4th International Conference on Smart Energy Systems and 4th Generation District Heating
Aalborg, 13-14 November 2018

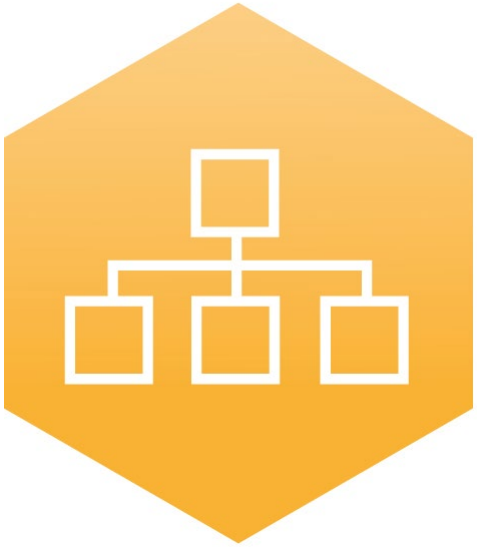
District-LAB Experimental Facility for Innovative District Heating Systems on a Community Level

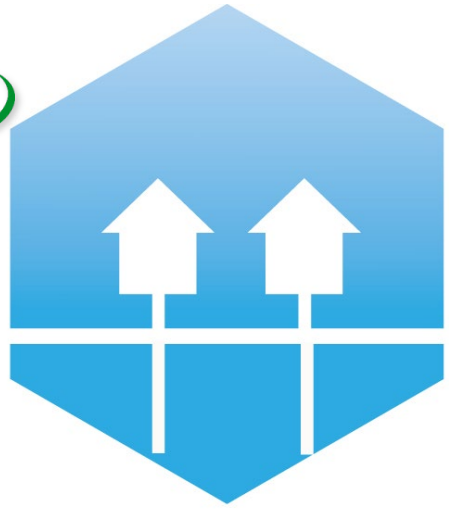
D. Schmidt, A. Kallert, H. Huther and S. Richter

Fraunhofer IEE

AGFW

GEF Ingenieur AG





AALBORG UNIVERSITY
DENMARK

4DH
4th Generation District Heating Technologies and Systems

Solutions for urban districts

Innovative heat supply on a community level

4DH
4th Generation District Heating Technologies and Systems

„Low temperature district heating is a key technology for an efficient integration of renewable energy sources and waste heat in our energy systems.“

