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Affordable High-Performance Green Redox Flow Batteries

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HIGREEW – Deliverable Report

D7.4 – HIGREEW I Workshop

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Summary

As stated in the Description of Work (under task 7.1), workshops will be addressed to the energy sector, battery manufacturers, and material developers; for central- and local governments and for other relevant stakeholders.

Officially two workshops have been planned and linked to two project deliverables: the first project workshop at M29 (March 2022) and a second one in the final stage of the project at M42 (April 2023).

This document reports on the programme and attendance of the first official project workshop organized by UWB in Pilsen (Czech Republic) the 2nd and 3rd of March.

Contents

2.3 Presentations

We had the opportunity to hear lectures of excellent speakers from world-known institutions and companies. The summary of all lectures is shown in Table 1 and

Table 2. Petr Kavalíř, director of New Technologies - Research Centre, University of West Bohemia, welcomed all attendees in his opening speech and introduced the hosting institution and importance of the 1st HIGREEW Workshop not only for the university but also for the whole Pilsener region. The role and market need of reliable energy storage was discussed by Vladimír Karas from Innogy from point of view of modern energy supplier. Karl-Heinz Pettinger (TZ Energie, University of Applied Sciences Landshut) clarified the significant role of stationary batteries in field of electromobility. The effort of European Union together with abundant opportunities for energy storage and EU policy framework was introduced by Aleksandra Kronberga (European Commission Directorate-General for Energy, Unit B5) and research and EU innovation support of stationary energy storage within Batt4EU was deeply clarified by Johan Blondelle (European Commission Directorate-General for Research and Innovation, Unit C2).
With the knowledge of market needs and EU support and opportunities, Petr Fischer (Fraunhofer ICT) introduced the concept of redox flow batteries with focus on recent activities in vanadium electrolyte recycling and manufacture of carbon composites for bipolar plates. Anthony Price (Flow Batteries Europe) explained where exactly the place of redox flow batteries on market is and clearly formulated the key advantages of redox flow batteries. It should be noted that one of the most important redox flow battery events was promoted, i.e., The International Flow Battery Forum 2022 (27-29 June 2022, Brussels, Belgium)[2].
Adam Whitehead (Invinity Energy Systems) and Pavel Mardilovich (CellCube/Enerox) showed in theirs exciting talks that vanadium-based redox flow batteries are a step forward the organic-based systems because they are being connected to grid in dozens of installations over the whole world. Petr Mazúr (NTC UWB) clearly summarized the status of research in organic-based redox flow batteries and he showed various chemistries that are being examined and developed for stationary storage. Eduardo Sánchez Díez, coordinator of HIGREEW project from CIC energiGUNE, clearly summarized the project achievements and discussed the challenges that are being solved within HIGREEW. Another H2020 project from LC-BAT-4-2019 call that is dealing with organic redox flow batteries, BALITH, was deeply introduced by Vicente Vert Belenguer from AIMPLAS – Plastics Technology Centre. The deep knowledge and experience with organic-based redox flow batteries together with recent progress and novel analytical methods suitable for organic-based systems was shared with workshop attendees in lecture of Michael J. Aziz (Harvard John A. Paulson School of Engineering and Applied Sciences). Despite the uncomfortable time shift, Thomas Nann, founder of Allegro Energy, clearly introduced the energy storage opportunities in Australia. During discussion, he had mentioned that his start-up develops new concept of microemulsion electrolytes that are suitable not only for various chemistries of redox flow batteries but also for supercapacitors. The first day of the workshop concluded Pekka Peljo (University Turku) with his lecture on computational screening of organic molecules that might be suitable for redox flow batteries and that is conducted within CompBat project.

Juraj Kosek (NTC UWB) opened as a chairperson the second day of the workshop with an overview, and he also clearly summarized the role of redox flow batteries in energy storage. During the second day the activities within HIGREEW project were deeply discussed. Eduardo Sánchez Díez followed his lecture from Day 1 with more details in selection of organic chemistry suitable for aqueous organic redox flow battery and he also introduced the pathway of electrolyte development. Autonomous University of Madrid is HIGREEW consortium member responsible for membrane development. Ivan Salmeron-Sanchez shown not only methods of membrane screening but also the impact of membrane modifications. Beside electrolytes and membranes, the electrode is the third active component of all redox flow batteries. Mathieu Etienne from CNRS explained that organic-based electrolytes excel in electrode kinetics on carbon felt electrodes. He also introduced the methodology that can classify the kinetics in bulk sample of carbon felt, and on

