



**CITIES Consortium Meeting, May 2015**

# **Status and Visions**

**Henrik Madsen**

**Center Manager**

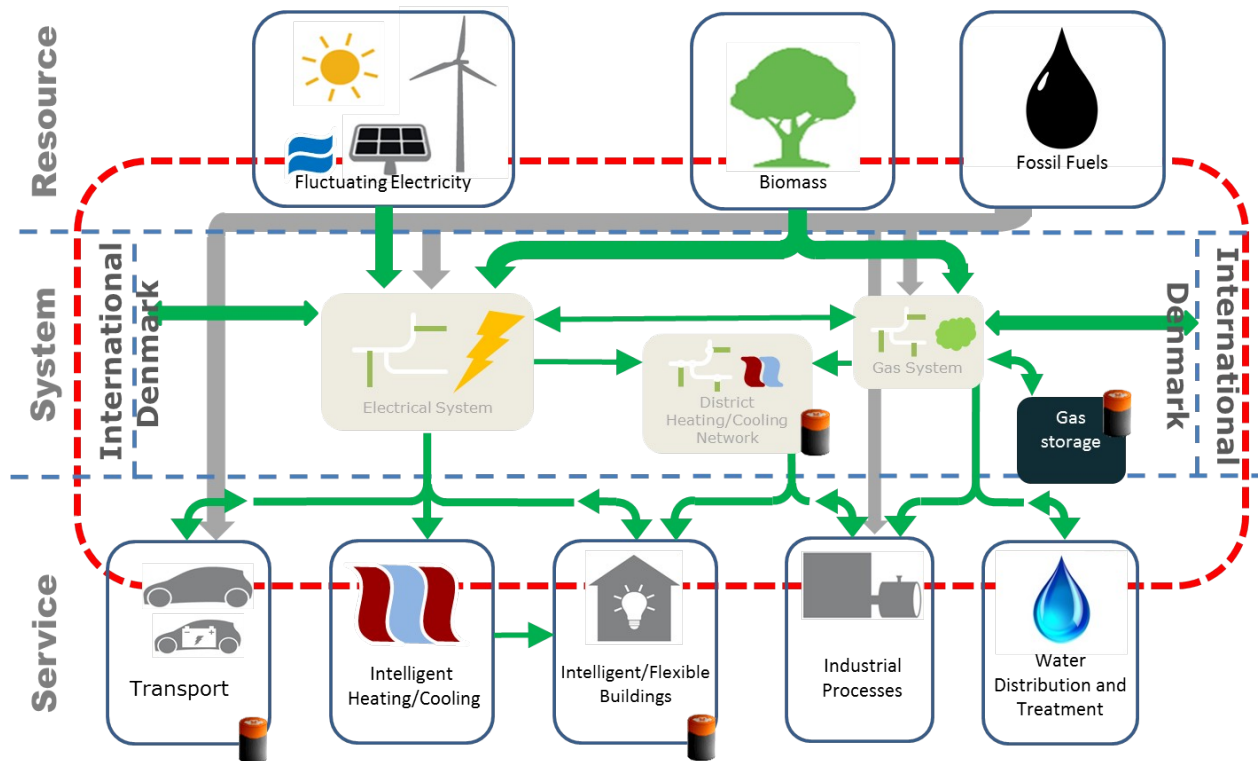


**CITIES**

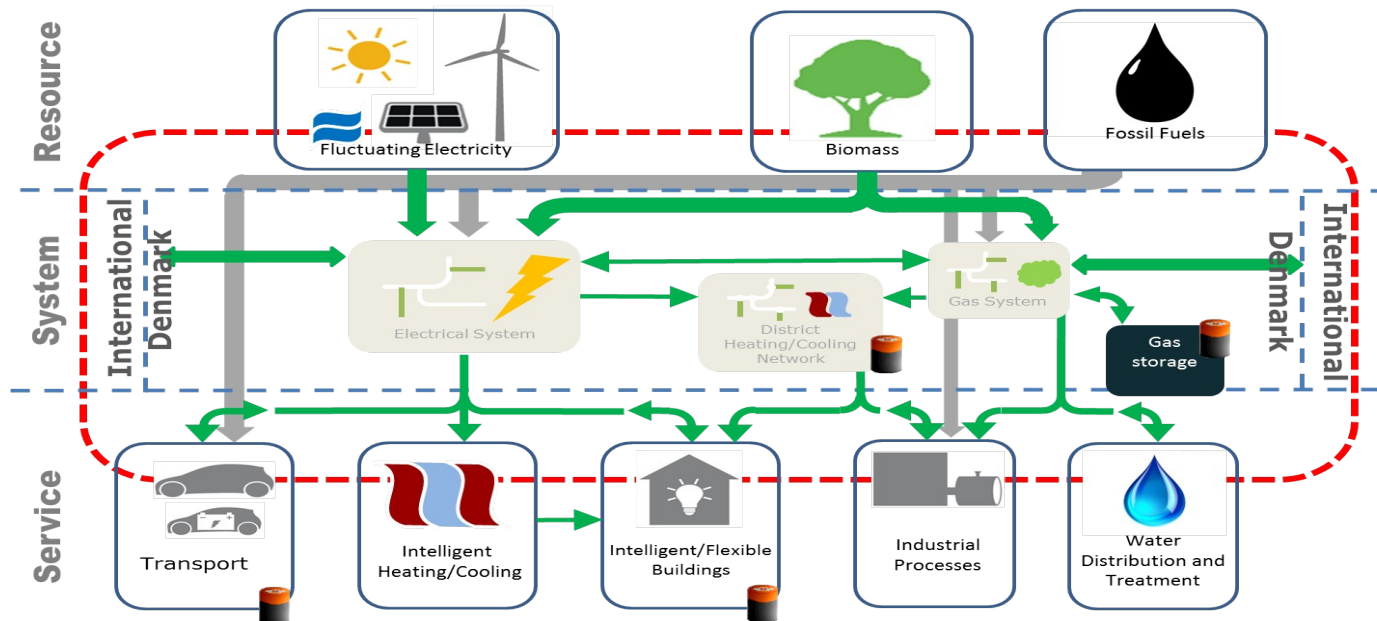
