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IMPLEMENTATION OF LOW TEMPERATURE DISTRICT HEATING

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Agenda

1. Orientation of book contents and background
2. Our definition of low temperature
3. Economics of low temperature
4. The low temperature business model particularities
5. Experiences from early low temperature implementations
6. Transition strategies
7. Overall conclusions

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1. Orientation and background

Low temperature was not taking off

Information was collected but we were curious to why it did not take off!

Identified that we needed to show that this is an ongoing transformation- not science fiction

The idea of TS2 was to package the information avaliable so it would be useful when implementing low temperature and to add real life experiences

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1. Orientation and background

Organization

- Task Share for IEA-DHC
- Operating agent for coordination

Process

- Definition phase (2017)
- Active phase (2018-2021)

  Graz
  Halmstad
  Copenhagen
  Trondheim
  Nottingham
  "Darmstadt"
  "Vienna"

1. Orientation and background

Contributors to the book

Fraunhofer IEE

TECHNISCHE UNIVERSITÄT DARMSTADT

UNI KASSEL VERSITÄT

HÖGSKOLAN I HALMSTAD

ivl Swedish Environmental Research Institute

TU WIEN TECHNISCHE UNIVERSITÄT WIEN Vienna | Austria

AIT AUSTRIAN INSTITUTE OF TECHNOLOGY

AEE INTEC

Austroflex Rohr-Isoliersysteme

DTU Technical University of Denmark

Danfoss

NTNU

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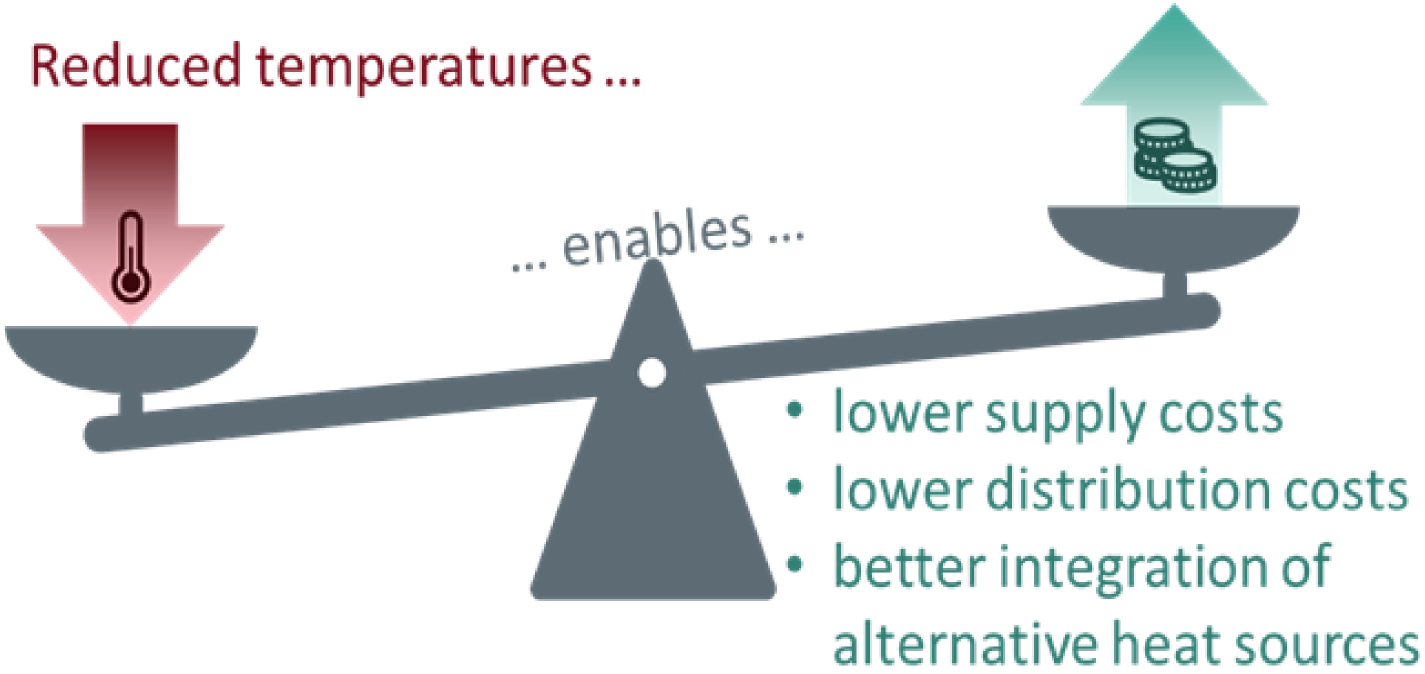
2. Definition of low temperature

All heat distribution technologies with supply temperatures below 70˚as annual average

Cold and warm networks are seen as siblings, in the low temperature district heating configuration

> Our definition of 4GDH in this guidebook applies to all new technological features and concepts using low temperatures, which are considered best available from 2020 onward. As experienced in previous technology generations, a wide diversity of technology choices in 4GDH is expected. Hence, cold district heating systems are also included in our definition of 4GDH. The corresponding technology comprises all heat distribution technologies that will utilise supply temperatures below 70 °C as the annual average. 4GDH technology is a family of many different network configurations for heat distribution. Notably, cold and warm networks are siblings in this family of configurations.

