



# LONG LASTING BATTERIES

Bringing Ni-Zn back to accelerate the European Energy Transition

## Objectives of the project

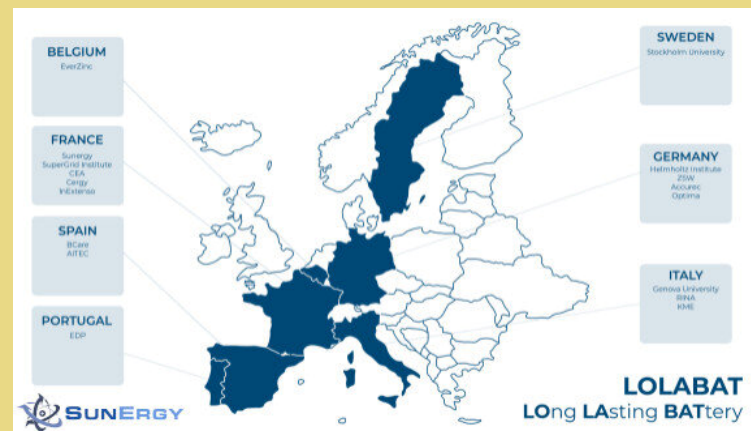
The aim of the LOLABAT project, funded by the European Commission through the Horizon 2020 programme is to demonstrate a new promising **Nickel Zinc battery** that can complement Europe's offer of energy storage technologies. Indeed, this technology offers advantages like **high cyclability** with 2000 cycles already demonstrated at deep discharge and high C-rate, involving ability to high power, abundance and availability of **raw materials, which are non-toxic elements with high recycling potential**. Furthermore, it presents **no risk of thermal runaway and therefore high safety**. Regarding the global environmental issues and pressing energy transition needs, this energy storage technology is ideal for the **next-generation battery** for stationary energy storage.

### LOLABAT ambition (2024 and after):

Cycle life increase -> up to 4000 cycles at 100% DoD by the end of the project

Developing NiZn for grid applications in LOLABAT & its preparation for a production in Europe by increasing its TRL via:

- **Capacity upscaling**
- Design and integration of **BMS and sensors** built up in battery pack
- Testing and demonstration in stationary energy storage applications via **six use cases in utility grid and industrial sites**
- Preparation for a future industrialisation by
  - realisation of life cycle and life cycle cost analyses: **LCA & LCCA**
  - **Recycling studies**
  - assessment of **Norms**
  - **Standards and grid compliancy**,
  - realisation of **business model and market studies**
  - and finally an extensive **dissemination and communication** of the project results and NiZn technology



## Objectives of the project

### News & Events

SUPEHR23 LOLABAT Conference

Project Technical Progress

Dissemination activities

Project meeting

## Inside this Issue

# News Events

## SUPEHR23



The “Sustainable PolyEnergy generation and HaRvesting” (SUPEHR23) conference is the dedicated conference planned inside LOLABAT project. It took place between 6th and 8th September 2023 at Savona University Campus (one of the project demo-sites) with the participation of International Academic and industrial partners. This event was a success with more than 100 people attending the plenary session, keynotes, technical sessions and workshops and it marked an important point in the dissemination of the project and it will continue after with the publication in October 2023 of two special issues in prestigious scientific journals.



The Conference Chair was **Paolo Silvestri**, Ph.D, assistant professor and researcher at University of Genova (UNIGE is Lolabat WP7 leader - Dissemination, Exploitation and Communication). **Cecilia Torti**, Ph.D, SIT Technologies, was a supervisor of the event with regards to scientific and organization aspects.

The Conference provided an unprecedented opportunity for the academic and industrial communities to meet in a highly interdisciplinary environment, to investigate new ideas, to share innovative solutions, and to discuss future research directions in the area of **energy storage battery technology, battery system/technology level and coupling in power plants and hybrid systems and of polygeneration**. Invited speakers presented potential applications for enhanced power generation efficiency, synergies with alternative technologies, industry-academia collaborative framework, intellectual property management and others.



Savona (Italy), 6<sup>th</sup>-8<sup>th</sup> September 2023

# News Events

# SUPEHR23



Technical papers have been presented and other conference events took place, such as Plenary sessions, Keynotes, technical visits and an exhibition from sponsoring companies. The main topics, one for each day of the conference, were:

- *electrochemical and alternative energy storage (1<sup>st</sup> day),*
- *thermal and electrical hybrid systems, sustainable power plants (2<sup>nd</sup> day),*
- *energy micropolygeneration and harvesting (3<sup>rd</sup> day).*

At the beginning of each day, a **plenary session** has been scheduled of general interest related to the Conference topics. In the afternoon a **keynote session** is also scheduled related to the specific topic of the day.

**Sustainable PolyEnergy generation and HaRvesting**  
Conference and Exhibition  
Savona (Italy), 6th - 8th September 2023

**SUPEHR23**

Updated 29<sup>th</sup> August 2023

Contributions from **19 countries** were received. In details:

53 technical papers and 10 oral presentations.

