



SUPERVISOR INFORMATION	
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Department	DEEC - Department of Electrical and Computer Engineering
Field(s) of research	AI-driven stochastic optimization, consumer-centric electricity markets, distributed energy resources, holistic market management and coordination, smart grid energy analytics
PROJECT PROPOSAL	
Title (optional)	Holistic Consumer-Centric Electricity Market Management: Coordinated Optimization for Flexible and Sustainable Power Systems
Brief project description	
<p>The electricity sector, particularly the distribution segment, is undergoing a profound modernization process driven by the large-scale integration of distributed energy resources (DERs), including distributed generation, battery energy storage systems, and electric vehicles. This transformation significantly expands both operational and commercial possibilities by increasing system flexibility, thus enabling new forms of value creation. As a result, it is fostering the emergence of consumer-centric electricity market structures in which consumers and prosumers are increasingly empowered to participate in energy transactions, flexibility services, and cooperative market arrangements.</p> <p>Although this expansion of operational possibilities and the emergence of consumer-centric electricity markets bring substantial benefits to the sector and to society at large, they also introduce inherent challenges for system management and operation. In this context, the role of the community manager becomes increasingly complex: faced with an almost unlimited space of operational, economic, and behavioral constraints, the manager must coordinate market participation in an intelligent and adaptive manner.</p> <p>Given this background, this project aims to develop advanced methodologies to support intelligent, coordinated, and adaptive managerial decision-making in consumer-centric electricity markets. Specifically, the project seeks to formulate a holistic optimization framework that balances socioeconomic welfare, affordability, and environmental sustainability while accounting for the interests of all relevant stakeholders and the operational and behavioral constraints of the system. In addition, the proposed framework will explicitly incorporate the intrinsic uncertainties of the problem, ranging from variability in distributed electricity generation to behavioral uncertainties such as electric-vehicle availability to provide vehicle-to-</p>	

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grid services, ensuring that decision-making remains robust, flexible, and realistic under real-world conditions. To address the inherent complexity, dimensionality, and computational demands of this problem, the project will rely on AI-driven stochastic optimization techniques, enabling scalable, uncertainty-aware, and data-informed market coordination strategies.

Finally, it is emphasized that this project has the potential to generate broad societal benefits, not only through the maximization of socioeconomic welfare, enhanced affordability, and environmental gains, but also by enabling more efficient and intelligent operational processes for the community manager. Given that community-based market structures remain at an early stage of development, the creation of advanced managerial tools is particularly relevant to support their safe, efficient, and sustainable evolution.