3. Economics of low temperature



1. **More geothermal heat extracted from wells** since lower-temperature geothermal fluid can be returned to the ground.

2. **Less electricity used in heat pumps** when extracting heat from heat sources with temperatures below the heat distribution temperatures **since lower pressures can be applied in the heat pump condensers.**

3. **More industrial excess heat extracted** since lower temperatures of the excess heat carrier will be emitted to the environment.

4. **More heat obtained from solar collectors** since their heat losses are lower, thereby providing higher conversion efficiencies.

5. **More electricity generated per unit of heat recycled** from steam CHP plants since higher p-t-h ratios are obtained with lower steam pressures in the turbine condensers

6. **More heat recovered from flue gas condensation** since the proportion of vaporised (steam) in the emitted flue gases can be reduced.

7. **Higher heat storage capacities** since lower return temperatures can be used in conjunction with high-temperature outputs from high-temperature heat sources.

8. **Lower heat distribution losses** with lower average temperature differences between the fluids in heat distribution pipes and the environment.

9. **The ability to use plastic pipes** instead of steel pipes to save cost.

COST REDUCTION GRADIENT (CRG)

Describes the cost reduction per lowered degree C for a reference volume of heat (Euro/MWh C˚). Below the gradient is described to different sources supplied to different DHNs.

Heat source	**Cost gradient Euro/MWh*˚C**
Geothermal	0,67-0,68
Waste heat (not sources in need of an HP but sources that are close to the supply temperature)	0,51
Boiler (biomass) with flue gas condensation	0,1-0,13
CHP (biomass) back pressure turbine	0,10-0,16
CHP (biomass) extraction turbine	0,09
CHP (waste) with flue gas condensation	0,07

CONCLUSION 1

Lower system temperatures render the laregest cost savings in combination with renewable heat sources

CONCLUSION 2

The motivation to lower temperatures is low when you have a CHP in place….but remember the RES efficiency!

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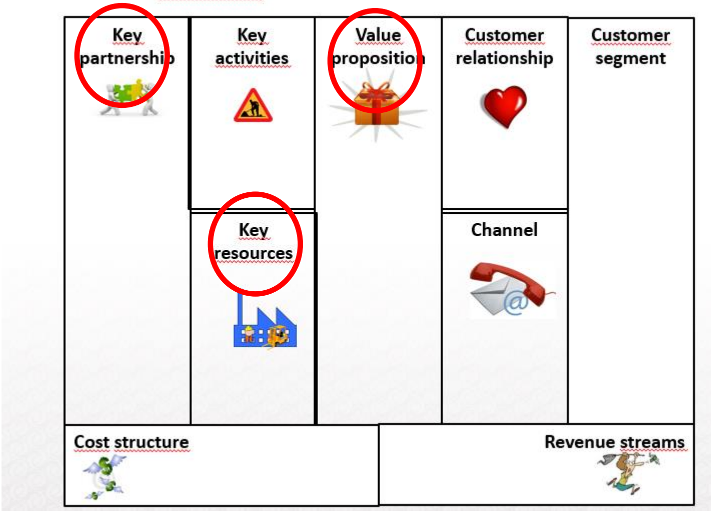
4. Business model particularities

Business model canvas



Green solution

Customer action can lead to win-win

Long term (prosumers)

Local heat supply (need of HP new staff)

CONCLUSION 1

Low and high temperature business models differ

CONCLUSION 2

The low temperature offer can be complimentary to current offers: making the DH offer overall more competitive

CONCLUSION 3

There is a tendency to focus on technology over business case and the high temperature model is applied to the low temperature case

