Exemplary Results of the German Eneff:Stadt Research Program: Strategies, Technologies and Tools

IEA-EBC Annex 73

Dr.-Ing. Rita Streblow

EBC | Institute for Energy Efficient Buildings and Indoor Climate

E.ON Energy Research Center

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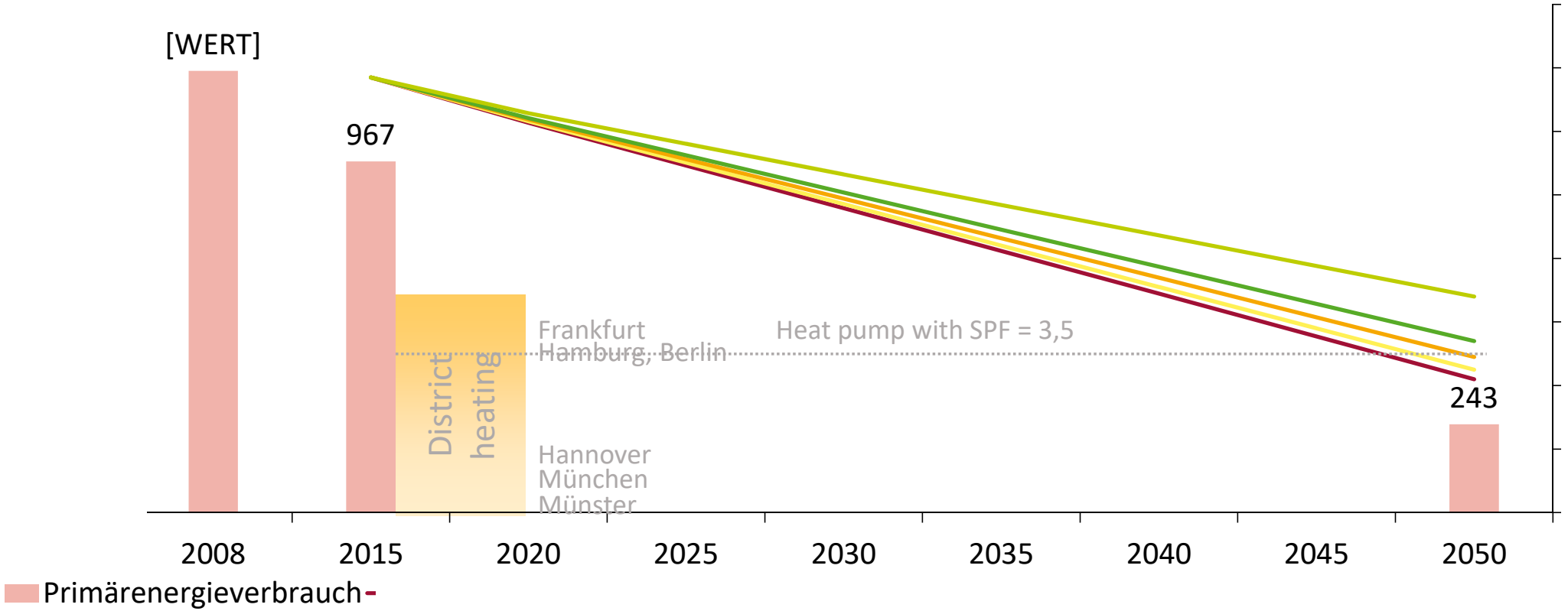
Initial Situation

Goals	2020	2030	2050
Greenhouse gas			
Greenhouse gas emission in comparison to 1990	At least -40 %	At least -55 %	At least -80 to 95 %
Increase the share of RE in energy consumption			
Share of RE in gross energy consumption	18 %	30 %	60 %
Reduction of energy consumption and increase in energy efficiency			
Reduction of primary energy consumption compared to 2008	- 20 %		- 50 %

Necessary Primary Energy Factor



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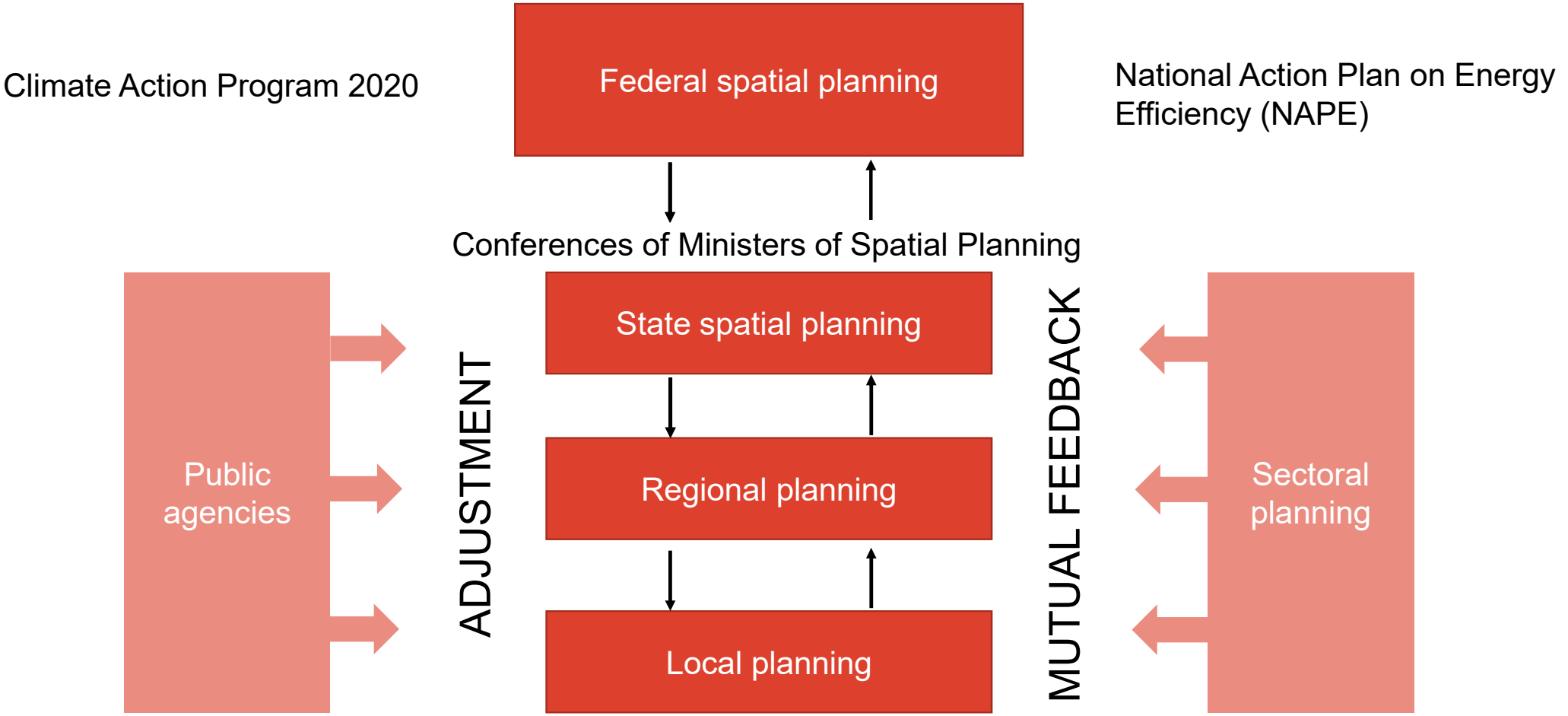
Planning Structure for Germany



