Goal: Advance science in power and energy systems to facilitate sustainable and efficient resource utilization for all through methodologies, tools, and data-driven approaches

Topics:
- Regional transmission system planning
- Distribution system planning
- Energy Communities
- Microgrids for off-grid areas and developing countries

Affiliation and group: DESTEC, University of Pisa - Power system group

Davide Fioriti, PhD

Scientific production:
Scopus , Google Scholar , ResearchGate

Energy shall be affordable and sustainable for all. We develop approaches for efficient sustainable optimization of large-scale areas

Topics:

- <u>Regional power system modelling:</u> achieving affordable sustainable electricity requires informed decisions supported regional and comprehensive perspective. We are advancing transmission system planning through tools and advanced techniques also within the PyPSA meets Earth initiative
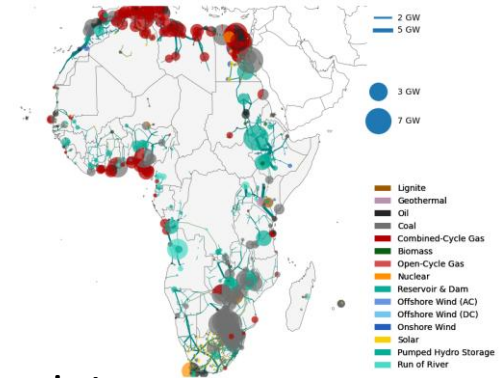 *Highlights: [power paper](#) and tool [PyPSA-Earth](#) to model any region and continent on Earth*

- <u>Regional energy system modelling</u>: the power system is interconnected with other sectors and only a holistic view allows effective impact. We have advanced system planning to account for interactions of power systems to other sectors.
  Highlights: [sector-coupled paper](#) and sector-coupled tool [PyPSA-Earth](#)

- <u>Efficient planning by Mathematical Decomposition:</u> uncertainties, robust planning and non-linearities introduce complexities that can be hard to solve. We investigate the use of mathematical techniques to efficiently solve our problems
  Highlights: [pySMSpp](#) , [pypsa2smspp](#)

Legend: 2 GW / 5 GW / 3 GW / 7 GW; Lignite, Geothermal, Oil, Coal, Combined-Cycle Gas, Biomass, Open-Cycle Gas, Nuclear, Reservoir & Dam, Offshore Wind (AC), Offshore Wind (DC), Onshore Wind, Solar, Pumped Hydro Storage, Run of River

Funded projects:
- **RESILIENT (EU/MUR CET Partnership project)**
  <u>Role</u>: Principal Investigator UNIPI
  <u>Topic</u>: Resilient planning of the European System
- **Ostbayerische Technische Hochschule Regensburg**
  <u>Role</u>: Principal Investigator
  <u>Topic</u>: Optimal planning of large-scale energy systems
- **Terna/Ensiel (2 projects)**
  <u>Role</u>: Member
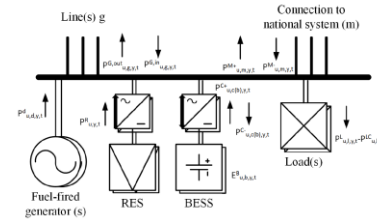 <u>Topic</u>: Dynamic Thermal Rating in transmission lines

Distribution system

Energy shall be affordable for everyone. In this stream we investigate on best electrification of off-grid areas and developing countries, where challenges are notoriously high

Topics:

- Optimal dispatch: Identify techniques to operate assets at low-cost, including priority-list, predictive and stochastic methods supported by machine learning
  Highlights: paper , matMicrogrid

- Optimal planning: We investigated the optimal size of the assets compatible to the dispatch technique, long-term needs, also accounting for uncertainties, multi-objective considerations and assets degradation
  Highlights: paper , paper, matMicrogrid

- Load forecasting: Any design is as good as the data it is fed with. Short- and long-term forecasting has also been investigated to populate previous tools
  Highlights: paper and dataset

Funded projects:

- **ENEA**
  Role: Deliverable coordinator
  Topic: estimation of distribution systems
- **LEAP-RE, SETADISMA (WP13) (EU Horizon project)**
  Role: delegate on scientific coordination
  Topic: Optimal planning of microgrids for rural electrification

Energy Communities

Users of the energy systems can achieve collective environmental, social and economic goals with Energy Communities. Methodologies for their efficient deployment are needed and investigated
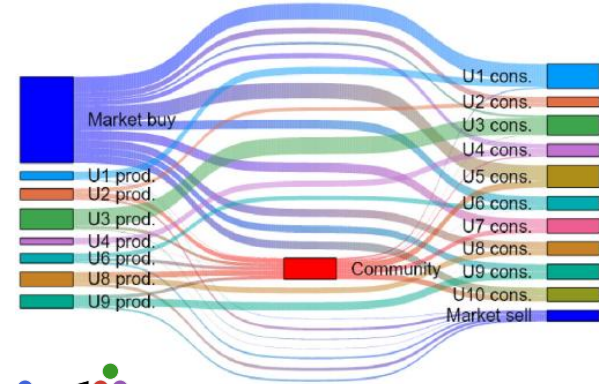
Topics:

- Optimal planning and dispatch: Identify the optimal size of assets and their location within the community, including possible flexibility and uncertainties
  Highlights: paper , EnergyCommunity.jl

- Optimal reward sharing: communities generate collective benefits and their fair redistribution is key. We are exploring this topic, also supported by game theory
  Highlights: paper , TheoryOfGames.jl

Funded projects:
- **PNRR**
  Role: Member
  Topic: Planning of Energy Communities also under uncertainties
- **AUTENS (PRA Project)**
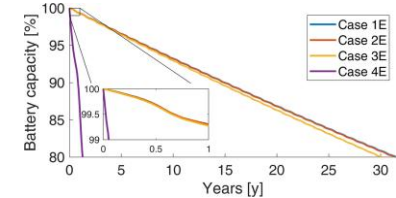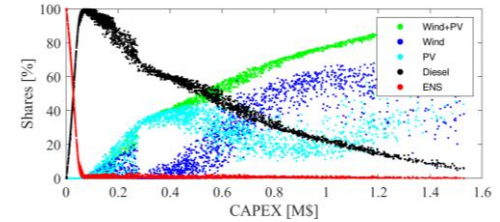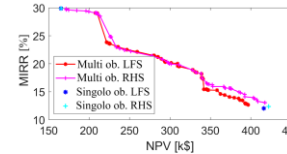 Role: Member
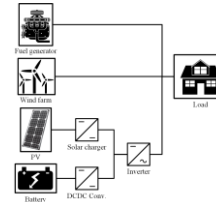 Topic: Sustainable Energy Communities

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Funded projects:

- **LEAP-RE, SETADISMA (WP13) (EU Horizon project)**
  Role: delegate on scientific coordination
  Topic: Optimal planning of microgrids for rural electrification
- **Ricerca Sistema Energetico (RSE)**
  Role: Principal Investigator
  Topic: Modelling and optimization of systems with storage
- **APOLLO (Regional project)**
  Role: Member
  Topic: Floating PV systems