

ENERGETICS

MUR DM 117/Edison - Technical and economic assessment of Long-Duration Energy Storage (LDES) options for the energy markets

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Context of the research activity	<p>The research focuses on technologies for bulk and long-duration energy storage (LDES). Different technologies will be explored and modelled with the aim of developing an extensive techno-economic tool able to assess the potential of LDES when providing different services in the energy market dominated by a high share of intermittent renewable power sources.</p> <p>Progetto finanziato nell'ambito del PNRR - DM 117/2023 - CUP E14D23001950004</p>
	<p>The project intends to investigate storage technologies and applications in the Long-Duration Energy Storage (LDES) domain, which requires discharge durations comprised between 6 hours and a few days up to seasonal storage.</p> <p>The research will start from an in-depth analysis of the state-of-the-art and prospective technologies, including hybrid storage solutions and their control strategies. The research will include all sort of promising / actual technologies able to store intermittent renewable energy and then deliver electricity and/or heat.</p> <p>The international, European and Italian regulatory frameworks and energy market rules will be assessed to define available remuneration schemes under different application contexts.</p> <p>After mapping the different application fields and connected operating modes / remuneration schemes of the LDES technology, for selected applications a detailed techno-economic analysis will be carried out. Optimal sizing and dispatch models, complemented with thermodynamic models of the selected technologies, will be developed to assess the performance of different LDES technologies under different application cases. The developed models will</p>

Objectives

allow to configure different application sizes, technology performances and market constraints, in order to enable sensitivity / optimization analyses.

Finally, the developed techno-economic framework to evaluate LDES options will be used to evaluate business models relevant at the utility-scale. The proposed framework will incorporate the information from different intermittent and large-scale renewable power installations and market signals on the need of a given energy service or for curtailment. In fact, the statistical (multi-annual and multi-site) significance on the variability of the RES variability and market signals is key to perform realistic simulations.

For the most promising business models, the associated market potential will be assessed looking both to the current market regulation as well as perspective scenarios. Different grid services in addition to the basic energy arbitrage will be evaluated, according to the business case analyzed, such as unbalancing reduction, renewable generation curtailment reduction, industrial process decarbonization, etc. The techno-economic analysis will consider typical economic metrics for these applications, such as IRR, TCO and LCOS, according to the market context of the application. A final benchmarking against reference storage solutions in the current market will also be considered to complete the overall evaluation.

Skills and competencies for the development of the activity

The ideal candidate for this position has a scientific background in physics, engineering, mathematics, statistics, and software development. The development of the research activity requires a candidate with:

- Solid background in statistical methods and simulation techniques
- Solid background in mathematical and physical modelling
- Background on energy systems
- Background in computational methods
- Experience in object-oriented programming (e.g., python)
- Ability to analyze the scientific literature state of the art
- Scientific writing and reporting
- Proactive, independent, and parallel thinking
- Ability to work in a multi-disciplinary team