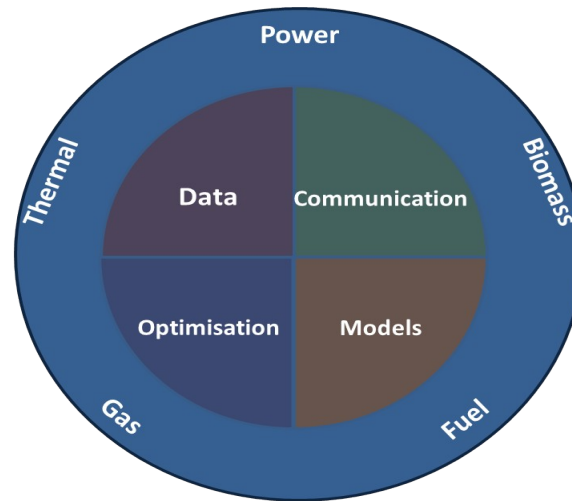


# CITIES

**DSF - 1305-00027B**



## Center for IT-Intelligent Energy Systems in Cities

<http://www.smart-cities-centre.org>

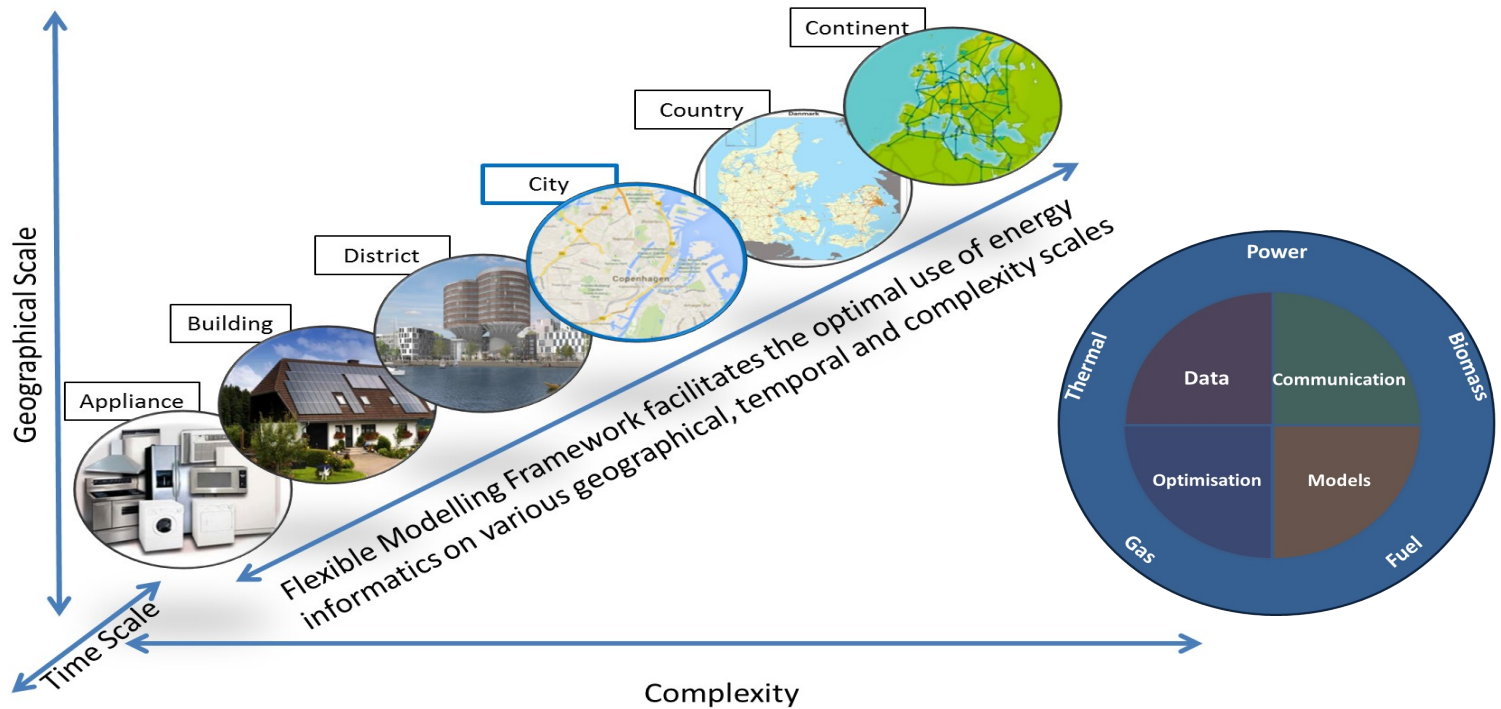
**Henrik Madsen, DTU Compute**



**CITIES**

Centre for IT Intelligent Energy Systems

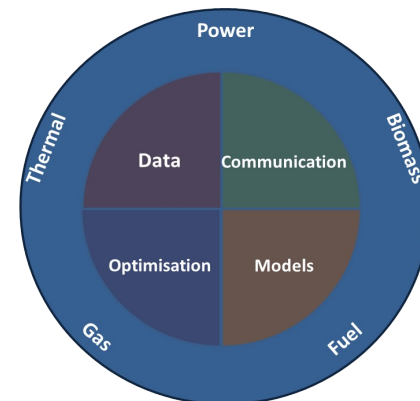
**Nationalt center (CITIES – budget 75 mill.kr.) med det formål at