



PhD in SCIENZE E TECNOLOGIE ENERGETICHE E NUCLEARI / ENERGY AND NUCLEAR SCIENCE AND TECHNOLOGY - 38th cycle

PARTENARIATO PNRR Research Field: IMPROVING UNDERSTANDING OF CAPACITY DECAY AND PERFORMANCE LOSS IN REDOX FLOW BATTERIES

Monthly net income of PhDscholarship (max 36 months)

€ 1500.0

In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity

Motivation and objectives of the research in this field

CUP D43C22001410007

Decreto di concessione D.D. 1055 del 23/06/2022

D.D. 3277 del 30/12/2021 Avviso pubblico per la presentazione di Proposte di intervento per la creazione di 12 Ecosistemi dell'innovazione sul territorio nazionale da finanziare nell'ambito del Piano Nazionale di Ripresa e Resilienza, Missione 4 Componente 2 Investimento 1.5 - Creazione e rafforzamento di "ecosistemi dell'innovazione", costruzione di "leader territoriali di R&S" - finanziato dall'Unione europea - NextGenerationEU.

Considering the indications of PNIEC 2030 (Piano Nazionale Integrato per l'Energia e il Clima), the development of storage technologies is fundamental to boost the penetration of renewable energy sources, permitting a reduction of overgeneration and a flexible and efficient operation and management of the electric grid. As reported in PNIEC, to tackle this issue the development of storage technologies with energy-to-power ratio equal to 8 will be necessary by 2030. In this scenario, redox flow batteries (RFBs) are a promising technology due to the high cycle life and the intrinsic possibility to decouple energy and power. However, some technical issues need to be further investigated in order to increase technology competitiveness, among which capacity decay and performance loss. The research



	<p>project, mainly focused on all-vanadium and iron-chromium flow batteries, aims to increase the understanding of the physical phenomena regulating system operation, aiming to identify, develop and validate innovative solutions to increase technology competitiveness. The following activities are identified: a) experimental and model-based analyses to identify the physical origin of capacity decay and performance loss during charge-discharge cycles representative of real applications; b) development and validation of innovative solutions and operating strategies to mitigate battery capacity decay and performance loss; c) scale-up of innovative solutions to size more representative of real systems.</p>
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>The experimental analysis will be carried out through the experimental facilities available at MRT Fuel Cell & Battery Lab research group and Pro-e-Storage laboratory for manufacturing of materials. The experimental analysis will mainly consist of electrochemical characterizations, such as charge-discharge cycles, polarization curves in symmetric cell configuration and electrochemical impedance spectroscopy.</p> <p>Modeling analysis will be developed starting from proprietary codes based on Matlab® to simulate battery operation and capacity decay.</p>
<p>Educational objectives</p>	<p>The topic is extremely interdisciplinary. The student will deepen his/her knowledge in thermodynamics, mass and heat transfer, electrochemistry, as well as on theoretical and experimental activities.</p>
<p>Job opportunities</p>	<p>Placement in companies operating in the field of energy storage, materials manufacturing, modelling of energy systems.</p>
<p>Composition of the research group</p>	<p>1 Full Professors 2 Associated Professors 1 Assistant Professors 7 PhD Students</p>
<p>Name of the research directors</p>	<p>Matteo Zago, Andrea Baricci</p>



Contacts

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Additional support - Financial aid per PhD student per year (gross amount)	
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Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
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Amount monthly	750.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

<p>Educational activities: Financial aid per PhD student is available for purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences, instrumentations and computer, etc. The amount is equal to 10% of the annual gross amount, for 3 years.</p>

<p>Teaching assistantship: Availability of funding in recognition of supporting teaching activities by the PhD student. There are various forms of financial aid for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.</p>

<p>Computer availability: individual use.</p>
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<p>Desk availability: individual use.</p>
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