So it was possible to define **technical sections along the 3 days** scheduled according the Conference program published on the conference web site:

<https://supehr23.unige.it/it>

Papers are published **open access** (which is a plus to disseminate project results), **indexed by Scopus** and available at the conference web site and at the following link:

|             | Wednesday<br>6 <sup>th</sup> September 2023                        | Thursday<br>7 <sup>th</sup> September 2023                              | Friday<br>8 <sup>th</sup> September 2023         |
|-------------|--|---|--|
|             | <b>Electrochemical And Alternative Energy Storage</b>              | <b>Thermal And Electrical Hybrid Systems – Sustainable Power Plants</b> | <b>Energy Micropolygeneration And Harvesting</b> |
|             | <i>Track Chair:<br/>Dr. Maria Paola Carpanese</i>                  | <i>Track Chair:<br/>Dr. David Tucker</i>                                | <i>Track Chair:<br/>Dr. Daria Bellotti</i>       |
| 8.00-8:30   | Registration   |   |  |
| 8.30-9.00   | Opening session  | Registration  | Registration                                     |
| 9.00-11:00  | Plenary session  | Plenary session   | Plenary session                                  |
| 11.00-11.20 | Coffee break & Exhibition time                                     | Coffee break & Exhibition time  | Coffee break & Exhibition time                   |
| 11.20-12.40 | Conference sessions  | Conference sessions   | Conference sessions                              |
| 12.45-14.00 | Lunch  | Lunch   | Lunch  |
| 14.00-16.00 | Keynote Sessions   | Keynote Sessions  | Keynote Sessions                                 |
| 16.00-16.20 | Coffee break & Exhibition time                                     | Coffee break & Exhibition time  | Coffee break & Exhibition time                   |
| 16.20-17.40 | Conference sessions  | Conference sessions   | Conference sessions                              |
|             | Tirreno Power combined cycle & Reception<br>Cocktail – 18.00-20.00 |   |  |
|             |  | 20.00 – Gala dinner   |  |



<https://www.e3s-conferences.org/articles/e3sconf/abs/2023/51/contents/contents.html>

**download the conference proceedings**

# News Events

## SUPEHR23



The **Scientific Technical Committee** of the conference includes **Lolabat Coordinator** and all the **WP Leaders** (<https://supehr23.unige.it/it/node/13>), in addition experts from industrial and academic world.

The main events inside the conference where **Lolabat consortium** was widely directly involved have been:

Keynote session “**Battery Energy Storage Systems**” (part 1) on 6th September (DAY 1) offered all delegates. Chairs: **Fabrice Fourgeot**, LOLABAT-SUN and **Paola Carpanese**, University of Genoa (part 1)

Keynote session “**Battery Energy Storage Systems**” (part 2) on 6th September (DAY 1) offered all delegates. Chairs: **Shadi Mirhashemi**, LOLABAT-SUN and **Nora Ganzinelli** (RINA-C) – Italy (part 2)

**Lolabat Workshop** on 7th September (DAY 2) - (Chair: Fabrice Fourgeot and Shadi Mirhashemi - SUNERGY) where at the end was held a Visit to the NiZn batteries laboratory in Savona Campus.

Special **technical sessions** drafts were scheduled inside the conference with topics very close to the ones of Lolabat projects. Among these, the most significant scheduled technical sessions were:

- Development of storage systems: **hardware**;
- Development of storage systems: **modelling**;
- Integration of storage systems;
- Development of storage systems: **materials**.

Papers from Lolabat Consortium were presented also in these technical sections.



<https://www.e3s-conferences.org/articles/e3sconf/abs/2023/51/contents/contents.html>

download the  
conference proceedings



# News Events

## SUPEHR23



### Keynote Sessions

Auditorium "Tirreno Power" (Room AN1)

6<sup>th</sup> September : Battery Energy Storage System

#### Battery Energy Storage Systems (Part 1)

"Auditorium Tirreno Power" – Room AN1

Moderators: Fabrice Fourgeot, LOLABAT Coordinator, Sunergy  
Maria Paola Carpanese, University of Genova



**Speakers:**

**Zn based batteries, including NiZn,** Fabrice Fourgeot, SUNERGY – LOLABAT coordinator (France)

**SUPEHR23-37 – Modelling Gas Evolution in Aqueous Nickel-Zinc Battery Cells;** Britta Doppl, Niklas Herrmann, Felix Konrad Schwab and Birger Horstmann, DLR

**SUPEHR23-70 – Current state of Na-Zn battery research;** Norbert Weber Helmholtz-Zentrum Dresden-Rossendorf

**A review on comparison of different electrochemical technologies (performance and cost),** Alba Saenz, BCARE – Spain

**Perspectives of the zinc battery market,** Grégory Sacré, EverZync Group SA - Belgium



14:00-16:00

### Keynote Sessions

Auditorium "Tirreno Power" (Room AN1)

6<sup>th</sup> September : Battery Energy Storage System

#### Battery Energy Storage Systems (Part 2)

"Auditorium Tirreno Power" – Room AN1

Moderators: Shadi Mirhashemi, Sunergy  
Nora Ganzinelli, RINA-C

**Speakers:**

**Graphite Resilience For lithium-Ion baTtery anodes through a sustainable European End-to-End supply Chain,** Nora Ganzinelli (RINA-C)

