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Dissemination Level		
PU	Public	x
CO	Confidential, only for members of the consortium (including the Commission Services and MOST)	
INT	Confidential, only for members of the consortium	

Deliverable number:	D7.1
Deliverable title:	Knowledge-sharing events
Deliverable description:	Major consortium events hosted since the project start in 2017 is summarised in the deliverable. These meetings have facilitated information exchange between the different working groups within the CHEERS CLC project, as they included thorough presentations of each work package that were active at the time of the meetings. The deliverable gives further a summary of dissemination activities (networking actions) which includes a CHEERS website, LinkedIn account and a YouTube channel. Results from each work package has been presented in webinars and a public seminar at the end of the project. All publications from the CHEERS project, including PhD thesis, journal articles and publications for the proceedings of topical international conferences are finally listed at the end of the deliverable.
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Lead participant:	BELLONA

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1	2024-08-30	Einar JORDANGER (SINTEF ER) and Cathrine RINGSTAD (BELLONA)	Comments from CINEA addressed and extended with dissemination activities.

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1 INTRODUCTION

CHEERS conforms to the European Horizon 2020 Work Programme 2016 – 2017, 10. 'Secure, Clean and Efficient Energy', under the low-carbon energy initiative (LCE-29-2017: CCS in Industry, including BioCCS). The ambition is to improve the efficacy of CO_2 capture in industry, and help ensuring sustainable, secure, and affordable energy.

CHEERS started in October 2017 and was supposed to be finished by September 2022. Due to the Covid pandemic and various technical challenges some delays occurred. The successful testing was completed in May 2024. The final accounts show that the costs of CHEERS amounted to almost EUR 30 million, financed by the European Union's Horizon 2020 research and innovation programme under grant agreement No. 764697 together with the Chinese Ministry of Science and Technology (MOST), and some of the partners of the Consortium.

The responsibility of the action lies with the CHEERS consortium, which comprises nine parties: SINTEF Energy Research (coordinator, Trondheim, Norway), IFP Energies nouvelles (IFPEN) (Lyon, France), Tsinghua University (Beijing, China), SINTEF Industry (Oslo, Norway), TotalEnergies OneTech (France), Dongfang Boiler Group (Zigong, China), Zhejiang University (Hangzhou, China), Politeknika Slaska (Silesian University of Technology) (Gliwice, Poland), and Bellona (Brussels, Belgium). The system prototype demonstration was carried out in Deyang at Dongfang's Key Laboratory for Clean Combustion and Flue Gas Purification of the Sichuan Province, P.R. China.

The action involves a 2nd generation chemical-looping technology tested and verified at laboratory scale (150 kW_{th}). Within the framework of CHEERS, the core technology was developed into a 3 MW_{th} system prototype for demonstration in an operational environment. This constitutes a major step towards large-scale decarbonisation of industry, offering a considerable potential for retrofitting industrial combustion processes.

The system prototype is based on a fundamentally new fuel-conversion process synthesised from prior research and development actions over more than a decade. The system complies with industrial standards, specifications and safety regulations. Except for CO_2 compression work, the innovative concept is capable of removing 96% of the CO_2 while eliminating capture losses to almost zero.

This deliverable summarises in Chapter 2 major consortium events hosted since the project start in 2017. These meetings have facilitated information exchange between the different working groups within the CHEERS CLC project, as they included thorough presentations of each work package that were active at the time of the meetings. The following document charts key takeaways from the work packages presentations, in addition to an overview of the points discussed over successive meetings. Updates of timelines and administrative meetings are also made during these events.

Chapter 3 gives further a summary of dissemination activities (networking actions), which includes a CHEERS website, LinkedIn account and a YouTube channel. Results from each work package has been presented in webinars and a public seminar at the end of the project.

All publications from the CHEERS project, including PhD thesis, journal articles and publications for the proceedings of topical international conferences are finally listed in Chapter 4.

2 Major Consortium Events

The Consortium Agreement states that the General Assembly (GA), in which all partners are represented by one member, should be arranged at least once a year. At the kick-off meeting in Trondheim in November 2017 it was decided to arrange annual meetings, normally lasting three days. This arrangement allowed members of the Executive Board (EB) and the Management Support Team (MST) to meet in person, as well as members of the various Work Packages. In between these Annual Meetings, and eventually Microsoft Teams, were used for both administrative and technical meetings, sharing knowledge and results between partners.

The overall programme of the annual meetings was quite similar for each event; see example in Figure 2-1 from the 1st Annual Meeting in 2018.