AALBORG UNIVERSITY
DENMARK

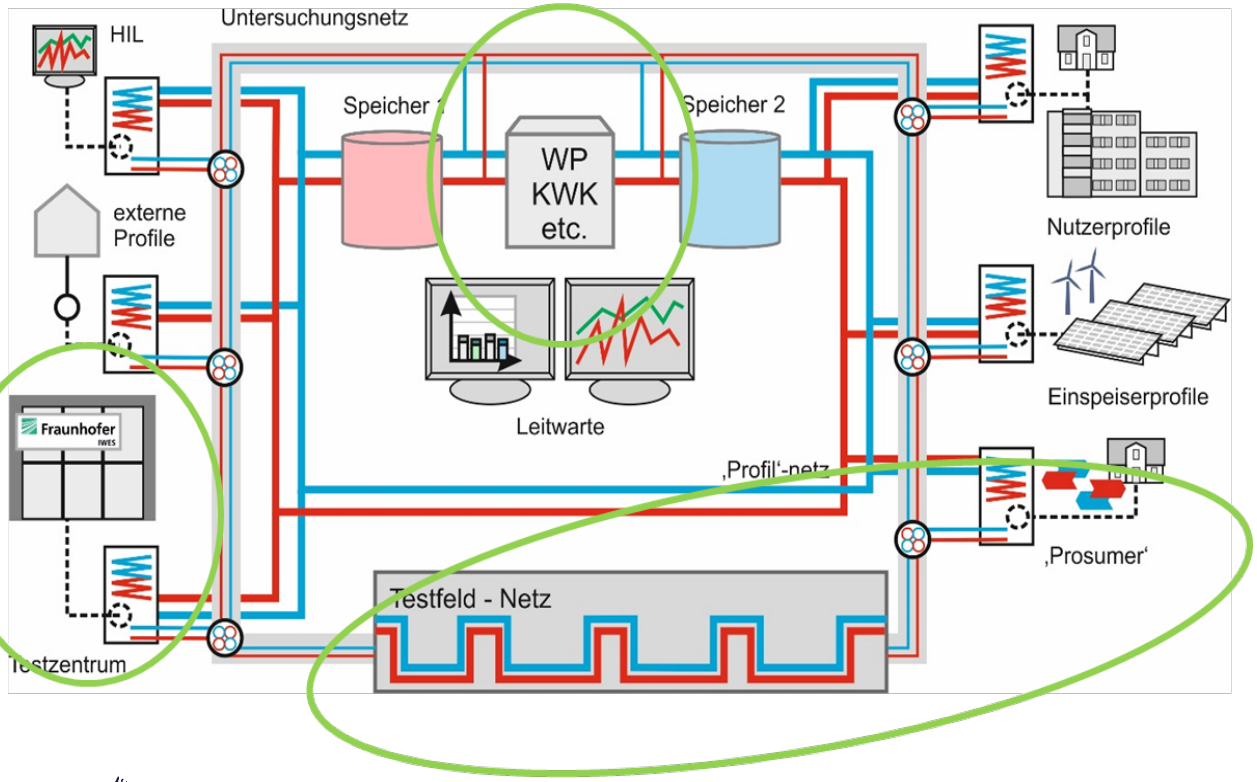
IEA DHC|CHP Annex TS1

Why do we see a need for action?

- District heating is under scrutiny in many cities
- Economic situation of networks and generation facilities?
- Needed extension of district heating grids
- Promising examples from different developments of energy systems in urban districts
- Make new business models accessible
- Strengthen customer relations
- New upcoming technology sets offer opportunities for innovative heat supply, e.g. P2DH….

District LAB
Experimental facility for innovative district heating systems on a community scale