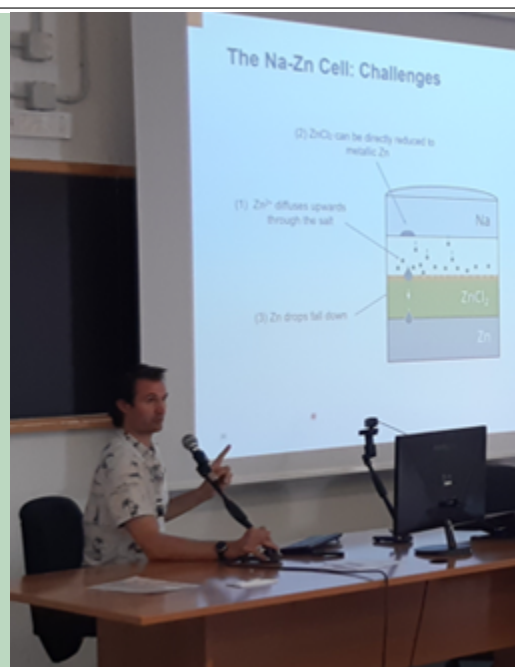
**SUPEHR23-72 - Development of new polymer coatings for Nickel-Zinc battery separators;** David Vidal, Odile Fichet, Linda Chikh and Séverine Alfonsi, Cergy Paris University - CYU, France

**SUPEHR23-71 - Electrochemical properties and performance optimization of the Na-Zn All-Liquid Cell;** William Nash, Tom Weier, Martins Sarma and Norbert Weber, Helmholtz-Zentrum Dresden-Rossendorf

**High-energy density graphene-based electrochemical double layer capacitors;** Sebastiano Bellani (BeDimensional)

**Integrating electrical storage and generation in industrial environments through Advanced Grid Interfaces (AGISTIN project);** Gianluca Lipari (EPRI)

16:20-18:00



# News Events

## SUPEHR23 LOLABAT Workshop

Room MA218

7<sup>th</sup> September: LOLABAT WORKSHOP

### LOLABAT WORKSHOP

Room MA218

Moderators: Fabrice Fourgeot, LOLABAT Coordinator - Sunergy  
Shadi Mirhashemi, Sunergy

**Speakers:**

Involved EU research projects: LOLABAT

Contributions:

**SUPEHR23-58 – Game-changing breakthroughs in Ni-Zn battery development: RNZB in LOLABAT project for a next-generation stationary energy storage battery**, Fabrice Fourgeot, Shadi Mirhashemi and Alice Boudet - SUNERGY

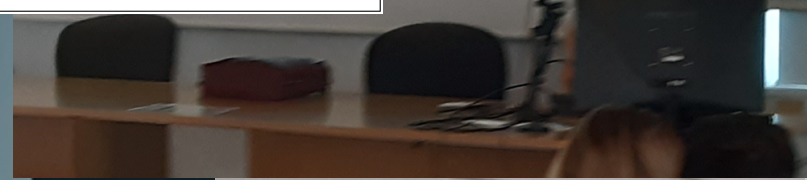
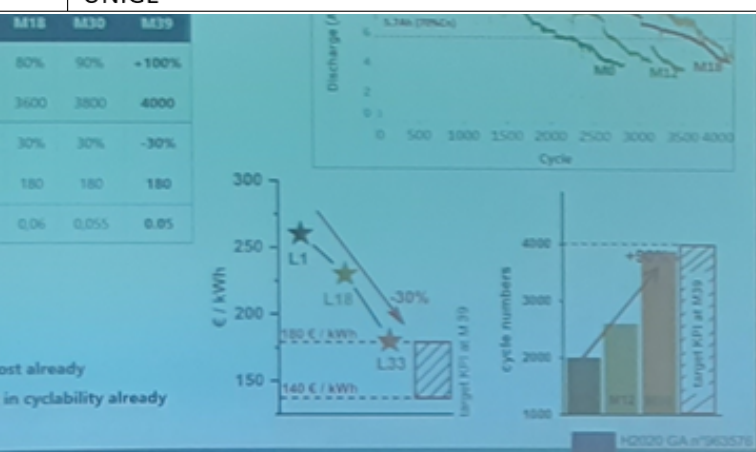
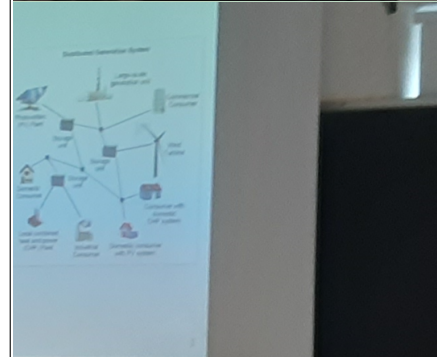
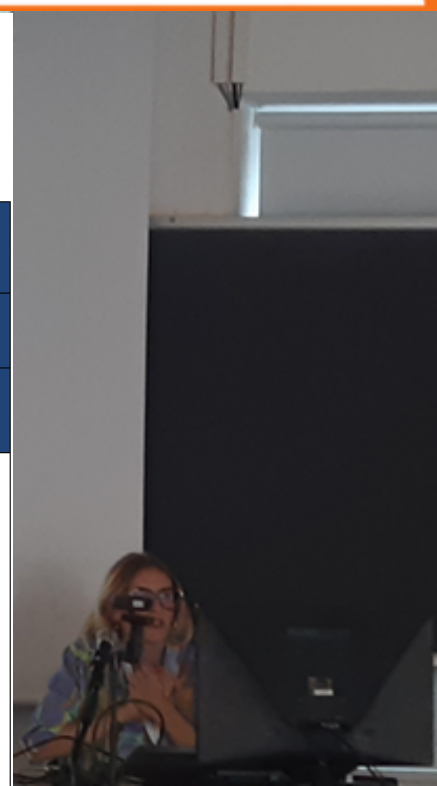
**SUPEHR23-30 – Energy management and load profile optimization of 10 kWh BESS integrated into a Smart polygeneration grid subnetwork** Martina Raggio, Carlo Alberto Niccolini Marmont Du Haut Champ, Tommaso Reboli, Paolo Silvestri and Mario Luigi Ferrari – University of Genova