	Wednesday 14-Nov	Thursday 15-Nov		Friday 16-Nov
8	Registration	Registration		Registration
9	**Result**	**General Assembly GA02**		**WP2-WP4-WP6 mtg.**
10				
		Break		
11	Break	**WP5 Launch**		
12				Lunch
		Lunch		
13	Lunch			
		Site visit		
14				
15		Break		
		Executive Board EB03	**WP3 mtg.**	
16	Break			
17				
18	**MST mtg.**			
19				
	Joint dinner			
20				
21				

Figure 2-1 Overall programme for Annual Meeting in 2018 in Lyon, where “Result” refers to Work Package presentations.

When Covid imposed restrictions for travelling, the annual meetings were arranged as Teams meetings. This was the case for the meetings in 2020 and 2021. The programme for these meetings were similar to the physical meetings. The valuable personal contact between partner representatives was, however, not possible. It was therefore fortunate that people had met in person on several occasions before Covid appeared.

2.1 Technical pre-meeting 18 to 20 November 2017 (Chengdu and Deyang, China)

A physical meeting was arranged in Chengdu and Deyang in China just before the official kick-off meeting of CHEERS. Here, representatives from the main partners involved in the design of the demonstration unit met for initial discussions on technical issues, and not the least, to establish personal relationships for improved collaboration during the project. The Core Design Team (CDT) that was established at this meeting met frequently during the design, construction and demonstration phases of the project.

2.2 Kick-off Meeting 28 to 30 November 2017 (Trondheim, Norway)

2.2.1 Programme

Launch Event hosted by **SINTEF in Trondheim, Norway**

Number of participants: 25, including the Project Officer Laura GOMEZ LOZANO

- Round Table Presentations of all actors
- Presentation on Rules of Horizon 2020
- Review of objectives and S&T goals
- Work Package Presentation (1-7)
- Presentation of D1.2: Project management plan
- General Assembly Meeting
- Site Visit
- Executive Board meeting
- WP 2, 3, 4, 6 meetings

2.2.2 Key takeaways

Kick off meeting presentation on Innovation and Networks Executive Agency by Laura Lozano from the H2020 department. Highlighted the role of INEA and working of the grant for CHEERS project.

The primary objectives of CHEERS are to demonstrate a new innovative second-generation CCS technology and to advance chemical looping combustion technology with CCS. Aim move along TRL of such systems; from TRL 4 (150 kW_{th}) to TRL 7 (3 MW_{th}).

Each Work Package presented on its clear objectives throughout the project, highlighting deliverables and reporting timelines.

2.3 1st Annual Meeting 14 to 16 November 2018 (Lyon, France)

2.3.1 Programme

Event hosted by **IFPEN in Lyon, France**

Number of participants: 29

- Work Package presentation (1-7)
- Management Support Team meeting
- General Assembly meeting
- Launch of Work Package 5
- IFPEN lab visits
- Executive Board meeting
- WP 2, 4, 6 meetings

2.3.2 Key takeaways

WP2 updates
Two designs greenlit for fuel reactor system.

Task 2.1 on establishing basis of design completed with information sharing from Tsinghua University/ DONGFANG and design parameters defined.

Task 2.2 on conceptual design of CLC section completed waiting for confirmation. MOU for the design pilot plant.

WP3 updates

Selection of oxygen carrier material for pet coke conversion in CLC technology done. After Thermogravimetric analysis and attrition testing, Ilmenite was chosen as the first OCM. Low sulphur pet coke chosen and lab scale production and testing of CMFT started. Experimental rig for high heat rate pet coke kinetic studies built.

WP4 updates
Statement of requirement drafted; a document defining basic requirements, scope and objectives.

Supporting documents drafted such as engineering planning for the project.

WP6 updates
Retrofitting existing 3MW CFB unit suggested, and other site facilities evaluated. A container of Titania, a substitute oxygen carrier shipped to China.

Design of a cold flow model initiated alongside tendering and procurement of related equipment. Start-up and initial operation of the model confirmed the possibility of qualitative solid circulation around the entire loop. This helps avoid potential hazards during hot operation. Modifications such as more accurate flowmeters and decreasing diameter of pipes to ensure uniform gas velocity were noted based on certain problems from the cold mock up.

WP7 updates
Publications on website as well as social media regarding CHEERS project. Academic papers published in journals. Project website launched, YouTube channel created, and twitter account launched.