etablere intelligente løsninger for design og styring af integrerede energisystemer (el, fjernvarme, gas, biomasse).**



# CITIES - Formålet

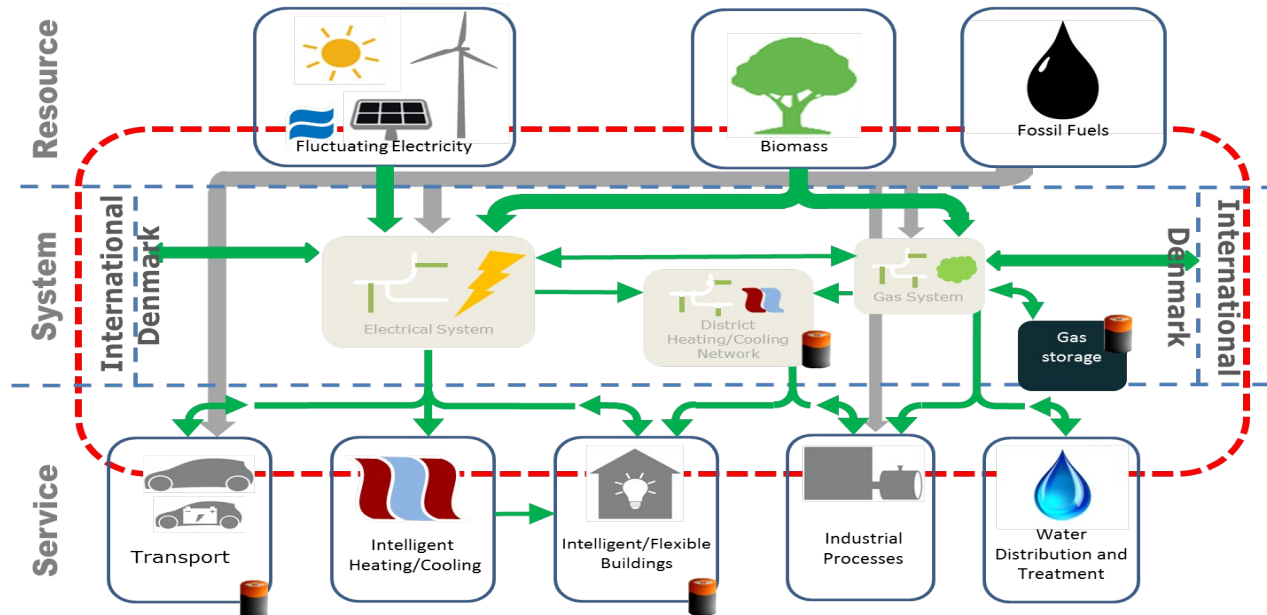
**Formålet er at vise at en intelligent integration af energisystemerne (varme, el, gas, biomasse, mv.) gør det muligt at integrere store andele af vedvarende energi - og dermed at opnå en væsentlig reduktion i CO2 emissionen.**

