

CITIES Korean International Workshop

October 22nd, 2015

Introduction and Status

Henrik Madsen

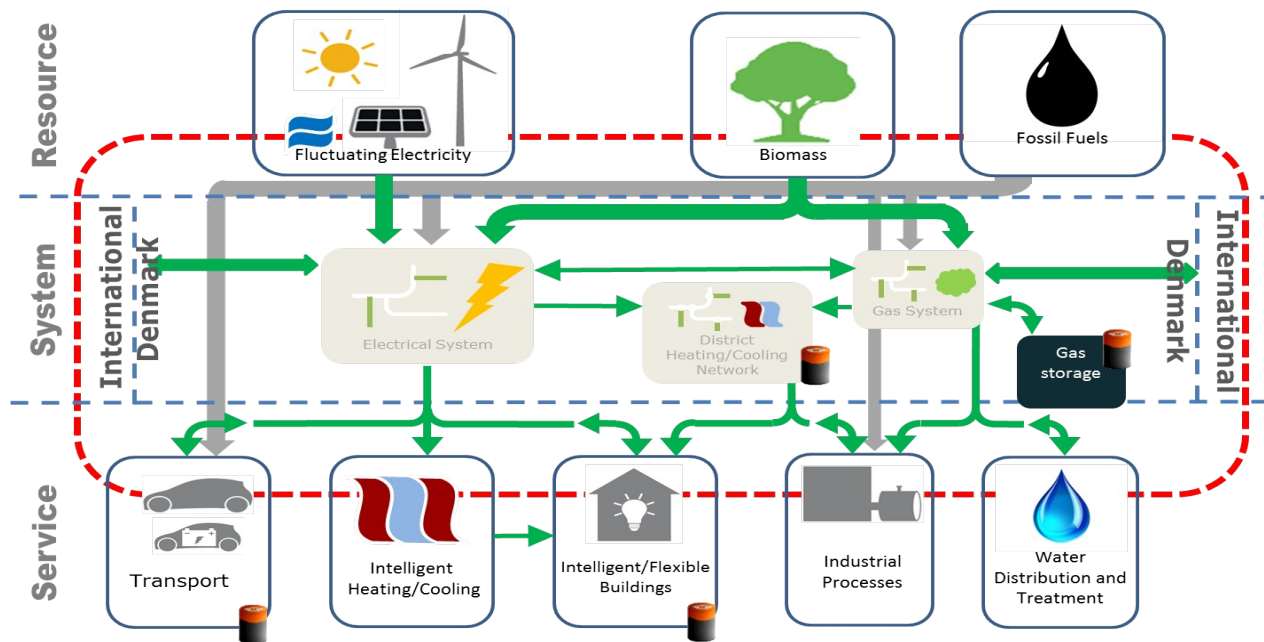
Center Manager



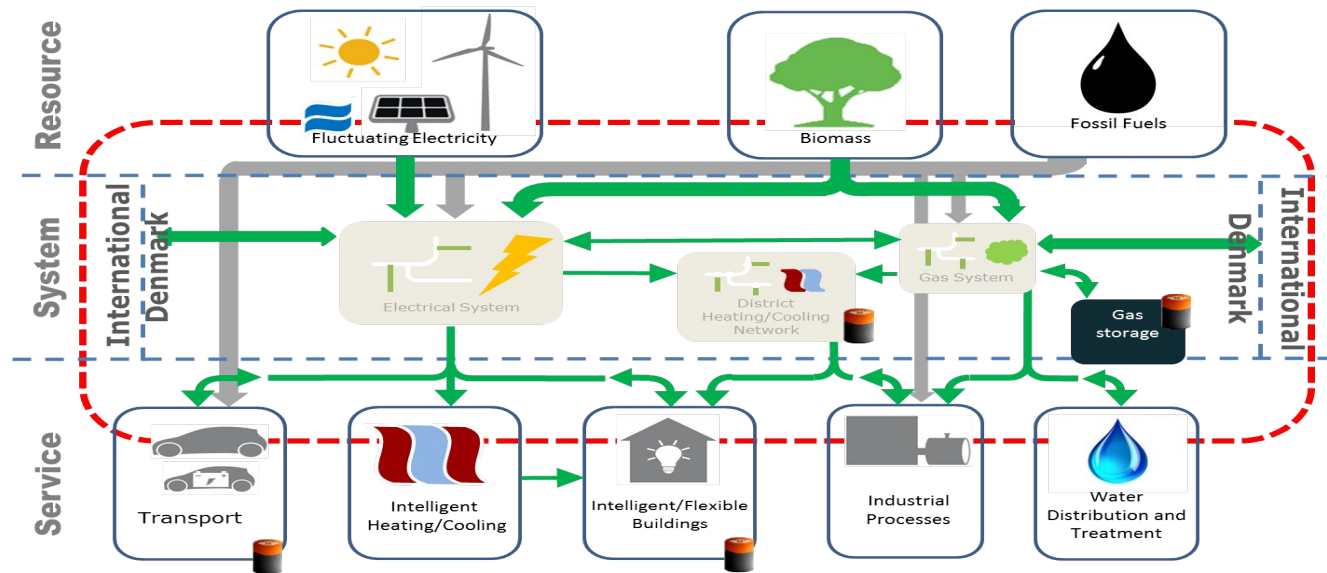
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Concepts

