portalegre-Portugal region
Paulo Brito, IPP	Waste thermal gasification for hydrogen production
Thomas Kolb, KIT	H <sub>2</sub> from methane-pyrolysis
Cesare Freda, ENEA	Air gasification of anaerobic digestate in a pilot scale rotary kiln
Giovanni Stoppiello, ENEA	3-stage gasification technology – pilot plant at ENEA Research Center of Trisaia
Enrico Cattizone	Techno-environmental assessment for a bio-methanol integrated plant using anaerobic digestion of OFMSW and biomass gasification
Catarina Nobre, BIOREF	Thermochemical upgrading and valorization of Refuse Derived Fuel
Reinhard Rauch, KIT	Hydrogen for Refineries
Rolf Ljunggren, Cortus Energy AB	Experiences from starting the first industrial 6 MW WoodRoll® plant at Höganäs AB
Erik Karlsson, Tenmat Ltd	High Temperature Gas filtration
Klas J Andersson, Haldor Topsoe A/S	Gas upgrading and related technologies
Niclas Davidsson, MEVA Energy	MEVA-ongoing projects focusing on low cost production of syngas

### 3. Participants in the workshop

Table 2 lists all the participants attending the workshop where out of totally 47 participants, 21 were directly connected to the WASTE2H2 project, 21 were working as researchers at different levels within universities and institutes, 22 were PhD students and six represented participating companies. In terms of gender distribution, 23% of the workshop participants were women.

**Table 2** List of participants in the workshop with affiliations

Name of participant	Organisation	Type of organisation	Country	Occupation
Klas Engvall	KTH Royal Institute of Technology	Uni (Waste2H <sub>2</sub> )	Sweden	Executive senior researcher
Efthymios Kantarelis	KTH Royal Institute of Technology	Uni (Waste2H <sub>2</sub> )	Sweden	Researcher
Nima Mirzaei	KTH Royal Institute of Technology	Uni (Waste2H <sub>2</sub> )	Sweden	PhD student
Saiman Ding	KTH Royal Institute of Technology	Uni (Waste2H <sub>2</sub> )	Sweden	PhD student
Joakim Lungren	KTH/LTU	Uni (Waste2H <sub>2</sub> )	Sweden	Executive senior researcher
Paulo Brito	Instituto Politécnico Portalegre	Uni (Waste2H <sub>2</sub> )	Portugal	Executive senior researcher
Luiz Rodrigues	Instituto Politécnico Portalegre	Uni (Waste2H <sub>2</sub> )	Portugal	Senior researcher
Roberta Mota Panizio	Instituto Politécnico Portalegre	Uni (Waste2H <sub>2</sub> )	Portugal	PhD student
Pedro Lopes	Instituto Politécnico Portalegre	Uni (Waste2H <sub>2</sub> )	Portugal	Researcher

