

Change in design targets for building energy towards smart cities

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Driver for CITIES - Demand by Society



The government's energy policy milestones up to 2050

In order to secure 100 pct, renewable energy in 2050 the government has several energy policy milestones in the years 2020, 2030 and 2035. These milestones are each a step in the right direction, securing progress towards 2050.







Solution – Renewable Energy Sources

- Wind power
- Photovoltaic power
- Solar Heating
- Biomass
- Etc.





Challenge – Fluctuations







The proposed solution – Smart Grid

- Electrification
- From centralized to decentralized production









The Concept of CITIES

Integration & *IT-solutions* for *operation* and *planning* for future energy systems







The Goal - Flexibility

Can we shift energy?



Author: Henrik Madsen, DTU Compute





How do buildings impact? Can buildings be part of the solution?

The basic idea is to utilize the thermal mass of buildings

Research Question: How much of the thermal mass within a building can be utilized for demand management?

Demand shifting in time





Solution idea

- Optimization targets change
 - from energy demand
 - to energy demand with respect to time = flexibility

Methodology

- Typology for buildings
- Modelling and simulation of types
- Stochastic shaping of building demand
- Aggregation (from single building toward cities)











First findings

- The mass inside the insulation layer is "active" for flexibility only
 - > Also inner walls are active
 - > Can be optimized the new target
- There is most probably no need for extra mass for the daily demand management if "loading time" is not considered
 - However: "loading time" is key due to the fact that the time with high production of renewable energy can be very short.
 - To meet high flexibility there is a need for fast "load efficiency"
- Possible solutions:
 - Floor heating
 - Wall integrated heating and cooling solutions (TABS)
- Flexibility seems to increase with level of insulation if designed properly
 - Hence low energy design and flexibility design seem to converge.



Regarding Design

There is a strong probability that

changes in design targets

Will lead to

CHANGE IN DESIGN BUILDINGS

Thermal dynamics is the key issue

Advanced simulation models

- reflecting the construction layers
- optimizing for active, controllable thermal mass
- Flexible constructions examples:
 - TABS
 - Floor heating









THANK YOU ANY QUESTIONS



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