OneNet Project summary

Stemy Energy

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1. Challenge

The energy market is shifting from the traditional paradigm typified as a passive distribution and one-way communication from the electricity supplier to the consumer (G-DL) to a new energy paradigm focusing on an active role of the customers. Consumers, their daily routines, and the social context in which they operate, should be more central for the DSOs (Distribution System Operators), where the focus is still mainly on technological issues and economic incentives. Stemy's solution, with a new user-centric approach, is the first of this kind of solutions within the energy sector.

Stemy's technology supported by an algorithm with AI, self-learning capacity and big data applied in controlling the energy consumption of each consumer optimizing CAPEX and OPEX and the participation on the existing energy and flexibility markets through the energy assets installed in the buildings. To be noted, it is the first aggregation platform able to optimize energy efficiency while providing flexibility to the grid.

This cost optimization is based on the learning capacity from the energy behavior, comfort levels, building performance and price signals received from the energy markets. This is achieved by acting automatically on the equipment in the building: advising on how to improve the consumption and on adequate investments to obtain greater benefits, suggesting the best rates and powers to contract. Apart from monitoring, forecast is enabled through self-learning algorithms, the Stemy's AI predicts performance, DER performance, weather (temperature, irradiation, and wind), markets (price and flexibility request), behavior & preferences of the final user (e.g., temperature reference). It has the capacity to manage the flexibility of all electrical devices at the consumer level in a cost-effective way, through a simple and connected low-cost technology which connects and operates the charging devices and DER: hot water, HVAC, water pumps, batteries, EV charging posts (V2G, G2V), refrigeration, water filtering, water heating, milling and chemical processes.

Additionally, the platform connects the user with the Energy market, fostering RES and is able to aggregates electricity resources with high precision and in real time, allowing participation in frequency response markets that require an immediate response (in seconds after that the request is sent by the operators).

2. Proposed solution

The project will develop a demonstration located in Cantoblanco (Madrid, Spain). The buildings have a maximum consumption of 500kW. They count with an installed power of 2,7MW of heating and cooling systems, which use to consume ~2,16MWh per day. The annual total consumption is ~1314 MWh.

The approach of the project can be summed in three main actions: 1) onboarding, solution design and installation, 2) operation and tests, 3) result analysis and dissemination.

The onboarding process will be done through Stemy's "Comunidad Flex".

The installation will intervene the fuseboards (installing Ampere, a Flex-ready monitoring device of Stemy) and the heating/cooling system (installing Carrier, a Flex-ready HVAC control device of Stemy).

Then the operation will be done by Stemy's aggregation platform. During this phase there are three main actors:

- The network operator (i-DE), who operates the distribution network and assesses the needs and constraints of the network. Thanks to a local flex market, operated by OMIE, DSO can request power consumption modifications to consumers to avoid congestions in the grid.
- A set of buildings which consume electricity and have some energy resources.
- The flexibility provider, who is Stemy. On one hand, Stemy oversees providing the flexibility to the network operator according to the market request. On the other hand, Stemy is in charge of operating the energy resources of the buildings to optimize their performance and fulfill the market commitments.

The relationship between these three agents is key to help achieve the stability of the grid: the network operator will send flexibility signals to the flex provider so it can operate the portfolio of their aggregation platform to accommodate the network needs according to the constraints given by the users. This is done thanks to a deep knowledge of consumers and their consumption patterns and thanks to the synergies generated from aggregating multiple types of resources. Once the flexibility signal is sent to the flexibility provider, the network operator will monitor the affected network to validate the signal and assess the impact of it.

Stemy's aggregation tool can respond effectively to flexibility signals within seconds so it can help the grid at many markets. In the meanwhile, the users will have two interfaces, one app and one web to interface with the "Comunidad Flex".

3. Expected results

To fulfill the scenario and provide flexibility at distribution level the main goals and KPIs defined are:

- Monitor disaggregated consumption and control the buildings' heating and cooling systems in seconds.
- Communicate with the network operator (i-DE) to be able to receive flexibility signals, which will translate in modifying the consumption of the energy resources.
- Respond to the flexibility signals to alleviate congestions by managing loads.
- Prove participation in distribution local markets.
- Generate data from the demand response to flexibility trials and the comfort levels of the users to evaluate impact. For the evaluation of the comfort levels, we will have the temperature measurements that the users will experience at every point of actuation.
- Exploit results after the project, in Redream H2020 project and other offices.