e-MOBILie
From Concept to HiL Testbench

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Lehrstuhl für Energiewirtschaft und Anwendungstechnik
Prof. Dr.-Ing. U. Wagner, Prof. Dr. rer. nat. Th. Hamacher

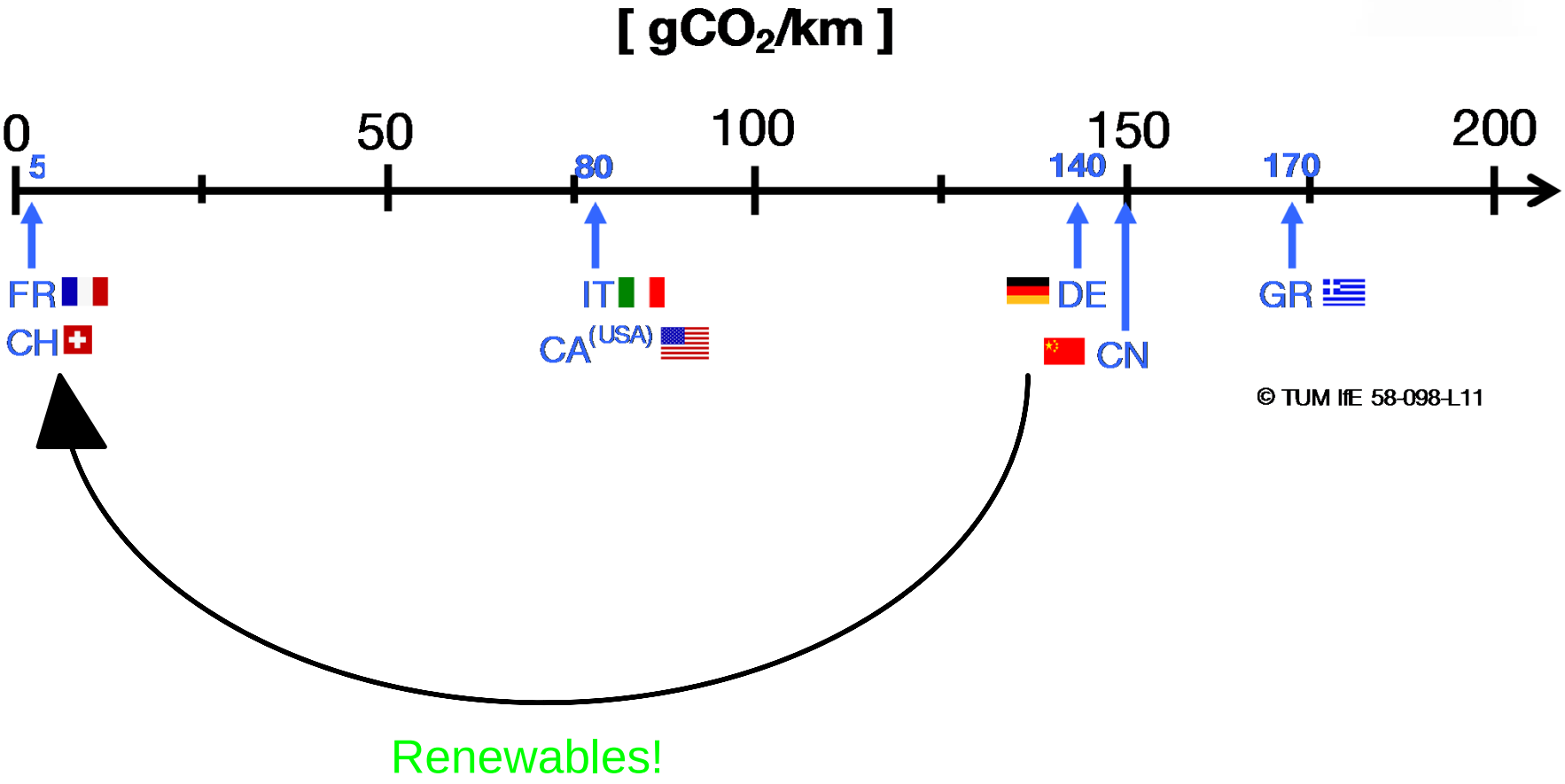
Agenda

- Motivation
- Project e-MOBILie
- From Concept Development to HiL Testbench
  - Software Simulation and HiL Testbench
  - Control strategies for heat pumps in smart buildings
- Demonstration case