4DH
4th Generation District Heating Technologies and Systems

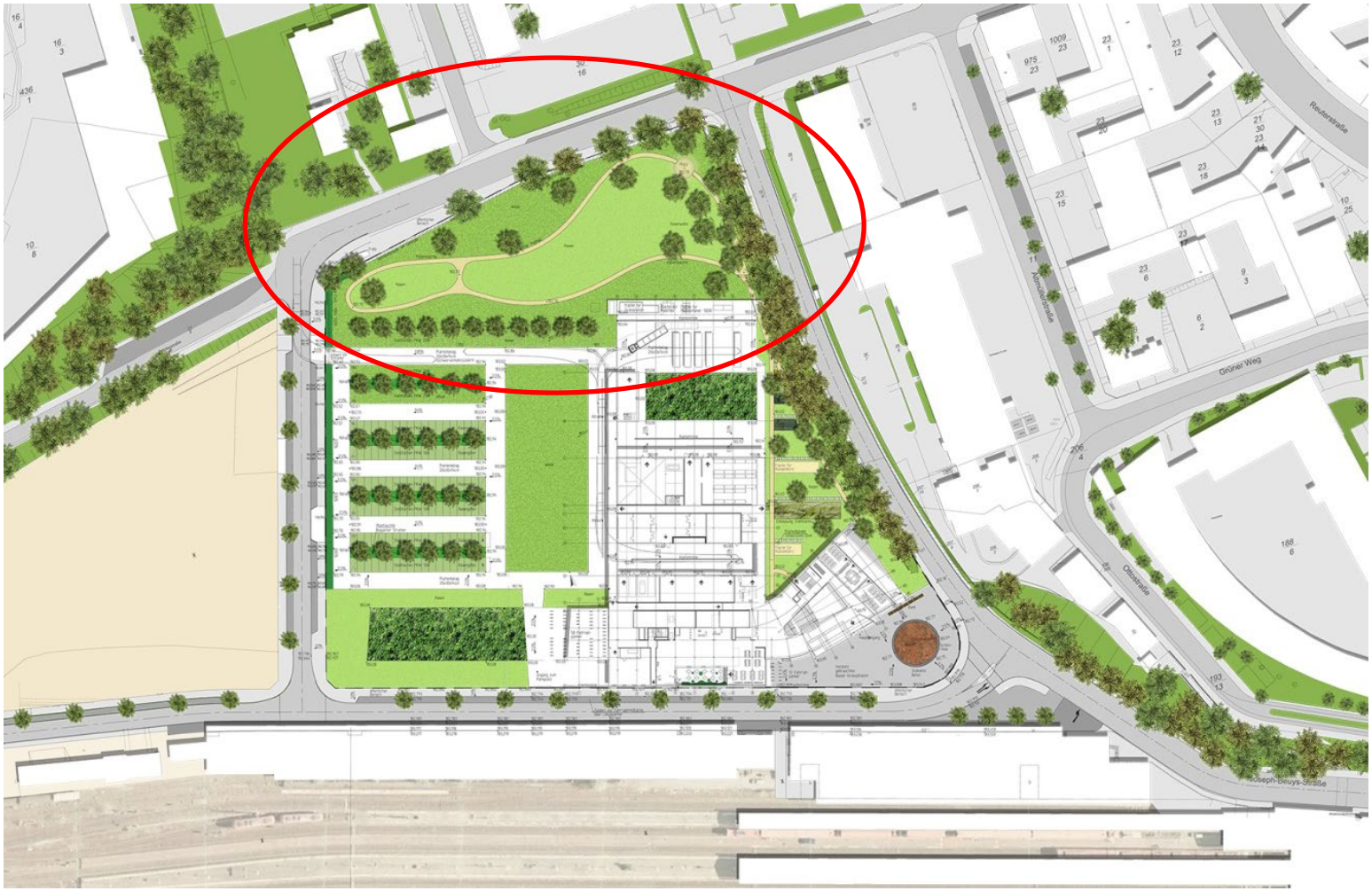


4 Focus areas:

- Innovative district heating grid with decentralized feed-in
- Mechanical tests – piping systems
- Central heat supply – large heat pump
- Smart Energy Utilization/ Test building