Integration based on *IT solutions* leading to methods for *operation* and *planning* for future energy systems



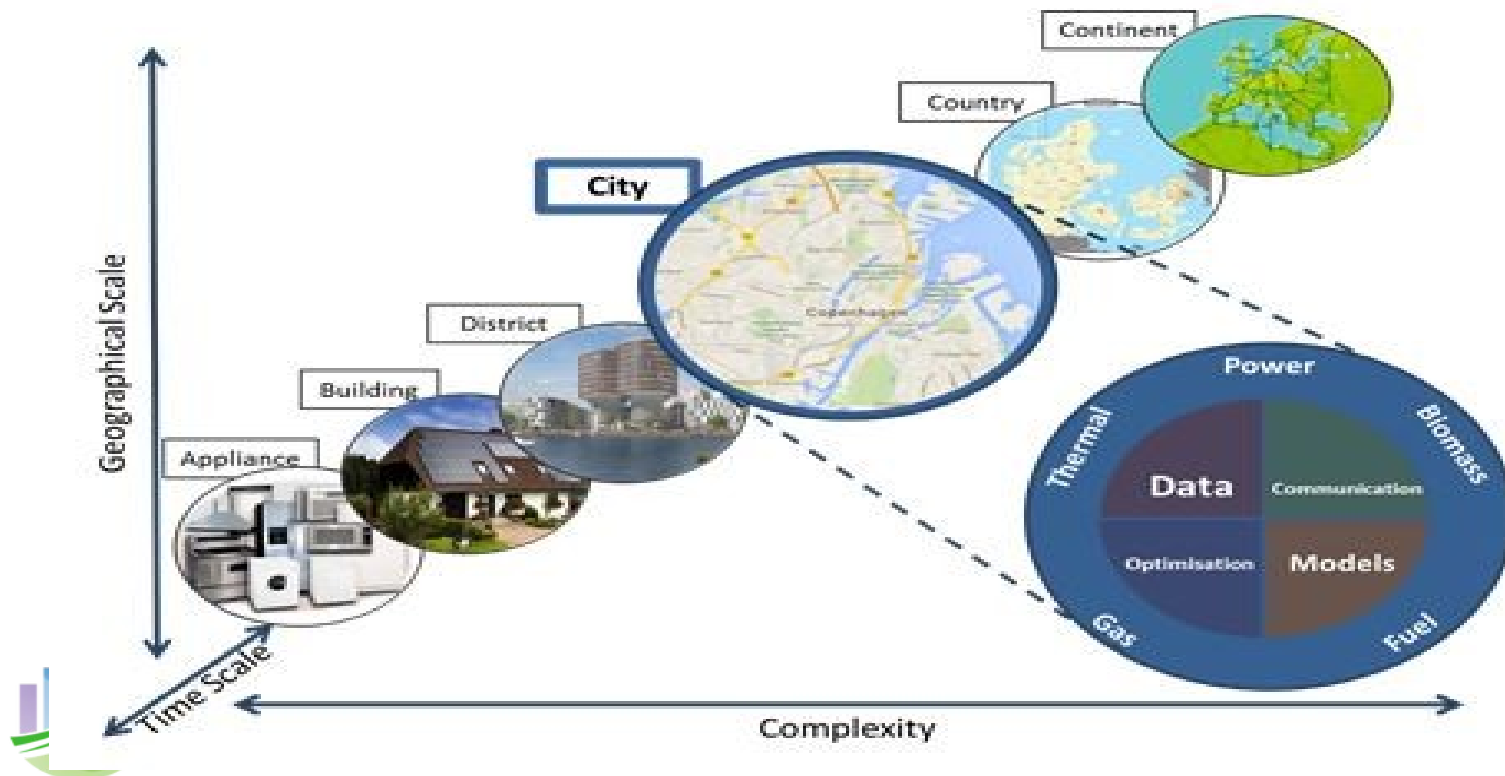
Example: Storage by Energy Systems Integration



