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Investment decisions and role of prosumers in energy communities

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Background

- Andreolli F., D'Alpaos C., Moretto M. (2020): Investments in domestic PV plants paired with energy storage: a stochastic dynamic optimization model (mimeo)
- Andreolli F., D'Alpaos C., Kort P. (2020): Households investment decisions in local energy communities: a real option model
- D'Alpaos, C., Andreolli, F. (2021): Renewable energy communities: The challenge for new policy and regulatory frameworks design, Smart Innovation, Systems and Technologies 178 SIST, 500-509
- D'Alpaos C., Bragolusi P. (2021): The market price premium for residential PV plants, Smart Innovation, Systems and Technologies 178 SIST, 1208-1216
- D'Alpaos C., Andreolli F. (2020).The economics of solar home systems: State of art and future challenges in local energy markets, *Valori e Valutazioni* 24, 77-96
- D'Alpaos, C., Andreolli, F. (2020): The Value of Investing in Domestic Energy Storage Systems, *Lecture Notes in Computer Science 12250 LNCS*, 148-161
- Andreolli F., D'Alpaos C., Moretto M. (2020). Investing in a Solar Home System by a grid-connected household: investment timing, technological choice and the value of flexibility. Proceedings "Energy & Finance Italia Edz. 5, Roma 10-11 February 2020.

Background

- D'Alpaos C., Andreolli F., Moretto M. (2019): Investments in domestic PV plants paired with energy storage: a stochastic dynamic optimization model. Proceedings "30th European Conference on Operational Research", Dublin, June 23-26 2019

- D'Alpaos C., Andreolli F., Moretto M. (2019): Investments in domestic PV plants paired with energy storage: a stochastic dynamic optimization model. Proceedings "30th European Conference on Operational Research", Dublin, June 23-26 2019

- D'Alpaos C., Moretto M. (2019): Do Smart grid innovations affect real estate market values? *AIMS Energy* 7(2), 141-150
- Bertolini, M., D'Alpaos, C., Moretto, M. (2018). Do Smart Grids boost investments in domestic PV plants? Evidence from the Italian electricity market, *Energy* 149, 890-902
- Bertolini, M., D'Alpaos, C., Moretto, M. (2018). Electricity prices in Italy: Data registered during photovoltaic activity interval, *Data in Brief* 19, 1428-1431

Motivation

- Clean Energy for all Europeans package, Energy Roadmap 2050, Energy union strategy
- The EU committed to reducing greenhouse gas emissions to 80–95% below 1990 levels by 2050
- These targets have serious implications for our energy system: we need to be far more energy efficient, two thirds of our energy should come from renewable sources and electricity production needs to be almost emission-free
- To achieve EU climate and energy objectives, current shares of RES are still insufficient, and there is an urgent need to **accelerate investments** in several sectors, such as generation and storage
- It is commonly agreed in literature that, compared to other options, solar photovoltaic (PV) plants have a rather large potential for electricity generation and play a relevant role in the achievement of energy efficiency targets
- To offer valuable services to grid management and favor high penetration of RES, energy storage systems are deemed as promising solutions
- Renewable energy communities, in which users can directly exchange energy quotas via Peer-to-Peer (P2P) energy trading are deemed as a promising solution as well

Our focus

- Storage systems and renewable energy communities can be key drivers in promoting investments and favoring market penetration of RES. They can provide as well ancillary services to grid management by reducing supply/demand mismatches due to the intermittent and variable nature of RES

- RES power plants, battery storage systems and P2P trading give *de facto*, prosumers operational flexibility and the opportunity to strategically decide their optimal consumption/production patterns

- Prosumers' option to strategically decide their optimal investment strategy contributes to energy savings and hedging of investment risks, thus increasing the attractiveness of investments

Research objectives

- Develop a theoretical-methodological framework to investigate investment decisions and valuate operating options embedded in RES investments coupled with storage and P2P trading

- Provide an interdisciplinary and multidisciplinary approach to:

  a) valuate investments in a dynamic perspective and identify key factors, which make energy communities more valuable compared to scenarios were prosumers do not aggregate but act individually
  b) analyze norms and regulations, which regulate the constitution of energy communities and their interactions with institutions, grid managers and energy market operators
  c) investigate governance and regulatory issues in a new setting, where local micro-grids and aggregators play a major role

- Support policy makers in the design of cost-effective incentives meant to promote the deployment of renewable energy communities

Ongoing research

- Development and implementation of the Real Option Approach to model households' investment decisions in small-scale PV plants coupled with battery storage, namely Solar Home Systems (SHS)
- Analysis of the impact of battery storage on investments' value
- Analysis of the potential of SHS integration in renewable energy communities
- Development and implementation of the Real Options Approach to model households' investment decisions in SHS in a P2P trading scenario

Thank you!

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