**NiZn Battery: Environmental Impacts and Cost Analysis**, Ashwani Kumar Malviya – AITEC-Parque TecnológicoValencia-Spain

**Energy storage integration in an electro-intensive industry applications**, Samuele Da Ronch (RINA Consulting)

**Visit of the NiZn batteries laboratory in Savona Campus**, Matteo Pascenti and Paolo Silvestri - UNIGE

11:20-12:40



# News Events

## SUPEHR23



The SUPEHR23 conference has been organized in **synergy with similar H2020 projects (Sister projects)** sharing the general objectives on innovative battery technologies, allowing to highlight the importance of such technologies for a low carbon footprint energy approach and influencing the public opinion and awareness on the emerging technologies in this field.

In this way it has been possible to organize inside the conference **additional workshops with the contribution of involved H2020 Sister projects**. Hereafter the Supporting European Research Projects:

### International Cooperation Workshop (Sustainable energy and international cooperation)

Involved EU research projects: ONEPlanET, JUST GREEN AFRH2ICA, CIRAWA, HYDRO4U

### Thermal storage Workshop (THUMBS UP)

Involved EU research projects: BEST STORAGE, THUMBS UP, ECHO, HYSTORE

### Innovative CSP and sCO<sub>2</sub> power cycles Workshop

Involved EU research projects: SHARP-sCO<sub>2</sub>, SOLARSCO2OL, CO2OLHEAT, HybridPLUS

### Clean Maritime Technologies Workshop

Involved EU research projects: ENGIMMONIA, ZHENIT, SEANERGY, NH3CRAFT, RAISE

### Islands Workshop Workshop

Involved EU research projects: INSULAE, ROBINSON

## Affiliated projects



SOLSTICE (G.A. n°963599)



ROBINSON (G.A. n° 957752)



FLEXnCONFU (G.A. n° 884157)



NextMGT (G.A. n°861079)



IANOS (G.A. n° 957810)



# Project Technical Progress

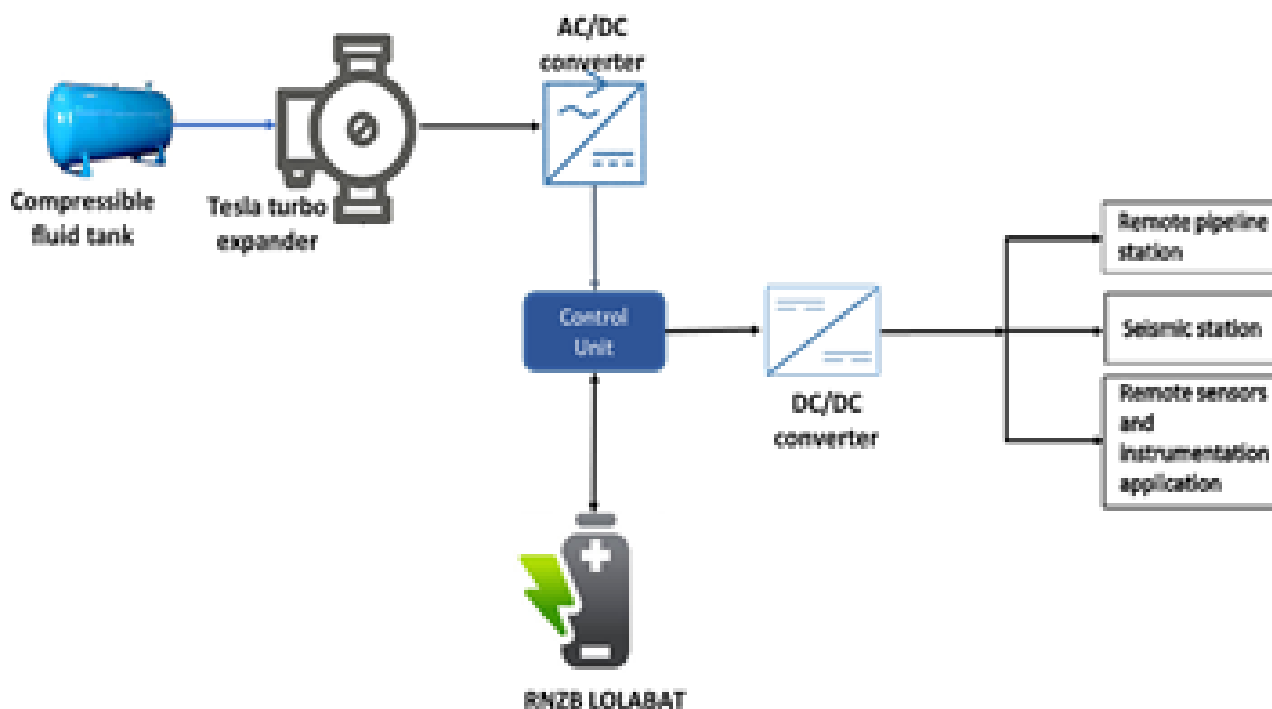
WP6: RNZB performance demonstration for stationary energy storage applications

## Reception of two 100Ah NiZn modules at the University of Genoa (2.5 kW and 7.5 kW): get ready for the demo cases!

The provided battery packs built by CEA ready to be used for the demo cases and validation works in WP6 are made with NiZn modules (8 cells of 100Ah in series) and the integration of sensors and battery management system (BMS) to perform a correct energy management. Battery packs were provided with their specifications, operating instructions and safety sheet to assure an efficient delivery of battery packs to the end-users and providing relevant training.