- Operational (simplified) models for optimization and control
- Example: Virtual storage principles:
 - Buildings provide storage up to, say, 5-12 hours ahead
 - District heating systems can provide storage up to 1-3 days ahead
 - Gas systems can provide seasonal storage


Scientific Objectives

To establish methodologies and ITC solutions for design/planning and operation of integrated electrical, thermal, fuel pathways at all scales



Tool box for green solutions


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Byernes grønne værktøjskasse

2012
2013
2014

Januar
Februar
Marts
April
Maj
Juni

Ny solcellepulje på vej

Nøjsomme energiløsninger

Sønderborg-området mindste cykler derudaf

Byernes grønne værktøjskasse

Farvel el

Elbiler indtager Sønderborg

Sønderborg cyklede 92.237 kilometer på arbejde

Danskerne vil gerne betale for vindmøller og grøn kraftvarme

ProjectZero til Folkemøde

Sjov med ny energi

Klog på energi

Ældre Sagen sætter ProjectZero på dagsordenen

Forskerne indtager Sønderborg

Fond donerer 50.000 kr. til skolebørns arbejde med energi

Spilder du også penge på det varme brugsvand?

E-pitstop i Sønderborg

Diamanten på vej mod guldet

MinKøbmand på vej mod nullet

Benyt dit fradrag før det er for sent

Vind en cykel med ProjectZero

Byernes grønne værktøjskasse

CITIES (Center for IT-Intelligent Energy Systems in Cities) afholdt ultimo maj 2014 projekt-opstartmøde på DTU, og det var en stolt Henrik Madsen, professor og initiativtager til CITIES, som bød de mange deltagere velkommen til det 6-årige projekt.

Energisystemet er i opbrud. Overalt i verden skal energien bruges mere effektivt, de fossile brændsler udfases, og byerne spiller en ledende rolle i omstillingen. Energi fra vind-, sol- og biomasse skal sammen med flere elbiler, varmepumper, grøn fjernvarme og smartgrids sikre et effektivt energisystem, som også fungerer når vinden ikke blæser.

Disse forandringer udfordrer energiselskabernes planlægning samt kompetencer og beslutningskraft hos medarbejdere i kommunerne, fjernvarmeforsyningerne m.v.

CITIES sætter over de kommende 6 år fokus på både systemkomponenterne, det samlede energisystem samt de markeder som skal drive efterspørgslen efter de grønne løsninger - alt sammen målrettet byernes omstilling. Kompetencerne samles i CITIES videnscentret, hvor en række forskere bl.a. skal udarbejde nye computermodeller, som kan hjælpe byerne med at simulere mulige scenarier i fremtidens energisystemer.



Professor Henrik Madsen



Henrik Madsen er professor ved DTU og leder af CITIES projektet. Henriks forskningsområder omfatter bl.a. matematisk modellering, time-series-analysis, forecasting og dynamic modelling of wind power. I de sidste 30 år har Henrik arbejdet i forskellige nationale og internationale forskningsprojekter og har været vejleder på 42 ph.d. projekter.

Computermodel

Computermodel - Det lyder nørdet og det er det også!

Computermodeller træder ind, hvor en alm. lommeregner ikke kan klare opgaven længere. Disse modeller regner med tusindvis af tal og prøver at skitsere komplekse sammenhænge, for at kunne træffe de rigtige beslutninger.



Status (1. April 2015)

Status (1. April, 2015)



Some statistics:

- 21 Public oriented presentations
- 7 Times in the media
- 62 Scientific oriented presentations
- 23 Conference papers
- 17 Journal papers (7 pub., 10 subm.)
- 8 Workshops
- 3 Post Docs
- 4 PhDs