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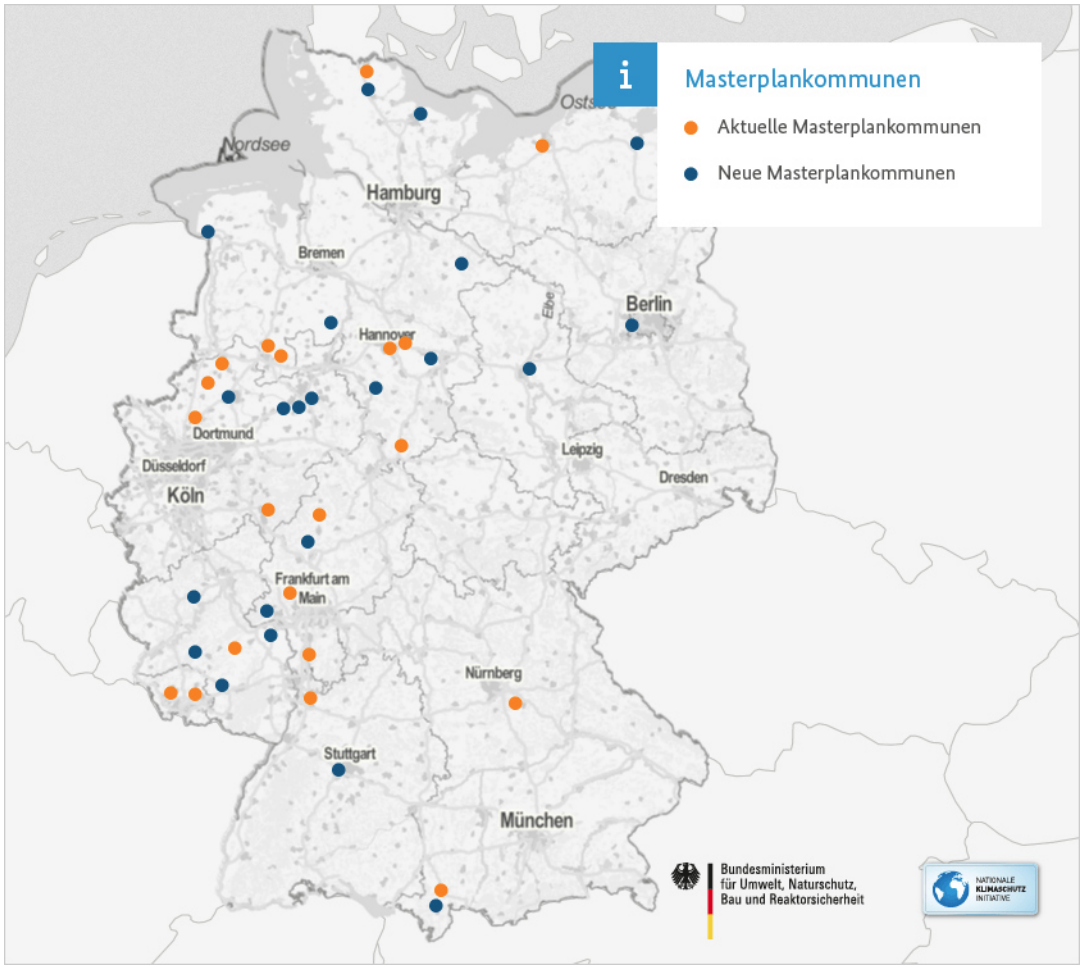
Federal Ministries in the field of urban and energy planning

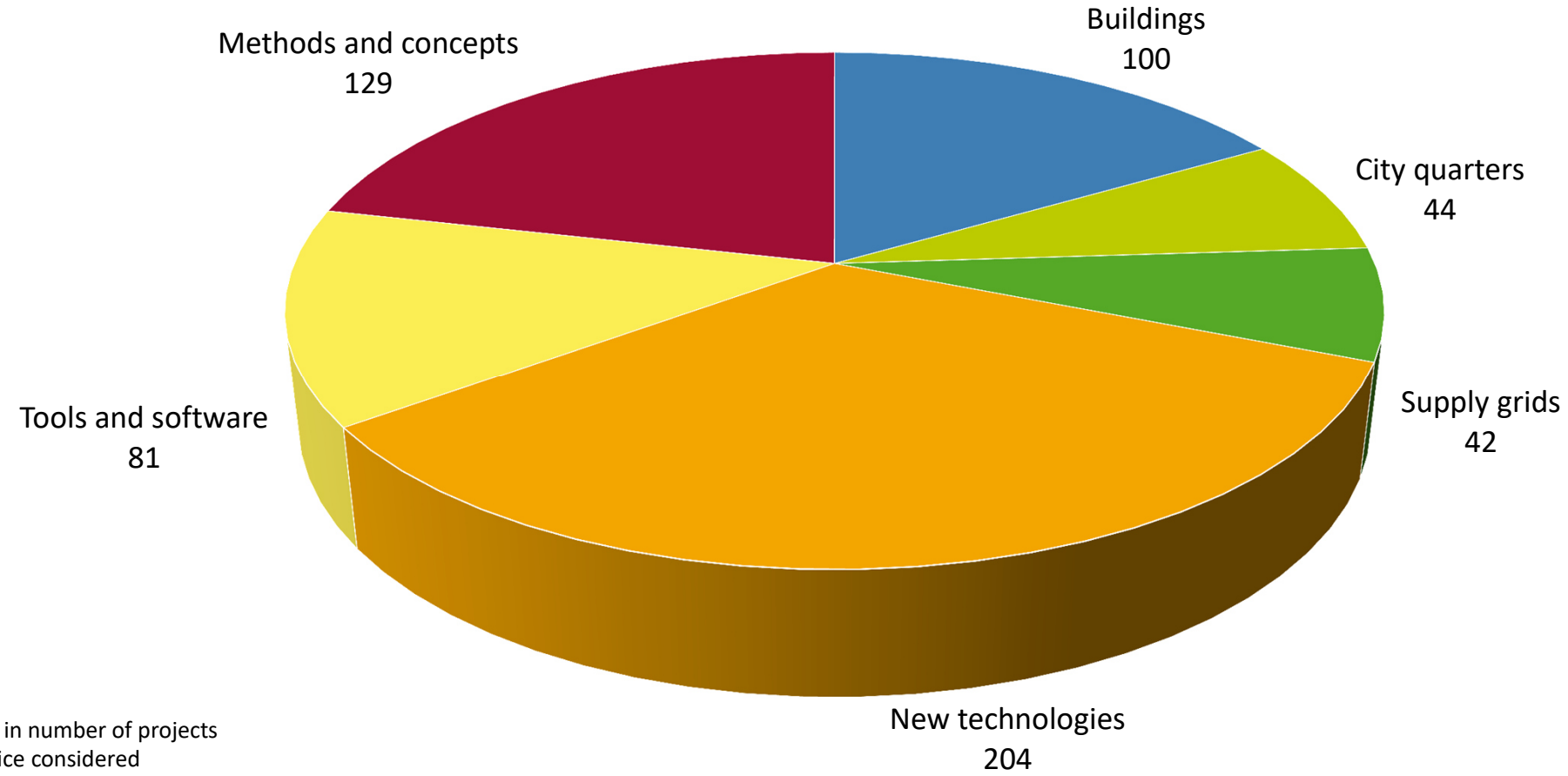
- Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMUB)
  - Create the framework conditions for good living standards and intact cities
  - Promote the high level of construction technology and building materials in Germany

- Federal Ministry for Economic Affairs and Energy
  - Demonstration and pilot processes
  - Systemic approaches to energetic optimization at city district level
  - Development of new technologies and planning tools

