ECs-nergy: a tool for the optimal local aggregation of different users within Energy Communities

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Background

Distributed generation
+
Sharing energy flows at local level

Less transmission losses
&
More penetration of renewable sources

Transaction to a clean energy system

Background

Energy Community (EC)

local aggregation of citizens, public entities, and private enterprises that, in synergy, organize their energy production maximizing energy sharing and self-consumption, and bring economic savings (in terms of reduced costs and/or incentives)

Directive UE 2018/2001
renewables self-consumer
jointly acting renewables self-consumers
renewable energy communities

Directive UE 2018/2001
citizen self-consumer

DL Dec. 30, 2019, No. 162 … et seq.
renewable energy communities

Background

- Many researches have already been proposed on ECs, demonstrating the strong interest of the scientific community (and not only) on this topic

- Currently, in practice and the literature, the creation of an EC is based on:

    Geographic adjacency

    Acquaintance among the subjects

    Resourcefulness and promotion of a principal entity (e.g., a private business or a public entity)

    There is not a real assessment of how many and which users to aggregate in the EC

Project goal

Developing the tool ECs-nergy which identifies the most cost-effective and environment-friendly aggregations of different energy users to form an energy community
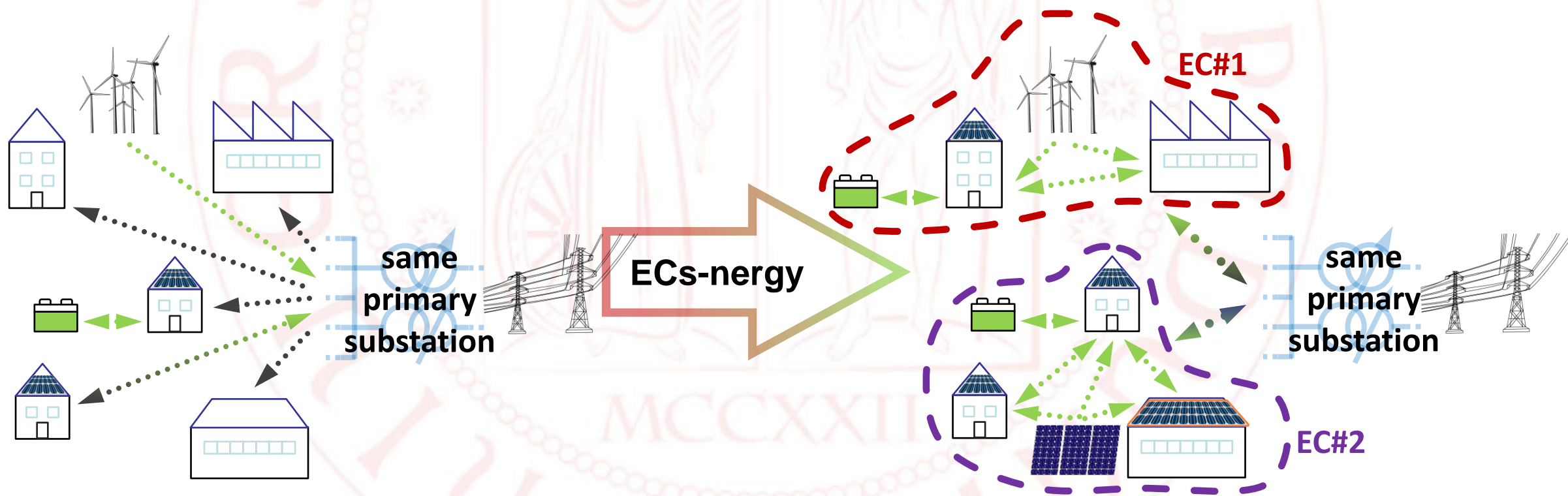
Advances compared to the state of the art

ECs-nergy will implement the new idea of "assembling" the most cost-effective and environment-friendly ECs in a given geographical area.