### June 2023

The battery pack of 2.5kW with 2 modules of 100 Ah (the small energy package) was provided in June 2023 to Savona Campus of the University of Genoa ready for use in WP6 validation works industrial application. This application actually is in progress and its aim is to validate NiZn battery as energy storage for remote autonomous low voltage supply solutions.



*Micro scale application for battery integration into autonomous smart meters, powered by energy harvesting device (Tesla turbine expander)*



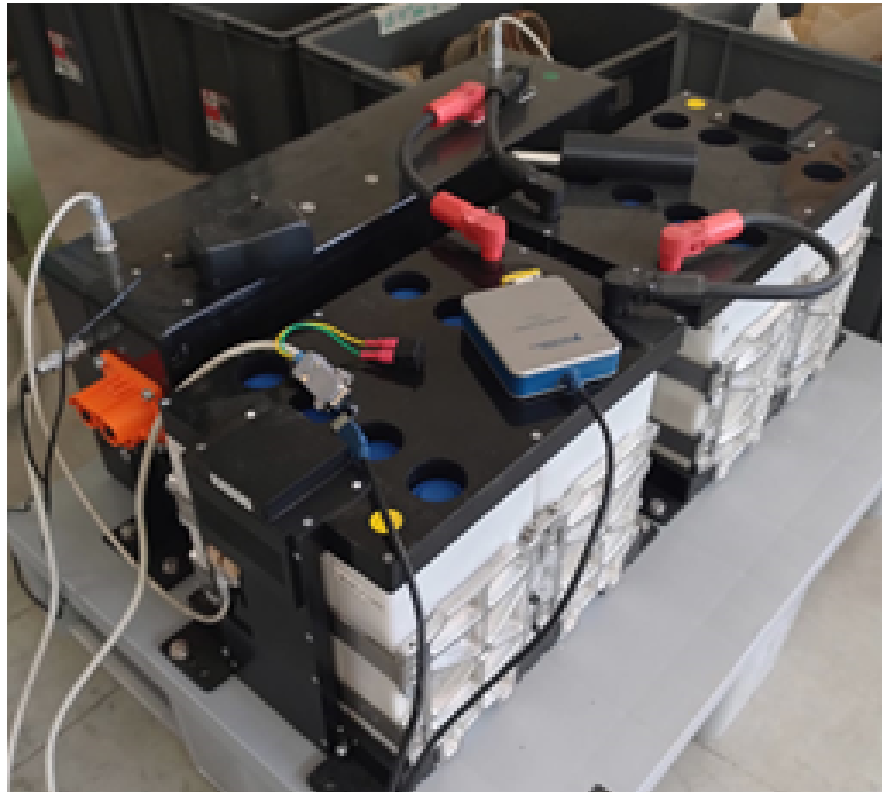
# Project Technical Progress

WP6: RNZB performance demonstration for stationary energy storage applications

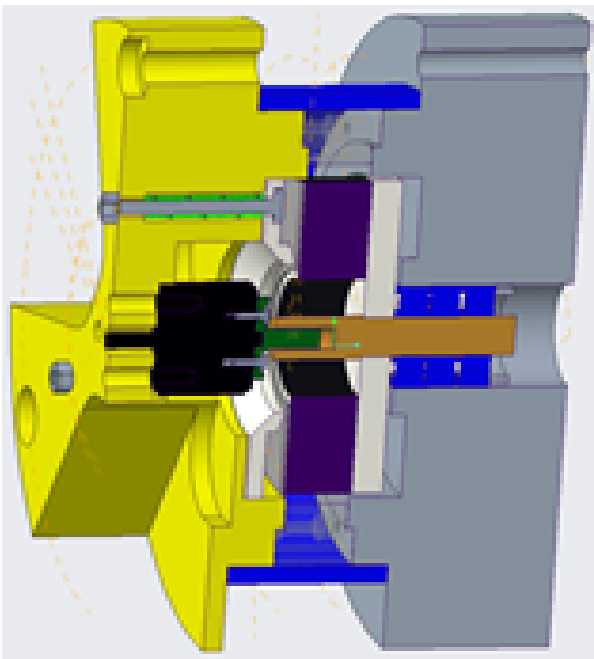
**Reception of two 100Ah NiZn modules at the University of Genoa (2.5 kW and 7.5 kW): get ready for the demo cases!**

June 2023

The NiZn battery pack has been installed into an integrated system equipped with particular energy harvester bladeless turbo expander that can convert any fluid stream in electricity and can therefore supply dedicated sensor systems in remoted and isolated areas.