Master Plan Communities

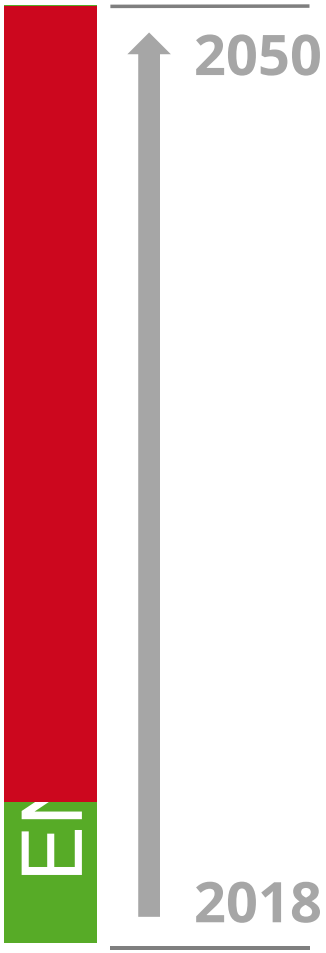


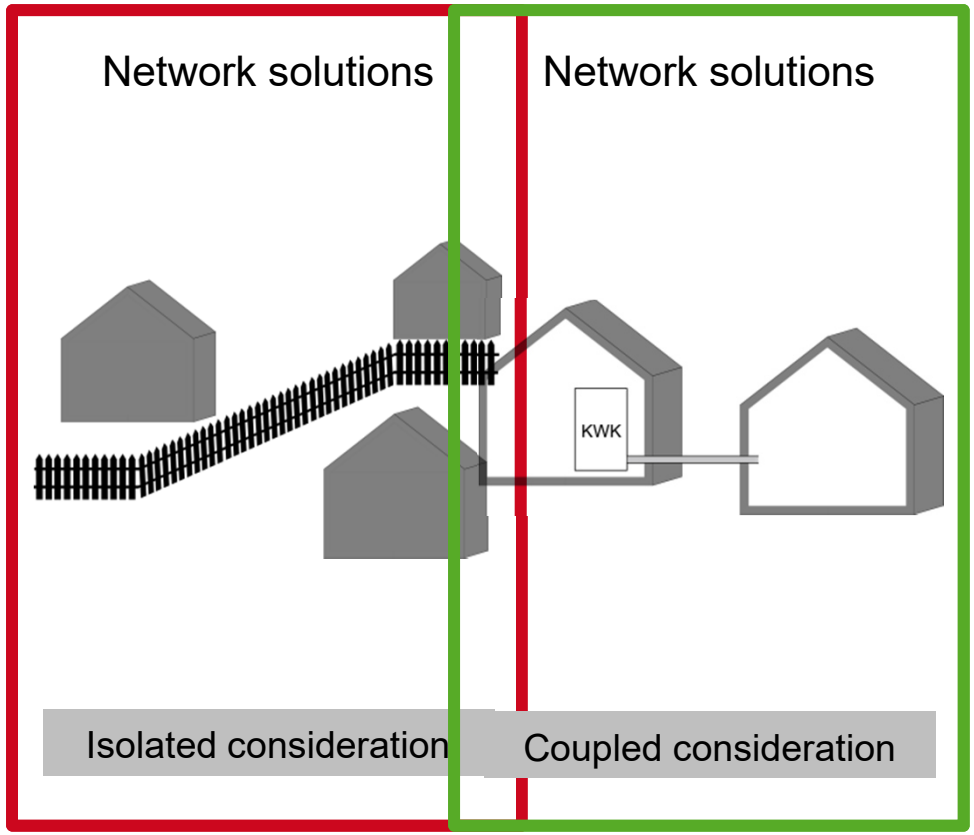
Distribution of the Research Projects



Specification in number of projects
Multiple choice considered

From Research to Practice





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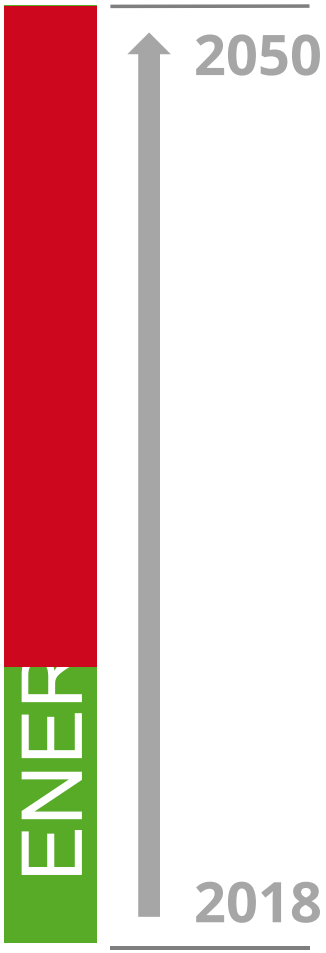
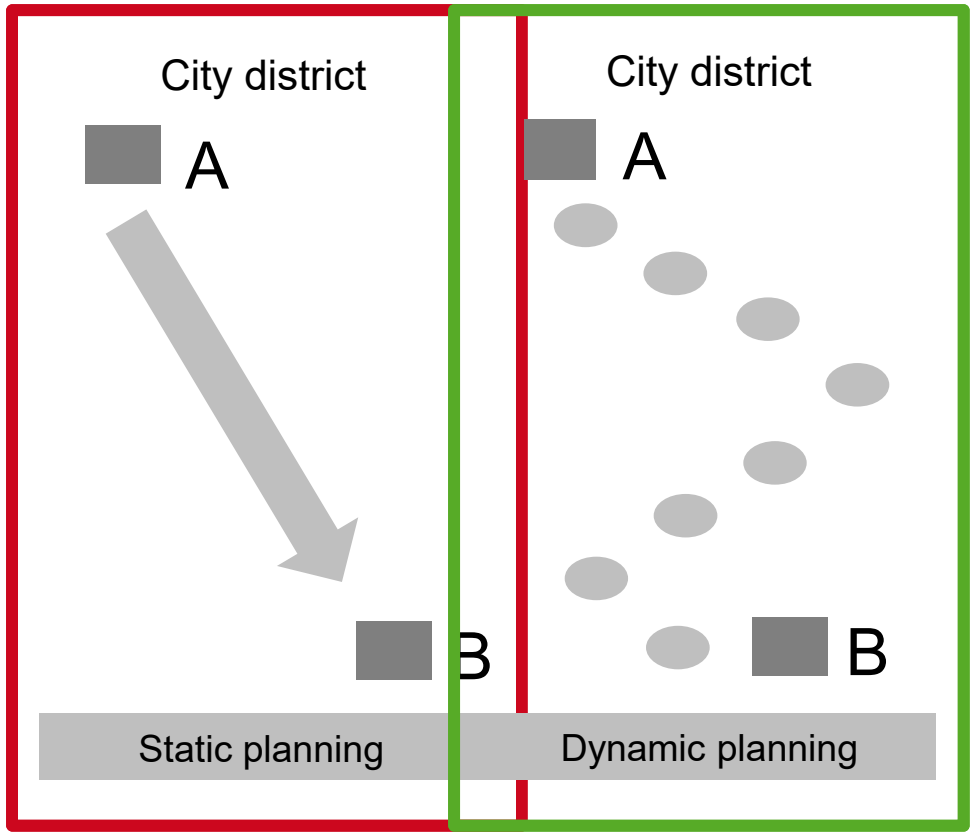
From Research to Practice





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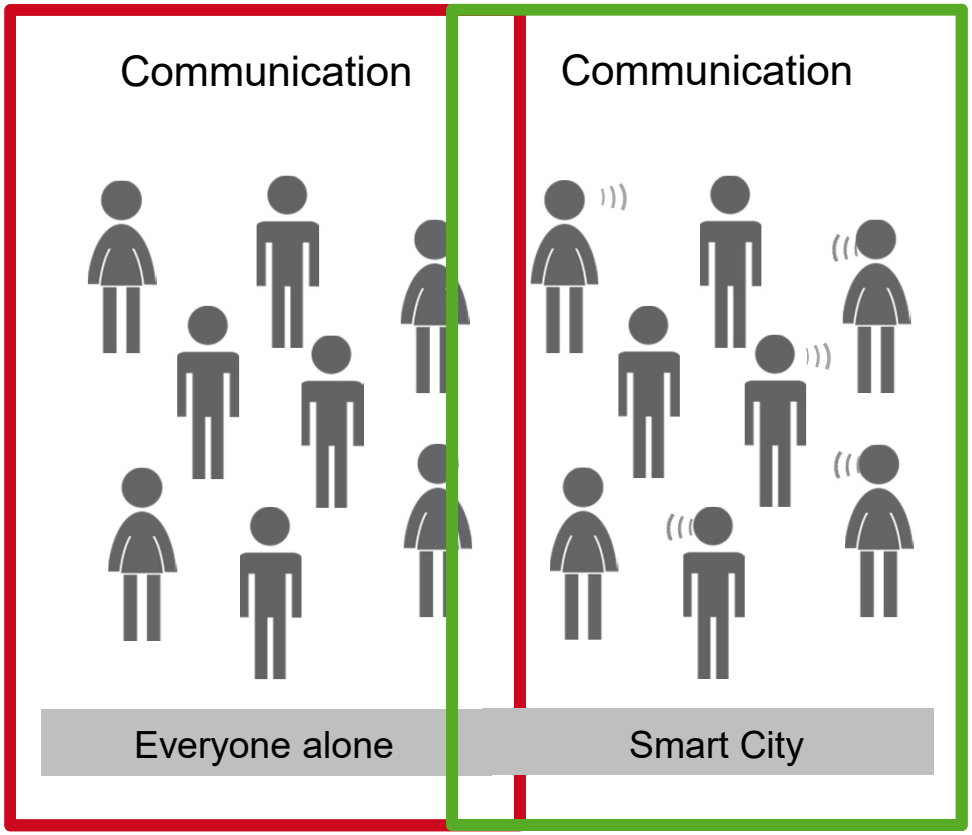
From Research to Practice