2.4 2nd Annual Meeting 4 to 6 November 2019 (Gliwice, Poland)

2.4.1 Programme

Event hosted by **SILESIAN in Gliwice, Poland**

Number of participants: 27

- Work Package presentation (1-7)
- Management Support Team meeting
- General Assembly meeting
- SILESIAN Lab visit
- Executive Board meeting
- WP 2, 3, 4, 5, 6 meetings

2.4.2 Key takeaways

WP2 updates
Retrofitting existing CFB does not meet CHEERS requirement hence grassroots alternative proposed by DONGFANG was adopted.

Design results of European and Chinese CLC systems presented.

WP3 updates
Pet coke acquired from China, shipped to Germany and onward to IFPEN and SINTEF.

A full CLC loop modelled and simulated. 3 new oxygen carriers obtained and possible candidates.

WP4 updates
Grassroots vs retrofitting alternatives weighed on constructability, costs, risks and schedule. The grassroots option is recommended based on the criteria.

The site survey, project scope definition and FEED dossier are near completion for the grassroots option.

Hazard studies carried out to identify risks and mitigation measures.

Construction plans for grassroots plant finished with first step of registering project on government portal. Report submissions ongoing.

WP5 updates

Tests done on batch units and 10kW scale started to identify pet coke kinetics. Model calibration started.

WP6 updates
Existing CFB unit needs some modifications to allow solid circulation and L-valves etc.

CFB was decided to be used as AR. Grassroots design faced road bumps due to land not being available and permitting issues. Local government approving requests and land purchased solving the previous issues.

DONGFANG's boiler test centre completed. Cold flow model experimentation showed stable and controlled circulation using the L-valves and loop seals.

WP7 updates
Updated list of academic publications. Updated content on relevant platforms such as the website, YouTube and Twitter.

2.5 3rd Annual Meeting 17 to 19 November 2020 (Microsoft Teams)

2.5.1 Programme

Event hosted by **TOTAL on Microsoft Teams**

Number of participants: 28 plus ca. 10 using the same Teams account at DONGFANG

- Work Package presentation (1-7)
- General Assembly meeting
- Exploitation Workshop
- Executive Board meeting

2.5.2 Key takeaways

WP2 updates
Cold flow model experiments conducted, and conclusions help feed demo unit operation. Wide range of operating conditions were covered and CFD modelling of entire unit now possible.

WP3 updates
Multiple alternatives for oxygen carrying material were tested in lab and at pilot scale at IFPEN. SINTEF ER tested at a pilot scale Ilmenite. Results were shared in a thorough presentation. First choice Ilmenite is low cost and moderately strong. Ores from China, chosen to be the second choice required pre-sintering, crushing, and sieving, adding to costs. Synthetic candidates exhibited excellent performance but carry high costs due to production.

WP4 updates
Pre-FEED and FEED studies completed. Remaining studies related to FEED ongoing.

Reports for grassroots permitting completed, assessment with local government officers to happen soon, final approval expected by end of year. A report is prepared in the different technological options for CO2 treatment.

WP5 updates
CLC-CCS process simulation carried out as well as benchmarked cases of CFB plant with CO2 capture. For the Natural gas plant with CCS reference case simulation carried out with solvent as MEA.

Reactor model updates were presented, concluding that kinetic models were calibrated, the pilot test (10kW) validates the reactor model and hydrodynamics are implemented in code. Equilibrium calculations were completed for fuel reactor.

WP6 updates
Test site permitting progress made. Cold flow model configuration was changed, allowing for stable and controlled solid circulation. Hydrodynamic models were obtained by fitting experimental data. Synthetic oxygen carrier tests carried out in collaboration.

WP7 updates
Pandemic restrictions resulted in fewer papers and presentations. Increased engagement through website, 2 new videos added to YouTube channel. CLC animation and cold flow rig video on LinkedIn gathered significant traffic. CHEERS project page set up on LinkedIn.

2.6 4th Annual Meeting 3 to 5 November 2021 (Microsoft Teams)

2.6.1 Programme

Event hosted by **Tsinghua University on Microsoft Teams**

Number of participants: 32

- CCUS research in Tsinghua University
- Work Package presentation (1-7)
- General Assembly meeting
- Exploitation Workshop
- Executive Board meeting

2.6.2 Key takeaways

WP3 updates
Oxygen carrier batch testing in IFPEN concluded that ilmenite is the best candidate. Pilot testing (150kW) of OCM at SINTEF also confirms that ilmenite is the better oxygen carrier.

WP5 updates
Two applications for the plants were chosen: refinery and power generation. These applications were analysed for all three cases: CFB-CCS, NGCC-CCS, CLC-CCS and the CO2 capture indicators were presented based on simulations.