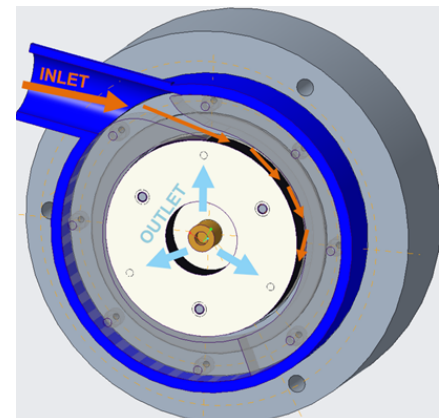
*Battery pack of 2.5kW with 2 modules of 100 Ah and BMS*



*Tesla expander connected to an high speed generator*

In this context, NiZn batteries will ensure an increasing of the reliability of this system. This application is an opportunity to tests small energy packages of 2.5 kWh and allows to validate that the NiZn batteries technology guaranties a smooth integration in the use-case test environments.

**LOLABAT Tesla Turbine**  
 Power produced: 130W  
 Tesla air flow: 0.012m<sup>3</sup>/min  
 (at 4.3barg)  
 Rotational speed: 20krpm



# Project Technical Progress

## WP6: RNZB performance demonstration for stationary energy storage applications

### Reception of two 100Ah NiZn modules at the University of Genoa (2.5 kW and 7.5 kW): get ready for the demo cases!

#### August 2023

The big NiZn pack (battery pack of 7.5kW with 6 modules of 100 Ah) installed inside a specific cabinet was provided in August 2023 to the Innovative Energy Systems Laboratory (IES Lab.) in the Savona's Campus of University of Genova. Battery pack is now ready for use in WP6 validation work "Energy Balancing in Smart Buildings with rechargeable NiZn battery". The Innovative Energy Systems Laboratory (IES Lab.) in the Savona's Campus of University of Genova (<http://www.tpg.unige.it/TPG/ies-laboratory/>).



3 modules of the big battery pack on a cabinet sliding shelf



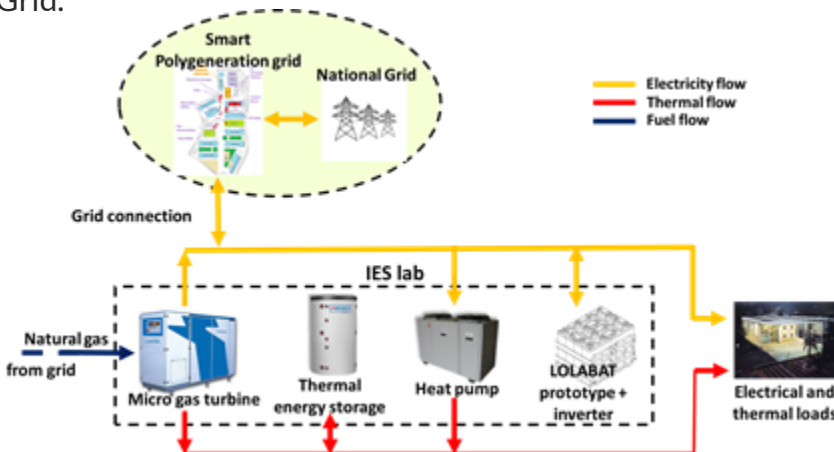
The purchased Inverter Santerno for the connection of the battery pack to the Savona campus smart grid

This application is a stationary energy storage application and aims to evaluate the performance of the NiZn batteries and the synergy with micro gas turbine, thermal energy storage and heat pump in a real civil scenario, since IES plant is connected to the local Polygeneration grid serving the Campus in terms of heat (local Heating District Network) and electricity. This application has required an inverter installation at the IES Lab for the connection of the battery pack to the smart grid. In addition, a DCDC converter allows to rise the battery pack output voltage to make it fit for the inverter. The DCDC converter has been installed inside the battery cabinet together with the BMS and related connector blocks. The battery pack is being integrated in the multi-device plant (in a "plug and forget" mode) to verify a better management of the energy shared with the grid, allowing to satisfy both thermal and electric demands.

In the next month's two validation scenarios will be tested: on-grid application and island mode. An energy management system (EMS) has been developed and will be used in the validation work. So the results will allow to validate the implementation and performances of NiZn battery pack into a multidevice plant connected to a Smart Grid.



Battery Pack Cabinet with inside 6 modules of NiZn cells, DC-DC converter, power Unit-BMS and connector blocks (side DCDC and inverter) work.