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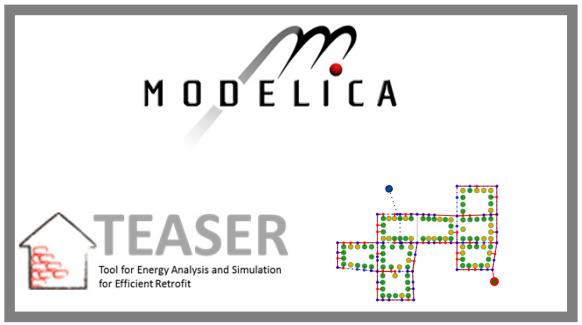
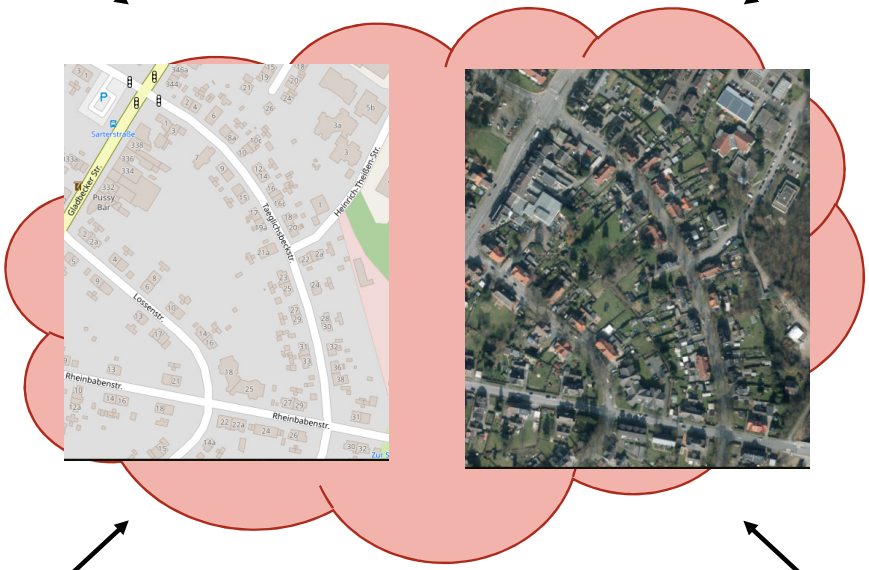
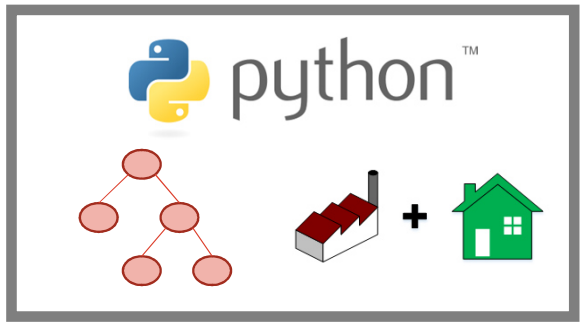
Research Fields

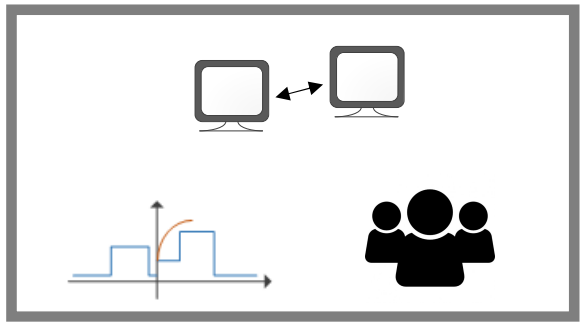
Simulation

Evaluations









Web application

Interfaces

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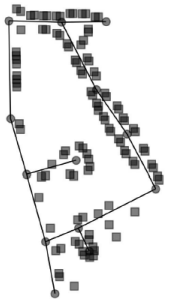
Simulations with Physical Models

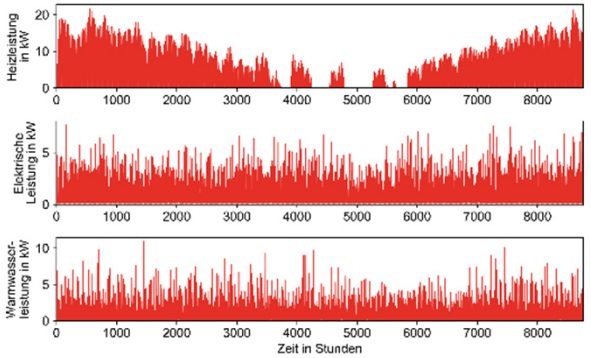
GIS-Data

Database model

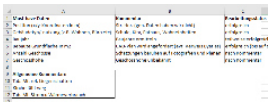


Building simulation

Load curves:
- Room heat
- Electricity
- Hot water



Additional infos



Building data:
- Year of construction
- Type
- Floor space
- Number of floors
- …

Building models

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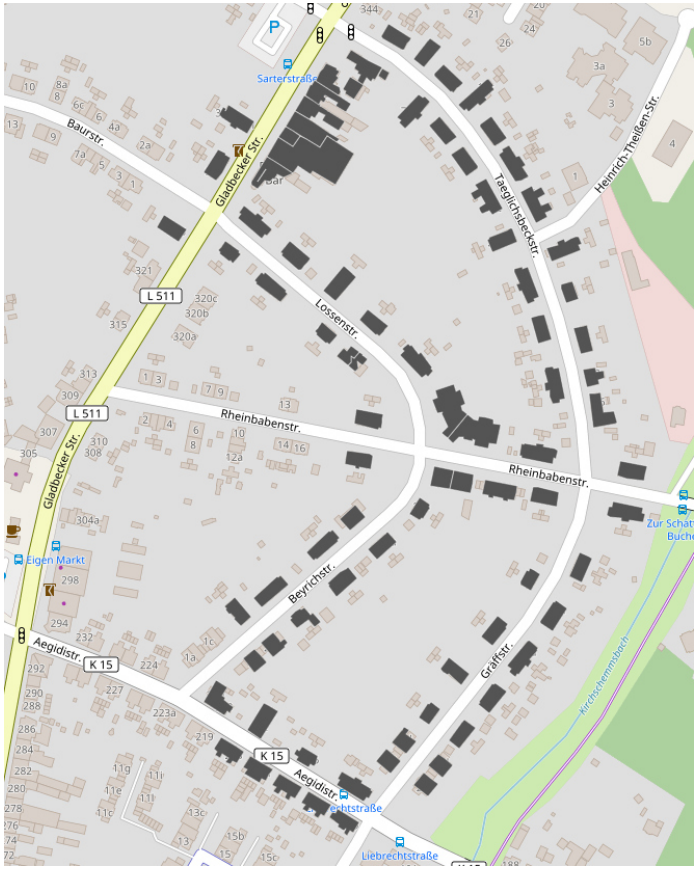
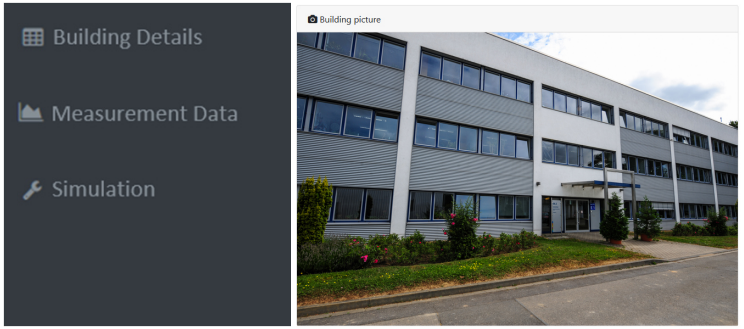
Web Services

