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# THE ROLE OF SOLAR THERMAL IN URBAN HEAT SUPPLY

PILOT SCHEME "FREIBURG-GUTLEUTMATTEN"

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# AGENDA

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- Project „EnWiSol“
- Pilot scheme „Freiburg-Gutleutmatten“
  - Boundary conditions
  - Dynamik system simulations
- Conclusions and outlook

# Project „EnWiSol“

## Motivation

- **Solar thermal** has an important role in all **future energy economic szenarios** (ISE: REMod-D, BMU: Leitstudie)
  - No detailed system concepts derived
  - Actually realized systems integrate usually one large, central storage
- **Development** of solar thermal occurs for dense populated urban areas significantly in relation with **district heating networks**
  - Competition with CHP development strategies
  - Competition with PV for useful areas
  - Lack of area for central storage
- Keep **technology option** despite **current comparative disadvantages** and prove its **robustness** for future application

# Project „EnWiSol“

## Issues

- Development of **energy economic szenarios** for the role of **solar thermal** in **urban heat supply systems**
- Optimising of the developed **system concepts**
- Leadership of **IEA SHC Tasks 52** „Solar Thermal and Energy Economy“
- **Realisation** of the heat supply system in the **pilot scheme** „Freiburg-Gutleutmatten“
  - Combination of **CHP district heating** and **decentralized ST**

### Background:

- High PV share in the electricity network will supplant CHP
- Solar thermal will take over heat supply during summertime

# Project „EnWiSol“

## Issues

- Development of **energy economic szenarios** for the role of **solar thermal in urban heat supply systems**
- Optimising of the developed **system concepts**
- Leadership of IEA SHC Tasks 52 „Solar Thermal and Energy Economy“
- Realisation of the heat supply system in the **pilot scheme „Freiburg-Gutleutmaten“**
  - Combination of **CHP-district heating** and **decentralized ST**

### Goal:

- Power-driven operation mode of CHP
- Switching off the district heating network for in sum of 3 months during summertime (supporting the power network)
- Economic integration of solar thermal into concept

# Pilot scheme „Freiburg-Gutleutmatten“

## Projec consortium

- Fraunhofer ISE
- badenovaWÄRMEPLUS GmbH & Co. KG
- Solites
- City of Freiburg i.Br.



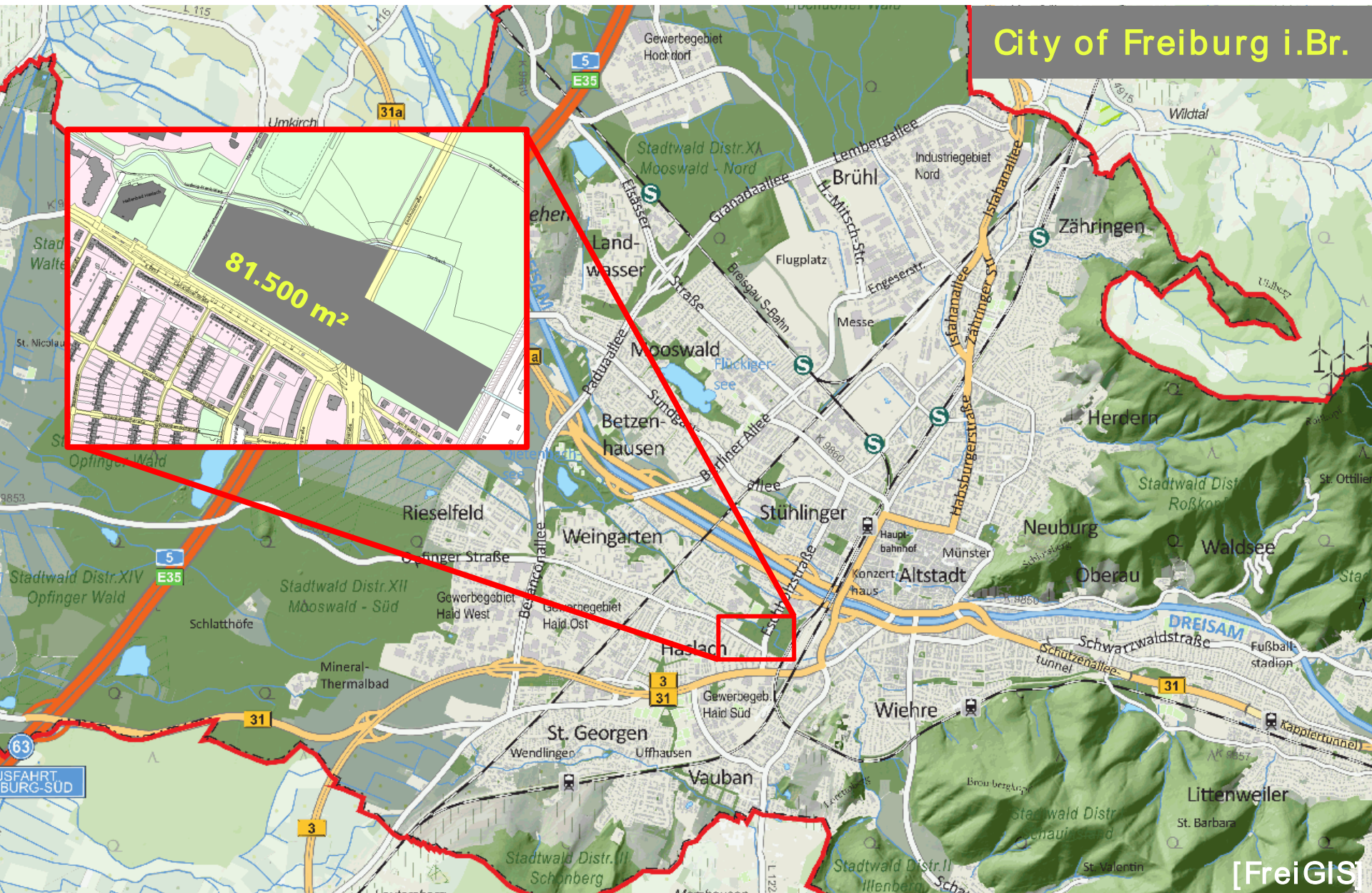
Support of:

- Projektträger Jülich
- BMU (formerly)



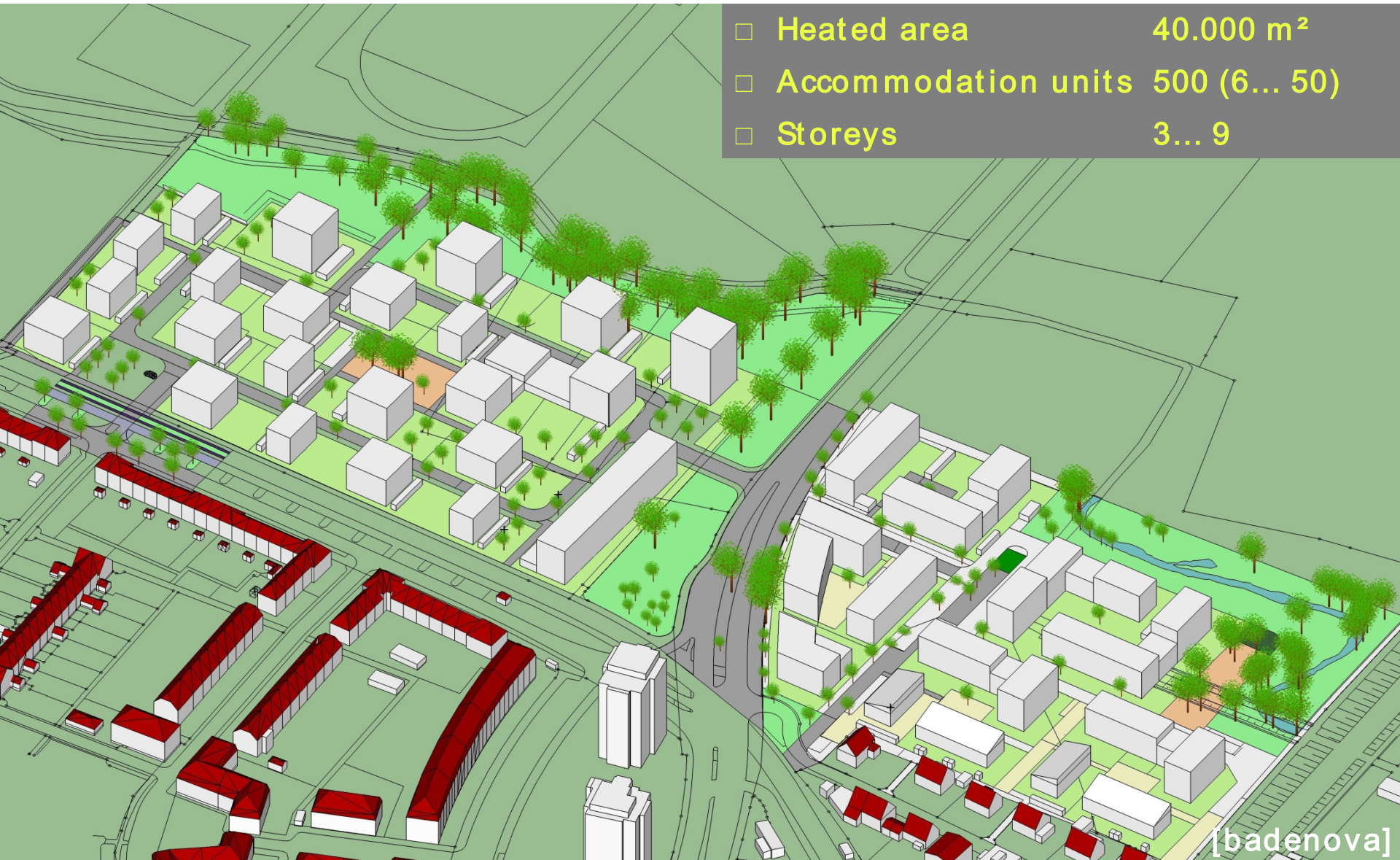


# Pilot scheme „Freiburg-Gutleutmaten“





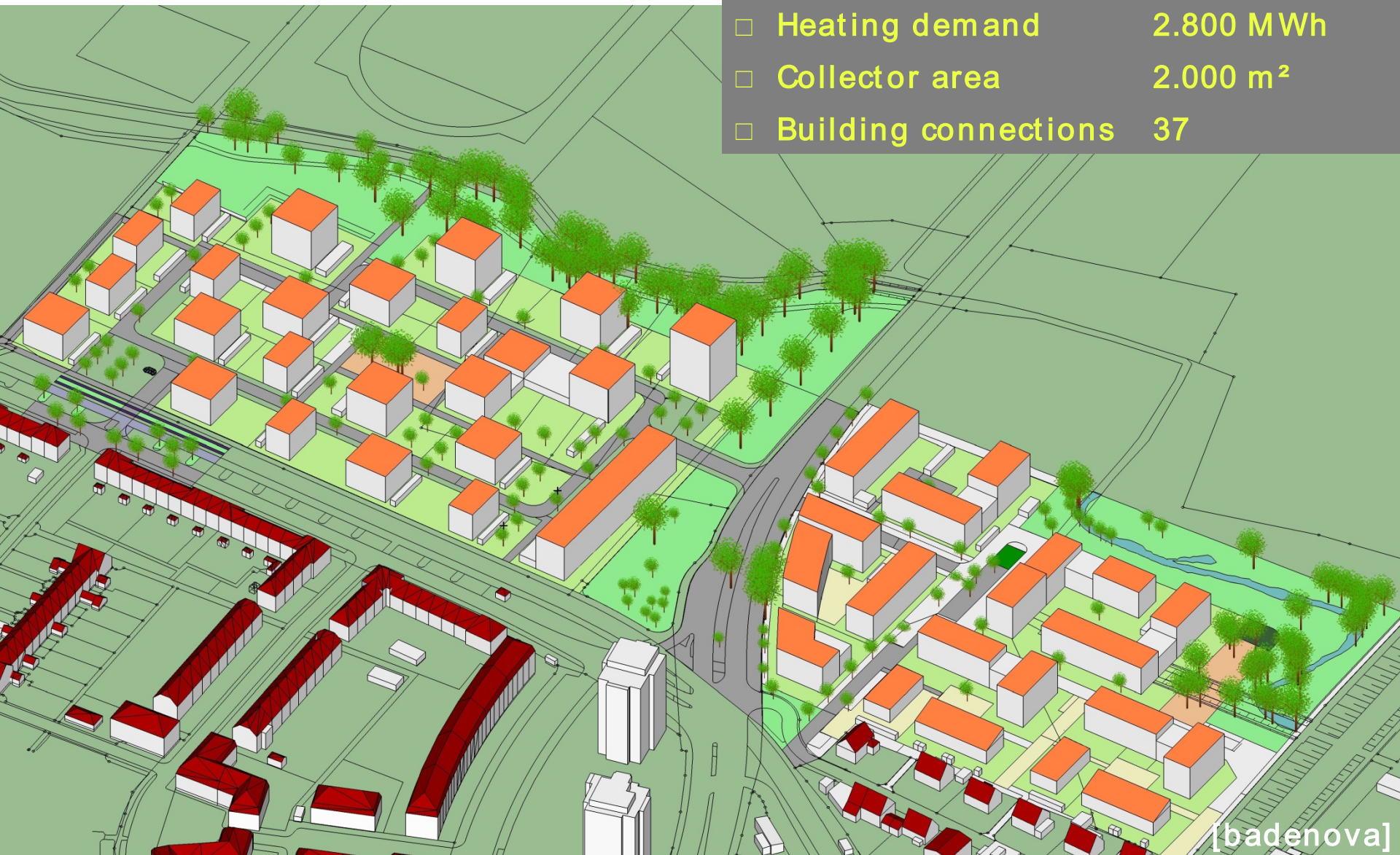
# Pilot scheme „Freiburg-Gutleutmatten“



- Heated area 40.000 m<sup>2</sup>