[2] https://flowbatteryforum.com/

individual fibres. Carbon felt storage conditions after some activation procedures might cause decay in electrode kinetics. The next step of organic redox flow battery development is testing of all active components together in laboratory flow cell. Václav Čmolík (NTC UWB) introduced the results of experiments and optimization of operational parameters. After verification of organic redox flow battery in laboratory conditions, the scale up to stack dimensions is the next step of technological development. Computational fluid dynamics (CFD) is useful tool that can minimize the experimental effort in prototyping of larger designs. Jiří Charvát (Pinflow energy storage) introduced the CFD results and model predicting shunt currents, another phenomenon that must be considered in scaling from flow cells to stacks. Experiments verifying the results from mathematical models were also introduced.
All other issues that must be handled in scale up of HIGREEW redox flow battery stacks were introduced by John Collins from C-Tech Innovation. The HIGREEW project should be concluded with verification of developed battery prototype of industrial parameters. Integration of technology from laboratory bench-scale into containerized redox flow battery in industrial standards was presented by Michael Schäffer from Fraunhofer ICT. Metrics such as levelized costs of energy storage are important descriptor describing the battery from market point of view. Eid Maraqah (Gamesa Electric) summarized how the techno-economic analysis allow to keep track with the project targets. The destination of testing of HIGREEW redox flow battery prototype are tough field conditions of La Plana. The lecture of Antonio Riesco from Siemens Gamesa was the teaser of the final steps in HIGREEW that has concluded the 1st HIGREEW Workshop. He introduced the La Plana Hybrid Facility of Siemens Gamesa that allows connection of various energy storage technologies to grid and also verifies their integration with wind and photovoltaic powerplant. It should be noted that all lectures were followed with lively discussion that often continued in ZOOM chat or during breaks on-site.

2.4 Used dissemination and communication tools and documents

In order to both promote the event, and – at the same time – inform and update the general public on the project workshop and its purpose, several dissemination tools and documents have been created.
Communication activities started several weeks/months before the HIGREEW Workshop I date. For example:

- First news item concerning the event
- Banner used for social media publications
- Preliminary programme of the HIGREEW Workshop I

Below an overview and print screens of the used documents and tools.

