

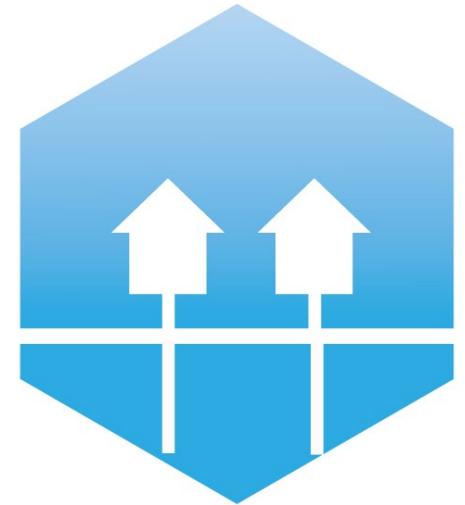
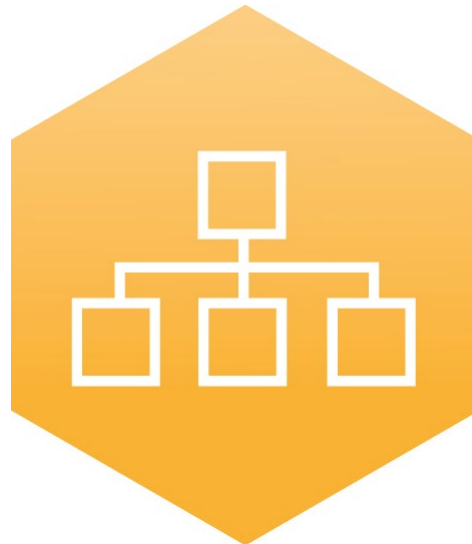


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Fault handling in district heating substations

- Experiences from the industry



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4th International Conference on Smart Energy
Systems and 4th Generation District Heating 2018
#SES4DH2018

4DH

**4th Generation District Heating
Technologies and Systems**

Why investigate fault handling in substations?



- Two common reasons to increased return temperatures:
 - Faults in customers' internal heating system
 - Faults in customer substations
- Many installations are poorly performing in some way → higher return temperatures
- Substations must be well performing in 4GDH systems to maintain low temperatures



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Research questions and method



How do the utilities work with fault handling today?

- Interview study:
 - Qualitative interviews with representatives from 6 utilities
 - Focus: how the utilities worked with the customers to decrease the return temperatures

What faults are most common today?

- Survey study:
 - Survey was sent to 139 different utilities in Sweden - 56 utilities answered
 - Focus: what are the most common faults and how the utilities work with them



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What incentives do DH utilities have to work with customer fault handling?



Incentives for DH utilities

- Maintain good system efficiency
- System advantages when certain production units are used, e.g. flue gas condensation
- Diminish pump effort and electricity use by avoiding high flow
- Enhanced customer satisfaction

Incentives for DH customers

- Relationship with the utility – information and willingness to help
- Flow component in price model
 - Information extremely important!
- Collective responsibility to keep DH prices down



Results from interview study

How are the utilities working with fault handling?



Fault detection and fault diagnosis

- Using customer data for fault detection
 - Overflow/overconsumption
 - Return temperature analysis
 - Own analysis methods
- Most faults are identified on-site by service technicians

Access to and mandate of the substations

- Important to gain physical access to the installations
 - Service agreements - Some utilities included this in the price
 - Free of charge inspections
- **One of the most important aspects of the fault handling process**



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Survey study

What faults are most common today?