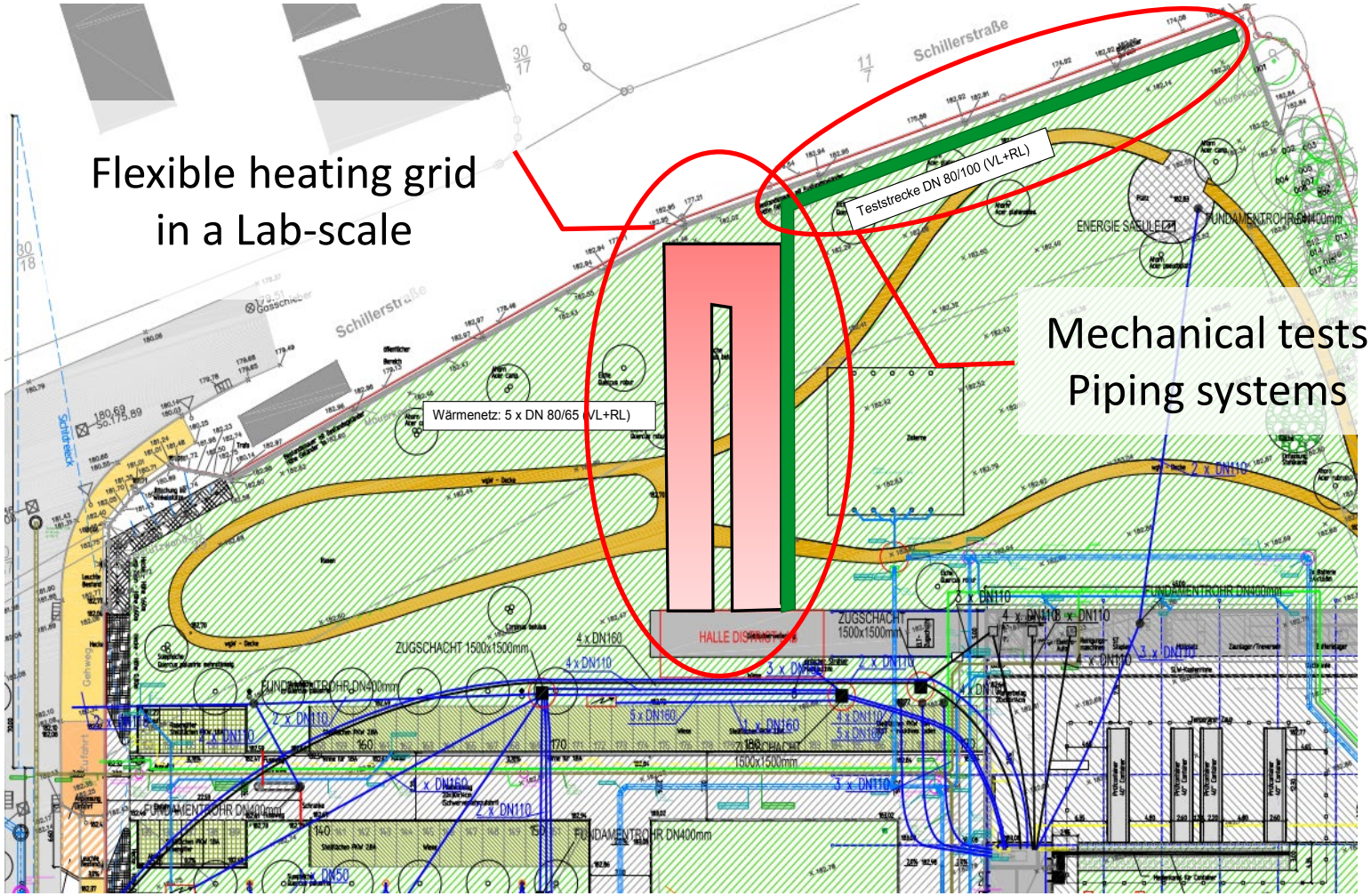
AALBORG UNIVERSITY
DENMARK

Location at the new Fraunhofer IEE office building in Kassel



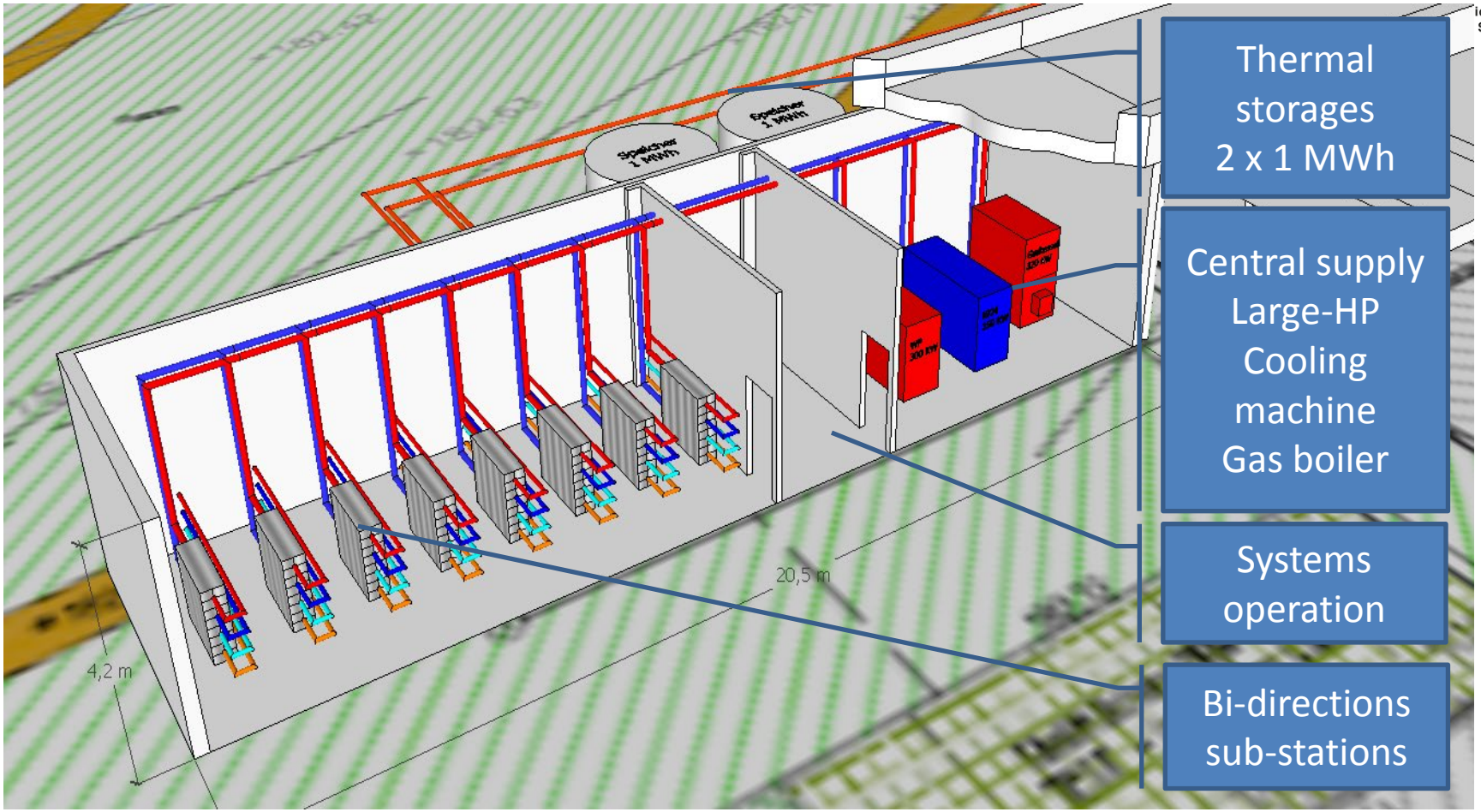
4DH
4th Generation District Heating Technologies and Systems

