CITIES
Centre for IT Intelligent Energy Systems

DTU Electrical Engineering
Department of Electrical Engineering

DTU

# Classification and aggregation of energy components

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## Relevance, challenges, problem or opportunity

The world is in the middle of a massive energy transition due to the globalization and the economical growth of its main actors. Climate mitigation and fossil fuels scarcity are at the center of all interest which leads to an evolving landscape in the energy sector. Better interconnection between countries, integration of high share of renewable energy, electrification of the heating and transport system are some of the changes that are already happening. The latter raise challenges in term of energy system operation with different networks that are interconnected and need to be optimally operated as a whole. CITIES, aims at tackling the deficiencies related to Smart Grid . Its research activities supports the Danish target of a 100% renewable energy system by establishing an integrated research center covering all aspects of the energy system, including gas, power, district heating/cooling and biomass, and most importantly methods to forecast, control and optimize their interactions through the use of advanced ICT solutions.

## Research question

How to aggregate distributed energy resources in a multi-carrier energy system environment?

## Conceptual model/theory

The objective of the PhD project is to clarify the aggregation challenges that multi-carrier energy systems imply when smart grid solution are applied to it. This includes:

- Understand the synergies between the different networks (heat, electricity, gas)
- Identify the flexible resources/components and study their characteristics
- Identify the constraints under which components are needed to be operated (multi-dimensional constraints)
- Study the information flow required to control flexible energy resources
- Propose aggregation methodology at different levels with their associated ICT
- Perform simulation using multi-horizon planning tools (IPSYS)

## Expected results

Aggregation solutions that can be applied in a multi-carrier energy system environment. Understanding of the degree of modelling required for the aggregated energy components in order to control them in an optimal manner.

*WP4.1 Develop methodologies for aggregated simulation, based on detailed models from WP1 and WP2. Investigate methods for classification and aggregation of such components, including the network and associated constraints, and express the technologies at more generic, statistical and scalable levels.*

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