CONSORTIUM

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Università di Bologna
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PROJECT PROFILE

OVERALL GOAL
Development of a sustainable hybrid storage system based on high-power vanadium redox flow battery and supercapacitor technology.

FUNDING PROGRAMME
HyFlow receives funding from the European Union's Horizon 2020 research and innovation programme.

PROJECT NUMBER
963550

PROJECT DURATION
November 2020 – October 2023

TOTAL BUDGET
EUR 3.9 million EU funding

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SCAN ME

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 963550.

HyFlow

HYBRID ENERGY STORAGE SYSTEM

DEVELOPMENT OF A SUSTAINABLE HYBRID STORAGE SYSTEM

based on high-power vanadium redox flow battery and supercapacitor technology

OBJECTIVES

VISION

HyFlow´s hybrid energy storage system

SUSTAINABLE | COST-EFFECTIVE | HIGHLY FLEXIBLE

AFFORDABLE AND CLEAN ENERGY SUPPLY

Carbon neutrality and climate resilience are the main motivators for research and innovation actions in energy systems in the 21st century. The Paris Agreement and the Sustainable Development Goals from the United Nations lead the way to a more sustainable future. Efficiency improvements and the expansion of renewable energies in smart grids are essential to achieve an affordable and clean energy supply.

The increasing share of renewable energies in the European energy market poses new challenges to both private and public grid operators. Modern energy grids are influenced by the fluctuations of renewable generation as well as load peaks of private and public grids. In order to absorb those power peaks, modern grids need more dynamic storage systems.

HIGH STORAGE CAPACITY AND HIGH POWER

HyFlow is meeting these challenges with the development of a **Hybrid Energy Storage System (HESS)**. The system guarantees the fast and flexible availability of electricity by managing load peaks of private and public grids as well as renewable energy production. It will be capable of meeting high energy demands and high power demands using two technologies: On the one hand, **redox flow batteries** offer large storage capacities. However, the charging and discharging processes are slow. **Supercapacitors**, on the other hand, have short charging times with low storage capacities. The **hybridisation** of these two high performing solutions creates an energy storage system that combines the advantages of both systems: **high storage capacity and high power**.

POWERFUL, SUSTAINABLE AND COST-EFFECTIVE

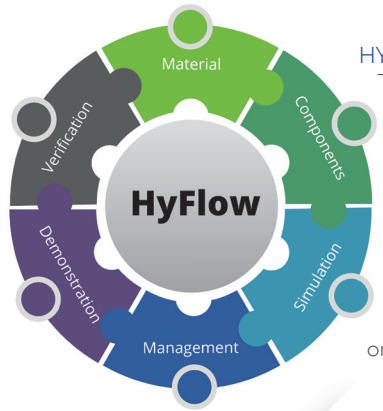
Hybrid energy storage systems with high-power redox flow batteries and supercapacitors working together are uniquely suited to provide multiple system services. In demanding applications, hybridisation leads to **more efficient** storage systems with **longer lifetime** as well as **higher adaptability** and potentially **lower costs**. The hybrid system avoids the usage of critical raw materials, thus ensuring environmentally friendly operation. Another contribution to this goal is, among others, the implementation of recycling strategies for the vanadium used in the redox flow batteries.

OBJECTIVES OF HYFLOW

HyFlow is focused on **technological and ecological improvements** of the components, their management systems and their interaction. The main goal is to adapt and enhance already existing storage components for optimal hybridisation. Thus, improved material utilisation and cell design as well as high-level control algorithms are part of the research work. The results will contribute to a sustainable, cost effective and highly flexible electricity grid.

The objectives of HyFlow are:

- Development of high-power vanadium redox flow batteries
- Development of green aqueous based supercapacitors with increased cell voltage
- Development of advanced component management systems
- Development of discrete and optimised simulation models for each components
- Demonstration of adaptable management strategies for at least four different application scenarios
- Improvement of ecologic sustainability



HYFLOW VISION

The project forms a **unique opportunity** for both research and industrial stakeholders to **develop tailor-made solutions** and to **explore new markets**. By combining the best of both worlds, a supercapacitor and a high-power vanadium redox flow battery, this solution will unlock numerous applications in the grid, boosting its stability while decreasing the dependence on fossil fuels.

CONSORTIUM

HyFlow operates along the entire value chain to optimise each part of the HESS, combining the interdisciplinary knowledge and experience of all partners. Manufacturers of the storage components interact with specialists in converter and management strategies to enable the improvements needed for the advanced system. In order to accelerate the verification of the demonstrator for different applications, high-level computational analysis is carried out. The infrastructure available at the partners' facilities is used for further investigations of the models. The final product, a demonstrator of the HESS at two different kW scales, combines the knowledge of all partners proving its innovative potential for high-level control and advanced cell and stack design.