Name of participant	Organisation	Type of organisation	Country	Occupation
Vitor Manuel Silva	Instituto Politécnico Portalegre	Uni (Waste2H <sub>2</sub> )	Portugal	PhD student
Luís Filipe Carmo Calado	Instituto Politécnico Portalegre	Uni (Waste2H <sub>2</sub> )	Portugal	Researcher
Catarina Nobre	BIOREF	Institute	Portugal	Senior researcher
Thomas Kolb	Karlsruhe Institute of Technology	Uni (Waste2H <sub>2</sub> )	Germany	Head of Department
Reinhard Rauch	Karlsruhe Institute of Technology	Uni (Waste2H <sub>2</sub> )	Germany	Executive senior researcher
Philipp Neuner	Karlsruhe Institute of Technology	Uni (Waste2H <sub>2</sub> )	Germany	PhD student
Wiebke Asbahr	Karlsruhe Institute of Technology	Uni (Waste2H <sub>2</sub> )	Germany	MSc student
Philipp Graefe	Karlsruhe Institute of Technology	Uni (Waste2H <sub>2</sub> )	Germany	PhD student
Stella Walker	Karlsruhe Institute of Technology	Uni (Waste2H <sub>2</sub> )	Germany	PhD student
Cesare Freda	ENEA	Institute (Waste2H <sub>2</sub> )	Italy	Senior researcher
Giovanni Stoppiello	ENEA	Institute (Waste2H <sub>2</sub> )	Italy	Senior researcher
Enrico Catizzone	ENEA	Institute (Waste2H <sub>2</sub> )	Italy	Senior researcher
Rolf Ljunggren	Cortus Energy AB	Company	Sweden	Deputy CEO
Erik Karlsson	Tenmat Ltd	Company	UK	Business Development Manager
Klas J Andersson	Haldor Topsoe A/S	Company	Denmark	Senior researcher
Niclas Davidsson	Meva Energy AB	Company	Sweden	CEO
Ernest Bykov	Lithuanian Energy Institute	Institute	Lithuania	PhD student
Raminta Skvorčinskienė	Lithuanian Energy Institute	Institute	Lithuania	Researcher
Dovil'ė Gimžauskaitė	Lithuanian Energy Institute	Institute	Lithuania	Researcher
Nerijus Striugas	Lithuanian Energy Institute	Institute	Lithuania	Senior researcher
Andrius Tamošiūnas	Lithuanian Energy Institute	Institute	Lithuania	Researcher
Miriam Huber	BEST	Company	Austria	Researcher
Munavara Farha	Chalmers University of Technology	Uni	Sweden	PhD student
Renesteban Forero Franco	Chalmers University of Technology	Uni	Sweden	PhD student
Tharun Roshan Kumar	Chalmers University of Technology	Uni	Sweden	PhD student
Judith González Arias	Chalmers University of Technology	Uni	Sweden	PhD student
Isabel Cañete Vela	Chalmers University of Technology	Uni	Sweden	PhD student
Guillermo Martinez	Chalmers University of Technology	Uni	Sweden	PhD student
Chahat Mandviwala	Chalmers University of Technology	Uni	Sweden	PhD student
Guillermo Martinez	Chalmers University of Technology	Uni	Sweden	PhD student
Diana Carolina Guío Pérez	Chalmers University of Technology	Uni	Sweden	PhD student
Francisco M. Baena-Moreno	Chalmers University of Technology	Uni	Sweden	PhD student

Name of participant	Organisation	Type of organisation	Country	Occupation
Yaxin Ge	University of Gothenburg	Uni	Sweden	PhD student
Marcelo Dal Belo Takehara	Luleå University of Technology	Uni	Sweden	PhD student
Andreas Johansson	RISE AB	Institute	Sweden	Researcher
Peter Blomdahl	Site Concept AB	Eng. company	Sweden	CEO
Weiss Naim	Technische Universität München	Uni	Germany	PhD student
Sebastian Bastek	Technische Universität München	Uni	Germany	PhD student

## 4. Evaluation of the workshop

No questionnaire was applied after the workshop, but oral opinions were collected from some of the participants. Some observations are compiled below.

- In view of the content of the workshop, the participants (especially for the PhD students and young researchers) were in favour of the industrial contributions, since it provided with a context for the research performed at the universities and institutes.
- The online presentations were performed using a zoom application on a computer with a connected external speaker/microphone for the audience. This system worked well for a smaller audience (first two days) but not with a larger audience (the third day) in a larger lecture hall. It was also difficult for the online participants to follow the presentation in detail since the speakers in many cases pointed on beamed screen instead of on the computer. For future workshops a professional speaker/microphone/camera system should be used.
- The discussions were generally performed directly in relation to each presentation. The questions to presenters worked fine in case a smaller audience regardless of if they were online or on campus. In case of a larger audience, the questions to online presenters were hampered and often relayed to the presenter by the chairperson. A professional speaker/microphone/camera system would also in this case probably be helpful to enhance the experience.