

Master project Proposal

Title: Simulating domestic Demand Side Management Programs participation: a CONSUMAT approach

Description of research: Meeting the new EU decarbonization targets requires a deep transformation of the power sector. This is why Demand Side Management (DSM) programs are receiving increasing interest as a viable alternative to fossil fuel plants to provide the necessary balancing reserves and optimize grid management. Energy models are an important tool for assessing the impact of these new programmes, but despite their wide use, such models are often criticised for their very optimistic assumptions about residential consumer engagement in demand response.

The aim of this Master project is to develop a model that simulates users' enrolment in DSM programs with an Agent-Based Modelling (ABM) approach. There will be a particular attention to the modelling of non-financial incentives, the influence of social networks and the decision-making process by different types of interacting agents, not only households. The decision-making model for households' agents will be inspired by the CONSUMAT approach [1], with the integration of the most relevant features of the TAM model, UTAUT2 [2] and other behavioural theories. The resulting model will be developed on a theoretical and empirical basis. This research will have the dual objective of assessing the impact of different energy policies (i) on the adoption of DSM programmes among a target population and (ii) how this may influence the optimal management of the network through uncertainty analysis methods.

Methods: probability and statistics methods; numerical analysis; Python programming language; Agent-Based-Modelling ABM; behavioural theories (e.g. Technology Adoption Model TAM); model predictive control methods.

Requirements: interest and basic knowledge of behavioural theories and agent based-modelling; knowledge of fundamentals of probability, statistical and numerical analysis; familiarity with Python programming language; good knowledge of English.

Ideal starting date: September 2020

Duration: 1 semester

Supervisors:

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References

- [1] Wander Jager & Marco Janssen (2012) An updated conceptual framework for integrated modeling of human decision making: The Consumat II. Paper for Workshop Complexity in the Real World @ ECCS 2012 - from policy intelligence to intelligent policy. Brussels, 5th & 6th September 2012
- [2] Venkatesh, V., Thong, J.Y.L., Xu, X., (2012). Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology.

Additional Researches of Interest

Magnus Moglia, Aneta Podkalicka, James McGregor (2018) An Agent-Based Model of Residential Energy Efficiency Adoption. *Journal of Artificial Societies and Social Simulation* 21(3) 3, 2018 Doi: 10.18564/jasss.3729
Url: <http://jasss.soc.surrey.ac.uk/21/3/3.html>

P. R. Van Oel & D. W. Mulatu & V. O. Odongo & D. K. Willy & A. Van der Veen (2019) Using Data on Social Influence and Collective Action for Parameterizing a Geographically-Explicit Agent-Based Model for the Diffusion of Soil Conservation Efforts. *Environmental Modeling & Assessment* (2019) 24:1–19
<https://doi.org/10.1007/s10666-018-9638-y>

Tina Balke and Nigel Gilbert (2014) How Do Agents Make Decisions? A Survey. *Journal of Artificial Societies and Social Simulation* 17 (4) 13 <http://jasss.soc.surrey.ac.uk/17/4/13.html>

Iacopo Iacopini, Benjamin Schäfer, Elsa Arcaute, Christian Beck, and Vito Lator (2020) Multilayer modeling of adoption dynamics in energy demand management. *Chaos* 30, 013153 (2020); doi:10.1063/1.512231