- Accommodation units 500 (6... 50)
- Storeys 3... 9



# Pilot scheme „Freiburg-Gutleutmatten“



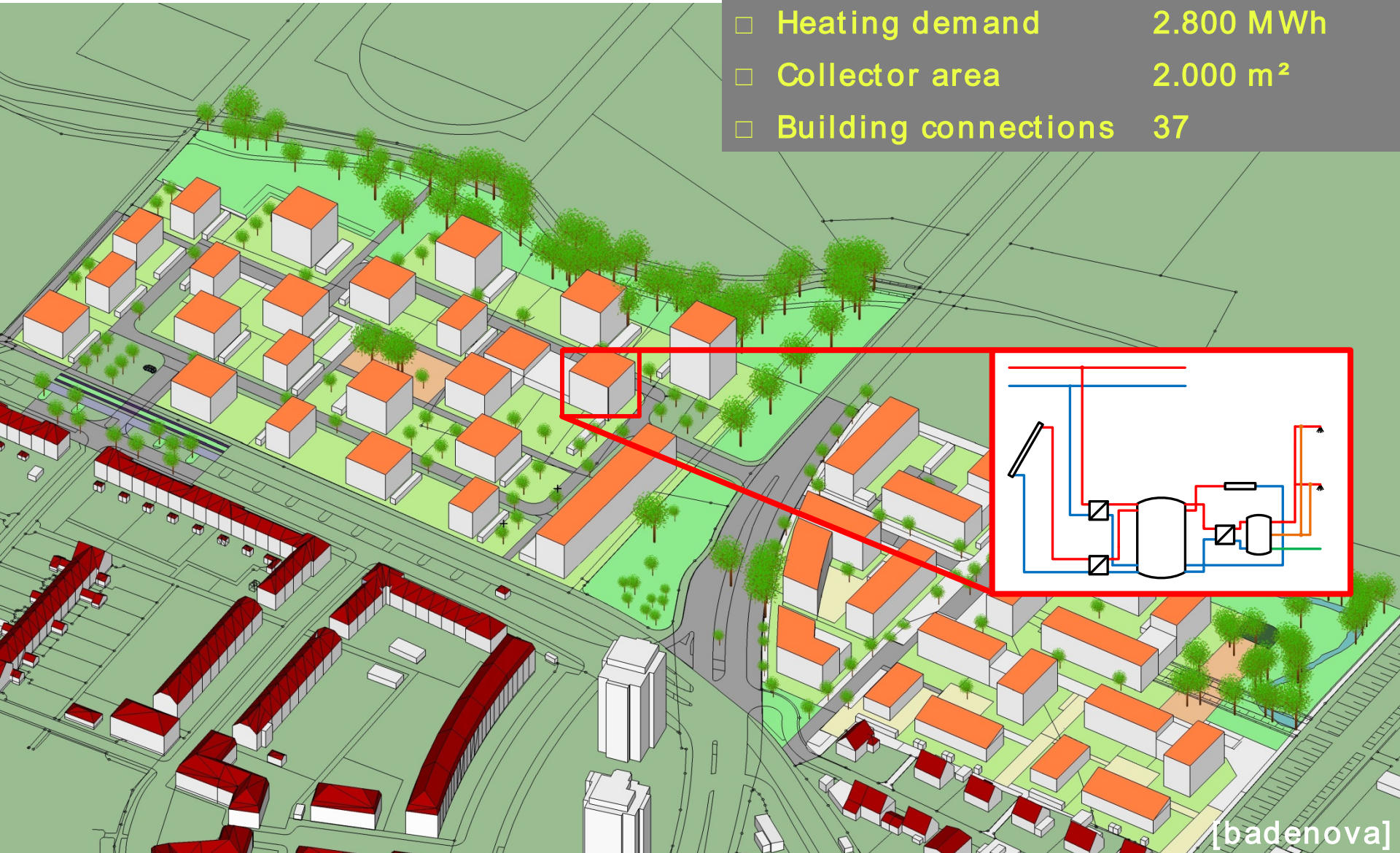
□ Heating demand	2.800 MWh
□ Collector area	2.000 m <sup>2</sup>
□ Building connections	37