Centre for IT Intelligent Energy Systems

# Concepts

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



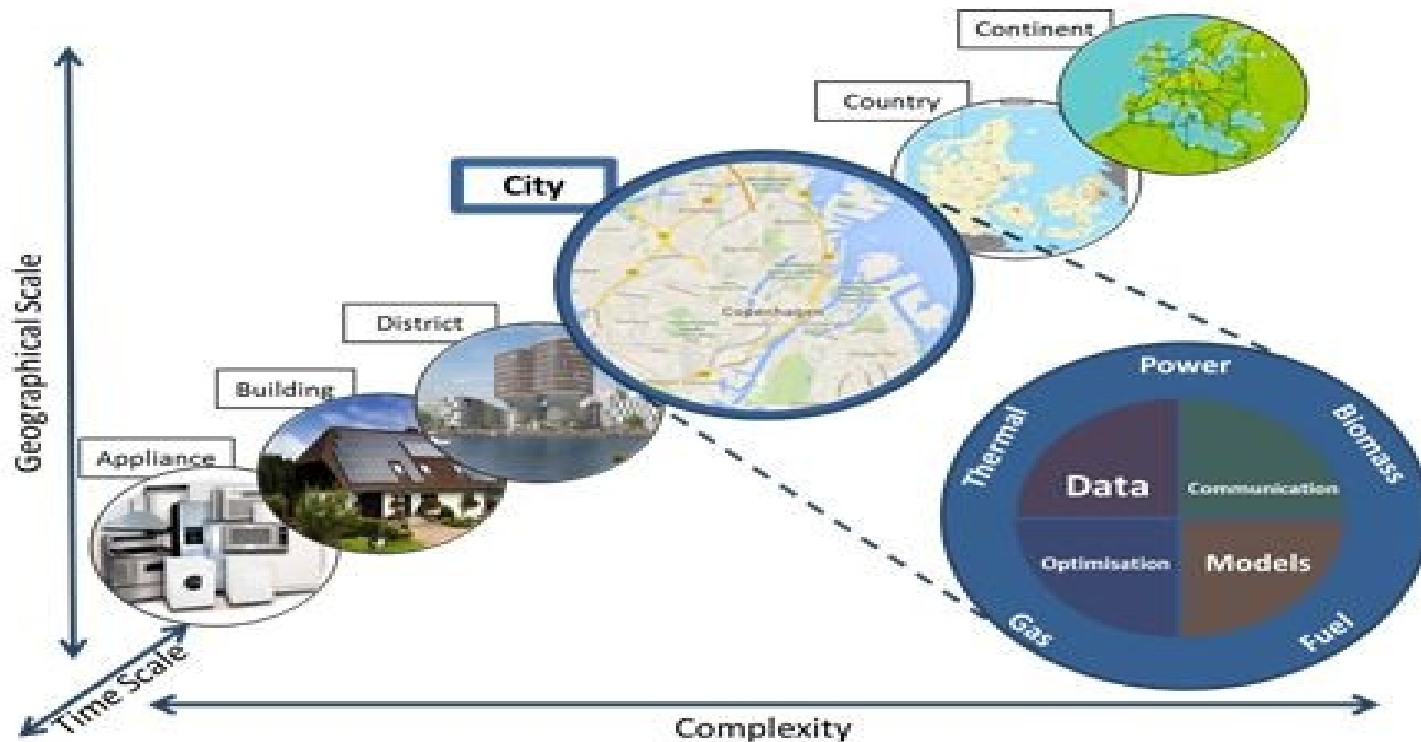
# Example: Storage by Energy Systems Integration



