Guido Francesco Frate, Ph.D.

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Education

2016 – 2020 **Ph.D., University of Pisa**, University of Pisa, Pisa, Italy.
Analysis of a pumped thermal electricity storage system with the integrationof low temperature heat sources
Final Grade: *Excellent*

2013 – 2016 **M.Sc. in Energy Engineering**, University of Pisa, Pisa, Italy.
Final Grade: 110 *cum laude*/110

2010 – 2013 **B.Sc. in Energy Engineering**, University of Pisa, Pisa, Italy.
Final Grade: 107/110

Employment

2022 – *today* **Assistant Professor**, University of Pisa.
Research Topics:
- Technologies and components for **grid-scale and long-duration energy storage**
- **Optimal scheduling of energy systems**, non-linear components and sector coupling technologies
- Technologies and components for **High-temperature heat pumps** (Rankine- and Brayton-based) for the recovery of waste heat and the decarbonized/electrified heating production

Teaching activities:
- **Co-teacher** of *Energy Systems* and *Design of Fluid Machines* for Bachelor's and Master's degree students of Chemical and Energy Engineering courses
- **Co-supervisor** for more than 20 Master-degree students' final dissertations
- **Teacher** of courses for PhD students on Grid-Scale and Long-Duration energy storage and optimal scheduling of energy systems

Other activities:
- **Member of the organizing committee** for the XXVI Biennial Symposium on Measuring Techniques in Turbomachinery (MTT 2622)
- **Guest editor** in the *Energies* special issue on *Advanced Systems and Components for Medium and Long-Term Energy Storage*
- **Member of the editorial board** of the *Journal of Clean Energy and Energy Storage*
- **Member of the IEA Task 44** *Hi CBest: Power-to-Heat and Heat integrated Carnot Batteries for Zero-Carbon (industrial) Heat & Power supply*

2020 – 2022 **Postdoctoral researcher**, University of Pisa.
Research Topics:
- Techno-economic optimisation of the design of Power-to-heat-to-power technologies (P2H2P)
- Off-design characterisation, dynamic simulation, and advanced control logics of Brayton-based high-temperature heat pumps and storage technologies

Teaching activities:
- Seminars in the Energy Engineering master's degree
- Supervision for the final dissertation of master's degree students

Other activities:
- Participation in national and international conferences

Awards

Best Paper Award For the paper titled *Pumped Thermal Energy Storage for Multi-Energy Systems Optimization* awarded by the scientific committee of the *64th International Conference of Scandinavian Simulation Society, SIMS 2023 Västerås, Sweden, September 25-28, 2023.*

Research topics

- **Rankine-based High-temperature heat pumps and storage technologies** with integration of waste/renewable heat: Multi-objective optimised design and off-design characterisation
- **Brayton-based High-temperature heat pumps and storage technologies**: techno-economic analysis, off-design characterisation and optimised control strategies
- **Multi-energy storage** devices to couple thermal and electric energy vectors in industrial/civil energy systems
- **Optimal scheduling of energy systems** Modelling of components with non-linear performance and degradation over time. Impact of forecast uncertainties
- **Machine learning techniques to improve energy efficiency in civil energy systems** Energy consumption forecast to apply predictive control strategies. Identification of anomalous consumptions. Use of Machine Learning and Reinforcement Learning for optimal management of energy systems

Research activities

Bibliometric data

- Author of **69 publications**, **cited 1504** times, with an **h-index** of **17** (data from *Scopus* updated at 02/10/2025)

Collaboration with international research groups

- **Collaboration** with **German Aerospace Center (DLR) - Institute for low carbon industrial processes - High-temperature heat pumps in Cottbus** on the dynamic modeling and advanced control techniques for thermal load control in Brayton high-temperature heat pumps.
- **Visiting researcher** at the **Thermodynamics Laboratory (University of Liege, BE)** for three months. Detailed modeling of multi-energy storage technologies based on low-temperature Carnot Batteries
- **Visiting researcher** at the **Center for Energy Storage (University of Birmingham, UK)** for three months. Optimal dispatching and sizing of multi-energy, low-temperature Carnot Batteries.
- **Collaboration** with a **North China Electric Power University (China)** on the optimal scheduling of multi-source cogeneration units
- **Collaboration** with **University of Liege** (Belgium), **University of Ghent (BE)** (Belgium), **TU Berlin (DE)** on modelling and simulation of Carnot Batteries
- **Collaboration** with the **University of Zaragoza** (Spain) on Power-to-gas technologies for grid decarbonisation

International Conferences

- **Presenter** at seven international conferences (*ORC2023, ASME turbo expo 2021,100RES 2020, RDPE 2019, ASME turbo expo 2019, ECOS 2018, ECOS 2017*, and co-author of papers presented at *ASME turbo expo 2025 and 2022, ECOS 2025* and *SDEWES 2025*)
- **Member of the organizing committee** for the XXVI Biennial Symposium on Measuring Techniques in Turbomachinery (MTT 2622)

Involvement in funded research projects

- **Renewable energies for Africa: Effective valorization of agri-food wastes (REFFECT-Africa)** (2021 - 2026). (Horizon 2020, Grant No. 101036900)
- **Idrogeno per una MObilità VErde et sostenibile (H2MOVE)** (2021 - 2026). (Interreg ITA-FRA)
- **Innovative solar micro-thermal energy storage with high-power density (InnoSolPower)** (2021 - 2024) (CSP ERA-NET)
- **Next REnewable multi-GENeration technology enabled by TWO-phase fluids machines (REGEN-BY-2)** (2020 - 2024). (Horizon 2020, Grant No. 851541)
- **Computer aided design for next-generation flow batteries (COMPBAT)** (2020 - 2023) (Horizon 2020, Grant No. 875565)
- **Research program for the national electric grid** (2019 - 2021, 2022 - 2024, 2025 - 2027) (Italian national project, funded by ENEA)
- **Advanced management logic for energy saving in large-distribution retail (CERERE)** (2017 - 2019)(Italian regional project, Tuscany Region, POR FSE 2014 - 2020).