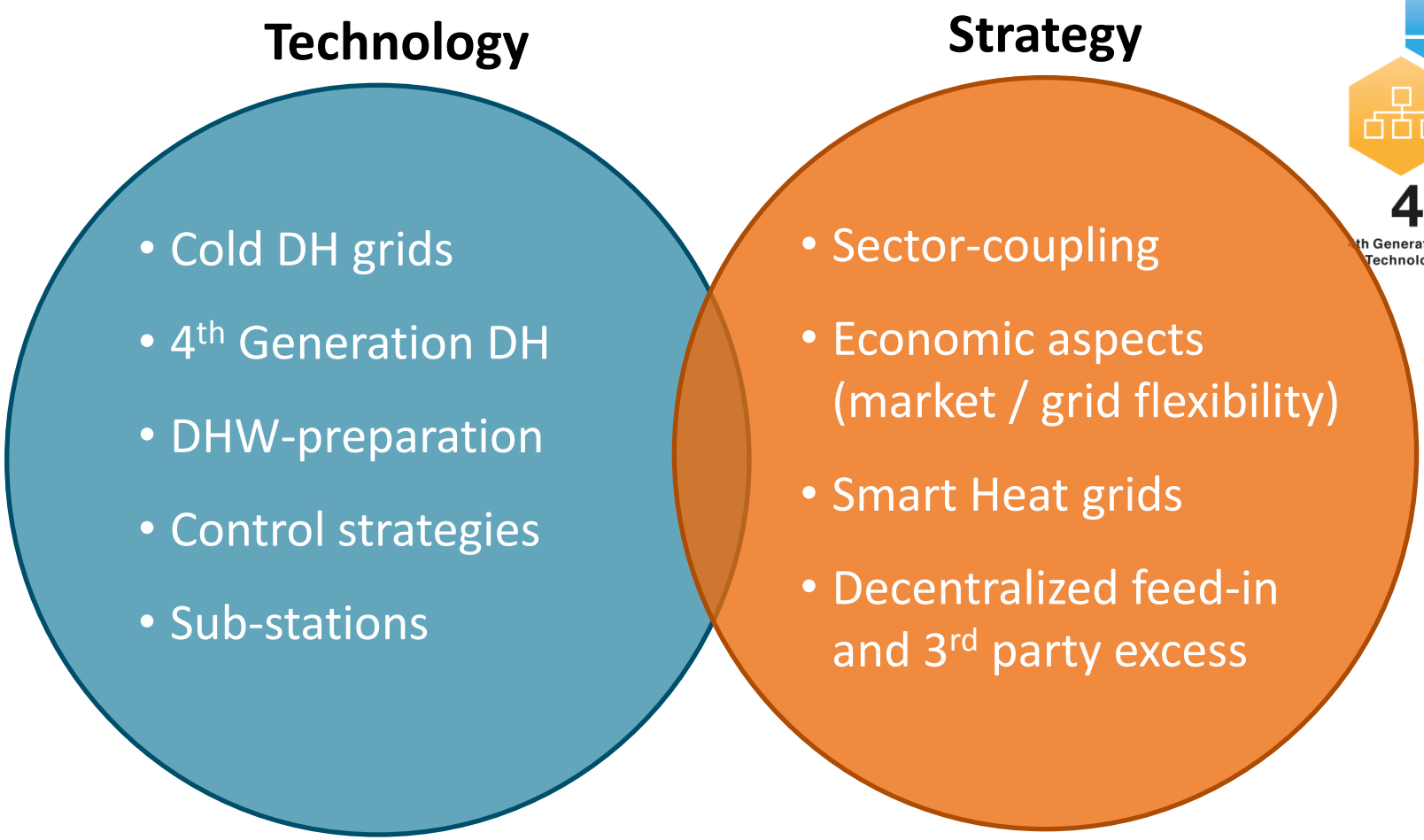
District LAB - concept



4DH
4th Generation District Heating Technologies and Systems

District LAB – Central supply technologies





4DH
4th Generation District Heating Technologies and Systems

The primary goal is the realization of an experimental and test facility for innovative district heating systems on a community scale.