- Operational (simplified) models for optimization and control
- (Virtual) storage principles:
  - \_ Buildings provide storage up to, say, 5-10 hours ahead
  - \_ District heating systems can provide storage up to 1-2 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



**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.)

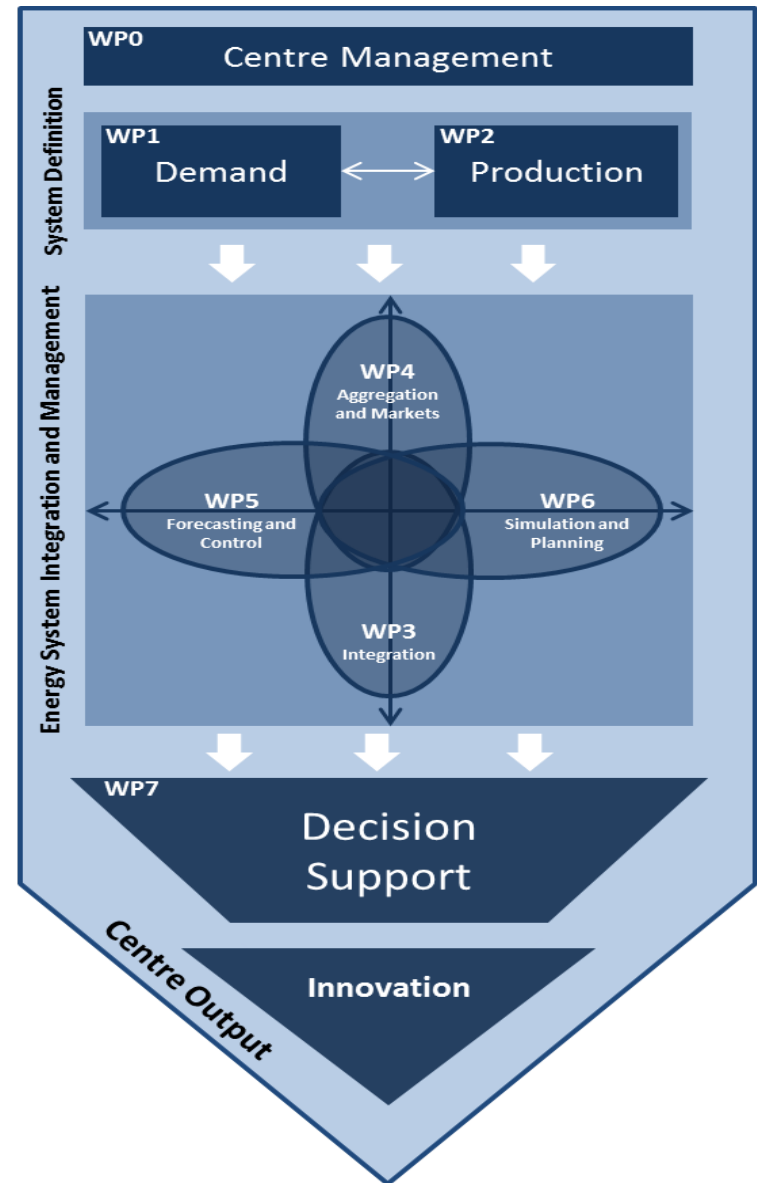
8 Workshops

3 Post Docs

4 PhDs

# Methodology

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





## WP0 – Project management



Homepage [www.smart-cities-centre.org](http://www.smart-cities-centre.org)

CITIES office in Building 303

A brochure with comments from the Minister  
Visit by Crown Princess Mary and the Minister  
International influence:

EU: EERA JP ESI (proposal)

Global: iiESI (Summer Schools / Works.)