# Pilot scheme „Freiburg-Gutleutmatten“

## Systemconcept: decentralized solar thermal

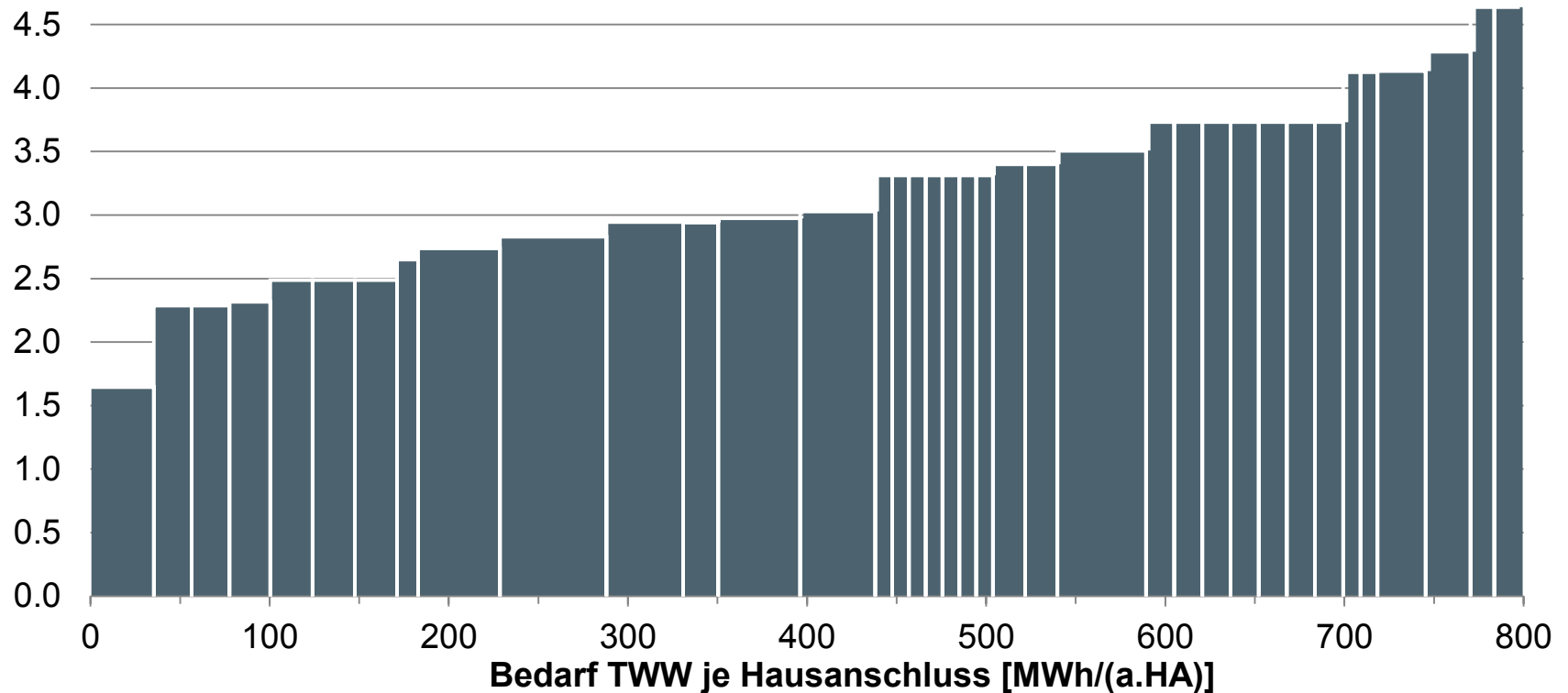
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# Max. of installable collector area per building connection

## Shading angle = 40°

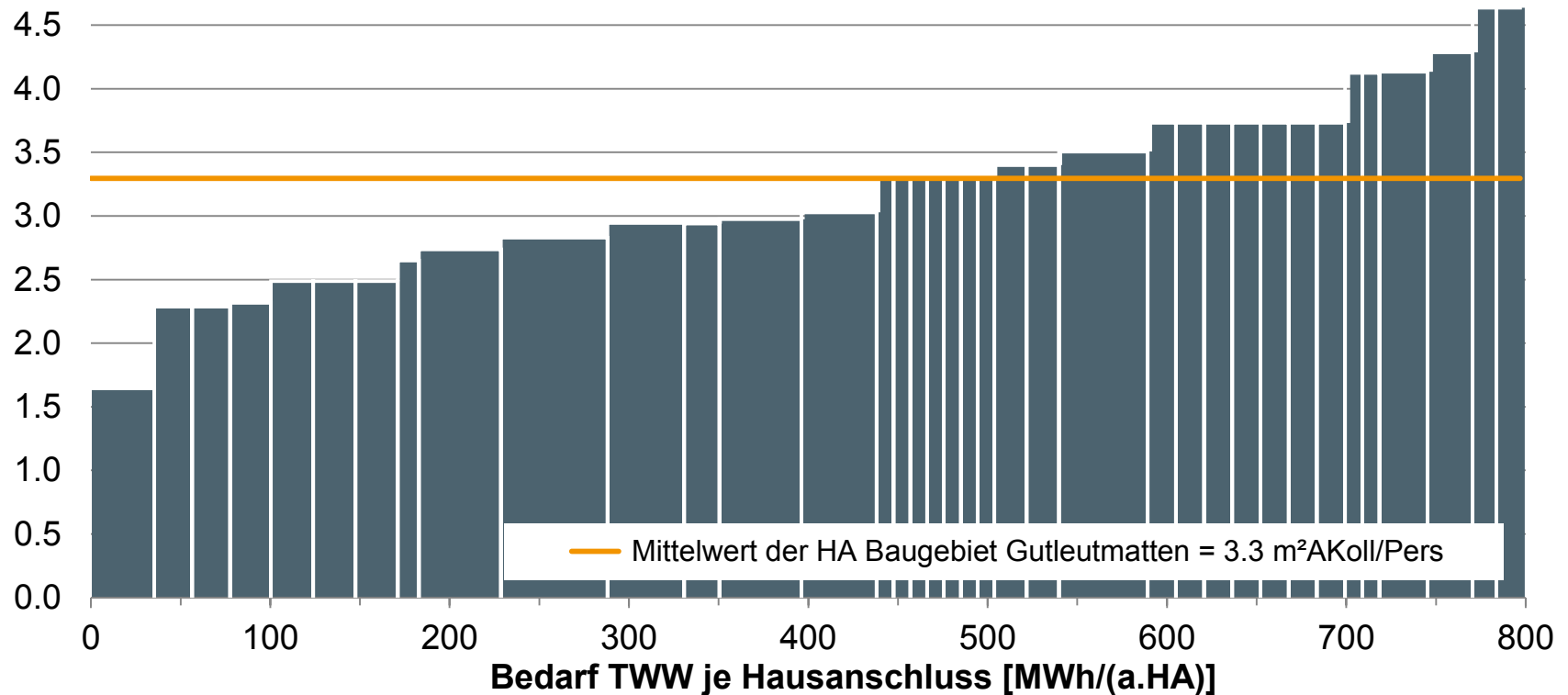
max. installierbare spez. Kollektorfläche  
pro Person und Hausanschluss  
[m<sup>2</sup>AKoll/(Pers.HA)]