CLC performed best in terms of CO2 capture indicators compared to the other cases for both applications. CLC fared better in terms of energy efficiency as compared to the CFB case in both applications. Heat and mass balance studies completed as well as CLC fuel reactor modelling. Cost estimates of all cases ongoing with full benchmark study being the final step slated for completion by October 2022.

2.7 5th Annual Meeting 21 to 23 November 2022 (Dunkirk, France)

2.7.1 Programme

Event hosted by **Total in Dunkirk, France (and MS Teams)**

Number of participants: 12 in person and 25 by Teams

- Work Package presentation (1-7)
- General Assembly Meeting
- Exploitation Workshop
- Executive Board meeting
- Site visit Arcelor Mittal 3D pilot

2.7.2 Key takeaways

WP5 update
Techno-economic analysis conducted for all applications (refinery and power generation) for all the benchmarked cases (CFB, NGCC and CLC). Considerations of energy, environment and economic factors influence the study. Levelized cost analysis results shared. LCOE of CLC slightly higher than that of the NGCC+CCS case. The CFB+CCS case faring worse than both other cases. There was however higher CO2 avoidance with CLC compared to NGCC due to carbon content of fuel. On fuel price sensitivity, a resulting matrix of gas prices vs pet coke price provided a clear imagine when CLC proves to be economically viable. This was done for both applications (refinery and power generation). From this matrix, it was evident that CLC case becomes viable only in cases of higher gas prices and significantly lower pet coke prices, more so for the refinery case.

Considering the full value chain for CCS, CLC becomes competitive with gas if the storage site is very close. CLC technology is a viable technology where pet coke is the feedstock as it provides high CO2 capture.

2.8 6th Annual Meeting 19 to 21 September 2023 (Chengdu and Deyang, China)

2.8.1 Programme

Event hosted by **Dongfang Boiler Company in Chengdu and Deyang, China (and MS Teams)**

Number of CHEERS participants: 34 in person

- Internal seminar (19 September)
- Executive Board meeting (19 September)
- Inauguration ceremony (20 September, before lunch)
- Public Seminar (20 September, after lunch)
- Site visit to the CLC demonstration unit (21 September)

2.8.2 Key takeaways

At the **internal seminar**, all work package leaders reviewed the work done thus far and organised the presentations for the public seminar in order to ensure a wholistic picture of the CHEERS project. The **public seminar** is summarised in Chapter 3.1.

The **official inauguration** of the CLC demonstration unit at Deyang was held hosting all the project partners. The event was covered by the Chinese media, attended by all project partners from both Chinese and European sides, reiterating the need to further collaboration and highlighting the importance of such alternative capture projects for climate change mitigation.

The **site visit** to the demonstration unit was open to the project partners. The demonstration unit entered its start-up phase in June 2023.

Figure 2-2 Participants at the inauguration ceremony in Deyang 20 September 2023

3 Engagement in networking actions

3.1 Website

A public CHEERS website was created at project start to view and share public project information and support awareness-building and understanding of the technology's relevance to the wider public. The homepage of the website is shown in Figure 3-1. The web site contains the following pages: Work Packages, Project Partners, News, Results, About and Contact.

Figure 3-1 Homepage of the CHEERS web site.

3.2 LinkedIn

With the same objectives as the CHEERS web site, a CHEERS LinkedIn account was established. Examples of the most recent posts are given in Figure 3-2. The account has, per date, 328 followers.

