

Ingegneria dei sistemi elettrici  
*Electric systems*

DII research group  
Accumulo energetico e modellistica elettromagnetica e multifisica



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## Strategic Project MAESTRA: Redox Flow Batteries for Energy Storage

Renewable energy sources are estimated to increase their penetration to more than 25% by 2030. Unlike conventional power plants, wind, solar, and other renewable sources are intermittent because they generate electricity according to time and climatic conditions. Recent studies have suggested that traditional electrical grids can become unstable if power from intermittent sources exceeds 20% of the whole generated power without energy storage.

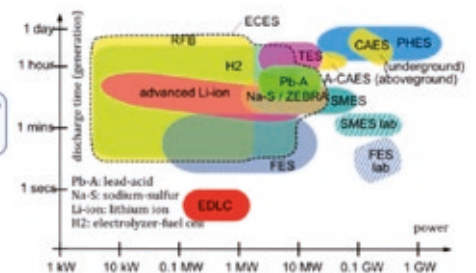
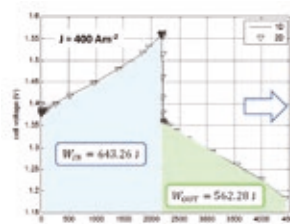
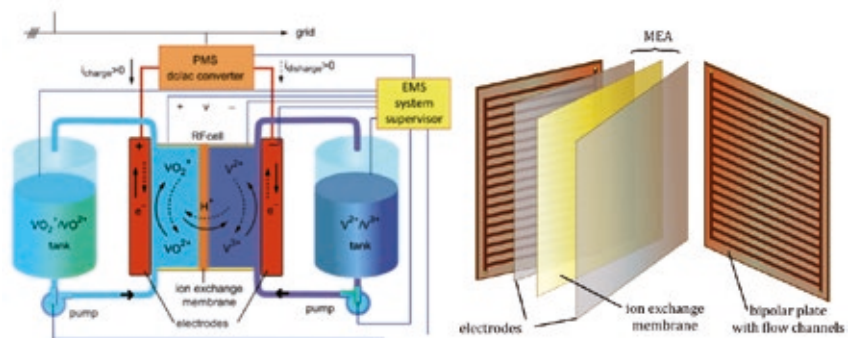
Redox Flow Batteries are a recent and a highly promising technology for stationary applications. The principle behind them is a couple of electrochemical reduction and oxidation reactions occurring in two liquid electrolytes containing metal ions. Both half-cells where the reactions occur are connected to external storage tanks provided with circulating pumps. Since RFBs operate by changing the metal ion valence, without consuming ion metals, they allow for long cycle service life. Other appealing features of this technology are: high round-trip efficiency (up to 85%), long durability, fast response. Moreover, RFB reactions are completely reversible, enabling the same cell to operate as converter of electricity into chemical energy and vice-versa.

The MAESTRA project, funded by the University of Padova with 809 k€, aims at developing state-of-the-art technologies, which are needed for the production of more durable, more flexible, and cheaper RFB. The final goal is to make innovative ECES technologies available to Italian industry for the implementation of products suitable for future grid requirements. Engineering efforts are centred on system scale-up and optimization as regards cell and stack flow geometries, power management and supervisor systems.

[www.dii.unipd.it/grp/eces/](http://www.dii.unipd.it/grp/eces/)

Project:

MAESTRA - "From Materials for Membrane-Electrode Assemblies to Electric Energy Conversion and Storage Devices" (cod. STPD11XNRY\_002)  
Progetti strategici UniPD 2011



Main research topics:

- Electrical Energy Storage
- Electrical Engineering
- Multiphysics Modelling
- Electrochemical Devices
- Electrical Systems
- Power Conversion and Storage