- Intergration of the user





Basic Data	
Name	30282
Description	N/A
BWZK Classification	6110
Year of construction	1954
Measured Height	5.6 m
Storeys above ground	2
Storeys below ground	1
Net floor area	272 m²

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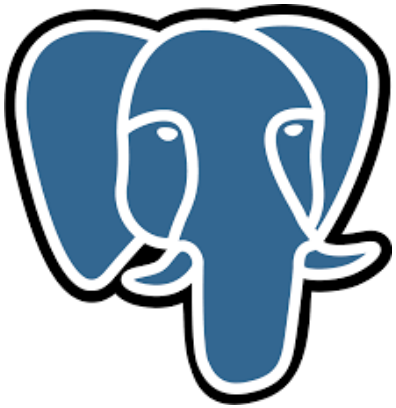
Database

- Database (PostgreSQL, Influx)
  - Static data
    - Year of construction
    - Floor space
    - ….
  - Dynamic time series
    - Heat demand
    - Electricity demand
    - ….



PostgreSQL

https://www.postgresql.org/

influxdb

https://www.influxdata.com/

Building Models

Need a building model or heat demand profile? Take one!

TEASER helps building engineers and researchers to quickly generate dynamic building models and heat demand profiles. You can try the TEASER Web App below or click here to Learn More

Parameterization

Enter your Building Information

Choose your building usage type*

Single family house

Single family house according to the german section of TABULA. For more information please use the Tabula webtool.

Your year of construction* 1952

Your number of floors* 2

Your net leased area* 110

Your height of floors* 2.8

Your name of the Building*

BuildingDemo1

Your methodology*

Tabula DE

Tabula (Typology Approach for Building Stock Energy Assessment) residential building typologies have been developed in the IEE Project.

Create Building

You just created a simulation model with:

Methodology	Type	Year	Area	Nr. Floors	Height of Floors	Name
tabula_de	single_family_house	1952	110	2	2.8	BuildingDemo1

https://github.com/RWTH-EBC/TEASER

http://teaser.eonerc.rwth-aachen.de/

Results

How would you like your results?

Modelica Model:

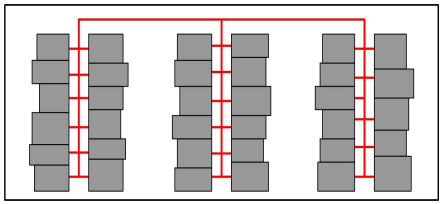
- [x] AixLib-Model
- [ ] IBPSA-AixLib-Model
- [ ] IBPSA-Buildings-Model
- [ ] IBPSA-BuildingsSystems-Model
- [ ] IBPSA-IDEAS-Model

Other options:

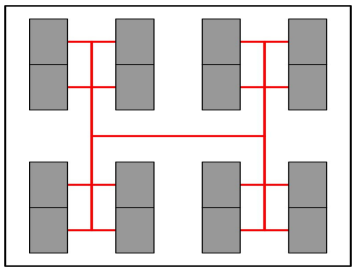
- [x] Download TEASER Project File?
- [ ] Simulate Model Online?

Download

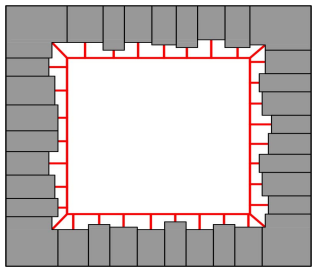
Optimization of Energy Concepts for Different Settlements



