

## Smart Energy Cities

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### Dimensions in Smart Cities

The topic of smart cities, even focusing on energies only, is rather complex. There is a scale issue that has to be addressed aggregating energy productions and energy flows from the individual components to buildings, street level, districts and up to whole cities. These city energy models and understandings must be in agreement with the overall energy systems for the country and the region. This must be done for all energy carriers involved in the city energy system. It is expected that buildings will play a major role in the overall stabilization of the volatile energy system. DTU Byg takes this issue up for research within the development area “Smart Energy Cities” through strategic research cooperation, dedicated research and development activities, such as the Nordhavn and Carlsbergbyen development areas in Copenhagen and the Vinge project in Frederikssund, a green field project with electricity only plans.

### Methodologies

**Monitoring and data management:** is the underlying structure that must be established to enable “intelligent” (smart) control of the energy mix.

**ICT:** One major technology to solve the energy challenges of cities is the application of IT-intelligent technologies for short term operational prediction and control, but also for medium and long term planning. Such infrastructures will spread within the components, buildings and cities impose an enormous task of coordination of many intelligent systems into an overall intelligent infrastructure. Within such infrastructures the interoperability issue must be addressed, getting the technologies to work together.

**Energy storage:** is probably the main issue to be addressed, actualised by the increasing share of fluctuating renewable energy in the overall energy mix.

**User aspects:** The users impact on energy demands is pivotal. Smart technologies address this aspect by intelligently inform the users to behave “smart”. This aspect has to be handled in cooperation with non-technical specialists.

**Regulation and planning:** Introducing dramatic changes as expected within the energy systems, regulation and planning must lead the path towards optimal solutions. The Smart Energy Cities research area will support knowledge based decision making.

**Modelling, simulation and scenario predictions:** The basic method applied in the smart cities area is numerical modelling of systems at various level of scale and complexity, aiming at getting detailed bottom-up models to meet large-scale top-down models to integrate. In a first version this will be done on basis of data interoperability. Later the ambitions will aim at integrated modelling platforms. Also full-scale demonstrations are ongoing.

### Buildings as prosumers – Focus for DTU Byg

Buildings and their users have key roles in this overall energy system and solutions towards a CO<sub>2</sub> neutral and sustainable future. Especially the consequences of buildings as prosumers (producer and consumer) must be understood. The development area “Smart Cities” addresses these issues through research and development, teaching and consulting.



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Energy Systems in Cities

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Appendix B

