Simulation Supported Real Time Energy Management in Building Blocks
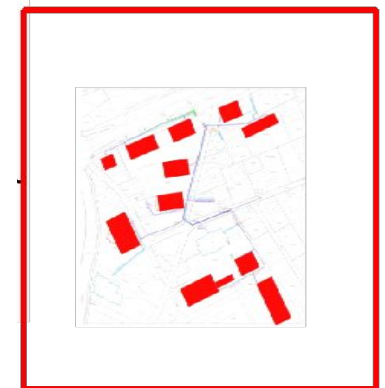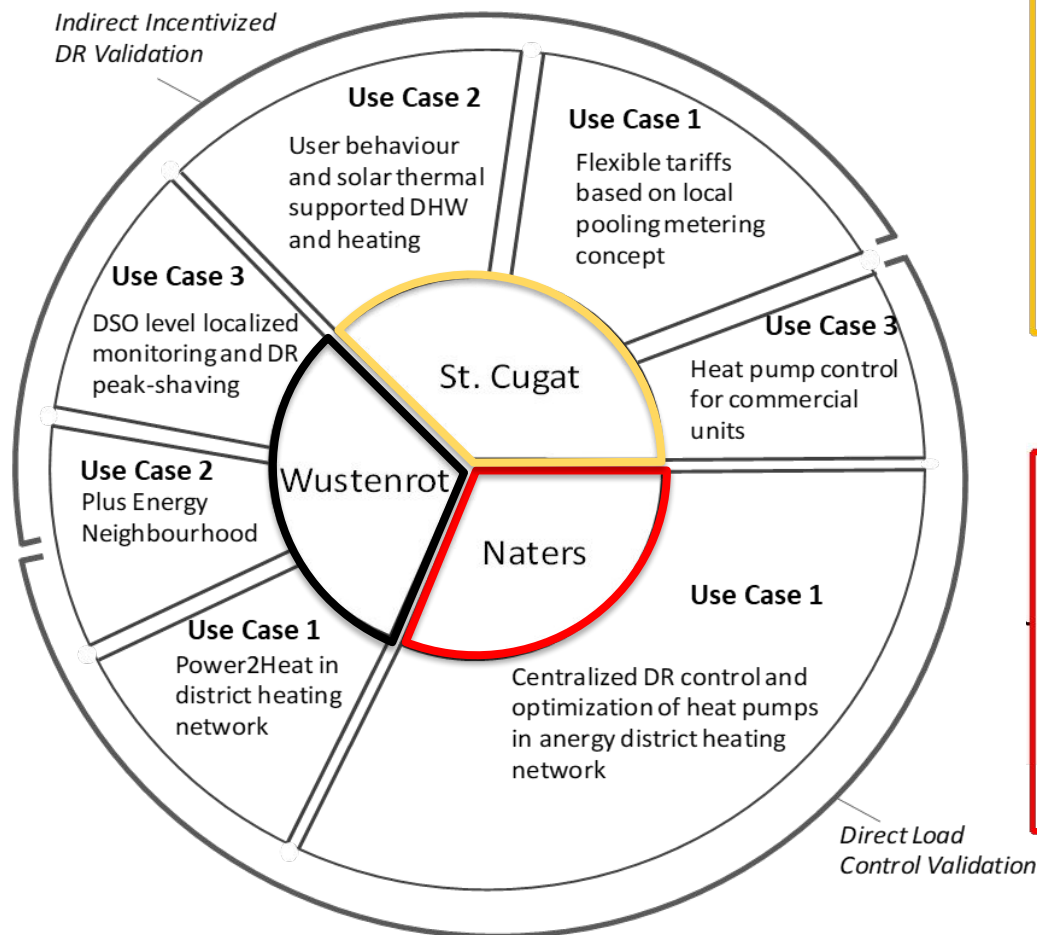
H2020 Contractors meeting on smart buildings

Use cases for studying direct, indirect and hybrid interactive control, mainly residential buildings and some offices

Indirect Incentivized DR Validation

Use Case 2
User behaviour and solar thermal supported DHW and heating

Use Case 1
Flexible tariffs based on local pooling metering concept

Use Case 3
DSO level localized monitoring and DR peak-shaving

Use Case 3
Heat pump control for commercial units

Use Case 2
Plus Energy Neighbourhood

St. Cugat

Wustenrot

Naters

Use Case 1
Centralized DR control and optimization of heat pumps in anergy district heating network

Use Case 1
Power2Heat in district heating network

Direct Load Control Validation

Opening services reserved for industry to residential users

Power Plant

Energy and Services

Peak (EEX)

Peak (OTC)

Base (EEX)
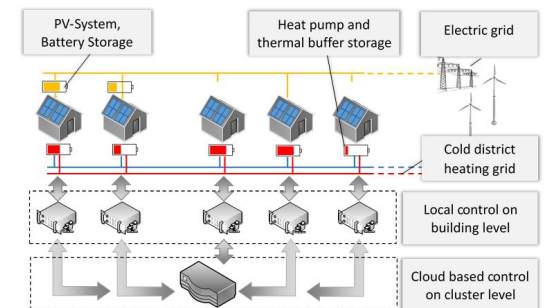
Base (OTC) (Eigenerzeugung)