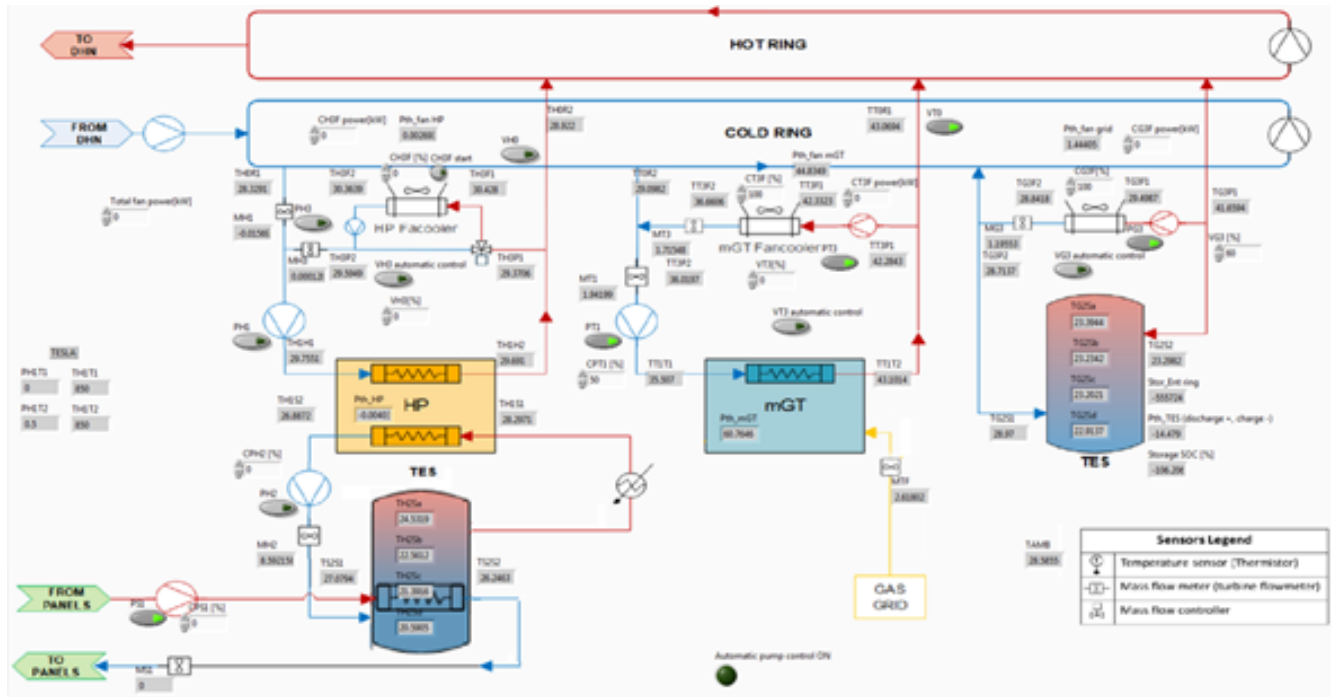
Implementation and performances of NiZn battery pack into a multi-device plant connected to a Smart Grid

# Project Technical Progress

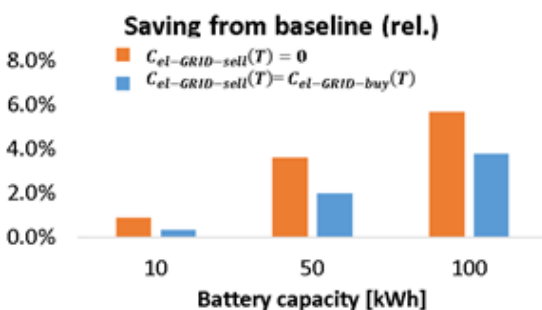
## WP6: RNZB performance demonstration for stationary energy storage applications

### T6.3 BESS Contribution to smart distribution grid management

#### Energy management and load profile optimisation of 10 kWh BESS integrated into UNIGE Smart Polygeneration Grid subnetwork – a “Cyber Physical approach” and simulations



UNIGE Smart Polygeneration Grids integrate different prime movers, such as traditional generators, renewable energy sources and energy storage systems to locally supply electrical and thermal power to achieve high conversion efficiencies and increase self-consumption. Integrating different energy systems poses some challenges on the plant Energy Management Systems (EMS), which must accommodate different operational requirements while following the electrical and thermal loads. Battery Energy Storage Systems (BESSs) can provide additional flexibility to the system. A UNIGE activity in WP6 evaluated the impact of integrating a Ni-Zn-based BESS into an existing cogeneration plant through a dedicated sensitivity analysis over the operative characteristics of the BESS itself (maximum power and capacity). The IES LAB of the Savona’s Campus already contains different energy systems: a cogenerative micro gas turbine, a heat-pump, solar thermal panels and two thermal energy storage systems that provide electricity and thermal power to the Smart Polygeneration Grid of the Campus. A new developed energy scheduler accommodates the integration of the new battery and meets the electrical and thermal demands. The aim of this work was to demonstrate that integrating the BESS provides additional benefits in the system management and can reduce fuel usage and OPEX. By relying on such energy scheduler, several simulations were performed in different scenarios which involve variable electrical market parameters like electricity purchasing cost and selling price; in this way, the best plant strategy which maximizes plant economical revenue can be found and then implemented in real-time by relying on a suitable plant control system. The obtained results show that by adding the Ni-Zn based BESS to the original energy system, an economical saving is obtained with respect to plant baseline cost which increases in a monotonic way with BESS capacity.



Moreover, such economical saving depends even on the current electricity market but, in this case, further developments are needed to better assess the influence of this. Adding a battery can lead to significant cost savings, especially when electricity cannot be sold. Cost savings increase with higher energy storage capacity. The next steps of this work can be adding a sensitivity analysis over the Crate, Depth of Discharge (DoD) and number of the BESS. In fact, extending the analysis over these parameters will help to better quantify and maximize the performance of the plant.

Additional information in:

[https://www.e3s-conferences.org/articles/e3sconf/abs/2023/51/e3sconf\\_supehr2023\\_03008/e3sconf\\_supehr2023\\_03008.html](https://www.e3s-conferences.org/articles/e3sconf/abs/2023/51/e3sconf_supehr2023_03008/e3sconf_supehr2023_03008.html)



# Dissemination Activities

## Participation of the partners to events and conferences to present the project

RINA had participated in **TALENT project final event** (supported by EASE), that was held on June 22nd in Brussels and presented LOLABAT project.