**Den intelligente integration vil give virtuelle og tabsfrie energilagre på en række forskellige tidsskalaer.**

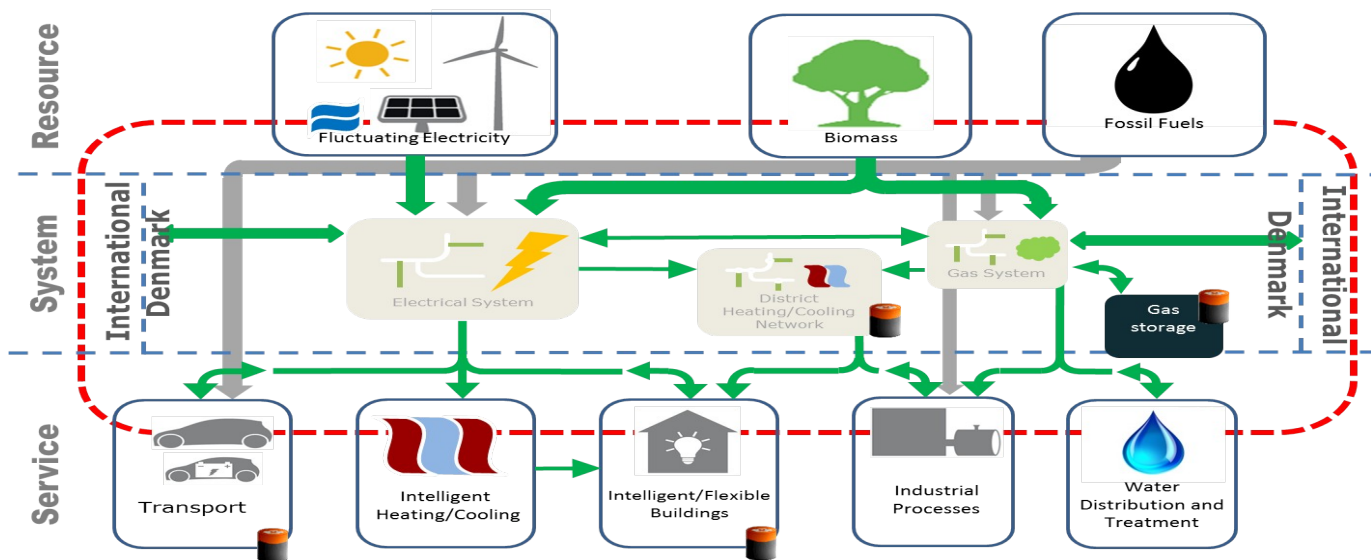


# CITIES konceptet

Intelligent og prognosebaseret energioptimering – også på tværs af energisystemerne (el, fj.varme, gas, biomasse)



# Lagring ved Integration af Energisystemer



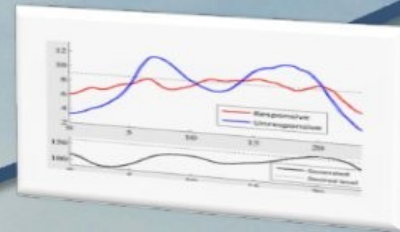
- Operationelle (simplificerede) modeller for optimering og styring
- Muligheder for (virtuel) energilagring:
  - Bygninger kan lagre energien 5-12 timer frem
  - Fjernvarmesystemer kan lagre energien 1-2 dage frem
  - Gassystemer kan give sæsonlagring