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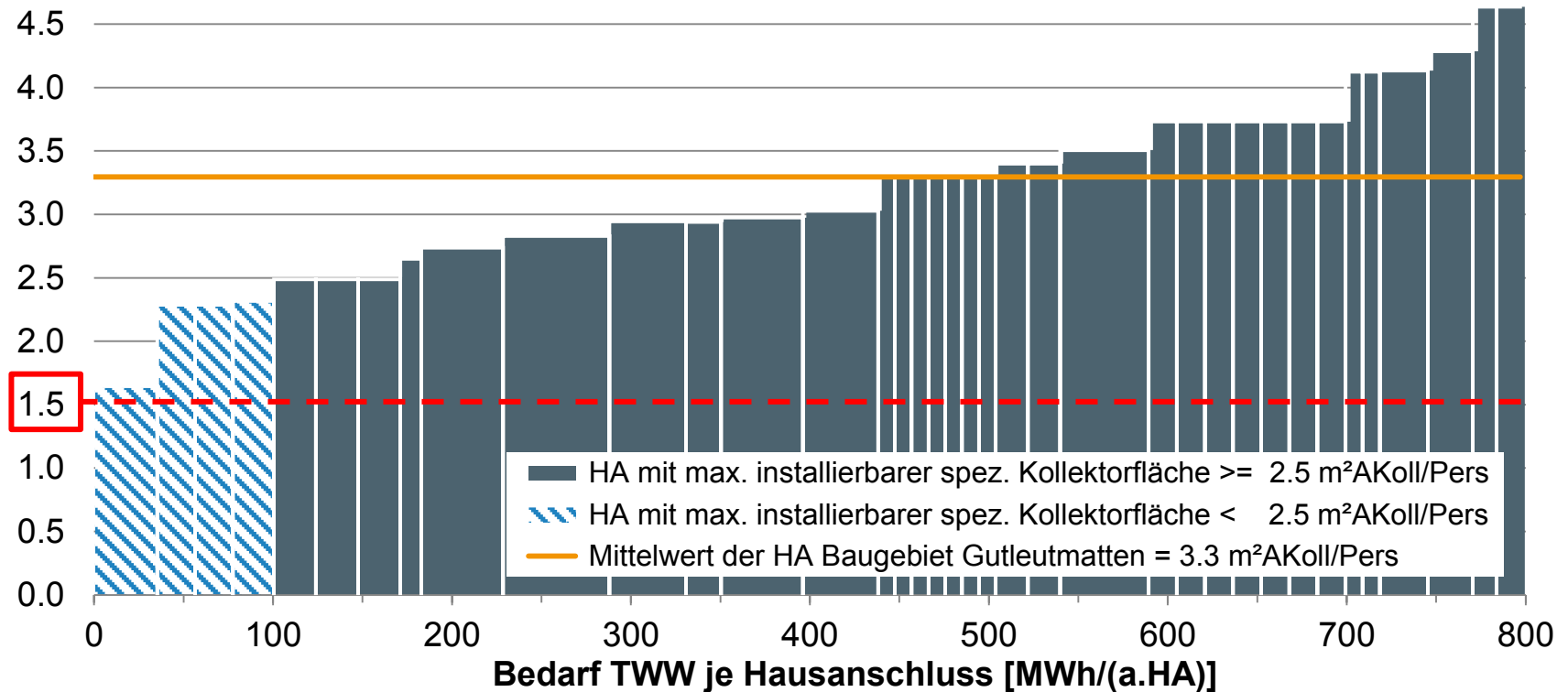




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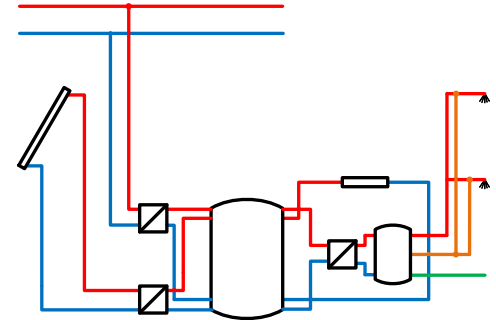