1. Terraced houses with 35 single family houses
   - Heat demand: 847 MWh
   - Electricity demand: 129 MWh

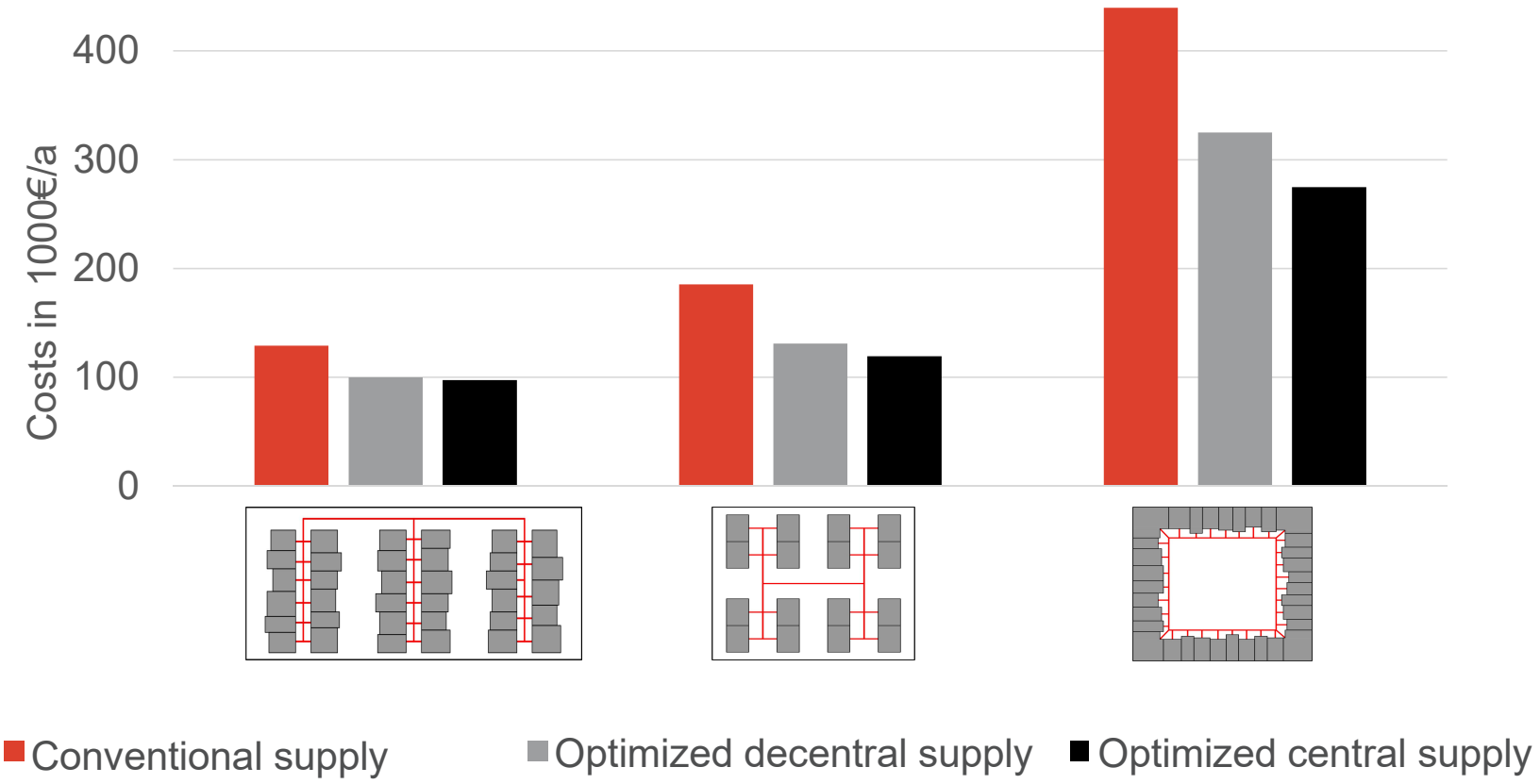


2. Block structure with 16 multi family houses
   - Heat demand : 1.329 MWh
   - Electricity demand : 214 MWh



3. Block development with 36 multi family houses
   - Heat demand : 2.851 MWh
   - Electricity demand : 582 MWh

Optimization of Energy Concepts for Different Settlements



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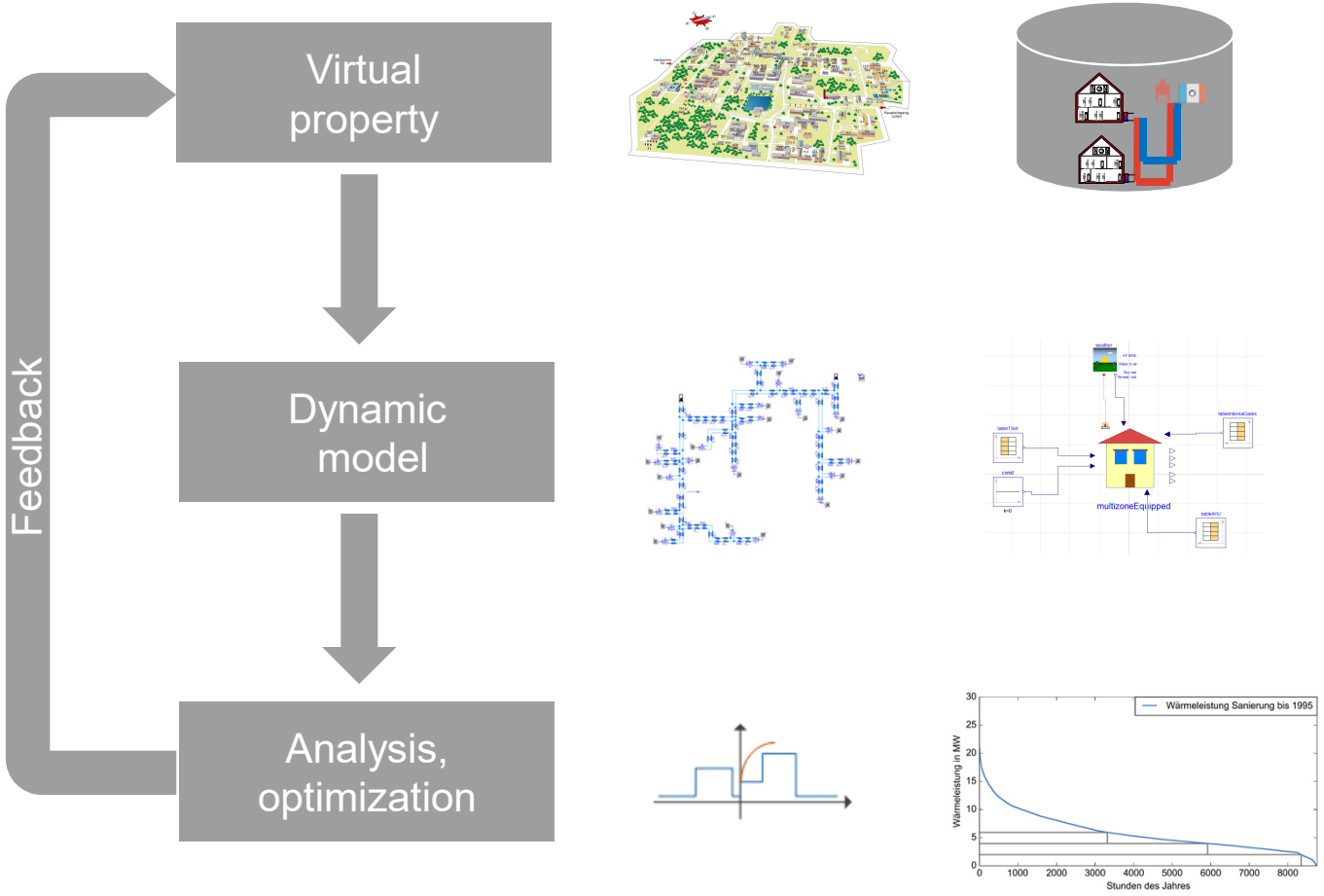
Virtual Property as Planing Instrument



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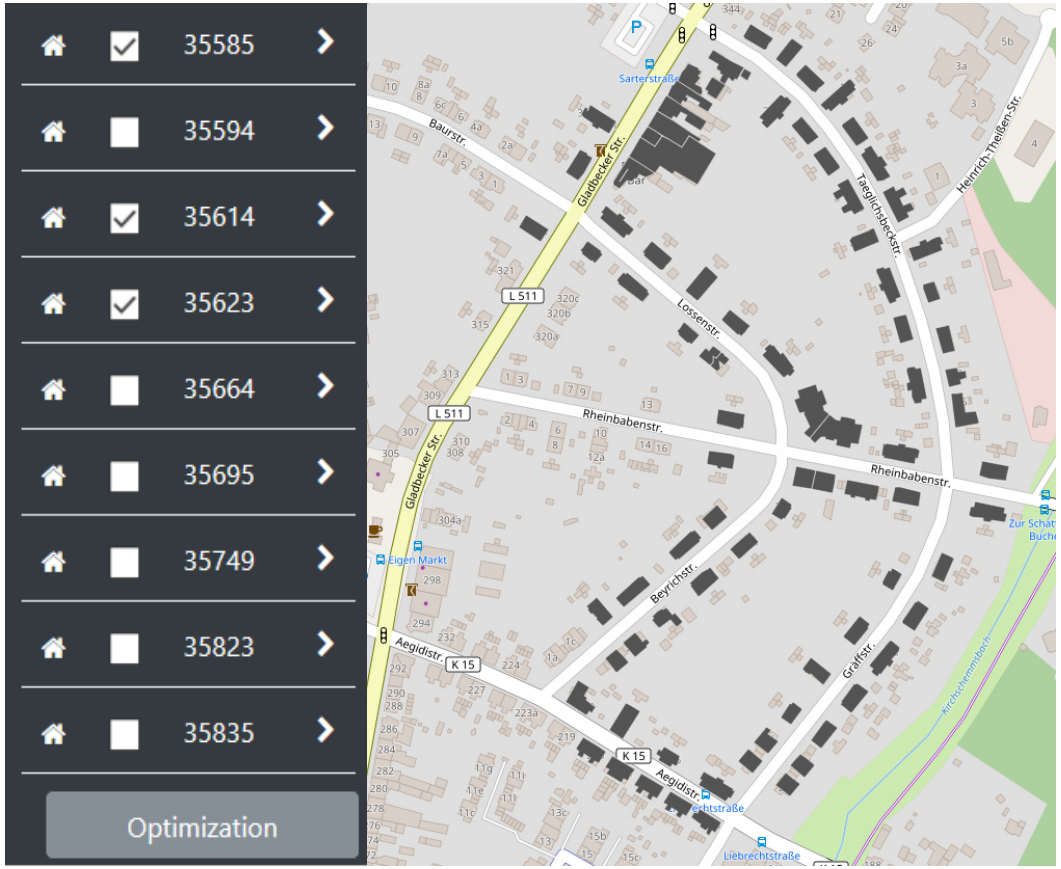
Cloud-Services: Optimization

- City district solutions



Zielfunktion

☑ Min. CO2 ☐ Min. Kosten

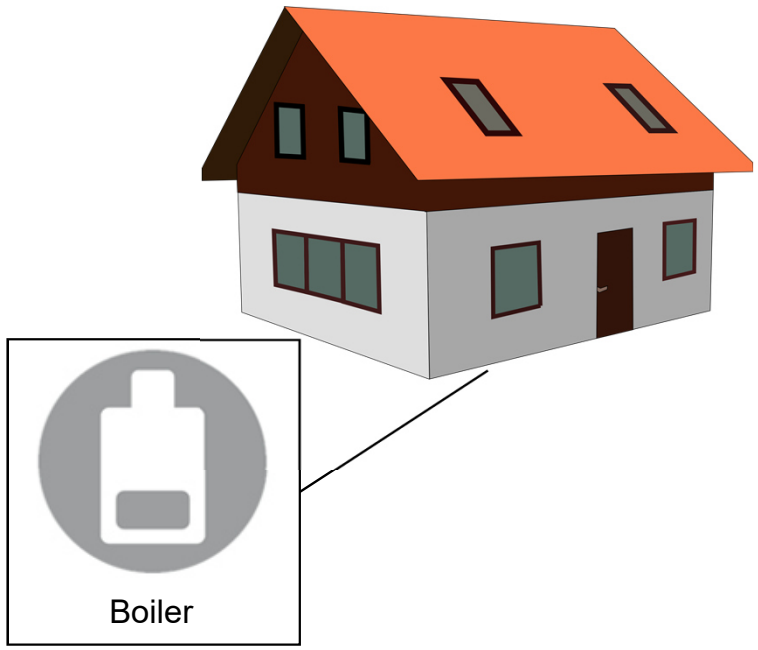
Anlagenauswahl

- ☑ Kessel
- ☑ Thermischer Speicher
- ☑ Blockheizkraftwerk (BHKW)
- ☑ Wärmepumpe (Luft/Wasser)
- ☐ Wärmepumpe (Wasser/Wasser)
- ☑ Photovoltaik (PV)
- ☐ el. Batterie
- ☑ Nahwärmenetze (NWN)
- ☐ el. Heizer