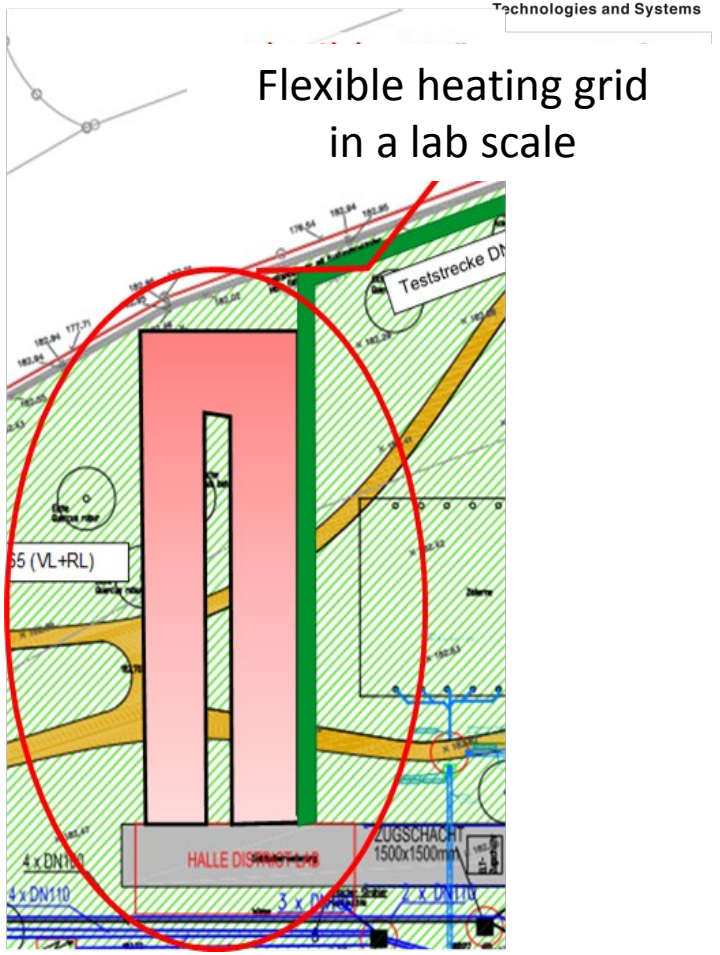
AALBORG UNIVERSITY
DENMARK

Flexible heating grid in a lab scale

Thermo-hydraulic tests for the assessment of district heating strategies

4DH
4th Generation District Heating Technologies and Systems

1. Cold grid / source for decentralized heat pumps
2. 4th generation district heating with decentralized feed-in
3. Transformation strategies (temperature reduction, etc.) for existing DH schemes
4. Hygienic domestic hot water preparation in low temperature district heating grids

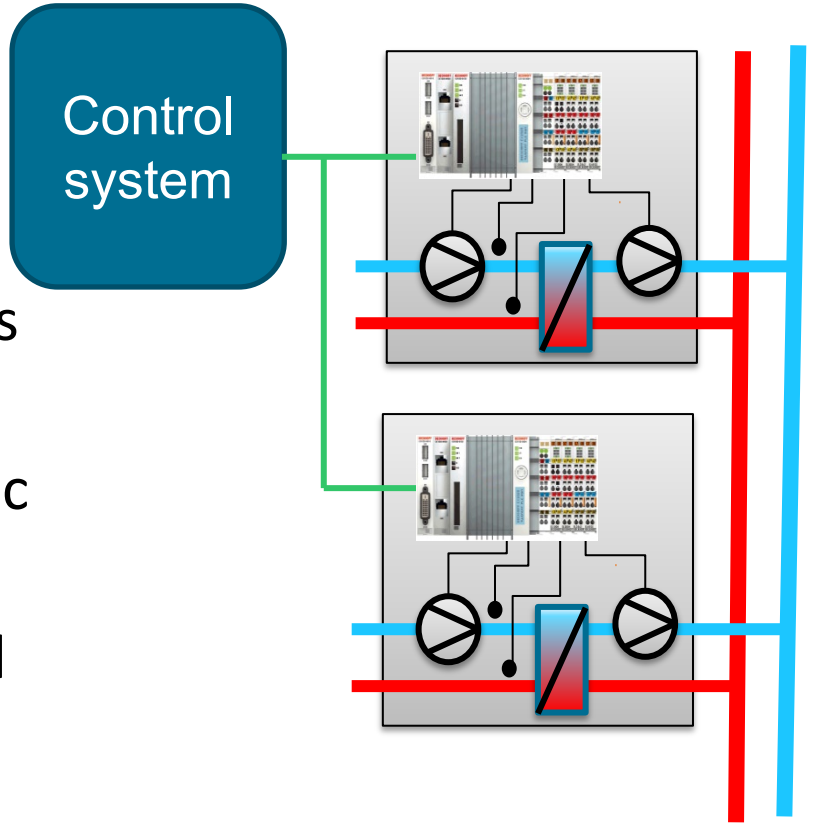


AALBORG UNIVERSITY
DENMARK

Management system and control concepts

Development of new operational strategies and control concepts for flexible district heating networks

