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

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Solutions for urban districts
Innovative heat supply on a community level

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

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
Location at the new Fraunhofer IEE office building in Kassel
District LAB - concept

Flexible heating grid in a Lab-scale

Mechanical tests Piping systems
District LAB – Central supply technologies

Thermal storages
2 x 1 MWh

Central supply
Large-HP Cooling machine
Gas boiler

Systems operation

Bi-directions sub-stations
The primary goal is the realization of an experimental and test facility for innovative district heating systems on a community scale.
Flexible heating grid in a lab scale
Thermo-hydraulic tests for the assessment of district heating strategies

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
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

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
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

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
Realisation

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
Contact

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