Multi-energy carrier system management

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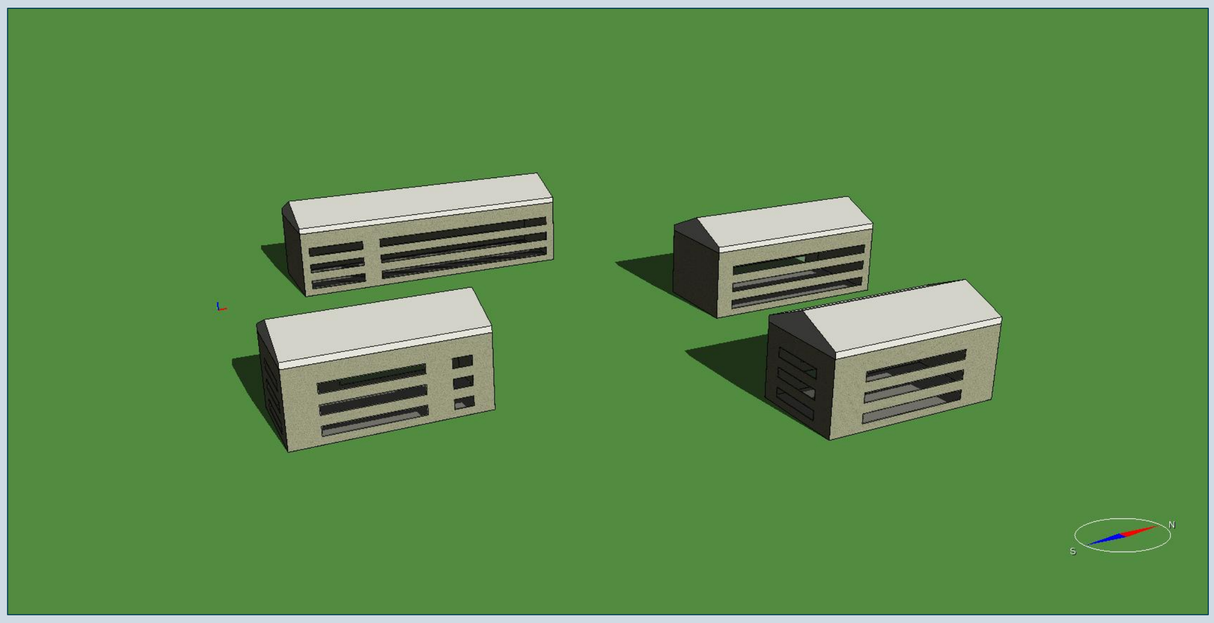
This study presents a dynamic energy community model based on real-world data for the implementation and analysis of distributed energy resource scenarios

Dynamic energy modelling is performed in IDA ICE modelling software to create and validate an energy community model based on real-world data, which would allow for optimizing energy system operations as well as management and allow for the assessment of possible technological development alternatives covered in future studies.

Basis for the energy modeling

- The modelled scenario is built based on a real case from Bauska, Latvia. Validation is based against data of past energy consumption and building energy performance certificates;
- IDA ICE modeling software was adapted to simulate multiple buildings. The model was further optimized to both match the real case and minimize simulation times;
- **As a result, a dynamic energy system control model for multiple buildings has been developed, enabling system-level optimization and the evaluation of various renewable energy integration strategies;**
- **The model allows for the assessment of cost-effective solutions, facilitating the successful integration of renewable energy sources and supporting the transition away from fossil fuels**.

The created energy community building model



The identified distributed energy resource solutions for the Energy community

- **Heat pumps**

The revised Renewable Energy Directive encourage the replacement of fossil fuel boilers with renewable technology like heat pumps. The benefits of high efficiency and system flexibility creates opportunity to combine heat pumps with other distributed energy resources.

- **PV systems**

PV systems have become the hallmark of individual renewable energy generations in recent years. Combining On its own, PV system have become cost effective and easy to access, but with heat pumps, cost can be decrease further for electricity heating and cooling

- **Energy storage**

Electric battery integration has become relevant, as more and more renewable energy sources are being installed. Benefits include peak load shifting and regulation, the implementation of energy flexibility, maximizing solar energy output as well as minimize energy costs.

Key aspects of distributed energy resource management systems

To synergies the different energy resources, energy management system should perform data monitoring of the production of solar PV energy, individual consumption data of heat pumps and other distributed resources, as well as the logging of indoor and outdoor temperatures. Data prediction is also key aspect that the management systems, for example upcoming weather forecast impact on energy consumption, or energy consumption patterns during different times of day. System optimization can further enhance the economic benefits of distributed energy resources and reduce energy costs, by monitoring market energy prices bills and optimizing when to use power from the grid, or when to store power, as well as it can maximize self-consumption to completely utilize all the self-produced energy. And most important of all, management systems introduce automatic control of the system, that can fully use the synergy of distributed energy resources to improve the overall systems efficiency.

Exploratory analysis results of distributed energy resource implementation