CITIES
Centre for IT Intelligent Energy Systems

## Qualitative investigation of the impact of energy communities on distribution grids

### Motivation

EU has recently agreed to increase its CO2 reduction target to 40% compared to the 1990 levels. Denmark is even more ambitious and they have stated a target of 70% of CO2 emissions reduction compared to 1990 levels by 2030. As a part of the raise of awareness about climate change, terms such as energy community and local energy systems have been getting more and more attention recently. The latter terms do not have a single definition but they all lean towards using more energy when it is locally available and less when it needs to be transported from distant locations. Usually, energy communities include prosumers (consumers of energy that produce energy at certain times) that can have or have not the possibility to store energy, e.g. via batteries or thermal energy storage. Although these concepts can sound attractive to different stakeholders, it is not yet clear what the impact of 'energy communities' on different distribution systems is.

### Objective

The objective of this demo project is to make a simple analysis of the impact of energy communities on three different grid layouts. The three grid layouts will represent urban, sub-urban and rural areas of Denmark. The objective is to estimate the consequences of different set-ups of energy communities on distribution grids, as well as to find the energy community set-ups that require further research.

### Methodology

Three simple grid layouts will be defined and three different cases will be investigated on each of them.

I) a small energy community, where all prosumers are connected to the same LV feeder.
II) a medium sized energy community, where the prosumers are located under the same 10/0.4 kV transformer, but are spread over various LV feeders.
III) a large energy community, where the prosumers are located in different MV feeders.

The impact of the energy community on distribution grids will be qualitatively assessed. Optionally power flow simulations will be carried out to support the finding of the qualitative analysis. The tools that are shortlisted to be used so far are Panda Power, NEPLAN and Power Factory, as well as any suitable packages for classical numerical calculations.

By using the mentioned modelling tools, impact of the local energy production and storage possibility will be assessed in terms of general electricity production/consumption imbalance, and possibly voltage and frequency regulation problems. Some of the questions that will be tackled are how should an energy community be billed and how should the distribution grid tariffs be constructed.

### Partners

Dansk Energi
DTU Compute

### Deliverables
A short report on the different energy community set-ups and the situations/layouts that should be investigated further in the future.

### Time frame
March – September 2020

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