This will be done by searching simultaneously for the best:

i)   aggregations of energy conversion and storage units with users' demands

ii) size of new units, and

iii) operation of the whole aggregate

This very complex task is approached by setting up and solving a rigorous optimization procedure of the design and operation of ECs

Advances compared to the state of the art

Some information required by the optimization problem is subject to high uncertainty (e.g., production from renewables, energy costs, decisions of members) which will be accounted with a <u>stochastic approach</u>
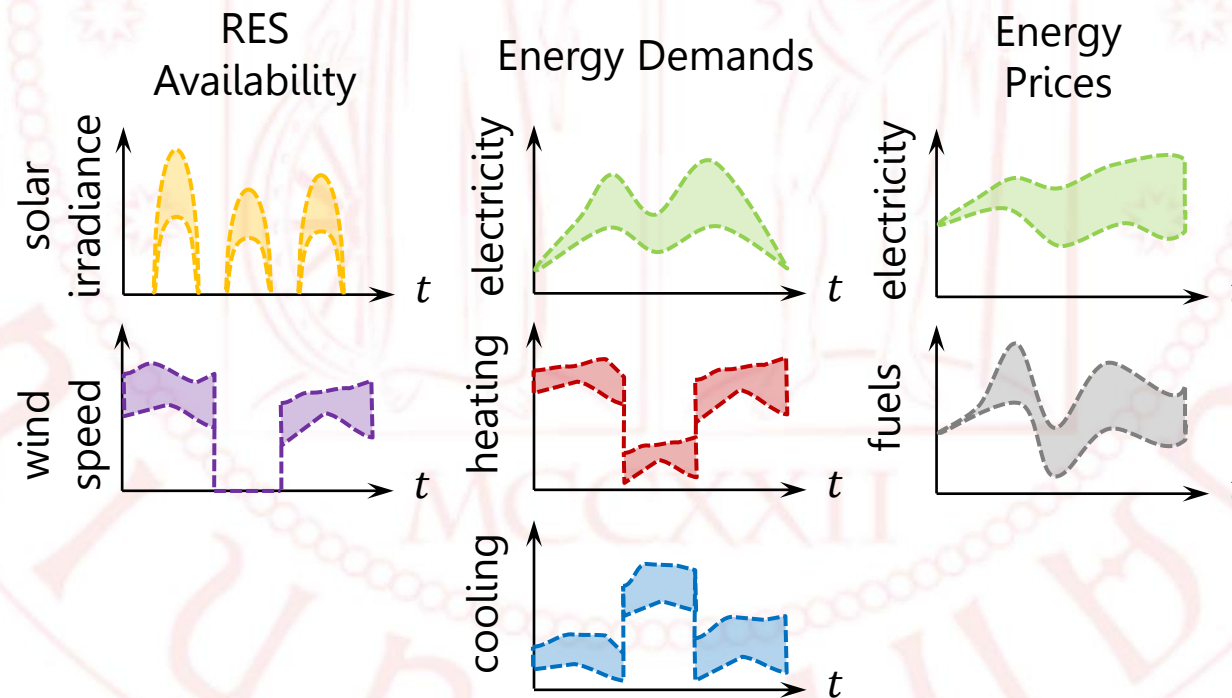
Topic of a multiple nature -> Multidisciplinary approach

- Define the <u>technical constraints</u> on the operation of energy conversion and storage units, and local distribution networks

- Build proper <u>economic and environmental objective functions</u>. Particular attention is to be paid to a fair distribution of benefits among EC members

- Apply stochastic approaches to consider <u>uncertainties</u> on renewable production and energy prices, and to reduce the huge amount of data associated with several possible scenarios

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Dept. of Industrial Engineering
Synthesis, design and optimization of multi-energy systems

Young researcher

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Stochastic methods and models

Expected results

- Provide <u>guidance</u> to governing bodies (e.g., municipalities and provinces) and other stakeholders (e.g., companies interested in setting up an EC, also acting as a third party) on opportunities to form ECs based on precise optimal aggregations

- Find <u>concrete examples</u> to make public and private stakeholders, and citizens understand the benefits deriving from using renewable energies on local level

- Contribute to improve the scientific body of <u>knowledge</u> on efficient conversion, and proper local distributions and final use of traditional and renewable energy sources (topics which are strongly promoted by the Centre Levi Cases)

- Stimulate new future <u>collaborations</u> with the research groups affiliated with the Centre Levi Case... maybe to be established during the project