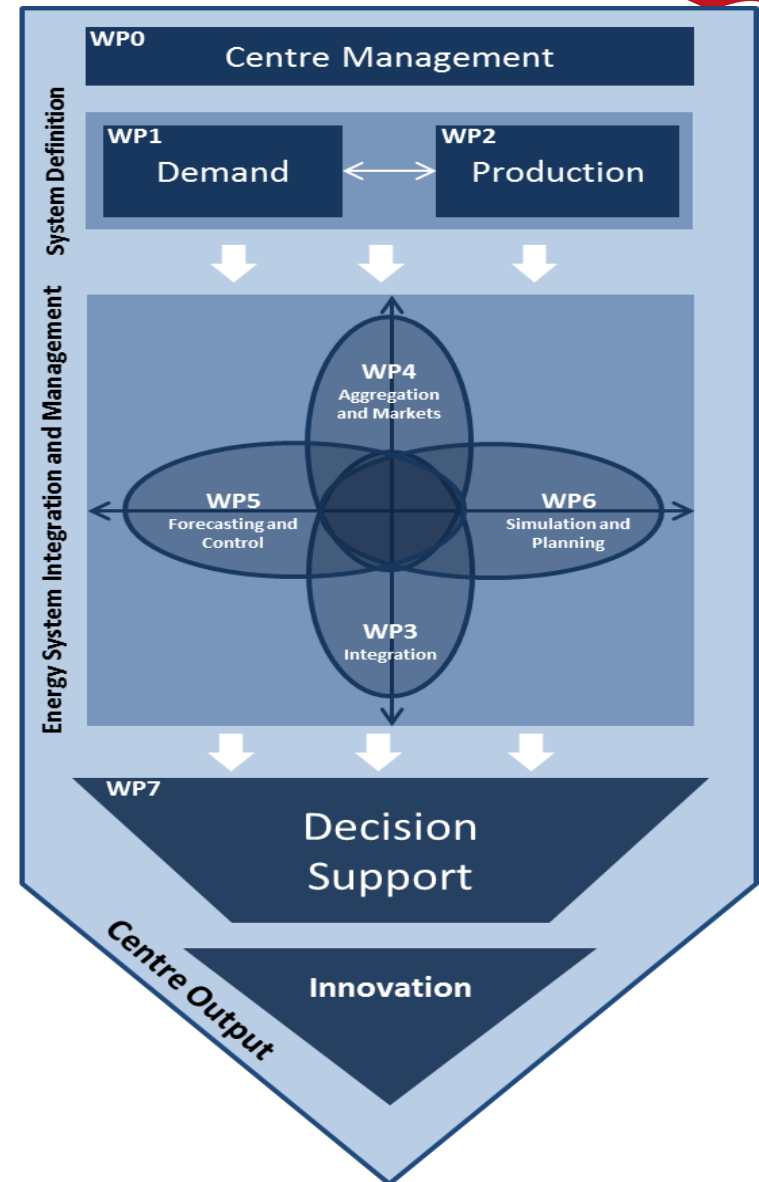


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Methodology

Research and work flow arranged into **work packages**.



WP0 – Project management

- Homepage www.smart-cities-centre.org
- CITIES office in Building 303, DTU Lyngby
- A brochure with comments from the Minister
- Visit by Crown Princess Mary and the Minister
- Visit of Irish Minister Alex White
- International influence
- EU: EERA JP ESI (proposal)
- Global: iiESI (Summer Schools / Works.)
- IEA (Annex 58, 66 and 67)
- New H2020 and innovation projects
- Innovation Networks:
 - INNO SE
 - DTI (VE-Net)



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Results

Some examples

Results – some examples



- Software:
- EMS: A Scalable Data Transformation and Analysis System
- HPMPC: A toolbox for High-Performance MPC
- CTSM-R: A toolbox for semi-physical modelling
- Modelling tools for aggregated loads
- Operational tool for isolated power systems
- Multiple Execution Tool for EnergyPLAN
- Sifre (Energinet.dk) tests in Sønderborg
- WEB-service for forecasting (load, wind, solar,...)
- Samsung (mainly) on use of simulation software for studying flexibility in demand shifting in buildings