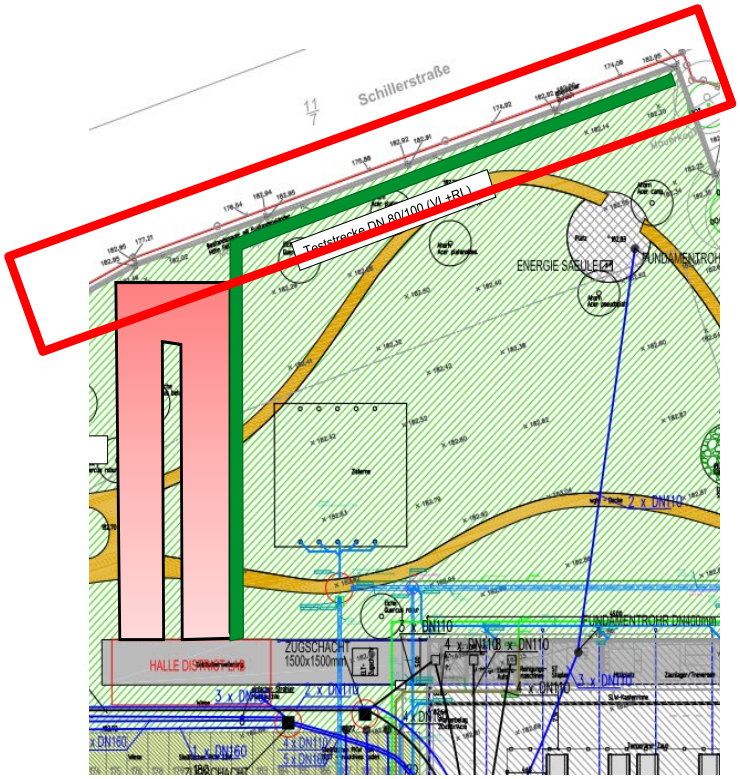
1. Control, monitoring and visualization of central and decentral components
2. Automatization of test sequences
3. Modell validation and identification of customer specific components
4. Predictive simulation and control



Mechanical tests of piping materials

4DH
4th Generation District Heating Technologies and Systems

1. Test of extreme **operating modes** taking into account pipe statics and material fatigue
2. Development of new **laying techniques**
3. Flexible tests of **bedding materials**
4. **Quality assurance** on the construction site
5. Derivation of evaluation and **design criteria** for pipes



AALBORG UNIVERSITY
DENMARK

First project ideas

1. District heating grids and new operational strategies

- Dynamic and changing boundaries for feed-in and utilization
- Grid operation with new temperature regimes
- Dynamic pressure- and temperature variations

2. Tests of components

- Piping systems
- Heat exchanger / sub-stations
- Pumps
- Control elements

3. Development of simulation tools and validation

- Static hydraulic simulations incl. heat losses
- Dynamic simulations of control sequences and pressure surges