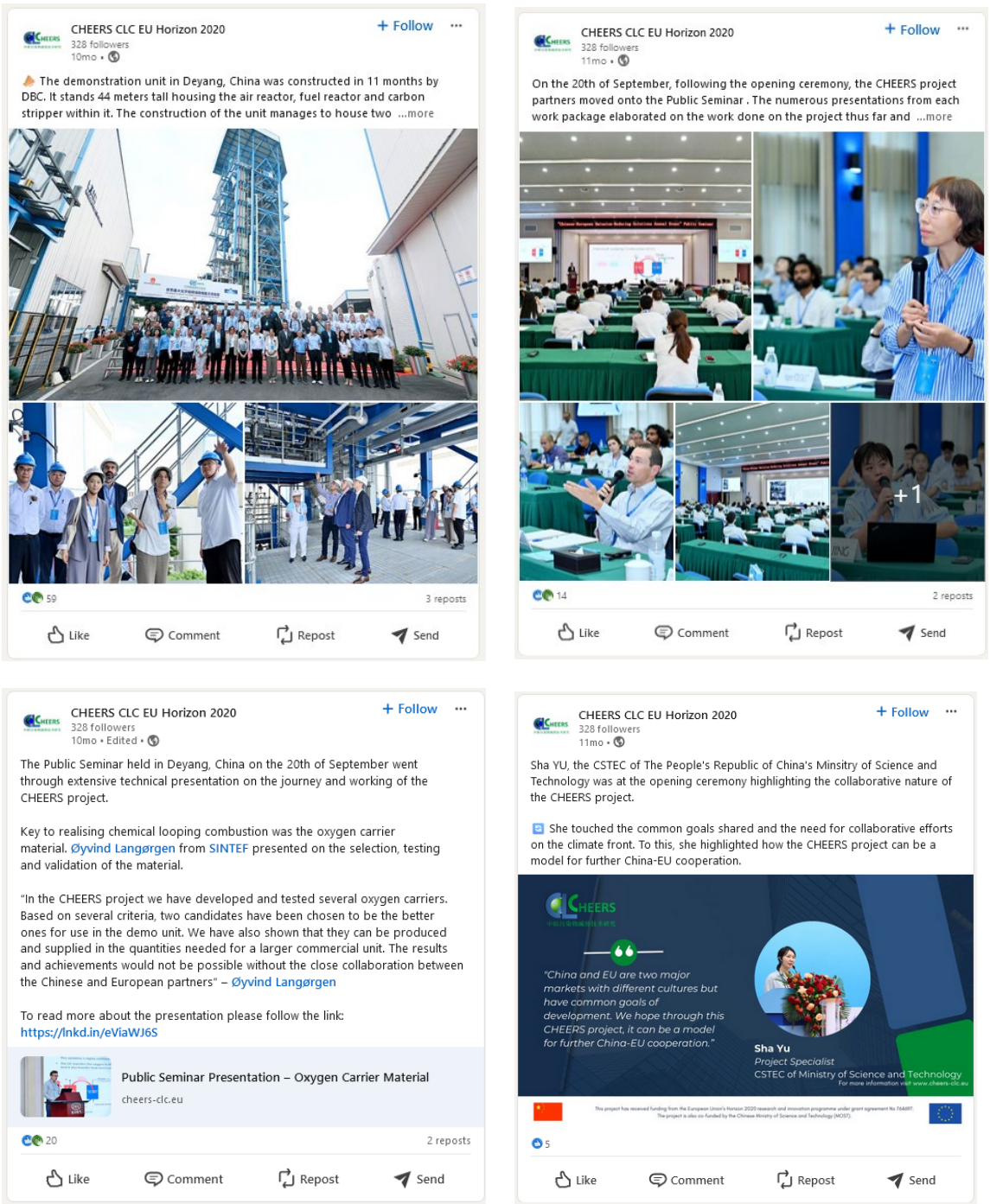

Figure 3-2 Example of posts at the CHEERS LinkedIn account.

3.3 YouTube

Videos explaining CCS and chemical looping combustion (CLC) in general, and videos of presentations from CHEERS webinars (see overview in Chapter 3.4) and the open CHEERS seminar arranged in October 2023 (see overview in Chapter 3.5) have been posted on the YouTube channel CHEERS EU CLC. The channel has, per date, 61 subscribers and have altogether 18 videos posted.

3.4 Webinars

When COVID struck the world early 2020 many conferences were cancelled. Hence, in order to disseminate results as much as possible in the lack of conferences, the MST decided to arrange webinars to reach the most relevant experts with results from CHEERS. Table 3-1 shows the four webinars that were arranged, with links to the recorded video of presentations held (posted at the YouTube channel CHEERS EU CLC).

Table 3-1: List of CHEERS webinars with links to the recorded video presentations

No	Date	Title and YouTube link	WP	Participants	
				Webinar	YouTube*
1	2021-07-01	Development and Design Studies CHEERS EU CLC	WP2	65	138
2	2022-01-12	CLC development: FEED of 3 MW_{th} demonstration plant and industrialization studies CHEERS EU CLC	WP4	45	101
3	2022-01-26	CLC development: Oxygen carriers for the $3MW_{th}$ demonstration plant and future development CHEERS EU CLC	WP3	45	184
4	2023-01-25	The Technical-Economic Case for Chemical Looping Combustion CHEERS EU CLC	WP5	53	107

*) Counted 30 August 2024

3.5 Public CHEERS seminar 20 September 2023 (Chengdu, China)

As part of the 6th Annual meeting in Chengdu, a public seminar was arranged 20 September in 2023 at the premises of DONGFANG. The seminar had approximately 100 participants.

The agenda is presented in Figure 3-3. The seminar covered final updates from each work package, summarising the work done over the complete duration of the project. The presentations charted key achievements along the project such as patents filed, and research gaps filled while also identifying the next actionable steps until the closure of the project and the potential for CLC beyond that.