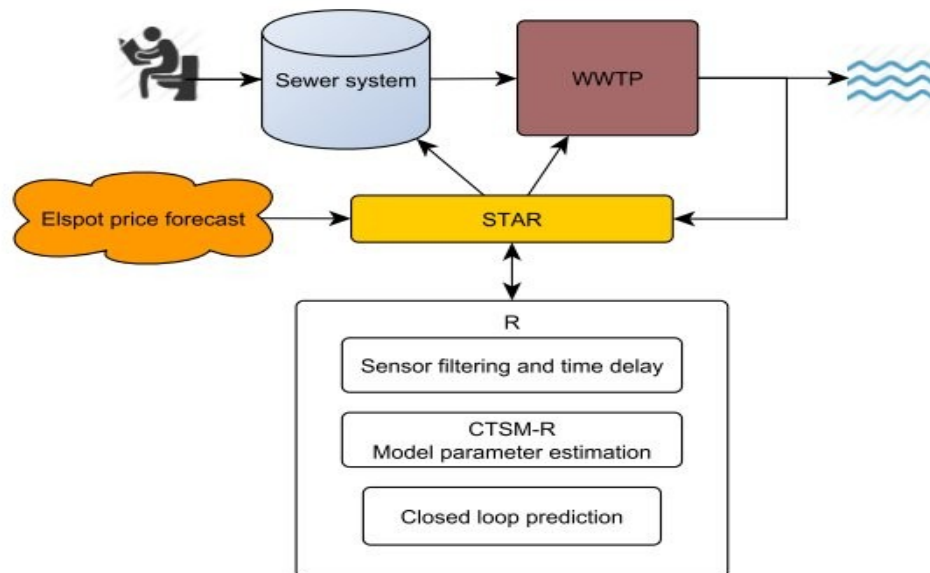


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Results – some examples (cont.)

- A number of Demo Projects (ex. - more later)
 - Sønderborg demo project (2029 scenarios for energy balance in Sønderborg Municipality)
 - Dynamic prices for heat delivered to DH systems
 - Energy flexibility in wastewater treatment:



SUMMER SCHOOL 2015

22 – 26 JUNE 2015, Lyngby, Denmark

Dynamic Methods for whole Building Energy Assessment



Deadline for submission is 1st June 2015



Organisers/Lecturer: DYNASTEE and CITIES – Hans Bloem (JRC, Ispra), María José Jiménez (CIEMAT, Spain), Henrik Madsen, Peder Bacher (DTU, Lyngby, Denmark), Paul Strachan (Strathclyde University, Glasgow, UK)

ROCKWOOL®
FIRESAFE INSULATION

The Centre for IT-Intelligent Energy Systems, CITIES, is a Danish strategic research centre with a range of world wide industrial and academic partners. CITIES aims at accomplishing energy integration through the use of IT solutions for design and operation of integrated energy systems in future smart buildings and cities; see also www.smart-cities-centre.org



DELIVERING LOW ENERGY BUILDINGS THAT WORK IN REALITY!

*"The first step towards real performance is to recognise, identify and address the gaps that exist between what is known and what needs to be known. That is why **Knauf Insulation** is supporting this Summer School, so that together with leading academics in the field, we can take our collective responsibility to ensure that we move rapidly towards buildings that really perform"*

knaufINSULATION
it's time to save energy



Results – some examples (cont.)



- Internationally:
 - A proposal for a new EERA JP on Energy Systems Integration
 - Further development of iiESI
 - New projects (H2020 – and also project funded entirely by private companies)



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Workshops

CITIES Workshops



- Ensure **cross WP interaction**
- Ensure deeper discussions on specific issues
- External experts will be invited from time to time
- Often arranged in collaboration with other groups / research organizations / companies / city projects / ...
- See www.smart-cities-centre.org



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Demo Projects

CITIES – Demo Project

- **Purpose:** To ensure an efficient and fruitful collaboration between smart cities projects (Sønderborg, Tjæreborg, Frederikssund, Odense, Aarhus, Copenhagen,..), companies, research organisations, and universities.
- Use test facilities
(eg. at Tecnalia, NREL, UCD, Samsung, Grundfos, Danfoss, PowerLab.dk/SYSLAB, DTI, ...)
- At least two Work Packages must participate
- Linked to new partner projects (EUDP, Innovation Centre, H2020 etc.)
- Linked to external existing and planned Smart Cities projects
- Use of high performance computing facilities (eg. ESIF and DTU-HPC)
- Described on our homepage.



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Consortium Meeting

May 2015

Consortium Meeting



- 54 participants
- Presentation of some Demo Projects
- Data sources and issues
- Cloud based control and solutions for Energy Information Services
- Some special presentations



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Plans and Challenges

Plans for the coming months

- More workshops
- International meetings
- IIESI and EERA JP ESI involvement
- New PhDs and Post Docs
- Definition of Demo Projects (incl some new H2020 projects)
- System(s) for data management
- Data ownership and security model
- Cloud based solution for Model Predictive Control
- Library: Grey-Box models for Energy Systems Integration



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