# Udfordringer

100% Renewables

Multiple supply strings

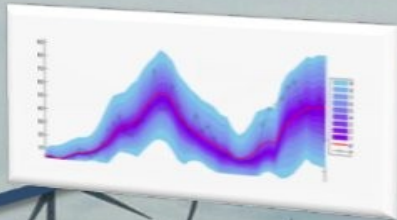
Dynamic tariffs



Biomass

Tax rules reflecting market price

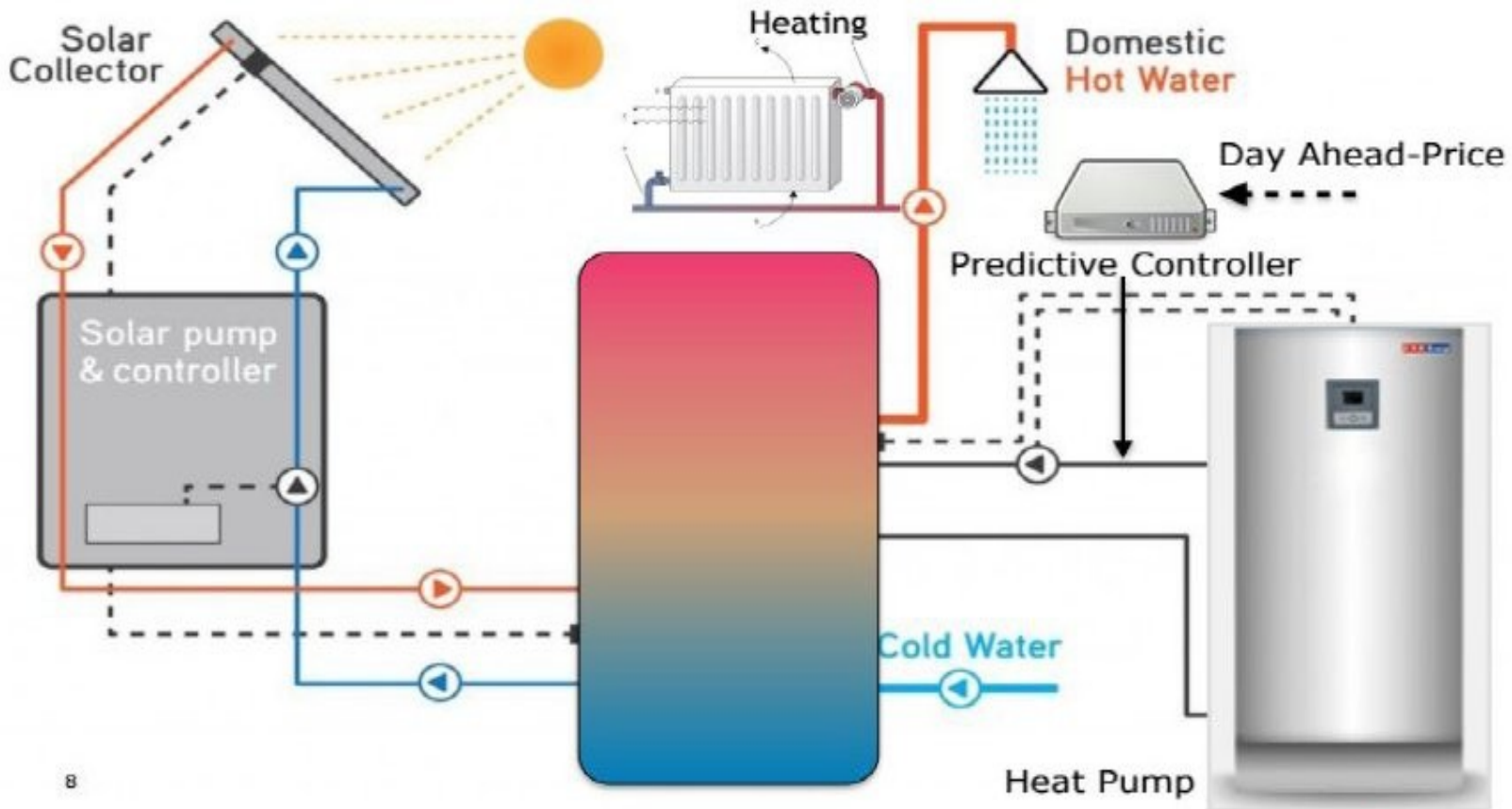
Intelligent consumption  
Demand response management