Time	Presentation and links	Presenter	Position	Affiliation
14:00	Welcome address and safety briefing	Weicheng LI	Vice General Manager	DONGFANG
14:10	Introduction to the CHEERS project and its carbon capture technology CHEERS blog[1]	Nils HAUGEN Zhenshan LI	EU coordinator CN coordinator	SINTEF TSINGHUA
14:25	Designing a CO_2 capture unit with chemical looping combustion CHEERS EU CLC CHEERS Blog	Patrice FONT Zhenshan LI	WP5 Leader WP6 Leader	IFPEN TSINGHUA
15:05	Materials used to transfer oxygen in the CLC demonstration unit CHEERS EU CLC and CHEERS EU CLC CHEERS Blog	Øyvind LANGØRGEN Lei LIU	WP3 Leader	SINTEF TSINGHUA
15:45	Tea break			
16:05	Planning the design of the CLC. From R&D design to Pre-FEED & FEED CHEERS EU CLC	Vincent GOURAUD	WP4 Leader	TotalEnergies
16:25	Engineering, Procurement, Construction and Commissioning for CHEERS project CHEERS EU CLC CHEERS Blog	Xinglei LIU	WP6	DONGFANG
16:45	Test run results CHEERS EU CLC CHEERS Blog	Nicola VIN Vincent GOURAUD	WP5 WP4 Leader	IFPEN TotalEnergies
17:05	Measuring the impact and business case of CO_2 capture with chemical looping combustion CHEERS EU CLC and CHEERS EU CLC CHEERS blog	Vincent GOURAUD Patrice FONT	WP4 Leader WP5 Leader	TotalEnergies IFPEN
17:35	End of seminar			

Figure 3-3 Agenda for the public CHEERS seminar in Chengdu 20 September 2023. 1 is not a summary of the presentation but an interview with the coordinator of CHEERS, Nils HAUGEN.

The presentations were recorded and can be found collectively at the YouTube channel CHEERS EU CLC. The presentations were also summarised as news and blog posts at the CHEERS web site and shared via CHEERS LinkedIn account. Individual links to the presentations and to the blog posts are given in Figure 3-3. Note that two videos are covering the "Materials used to transfer oxygen in the CLC demonstration unit" presentation. This is also the case for the "Measuring the impact and business case of CO_2 capture with chemical looping combustion" presentation.

4 Publications

The CHEERS project planned to submit two PhD theses, 9 papers to reputational journals (subjected to review) and 18 publications for the proceedings of topical international conferences. As per date, 7 PhD theses have been defended and awarded, while two are still in progress (Table 4-1). Altogether 25 papers have been accepted by reputational journals, including two that have not been published yet (Table 4-2). Results from the CHEERS project have been presented 36 times at topical international conferences where 5 of them are published in proceedings (Table 4-3).

Table 4-1 CHEERS: PhD thesis

Name	Thesis	University	Supervisor (CHEERS)	Graduation
Ye Li	Research on the gas-solid reaction kinetics in chemical looping based on microfluidized bed thermogravimetric analysis	Tsinghua University	Ningsheng Cai	July 2020
Hu Chen	Experimental and Modeling study on Fluidization Characteristics of Pilot-Scale Chemical Looping Combustion System	Tsinghua University	Zhenshan Li	July 2021
Ewa Karchniwy	Detailed modeling of char conversion	Silesian University / NTNU	Adam Klimanek / Nils Erland L. Haugen	April 2022
Lei Liu	Research on Redox Reaction Characteristics and Microscopic Mechanism of Perovskite Oxygen Carriers in Chemical Looping	Tsinghua University	Zhenshan Li	July 2022
Thamali Rajika Jayawickrama	Numerical simulations of gasification of resolved biomass particles	Luleå Technical University (LTU)	Nils Erland L. Haugen	December 2022
Junjie Lin	Multiscale Numeric Study of Gas-Solid Flow and Chemical Reaction in Chemical Looping Combustion	Zhejiang University	Kun Luo	July 2022
Dali Kong	CFD Simulation of Biomass Gasification Coupling with CO_2 Adsorption	Zhejiang University	Kun Luo	July 2023
Yang Wang	Large Scale Production and Pilot Test of Perovskite Oxygen Carriers in 4MW Chemical Looping	Tsinghua University	Zhenshan Li	in study
Jinzhi Cai	First Principle based Multiscale Study of Redox Kinetics for Oxygen Carrier in Chemical Looping	Tsinghua University	Zhenshan Li	in study