Five different categories of faults were identified:

1. Heat exchangers
2. Control system and controller
3. Actuators
4. Control valves
5. Customer's internal heating system



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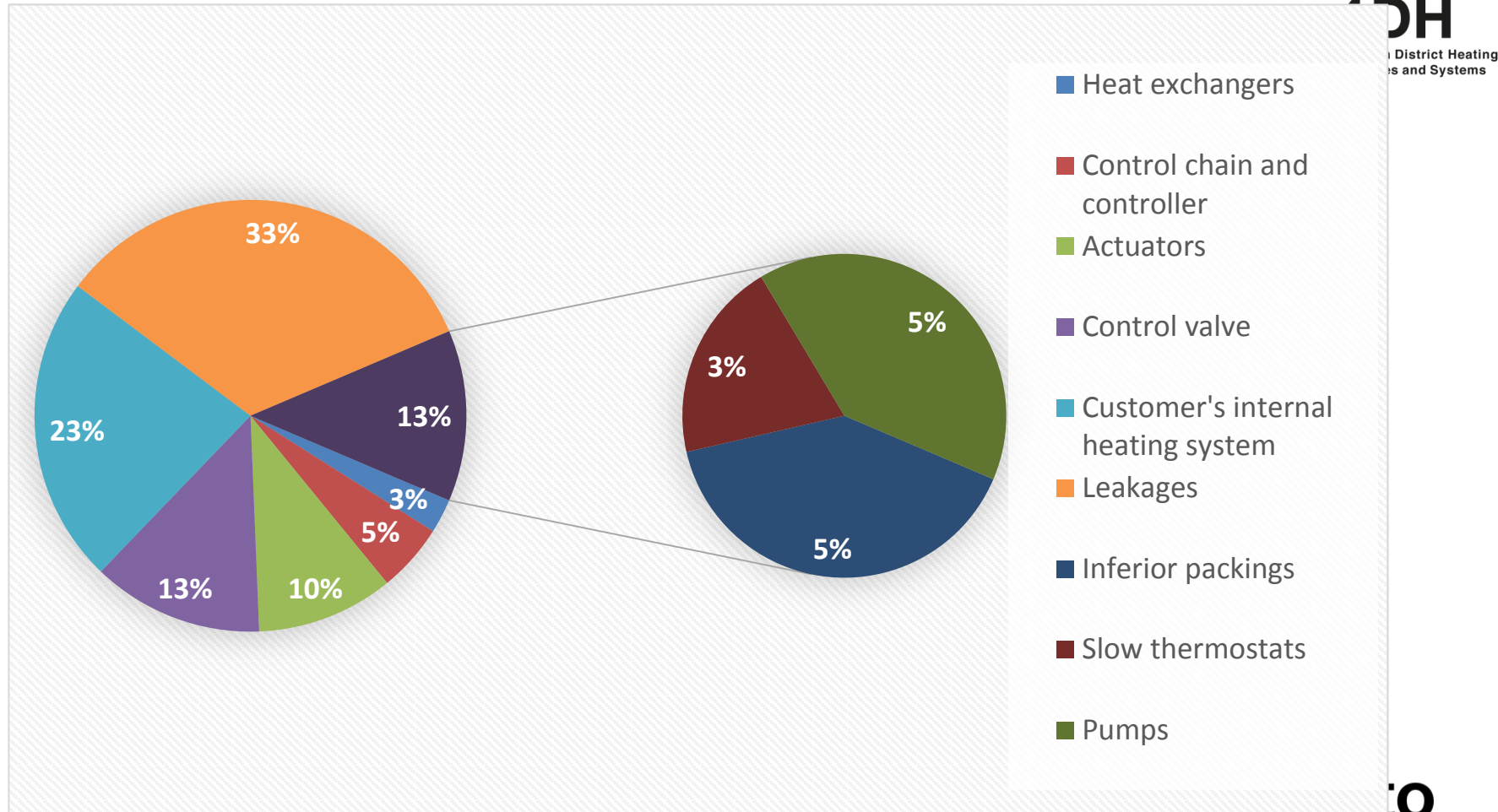


Results from survey study

What faults are most common today?



DH
District Heating
Systems and Systems



Conclusions and future work



- How do the utilities work with fault handling today?
 - Incentives for customer are important
 - Information and willingness to help
 - Access to and mandate of the substations is very important!
- What faults are most common today?
 - One overall category is most common: leakages
 - Faults in customer's internal heating system are common
- Future work:
 - Continued work with current fault handling procedures
 - Further investigation of the most common faults
 - Develop methods for identifying the most common faults off-site



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Thank you for your attention!

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