Figure 5: HIGREEW Workshop I final programme

Figure 6: Document explaining how to reach the location

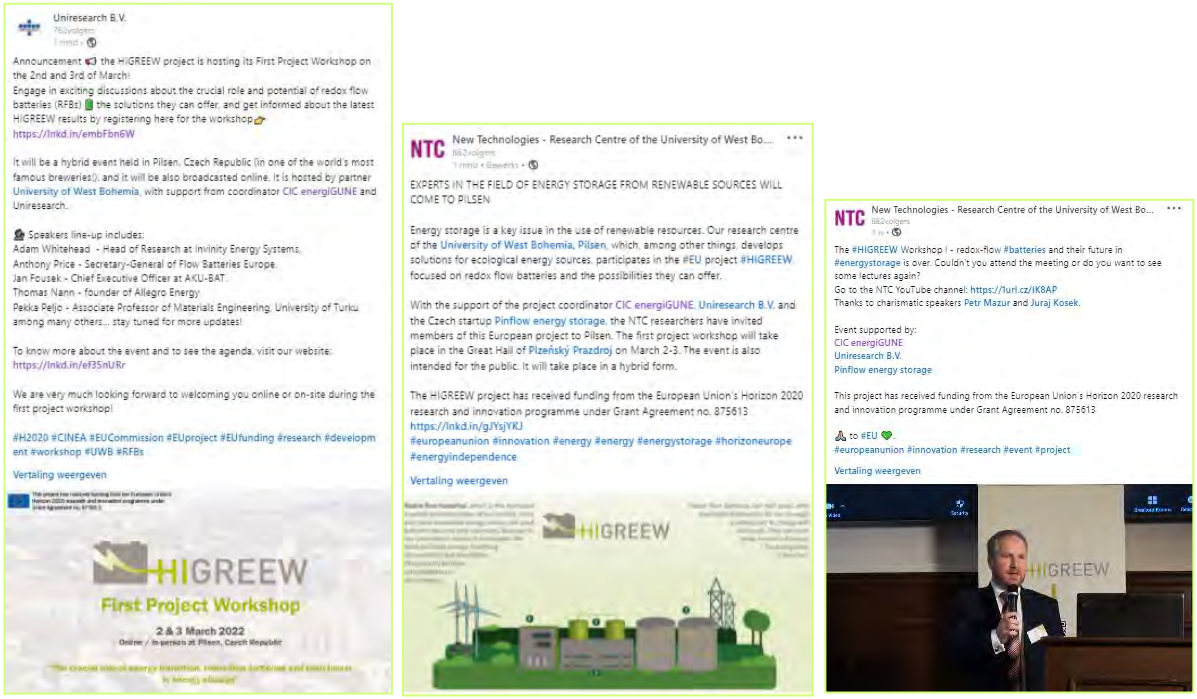

Figure 7: Selected social media posts on the workshop

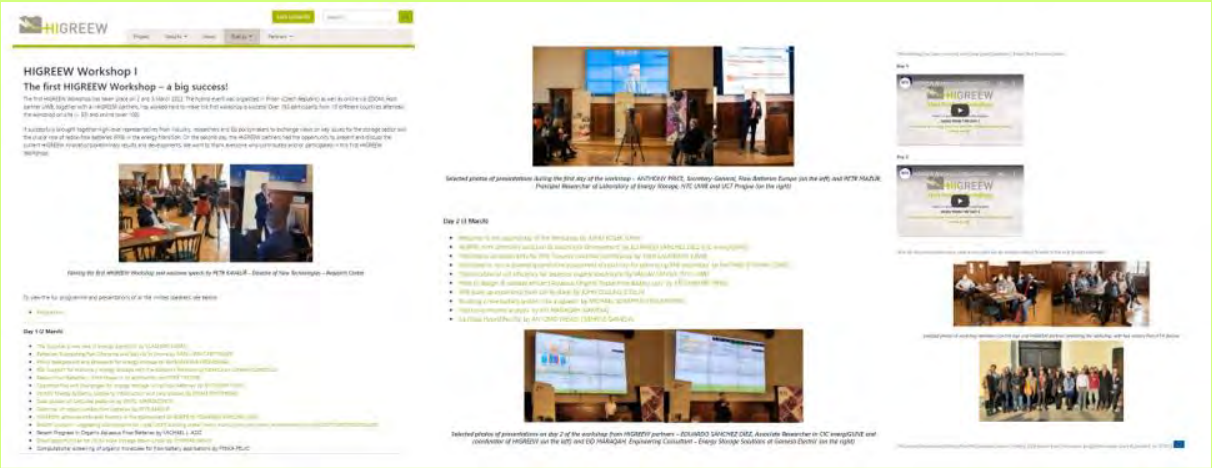

Figure 8: Final page dedicated to the workshop on the HIGREEW Website

2.5 Selected Pictures

Figure 9: Registrations.

Figure 10: Welcome speech of NTC UWB director Petr Kavalíř.

Figure 11: On-site audience.

Figure 12: Lecture of Peter Fischer from Fraunhofer ICT.

Figure 13: Anthony Price from Flow Batteries Europe.

Figure 14: Recording on-site.

Figure 15: Ongoing discussion with Johan Blondelle, policy officer from European Commission Directorate-General for Research and Innovation, Unit C2.

Figure 16: Refreshments and networking during break.

Figure 17: HIGREEW consortium.

Figure 18: Excursions - Pilsner Urquell brewery (top) and NTC UWB (bottom).

3 Follow up

The 1st HIGREEW Workshop was excellent event that help to share the latest progress in redox flow batteries. After long time, the possibility to meet with the community was gratifying from professional point of view but also from personal point of view. HIGREEW consortium thanks to workshop participants for their attendance and obtained positive feedback. The words of thanks were provided directly to all registered attendees. The presentations and full recordings from the workshop are publicly available on HIGREEW website[3]. A second workshop is planned towards the end of the project at M42 and will be organised by the project coordinator CIC energiGUNE at the partner's venue.

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Project partners:

#	Partner	Partner Full Name
1	CIC energiGUNE	CENTRO DE INVESTIGACION COOPERATIVA DE ENERGIAS ALTERNATIVAS FUNDACION, CIC ENERGIGUNE FUNDAZIOA
2	GAMESA	GAMESA ELECTRIC SOCIEDAD ANONIMA
3	UAM	UNIVERSIDAD AUTONOMA DE MADRID
4	CNRS	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS
5	C-TECH	C-TECH INNOVATION LIMITED
7	UWB	ZAPADOCESKA UNIVERZITA V PLZNI
8	PFES	PINFLOW ENERGY STORAGE, S.R.O.
9	UNR	UNIRESEARCH BV
10	SGRE	SIEMENS GAMESA RENEWABLE ENERGY
11	FRAUNHOFER	FRAUNHOFER INSTITUTE FOR CHEMICAL TECHNOLOGY

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[3] https://higreew-project.eu/higreew-workshop-i/