*Table 4-2 CHEERS: Journal publications. Publications denoted * are open publications. Publications denoted ** are accepted but have no link as they are not published yet.*

Title	Authors	Journal	Link to publication
Fully resolved simulations of single char particle combustion using a ghost-cell immersed boundary method	Kun Luo, Chaoli Mao, Jianren Fan, Zhenya Zhuang, Nils Erland L. Haugen	AIChE Journal	Link
CO_2 Gasification of a Lignite Char in Microfluidized Bed Thermogravimetric Analysis for Chemical Looping Combustion and Chemical Looping with Oxygen Uncoupling	Ye Li, Hui Wang, Weicheng Li, Zhenshan Li, Ningsheng Cai	Energy & Fuels	Link
The melting characteristics of Vietnamese ilmenite and manganese ores used in chemical looping combustion	Lei Liu, Zhenshan Li, Weicheng Li, Ningsheng Cai	International Journal of Greenhouse Gas Control	Link
The effect of Stefan flow on the drag coefficient of spherical particles in a gas flow	Thamali R. Jayawickrama, Nils Erland L. Haugen, Matthaus U. Babler, M.A. Chishty, Kentaro Umeki	International Journal of Multiphase Flow	Link *
Drag force for a burning particle	Hancong Zhang, Kun Luo, Nils Erland L. Haugen, Chaoli Mao, Jianren Fan	Combustion and Flame	Link
Cold Model Study of a 1.5 MW_{th} Circulating Turbulent Fluidized Bed Fuel Reactor in Chemical Looping Combustion	Hu Chen, Zhenshan Li, Xinglei Liu, Weicheng Li, Ningsheng Cai, Sina Tebianian, Stéphane Bertholin, Mahdi Yazdanpanah, Aoling Zhang	Energy & Fuels	Link
The effect of Stefan flow on Nusselt number and drag coefficient of spherical particles in non-isothermal gas flow	Thamali R. Jayawickrama, Nils Erland L. Haugen, Matthaus U. Babler, M.A. Chishty, Kentaro Umeki	International Journal of Multiphase Flow	Link *
The effect of turbulence on mass transfer in solid fuel combustion: RANS model	Ewa Malgorzata Karchniwy, Ewa Malgorzata Karchniwy, Nils Erland L. Haugen, Adam Klimanek, Øyvind Langørgen, Sławomir Sładek	Combustion and Flame	Link *
A numerical study on the combustion of a resolved carbon particle	Ewa Karchniwy, Nils Erland L. Haugen, Adam Klimanek	Combustion and Flame	Link *

Title	Authors	Journal	Link to publication
Kinetic Parameters of Petroleum Coke Gasification for Modelling Chemical-Looping Combustion Systems	Agnieszka Korus, Adam Klimanek, Sławomir Sładek, Andrzej Szlęk, Airy Tilland, Stéphane Bertholin, Nils Erland L. Haugen	Energy	Link
Perovskite oxygen carrier with chemical memory under reversible chemical looping conditions with and without SO_2 during reduction	Lei Liu, Zhenshan Li, Zuoan Li, Yngve Larring, Ningsheng Cai	Chemical Engineering Journal	Link
Design Theory of a CLC Air Reactor with Oxygen Carrier Recirculation and Its Application to a 3 MW_{th} Pilot	Hu Chen, Zhenshan Li, Ruiwen Wang	Energy & Fuels	Link
Industry-scale production of a perovskite oxide as oxygen carrier material in chemical looping	Lei Liu, Zhenshan Li, Yang Wang; Zuoan Li, Yngve Larring, Ningsheng Cai	Chemical Engineering Journal	Link
Conversion characteristics of lignite and petroleum coke in chemical looping combustion coupled with an annular carbon stripper	Lei Liu, Zhenshan Li, Sanjun Wu, Dan Li, Ningsheng Cai	Fuel Processing Technology	Link
Solid Circulation Study in a 1.5 MW_{th} Cold Flow Model of Chemical Looping Combustion	Hu Chen, Zhenshan Li, Xinglei Liu, Weicheng Li, Ningsheng Cai, Stéphane Bertholin, Sina Tebianian, Mahdi Yazdanpanah, and Aoling Zhang	Industrial & Engineering Chemistry Research	Link
Heterogeneous reaction kinetics of a perovskite oxygen carrier for chemical looping combustion coupled with oxygen uncoupling	Lei Liu, Zhenshan Li, Zuoan Li, Yngve Larring, Ye Li, Ningsheng Cai	Chemical Engineering Journal	Link
Three-dimensional unsteady numerical simulation of a 150 kW_{th} full-loop chemical looping combustion pilot with biomass as fuel: A hydrodynamic investigation	Liyan Sun, Enrica Masi, Olivier Simonin, Øyvind Langørgen, Inge Saanum, Nils Erland L. Haugen	Chemical Engineering Science	Link
Numerical approaches for thermochemical conversion of char	Haugen, Nils Erland L, Loong, Brandon Ka Yan, Mitchell, Reginald E.	Progress in Energy and Combustion Science	Link *