- Invest building energy systems
- Operating costs building energy systems
- Subsidies
- Construction costs grid
- Energy losses grid

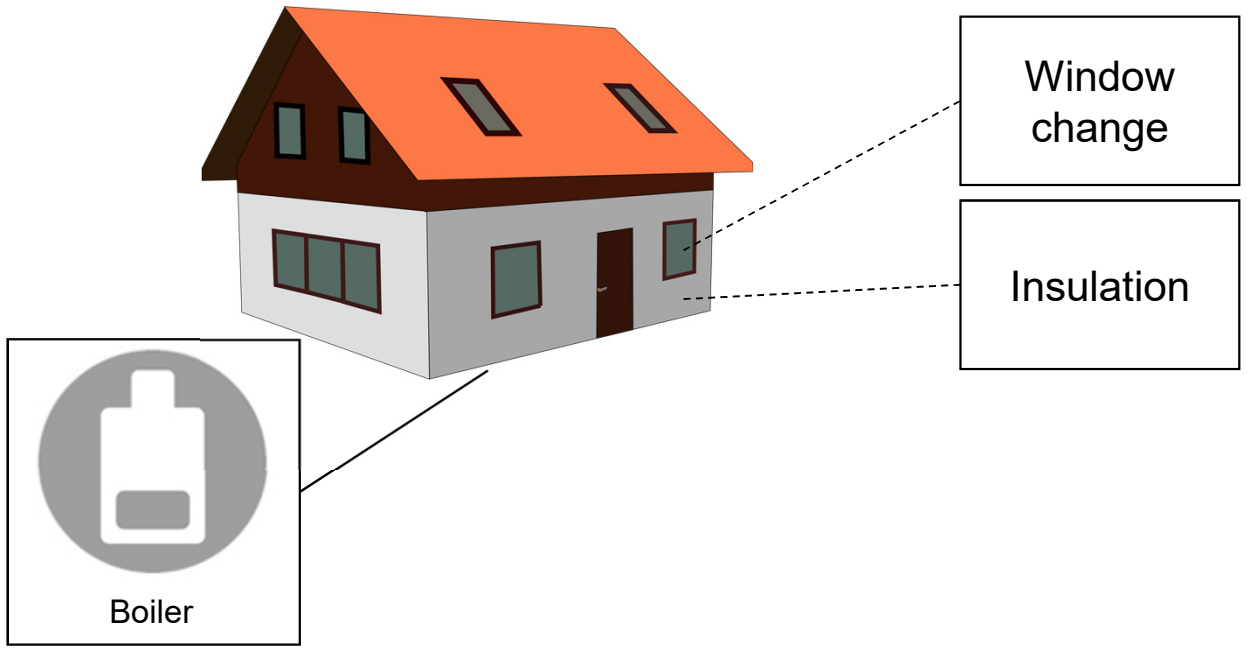
Cloud-Services: Physical Model

- Simulation of alternative solutions/ retrofit



Cloud-Services: Physical Model

- Simulation of alternative solutions/ retrofit
  - Insulation
  - Window change



Cloud-Services: Physical Model

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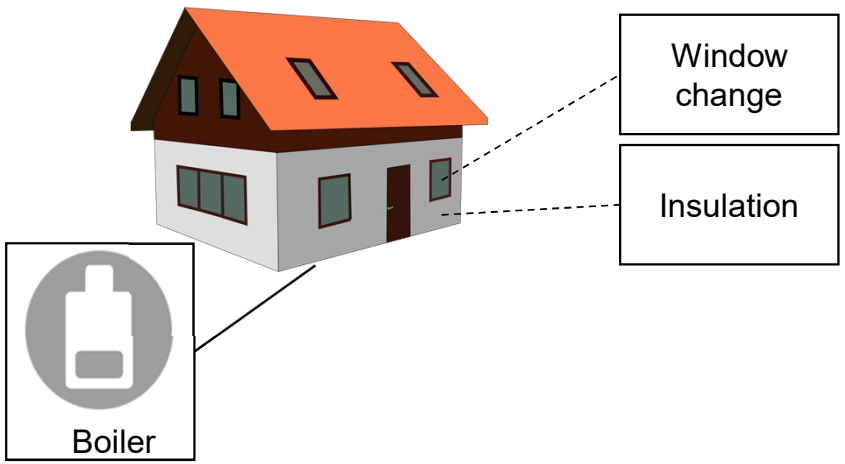