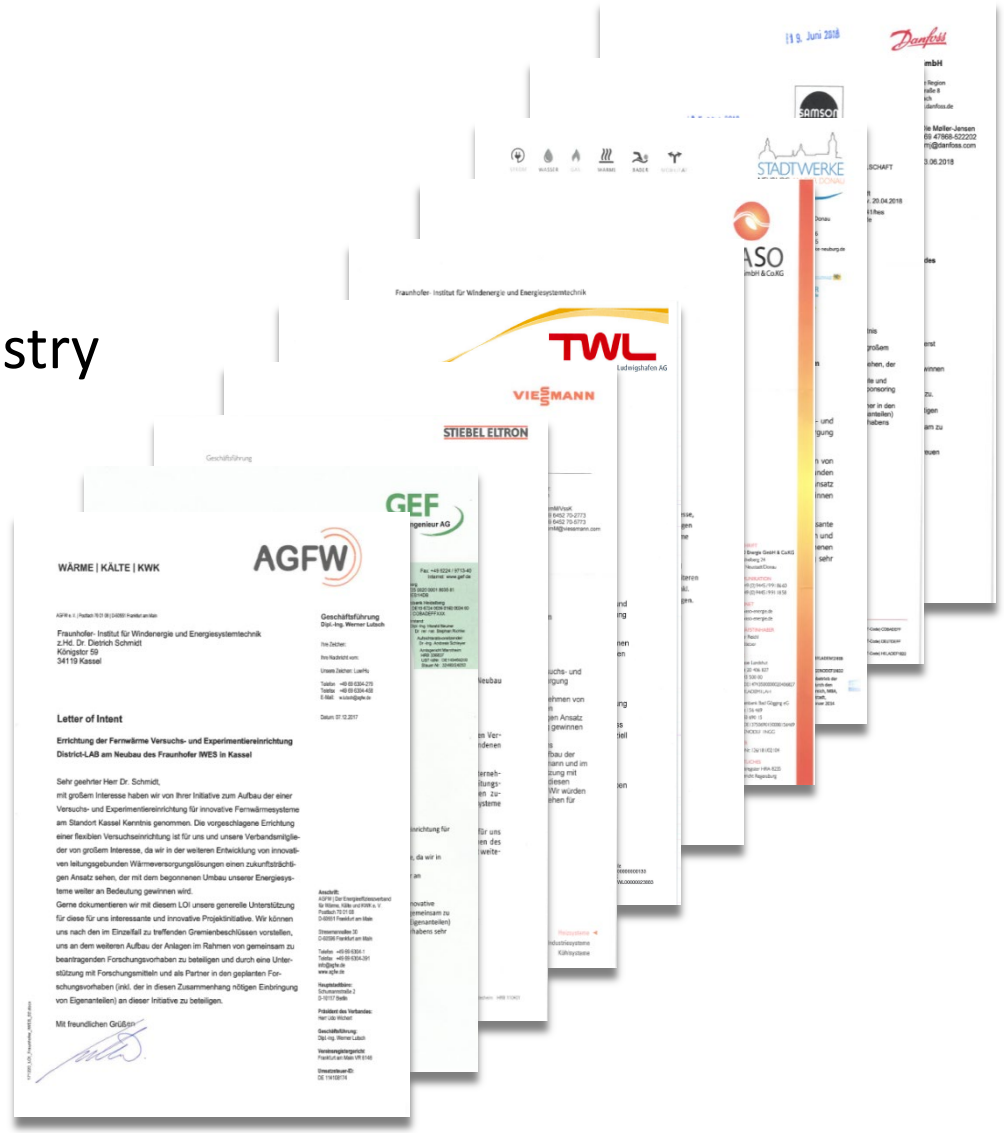
Extended possibilities of District Lab in comparison to existing research facilities

4DH
4th Generation District Heating Technologies and Systems

1. **In comparison to „demonstration projects“:** Higher flexibility based on the HiL units and the adjustable demand and utilization profiles as well as grid typologies.
   ⇒ Close to reality projection and comparison to a large number of supply scenarios
2. **In comparison to simulation:** „real behavior“ of components in heating networks representable
   ⇒ Critical user, pressure surges, temperature profiles in the pipes
3. **Validation** of own and other simulation approaches. Development and validation of simulation models/components
   ⇒ Validation of simulation components as pipes, pumps etc.

Our cooperation partners…

…from industry



…and science

4DH
4th Generation District Heating Technologies and Systems

NTNU
DTU
HALMSTAD UNIVERSITY
IEA DHC|CHP

AALBORG UNIVERSITY
DENMARK

Realisation

4DH
4th Generation District Heating Technologies and Systems

Next steps…

- **Conceptional design and planning of the facility in 2018/19**
  Detailed analyses of the research and development questions in cooperation with industry, formulation of a detailed concept, new staff members, etc.
- **Construction in 2019/20**
  Go along with the realization planning, create measurement and data handling concept, monitoring
- **Commissioning in 2021**
  Commissioning of the facility, work with orders from industry partners and in research projects. Extension of the facilities

AALBORG UNIVERSITY
DENMARK

Contact

Tekn. Dr. Dietrich Schmidt

Head of Department Heat and Power Systems

Fraunhofer Institute for Energy Economics and Energy System Technology IEE

Mail: dietrich.schmidt@iee.fraunhofer.de

Phone: +49 561 804-1871

http://www.iee.fraunhofer.de