Title	Authors	Journal	Link to publication
The effects of Stefan flow on the flow surrounding two closely spaced particles	Thamali R. Jayawickrama, M.A. Chishty, Nils Erland L. Haugen, Matthaus U. Babler, Kentaro Umeki	International Journal of Multiphase Flow	Link *
Building the world's largest Chemical Looping Combustion (CLC) unit	Nils Erland L. Haugen, Zhenshan Li, Vincent Gouraud, Stéphane Bertholin, Weicheng Li, Yngve Larring, Kun Luo, Andrzej Szlęk, Todd A. Flach, Øyvind Langørgen, Xinglei Liu, Mahdi Yazdanpanah	International Journal of Greenhouse Gas Control	Link *
Evaluation of CLC as a BECCS technology from tests on woody biomass in an auto-thermal 150-kW pilot unit	Øyvind Langøren, Inge Saanum, Roger Khalil, Nils Erland L. Haugen	International Journal of Greenhouse Gas Control	Link *
Chemical Looping Combustion of Petcoke Using Two Natural Ores in a 10 kW_{th} Continuous Pilot Plant: A Performance Comparison	Nicolas Vin, Kristina Bakoc, Arnold Lambert, William Pelletant, Stephane Bertholin	Energy & Fuels	Link
Fast redox kinetics of a perovskite oxygen carrier measured using micro-fluidized bed thermogravimetric analysis	Lei Liu, Zhenshan Li, Zuoan Li, Yngve Larring, Ye Li, Ningsheng Cai	Proceedings of the Combustion Institute	Link
Thermochemically Stable Novel Oxygen Carriers Based on CaMn1−*x*−*y*Ti*x*Fe*y*O3−*δ* for Chemical Looping	Zuoan Li, Yngve Larring	Published as part of Energy & Fuels virtual special issue “2024 Pioneers in Energy Research: Juan Adanez”	Link
Evaluation of two CaMn1− x−yTixFeyO3−δ-based granules oxygen carriers for chemical looping applications	Zuoan Li, Heiko Gaertner, Martin F. Sunding, Yngve Larring	Journal of Thermal Analysis and Calorimetry	Link

Table 4-3 CHEERS: Proceedings of topical international conferences.

Title	Authors	Proceedings	Link to publication
Demonstration of Chemical Looping Combustion (CLC) with Petcoke Feed for Refining Industry in a 3 MW_{th} Pilot Plant	Mahdi Yazdanpanah, Florent Guillou, Stephane Bertholin, Aoling Zhang	14th Greenhouse Gas Control Technologies Conference in Melbourne 21-26 October 2018 (GHGT-14)	Link
Heat balance analysis of a 3 MW_{th} pilot plant for CLC demonstration	Hu Chen, Mao Cheng, Lei Liu, Zhenshan Li, Ningsheng Cai, Weicheng Li	5th International Conference on Chemical Looping, 24-27 September 2018, Park City, Utah, USA	
Chinese-European Emission Reducing Solutions: Developing a new generation of chemical looping technology	Dr. Marko Maver, Nils Erland L. Haugen, Zhenshan LI, Mahdi Yazdanpanah, Stéphane Bertholin, Yngve Larring, Weicheng Li, Kun Luo, Andrzej Szlęk, Jens Hetland	5th International Conference on Chemical Looping, 24-27 September 2018, Park City, Utah, USA	
A framework for evaluating the effect of oxygen carrier characteristics on the performance of industrial-scale CLC using solid fuels.	Reyes-Lúa, Adriana and Kim, Donghoi, Linnerud, Marthe, Skjervold, Vidar T. and Anantharaman, Rahul	15th Greenhouse Gas Control Technologies Conference in Abu Dhabi 15-18 March 2021 (GHGT-15)	Link
Effect of wall boundary conditions on 3D hydrodynamic numerical simulation of a CLC unit with dual circulating fluidized-bed reactors	Liyan Sun, Enrica Masi, Olivier Simonin, Øyvind Langørgen, Inge Saanum, Nils Erland L. Haugen	13th International Conference on Fluidized Bed Technology, held online 10-14 May, 2021	Link