Utility
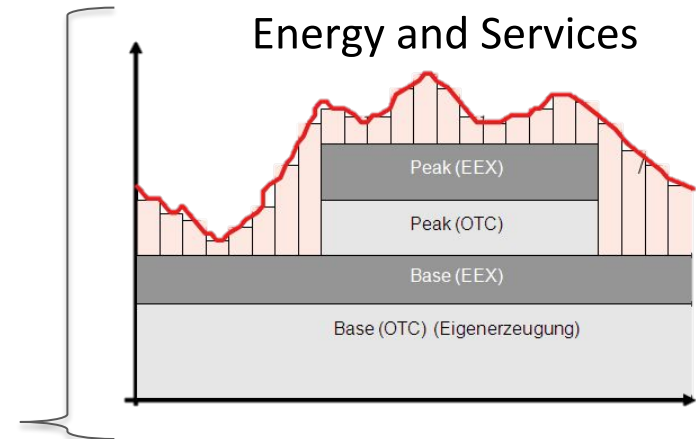
Households:
Blocks of buildings or
energy communities

Industry

?

Blocks of buildings versus energy communities

➢ Energy communities with central energy management of PV and batteries (Sonnen Gmbh as a successfull example for battery DR) or decentral (peer to peer trading via blockchain in Brooklyn)

➢ Blocks of buildings with coupled heating/cooling/electricity supply: cluster manager as the central energy manager, peer to peer trading mechanism between cluster managers

➢ Sim4Blocks organises hierarchical communication between cluster manager and building control unit and between cluster manager and agggregator

Peter in München   Paul in Flensburg   Martha in Leipzig   Magda in Hamburg

mit sonnenCommunity

PV-System, Battery Storage   Heat pump and thermal buffer storage   Electric grid

Cold district heating grid

Local control on building level

Cloud based control on cluster level

Cluster management in blocks of buildings

User interaction

- Allow user to set temperature bands in the building (web interface)
- Planning indirect incentivation trials in Spain

Day ahead pricing strategies with temperature bands
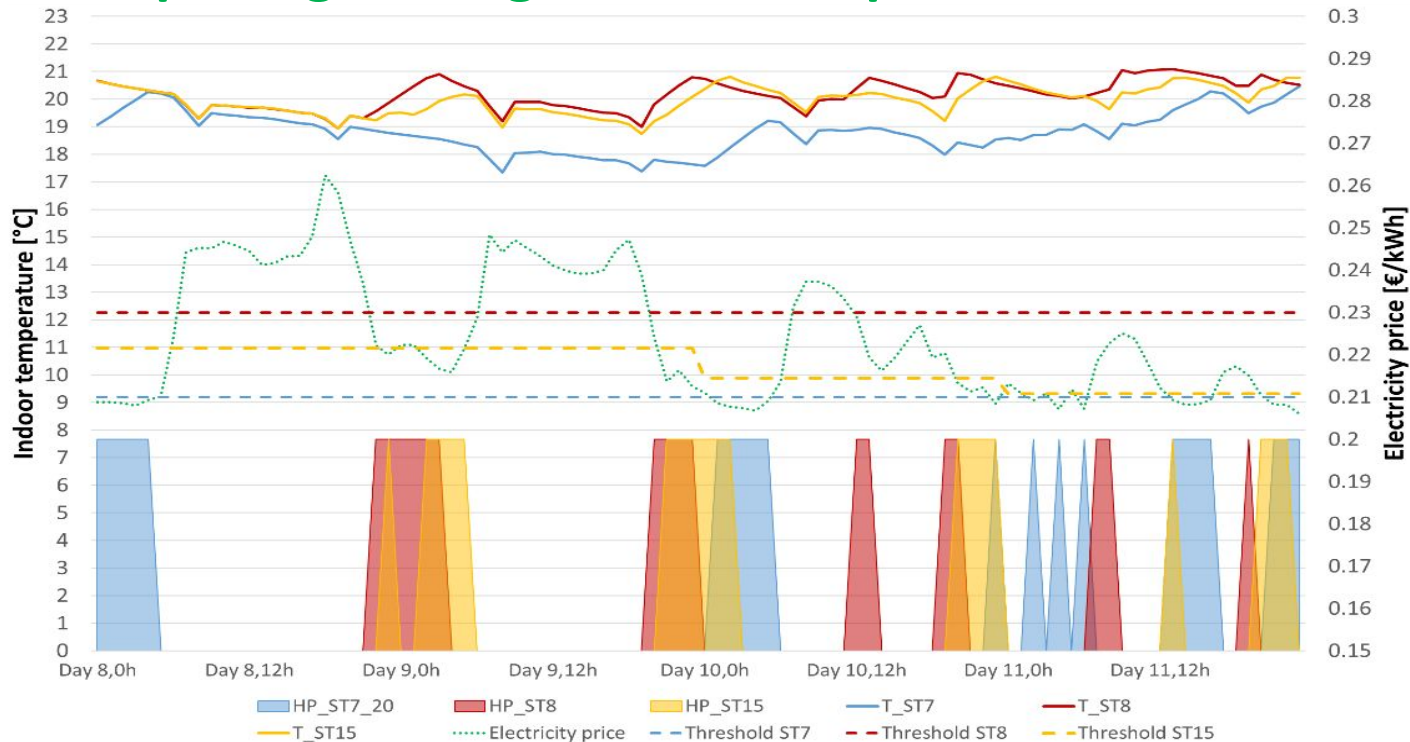
- Dynamic price thresholds instead of fixed price thresholds (to prevent low activations or overheating of the building)

