PhD Fellowship

Distributed Energy Resources Integration in Emerging Energy Markets

Background :

Local energy communities, specified in EU directives as Citizens Energy Communities and Renewable Energy Communities, are legal entities providing environmental, economic or social benefits by participating in activities like power generation, distribution and consumption. Appropriate management strategies and market designs shall be implemented in order to enable the full potential advantages of third party assets, located 'behind the meter'. Decentralized or fully distributed architectures (e.g., Peer-to-peer (P2P) energy trading) emerged as promising solutions to empower the role of the end-users in energy systems and allow market uptake for new actors. In the scope of an energy community, energy trading enables flexible trades between peers where the excess of energy generation coming from many small-scale DERs is traded among local customers. Such exchanges have to be done following tailored coordination strategies in order to ensure a fair distribution of the financial benefits among the different actors.

Objectives:

- Identify and characterize the flexibility potential at the end-user' level in the form of energy storage systems (battery or electrical vehicle), and/or partially controllable/shiftable loads.
- Identify and model market design settings and incentives that have the greatest impact on actor and energy asset behavior as well as impact on outcomes and acceptance for buyers and sellers (fees, prices, energy allocation).
- Investigate the provision of new services to the distribution system operators to leverage additional stream of revenues for the community.
- Identify how energy system user data could lead to autonomous orchestration of energy assets to benefit system users and grid operators, in particular relating to energy communities and innovative local energy market designs .
- Explore how intelligence can be brought to distributed energy assets through forecasting and optimization, considering data security, interoperability, and privacy.

Required education and skills:

- Applicants should hold a MsC in a relevant field - Electrical Engineering or Computer Science with specialization in power systems analysis , energy markets, and optimization.
- Good understanding in constrained optimization methods and mathematical problems with equilibrium constraints - convex optimization (LP, QP), mixed integer programming, heuristics, among others.
- Knowledge in simulation/modelling and development tools - MATLAB, Python, and mathematical Language Programming and experience in optimization solvers would be a plus - GAMS, Julia, YALMIP among others.
- Strong analytical and communication skills in an international environment (fluent English is mandatory), ability to present clearly and concisely.

Appointment Terms :

The successful candidate will be enrolled for a 3-years PhD, hosted partly at the G2Elab, Grenoble, France and at the Institute of Electrical Engineering IET, Lucerne, Switzerland.

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