Forecasting of Wind and Solar Power

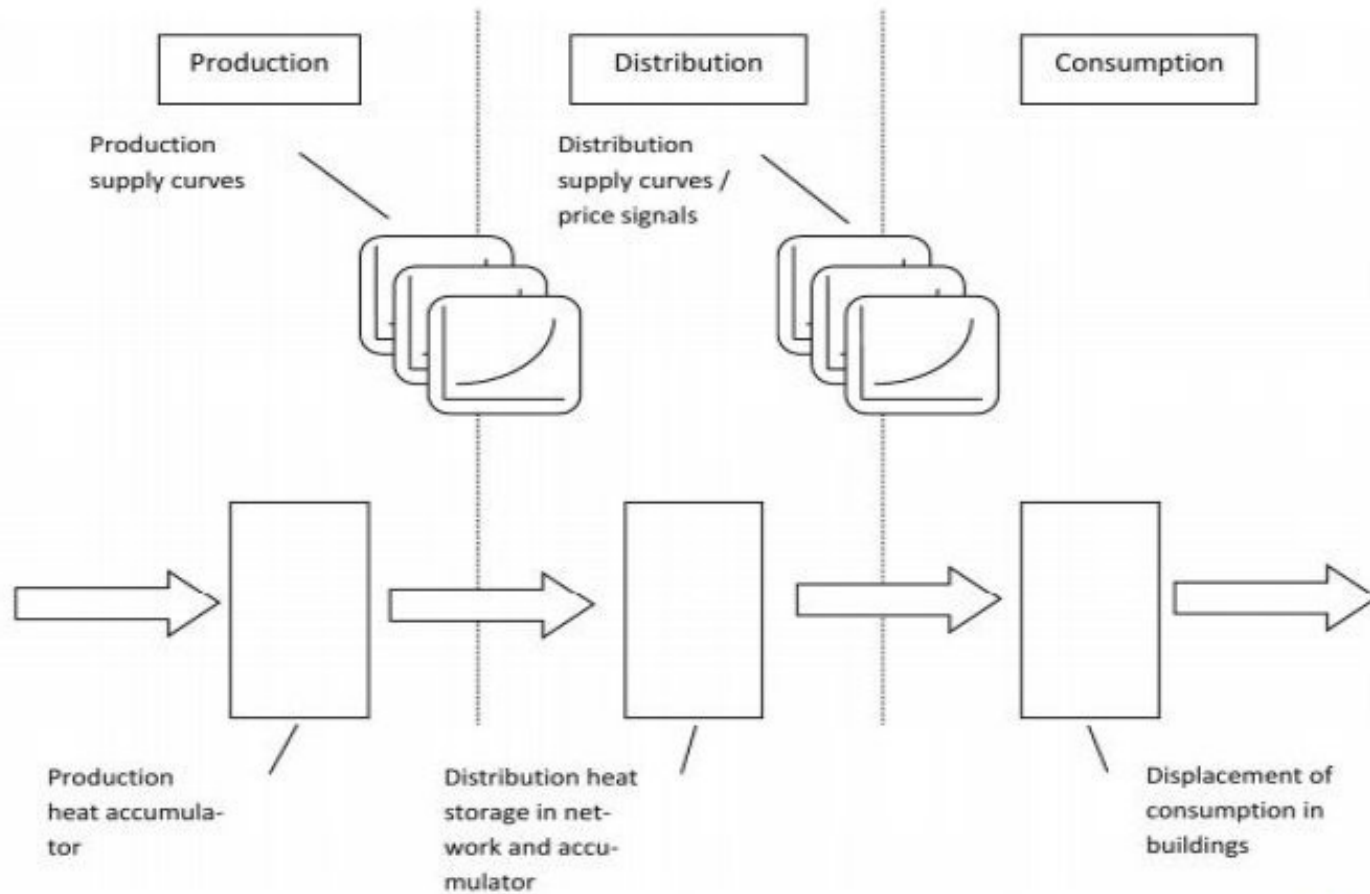
# Demo-Projekter

# Control of Heat Pumps (Grundfos, Enfor, DTU, ...)





# Flexibilities in DH Systems



**Fase 1: Prognose af varmelast i væksthuse, samt for Grundfos Kollegiet (?) Fjernvarme Fyn, AVA, DTU, Grundfos, Eurisco, Enfor, DMI, ....**  
**Fase 2: Fleksibel styring: + NeoGrid, NEAS, EMD, ...**

# Marginal value of heat



5

**EA Energianalyse, Fjernvarme Fyn, AVA, DTU, .....**