- Cost savings up to 25% may be achieved by using optimal strategies, increasing the self-consumption ratio, having almost no influence on the thermal comfort and achieving significant peak reductions on the grid

Sim4Blocks methods and use cases

- Data driven load prediction in Spain for cheaper electricity purchases on day ahead markets (Energea as the energy company)
- Model predictive control of heat pump cluster in Switzerland to follow traces given by the aggregator
- Pooling of loads in social housing apartments to reduce peak load costs in Spain
- Secondary reserve market participation and day ahead participation with flexible price thresholds in Germany

Secondary reserve market participation in Germany
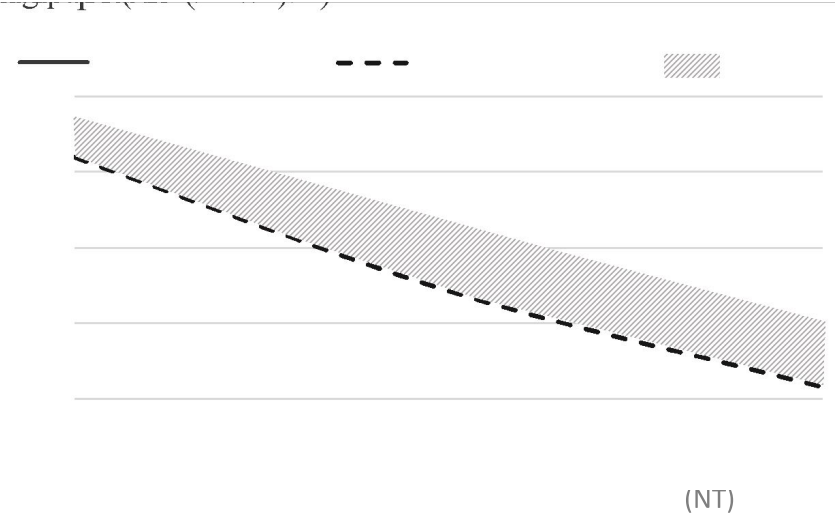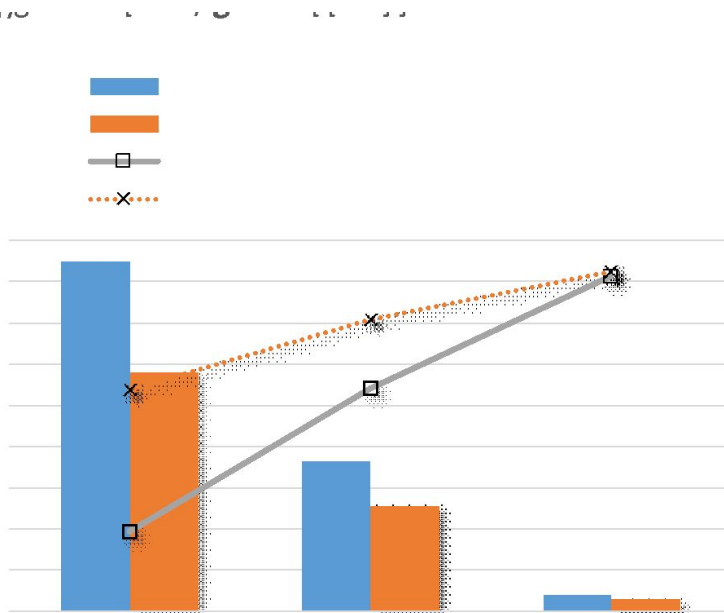
Annual contribution secondary reserve SR to heat pump electricity: 50%
PV own consumption with SR: 31%
PV own consumption without SR: 33%
Additional electricity demand with SR (losses COP and storage) : 7%

Conclusions

- Heat pumps, PV and batteries in combination with buildings offer large DR potentials (up to 35 GW negative reserve power in Germany)

- System technology in buildings is complex and different in nearly every building: local controller needs to become intelligent to offer flexibility potential to cluster manager

- Cluster can then offer blocks of building flexibility to aggregator or trade with other cluster managers on a peer to peer level

BARRIERS

- For blocks of buildings there is no market structure and market actor available – especially for small loads in residential buildings

- With given market prices, taxes and charges, DR is financially not very attractive (maximum profits of 50 to 60 Euro per customer)

visit Sim4Blocks website:

www.sim4blocks.eu