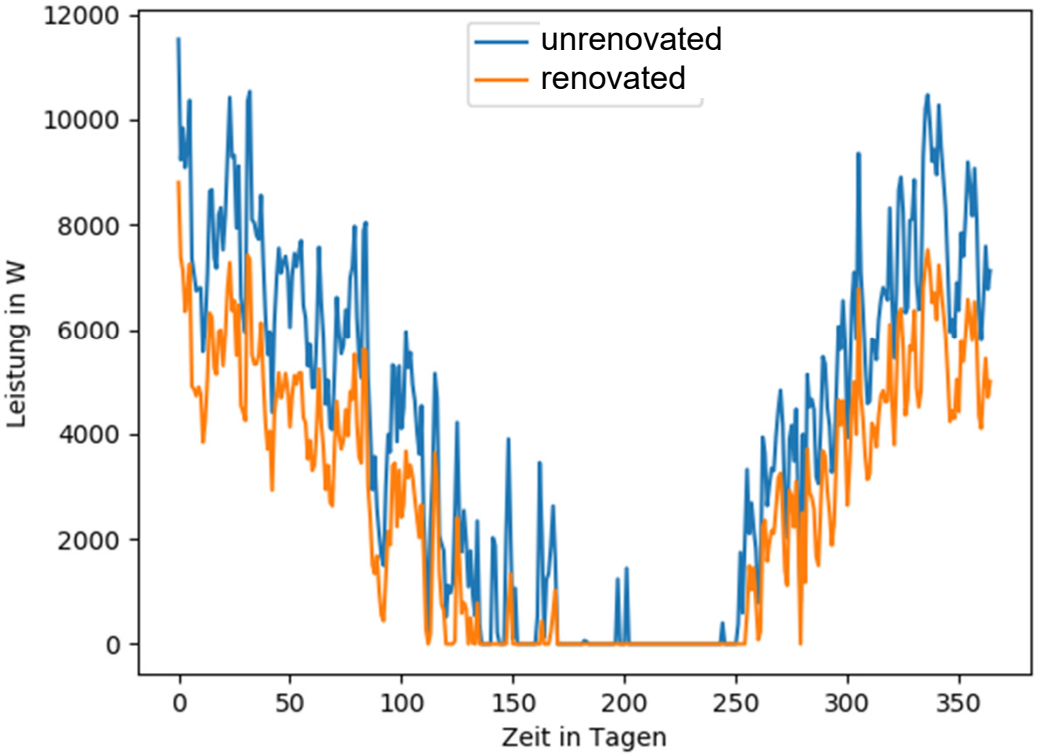

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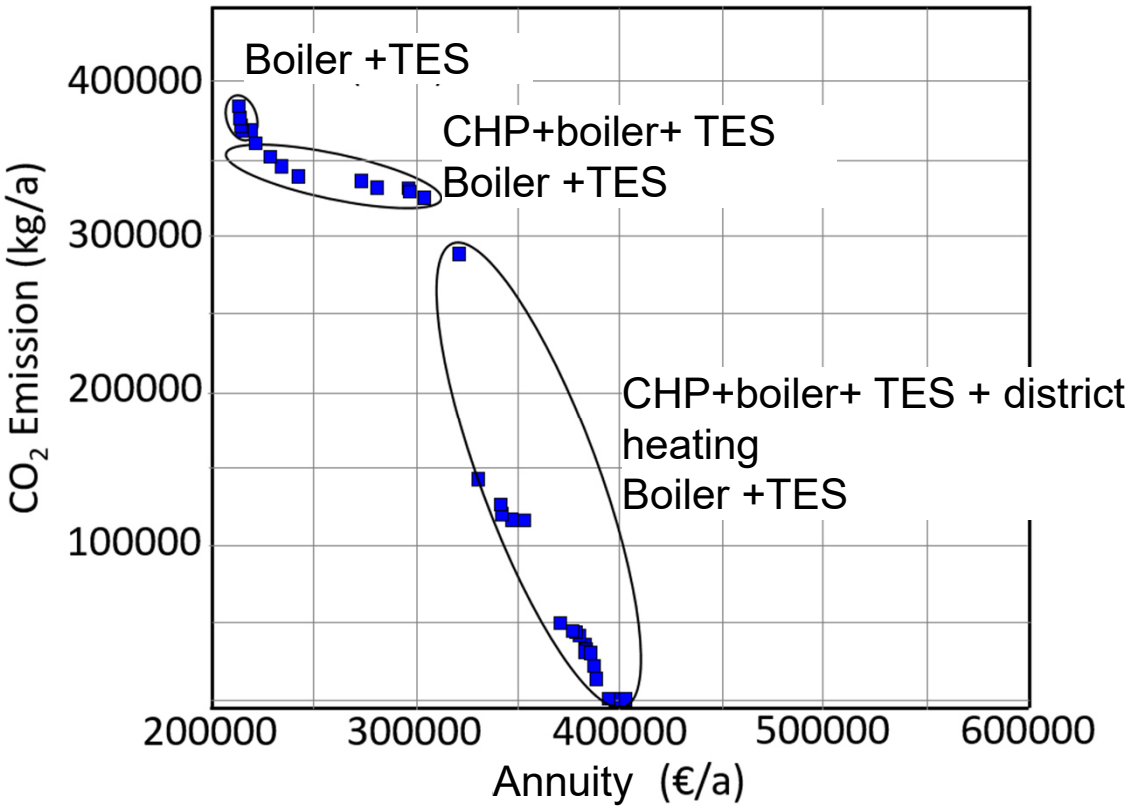
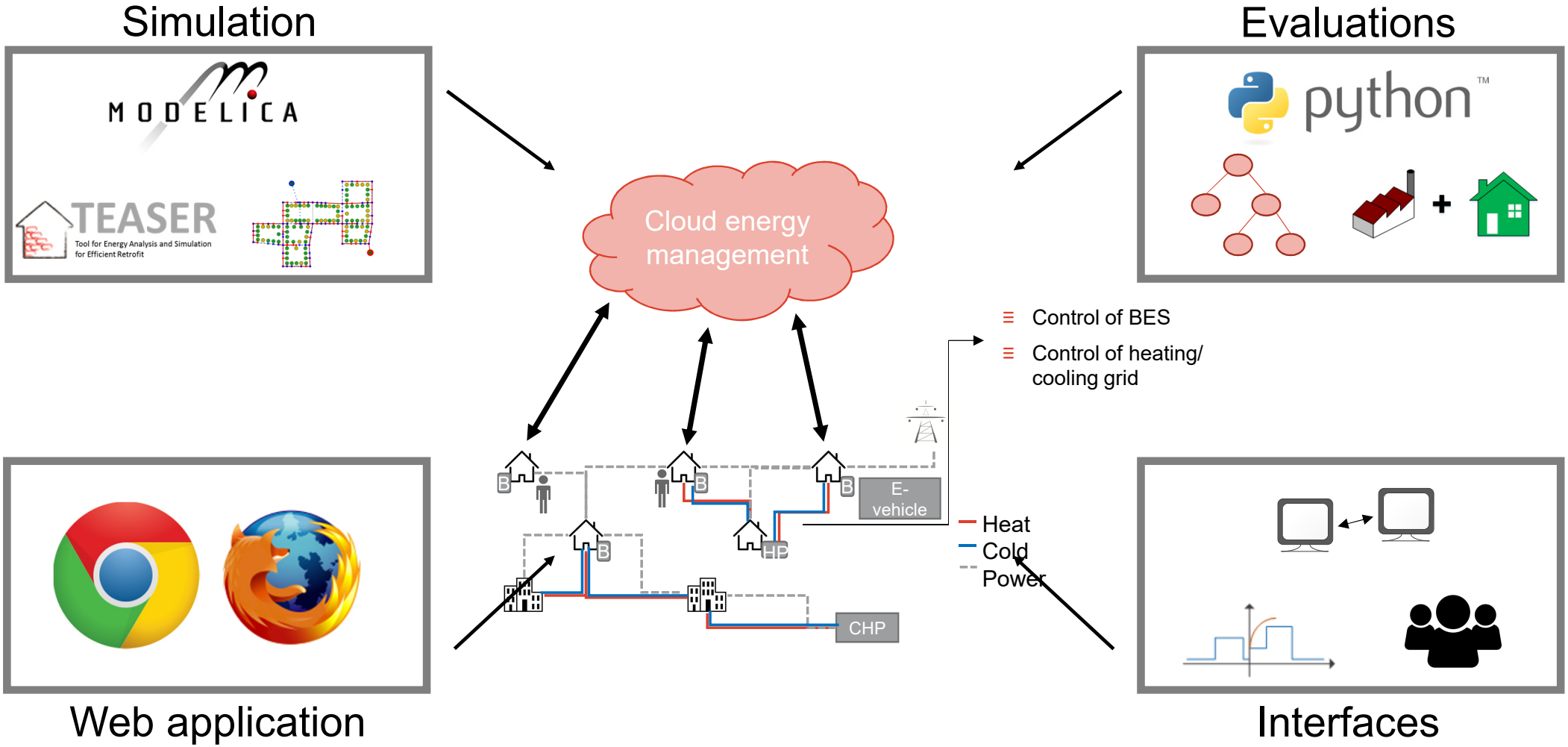
Cloud-Services: Optimization

- Use case with a city district of 50 buildings



Research Fields



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Towards Near Zero Energy Resilient Neighborhoods

System stability

Energy management systems

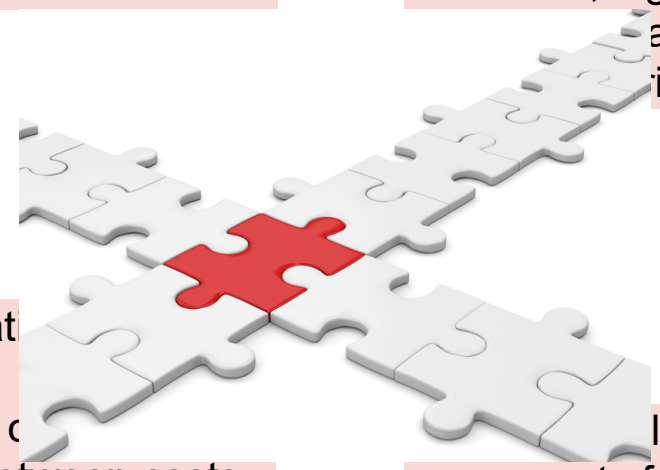
Data- and service platforms

Thermal electrical plants

Missing evaluation methods and control signals

Missing operator models, legal and ity

Classical business models and missing qualified personnel



Stat

between costs and emissions

l

concepts for dimensioning

Static procedures for single buildings

Data security and classical concepts for dimensioning

Evaluation methods

Control signals

Storage systems

User behaviour

Kontakt

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