5. Early experiences

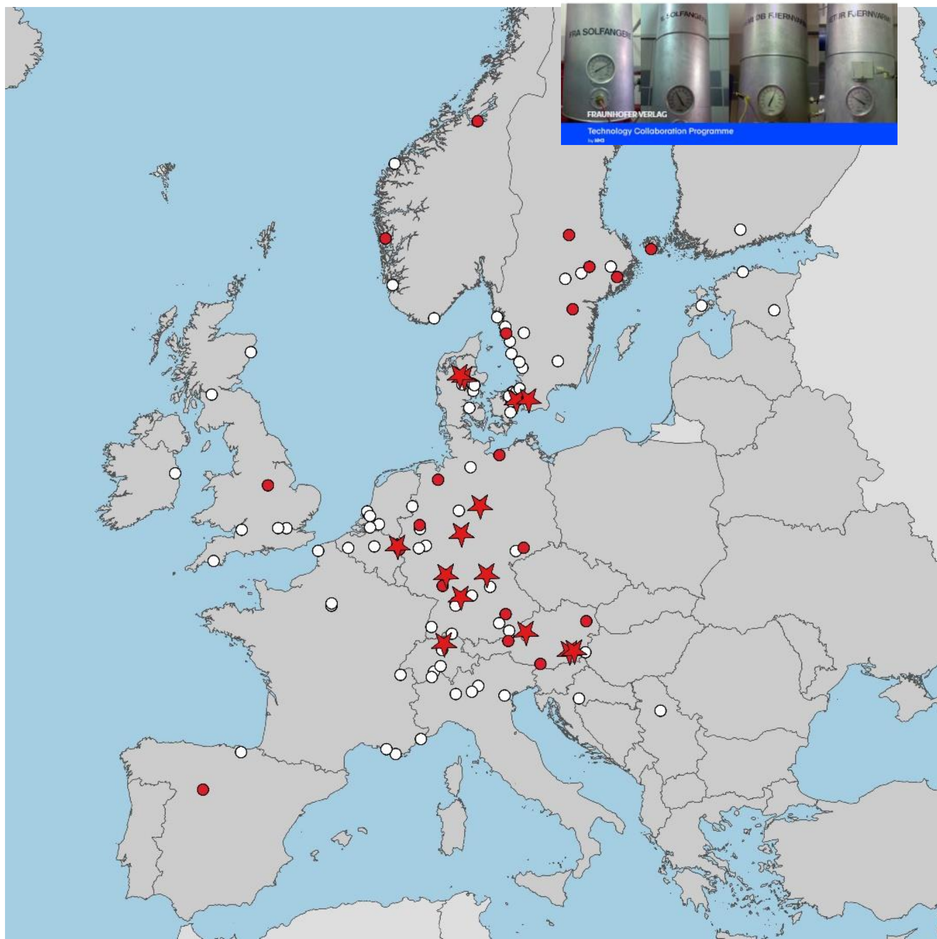
Identified case studies

- Approx. 160 Cases are identified and listed
- 25 Cases more are analyzed in different parts
- 12 Cases are described in detail and presented

The presented cases are from:

Austria, Denmark, Germany,

Sweden, Switzerland and The Netherlands



Six different classes of demonstrators have been identified

- Realised project on existing or conversion areas with a DHN
- Realised project on existing or conversion areas with a *new* DHN
- Realised project on new areas with a new DHN
- Realised project on building scale
- Simulation or design study
- Demonstrator at lab scale

Major conclusions from the case studies

Technical

– Large variety of cases and system configuration show flexibility in implementation

– For the integration of multiple heat sources digitalization is needed

– Relevant to collaborate with universities and low temperature forerunner implementations are often found in university campuses!

Regulatory boundary conditions

– Are not beneficial in all regarded countries

– Realization of sector coupling (cross sectoral energy systems) is not foreseen

Ownership

– Ownership issue important because of longer pay back times.

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6. Transition strategies

HOW 4 EUROPAN DH CITIES UNDERTAKE TRANSITION

CITY	COUNTRY	POPULATION (thousands)	CURRENT HEAT DELIVERY/ YR (DH)	HEAT DELIVERY PER CAPITA (MWh/yr)
Gleisdorf	Austria	10	7	0.7
Viborg	Denmark	40	210	5.3
Geneve	Switzerland	500	520	1
Munchen	Germany	1400	4300	3.1

…CONSIDERING OBJECTIVES AND STRATEGIES

CONCLUSION

- Lowering the temperatures in the DHN is an important part of the transition(4/ 4)
- Heat sources that do not require incineration are in demand (4 av 4)
- Long term goal on renewable DH (3 av 4)
- Expansion of DHN (new and densification) is important (3 av 4)

7. Overall conclusions

- The technology is there
- Lower temperatures in existing units to harvest benefits of RES
- The low temperature business model is not equal to the high temperature
- Upgrade existing frameworks and incentivize the future technology

The hurdles to start the transition are old habits and lock-in effects from application of current technology together with a lack of understanding of how to efficiently link stakeholders to each other!

Thank you for listening!

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