Framework for simulation and control of hybrid energy networks

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Abstract:

For the built environment it is envisaged that in the next decades the total annual energy demand, both thermal and electric, could be covered by renewable sources generated within the built environment.

More and more thermoelectric elements, such as heat pumps and thermal storage, will enable conversion from heat to electricity and vice versa. Control in this environment therefore requires an integral management of both the heat network and the electricity network.

In this paper we present a simulation framework which is able to simulate and coordinate multi-commodity flows on a district level using a wide variety of models to represent numerous types of appliances, taking into account different types of business objectives.

To manage these flows a market-based multi-commodity algorithm for integrated coordination of electricity and heat flows was developed and integrated in the simulation framework.

The algorithm is an enhancement of the PowerMatcher concept and inherits its advantages such as scalability and user autonomy. An example is given to demonstrate the usage of the simulation framework and integrated algorithm, in residential areas, to unleash a large flexibility potential of heat and electricity flows in support of the integration of renewable energy.