# Simulation

## Considered system concepts for DHW preparation

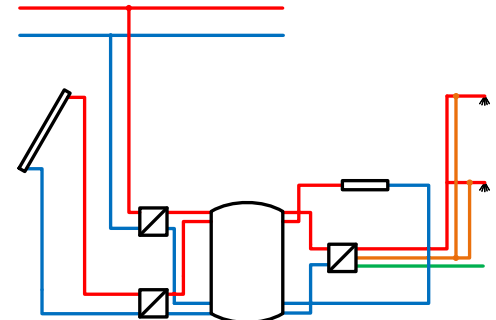
### ■ Stand-by tank charging

- High system temperature niveau
- High heat losses



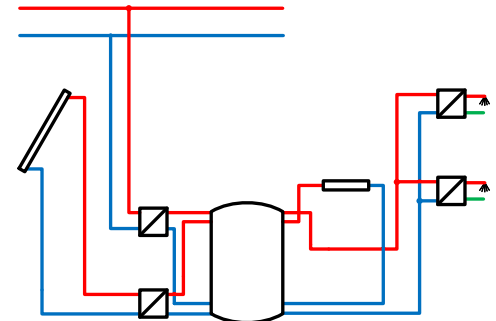
### ■ Central, flow-through

- High system temperature niveau
- + Reduced heat losses



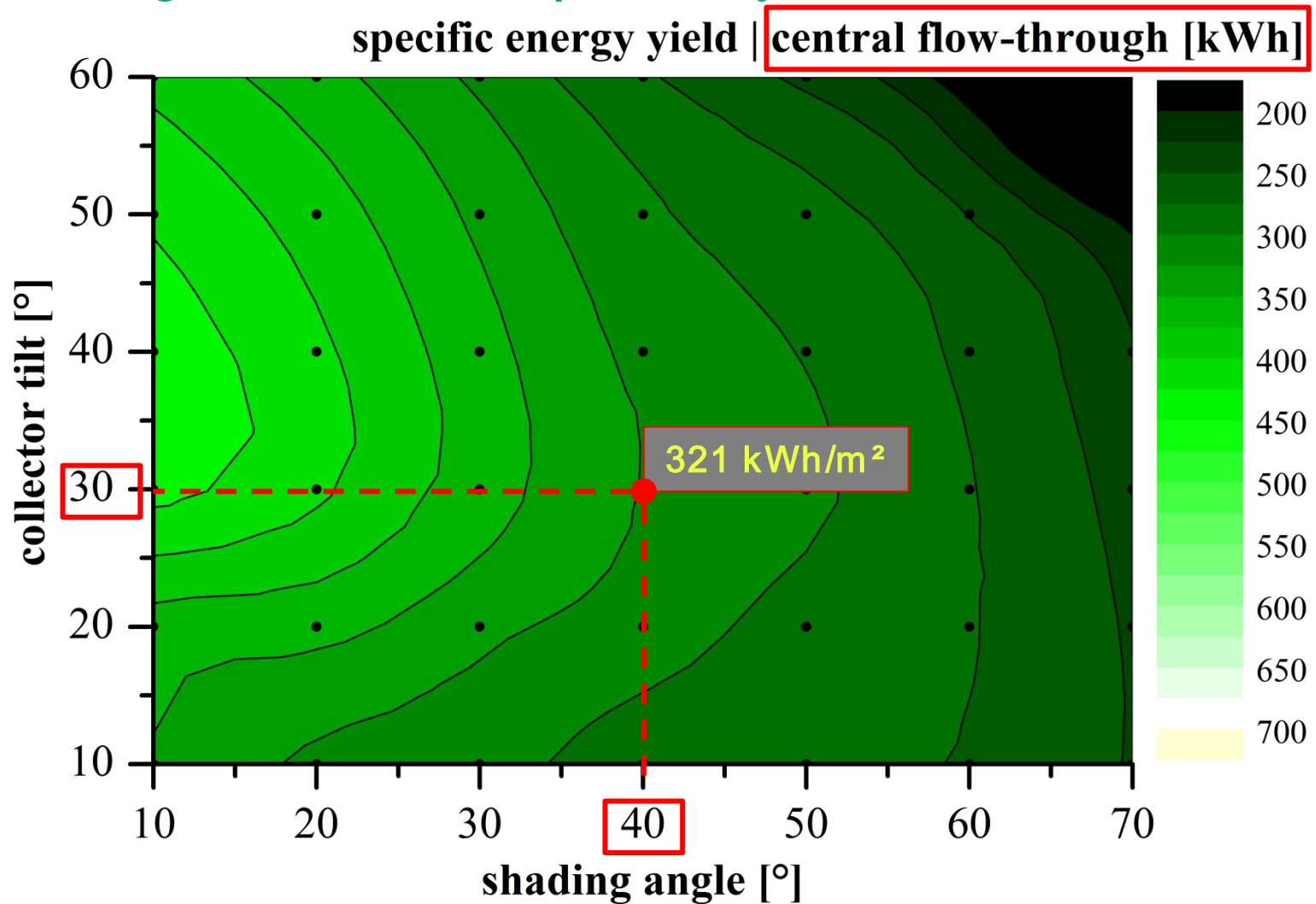
### ■ Decentral, flow-through

- + Reduced system temperature niveau
- High costs
- Effort for realisation



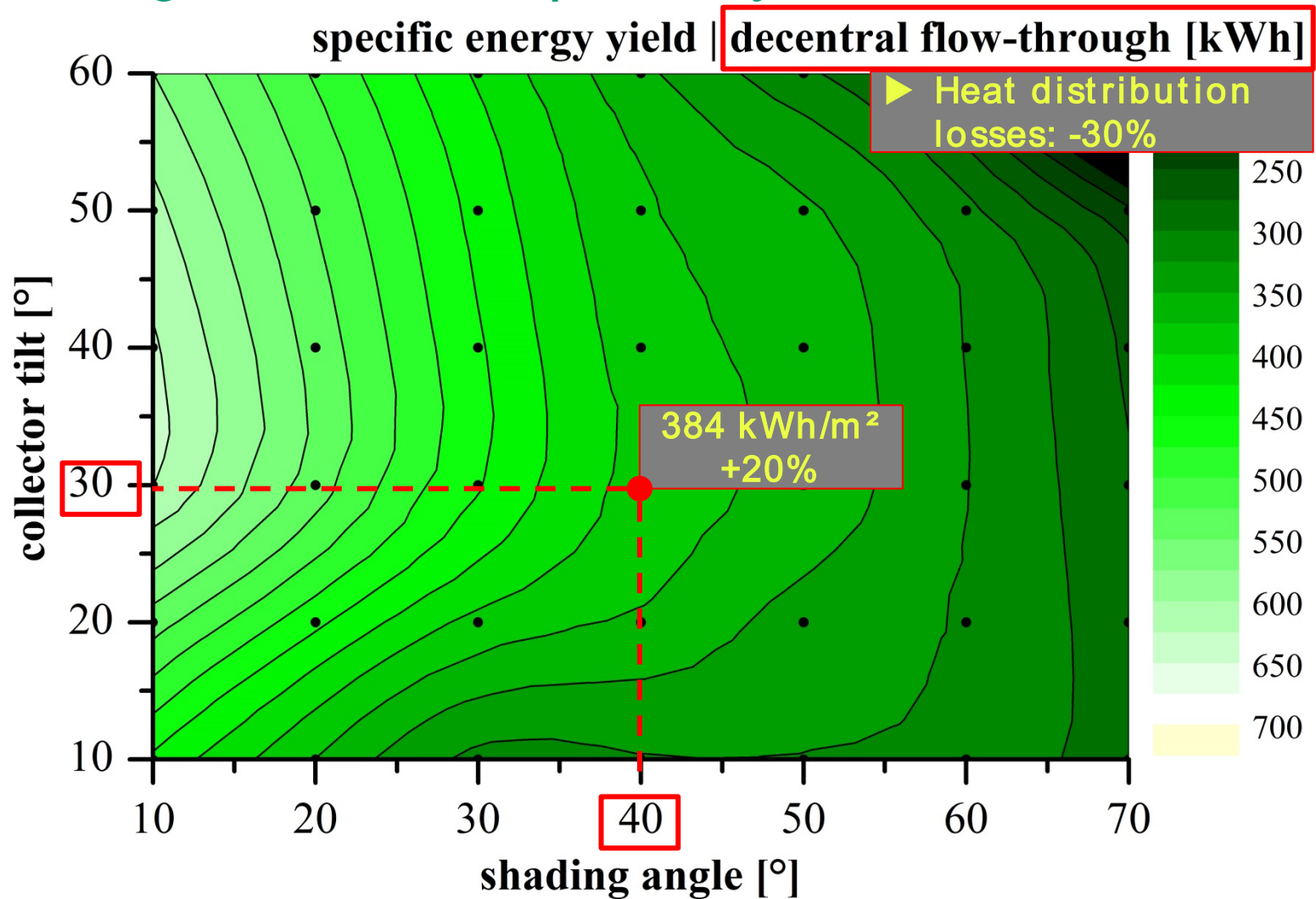
# Simulation

## Max. usage of roof area | 9 storeys



# Simulation

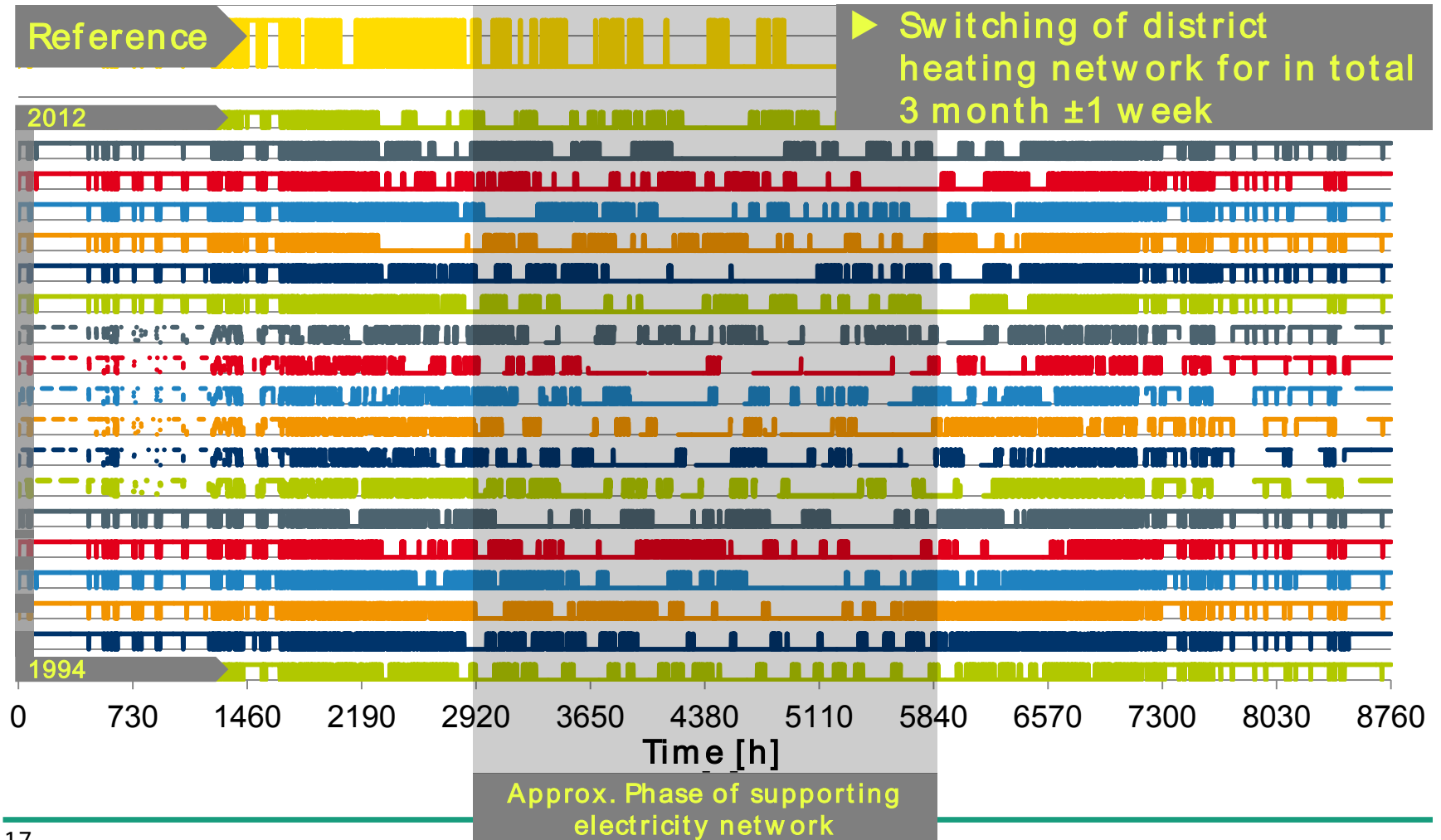
## Max. usage of roof area | 9 storeys





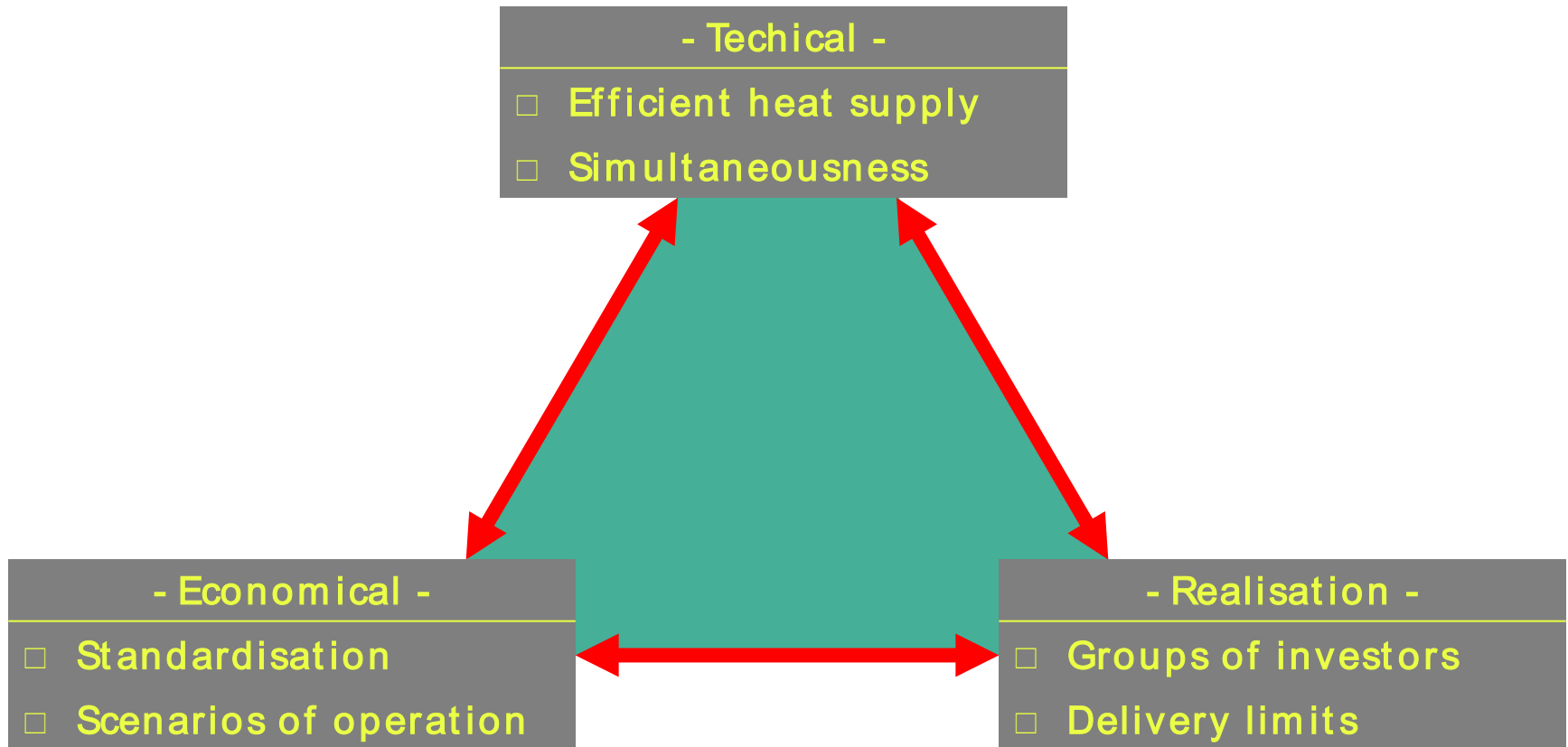