TALENT project has developed new designs and architectures for power electronics aiming at cost reduction, thus boosting the integration of electric batteries along the power system. The participation of **RINA** to the round table on Electric Battery Integration in the Electric System for Flexibility Purposes was the occasion to introduce the LOLABAT project to the audience but also to share insights and explore innovative solutions for a sustainable energy future.



## LOLABAT was present in Brussels at the **EUSEW**



The **European Sustainable Energy Week (EUSEW)** is the biggest annual event dedicated to renewables and efficient energy use in Europe. It is organised by the European Climate, Infrastructure and Environment Executive Agency (CINEA) and the Directorate-General for Energy. This year EUSEW has returned on **20-22 June 2023** in a hybrid format, in Brussels and online. The LOLABAT project has been presented in Brussels within **RINA** stand: "Climate change and energy transition: Innovative solutions and hydrogen applications" together with other projects on the topic. This participation in the largest annual event dedicated to renewable energy and efficient energy use in Europe, has allowed the LOLABAT project to increase its visibility and has facilitated a constructive exchange of information aimed at building a secure energy future for Europe.



# Project Meeting

5th Steering committee meeting – 13-14th June 2023

M30 - Outlines of the project & objectives (reporting period: 15/12/2022 -> 14/06/2023)

University of Genova (Savona Campus) - Italy

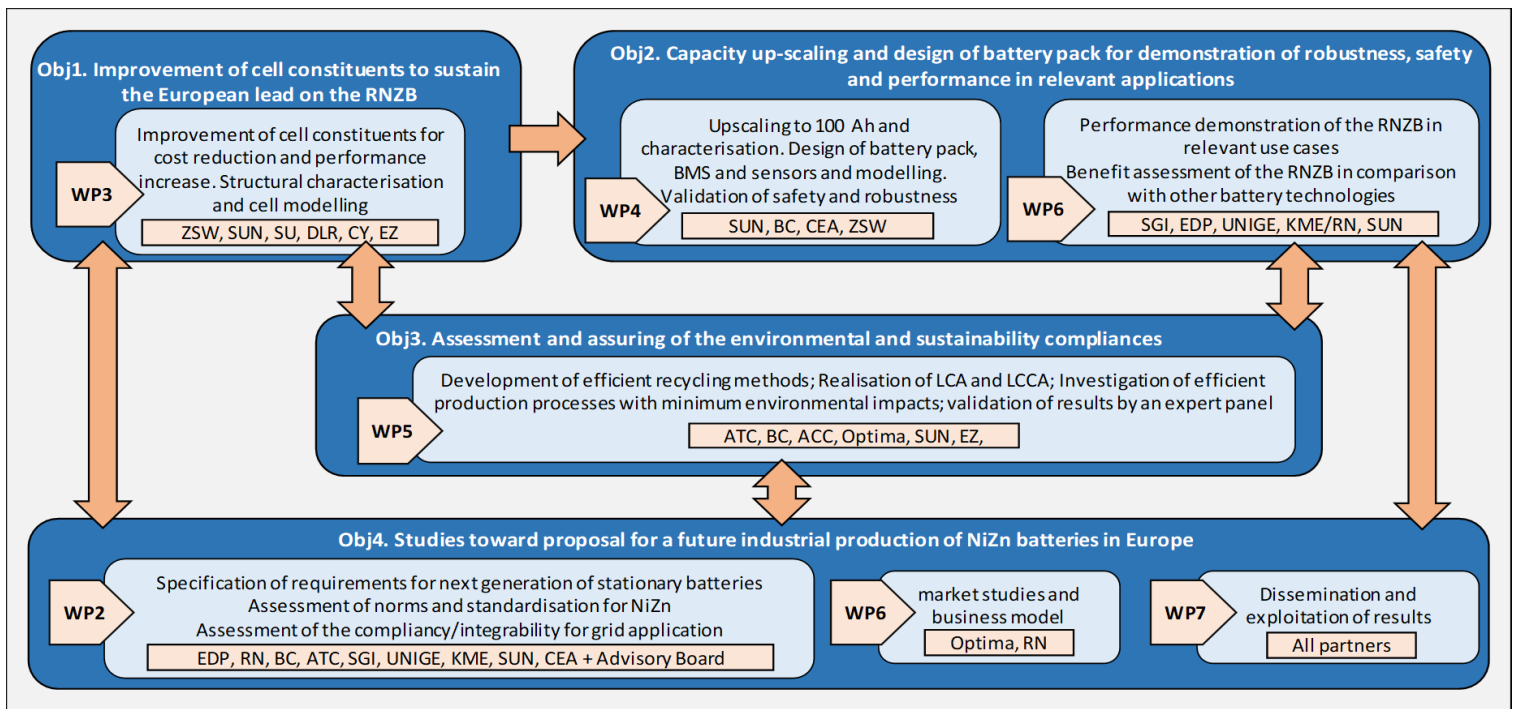


Savona Campus - one project demo site



Visit to Savona Campus facilities

Meeting room



- Welcome address, brief presentation of the Savona Campus - University of Genoa
- Presentation of the project Outlines of the project & Objectives
- WP1-7 status
- Advisory Board members overview (Results feedback, Potential applications feedback, Industrial and market deployment vision)
- Visit to Savona Campus facilities