IEA (Annex 58, 66 and 67)

Innovation Networks:

INNO SE

DTI (VE-Net)





 **CITIES**  
Centre for IT Intelligent Energy Systems



**FORSK  
NINGEN  
DØG**

**THI**

**THI**

**THI**

**THI**

**THI**





# WP 1: Energy Services and Demand



Two Conference papers

Software:

EMS: A Scalable Data Transformation and Analysis System

Demo Project:

Sønderborg demo project with WP2,  
Energinet.dk and more.

Employment:

Post Doc: Xiufeng Liu (Febr. 2015)

Phd Student (will start approx. August 2015)



# WP 2: Energy Supply, Transmission, Storage and Conversion



Master project in collaboration with Politecnico di Torino

Concrete solutions:

WP2 and Energinet.dk agreed that DTU will have access to Sifre.

Demo Project:

Sønderborg demo project (2029 scenarios for energy balance in Sønderborg Municipality)

Energinet.dk, Project Zero, ext.Gas consumer

Employment:

Post Doc: Dadi Sveinbjörnsson (July 2014)

Phd Student (will start approx. August 2015)



# WP 3: Intelligent Energy Systems Integration



6 Conference papers, 1 Journal paper (subm.)

Collaboration with Samsung (and WP5) on Building simulations and flexibility in demand shifting

Prosuming buildings (consump., storage, prod.)

Modelling tools for aggregation of load

Sønderborg demo project

Future smart cities

Demo project on DH systems and Greenhouses

Fjernvarme Fyn, WP5, ENFOR, ...

Employment:

Phd Student – Panagiota Gianniou



# WP4: Intelligent Aggregation and Markets



- 3 Conference papers, 4 Journal papers (3 subm.)
- Review of market structures and proposal of new market structures
- Study of dynamics tariffs
- Optimal bidding strategy for storage solutions
- Employment:
  - A PhD will start approx. Sept. 2015



# WP 5: Forecasting and Control



10 Conference papers, 2 Journal papers, 2 book ch.  
Collaboration with Samsung (and WP2) on Building sim.

New software for Soft Constrained MPC

Forecast of loads in family houses

WEB service for load, price and solar energy forec.

Demo projects:

- DH system and greenhouses

- Novasol – Flexibility and DSO/TSO interactions

- Grani – fossil-free society on the Faroe Islands

- Dynamic prices in DH systems

- Control of heat pumps

Employment:

- Phd Student – Jacopo Parvici

## WP 6: Simulation and Planning

- 2 Conference papers, 1 Journal paper (subm.)
- Focus on EnergyPLAN, the energy system analysis tool
- Multiple Execution Tool for EnergyPLAN – gives a possibility for modelling interactions between cities or regions, etc.
- From island operation to copper plate analysis
- Energy systems integration
- Study of export/import of electricity
- Several master projects
- Employment: A phd student has started



# WP 7: Decision-Making and Support Systems

2 Conference papers, 8 Journal papers (6 subm.)

Has focused on the joint operation of heat & power systems

Operational strategies for a portfolio of wind farms and CHP plants in a two-price balancing market

Analysis of profitability of electric boilers and large scale heat pumps

Several master projects with DONG, HOFOR, and COWI

Demo projects:

- Dynamic pricing in DH systems

- Summerhouses – flexibility and TSO/DSO interaction

Workshops related to 'Mathematics and Informatics for Intelligent Energy Systems.

Employment: A Post Doc – Marco Zugno

# 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 / .....
- Examples of upcoming workshops:
  - ***Workshop on Energy Systems Integration***  
(with iiESI – main responsible Prof. Mark O'Malley, UCD/ERC)
  - ***CITIES and Big Data***  
(with IBM, DEIC, Accenture, ....)
  - ***District Heating and Integration of Fluctuating Renewables***  
(with 4DH, Danish District Heating Assoc) (Nov. 2015)
- See [www.smart-cities-centre.org](http://www.smart-cities-centre.org)

# 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 Grundfos, Danfoss, SYSLAB, DTI, ...)
- At least two Work Packages must participate
- Linked to new partner projects (EUDP, Innovation Centre, H202 etc.)
- Linked to external existing and planned Smart Cities projects
- Use of high performance computing facilities (eg NREL-ESIF and DTU-HPC)
- Described on our homepage.



# **This Consortium Meeting**

# Consortium Meeting

- **Present some results**
- **Describe and discuss some Demo Projects**
- **Cloud based control and solutions for Energy Information Services**
- **Some special presentations**