# Sensitivity of performance of solar thermal 19 years of weather-data at site Freiburg

## Operation DHN on/off



# Area of conflict

## Multi dimensional optimisation



# Conclution

## - current status -

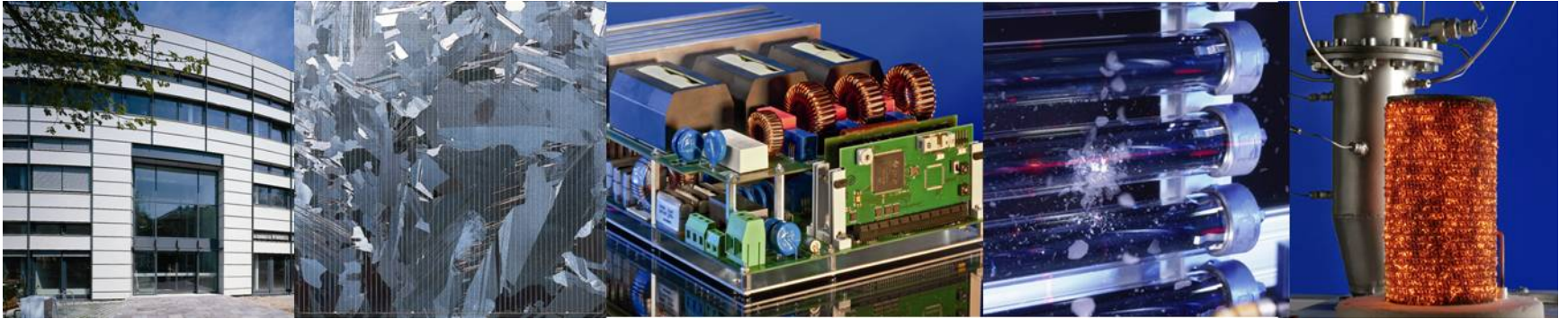
- The **district heating network** can be **switched** of for the aspired in **total 3 month during summertime**, when applying relatively high specific:
  - **Capacities of storage**
  - **Efficient technologies** for DHW preparation
- **Useful roof areas** allocated at **some building** connection units are **not adequate**
- ▶ **Alternative technologies will be taken into account:**
  - Shifting of solar thermal heat between building supply units
  - Alternative collector techniques
  - Electricity based systems as auxilliary heating units

# Outlook

- **Scientific and technical attendance of pilot scheme**
  - Implementation of operation concept
  - Monitoring
- **Dynamic system simulation** of building supply system, district heating network and the CHP
- **Development/optimisation of szenarios:**  
Technology – Design – Cost
- **Energyeconomically optimized operation of CHP**  
(Methods e.g.: modellpredictive control, rule based algorithm)



# Thank you for your attention!



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# Szenario | 25% Solar, 25% Wind, 50% KWK