Motivation

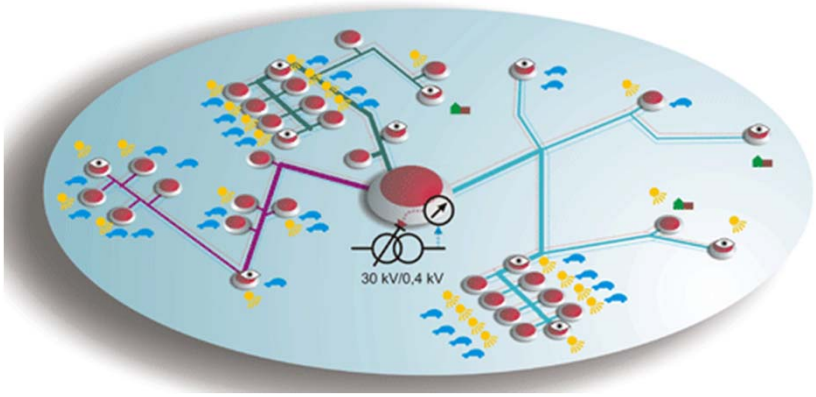
Electromobility: Carbon Emissions for Driving Purposes

- Energy Demand EV (Plug2Wheel): 15 kWh/100km
- Controlled Off-Peak Charging
- Power Plant Park: 2015



Motivation

Decentralised Energy Production



Quelle: Energie AG Upper Austria

Advantages:

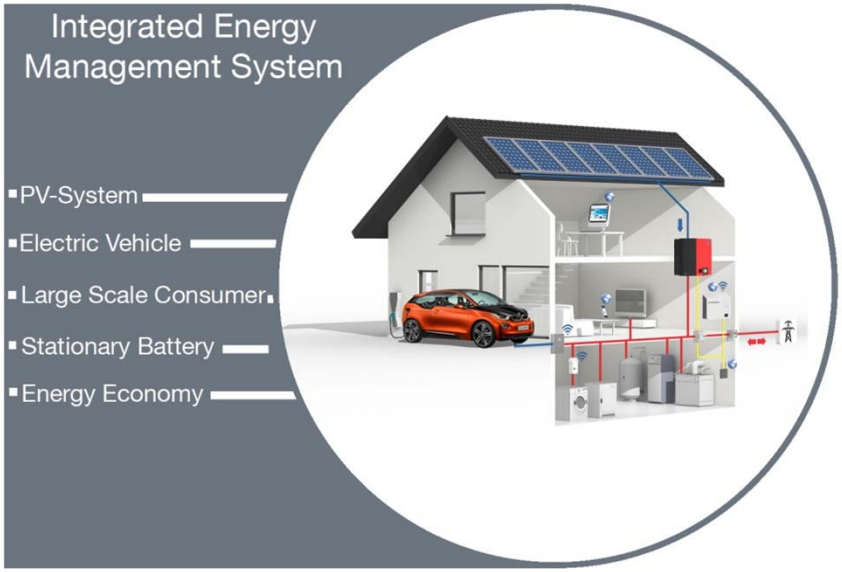
- Local Supply of Peak Load and Reactive Power
- Decentralised Production can lower Demand of Large-Scale Plants (Storages, Power Plants)
- Less transmission & transformation losses (2000-2012: -28% AG EnBil)

Disadvantages:

- High Excess Production
- Supply Shortfalls
- Possible Grid Imbalances

→ ‘smart‘ Integration into the Complex of a Residential Building

e-MOBILie
Energieautarke Elektromobilität



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Goals

- Development and implementation of hierarchical and distributed energy management systems
- evaluation of the environmental benefits of a combination between an electric vehicle and local energy generation

Main focus:

- Implementation and operation of an hardware-in-the-loop test bench for evaluating the integrated energy management concept (iEM)
- Demonstration of these concepts in a real residential building and a plus-energy parking garage

Modelling

Application

LabVIEW

SIMULATION X®
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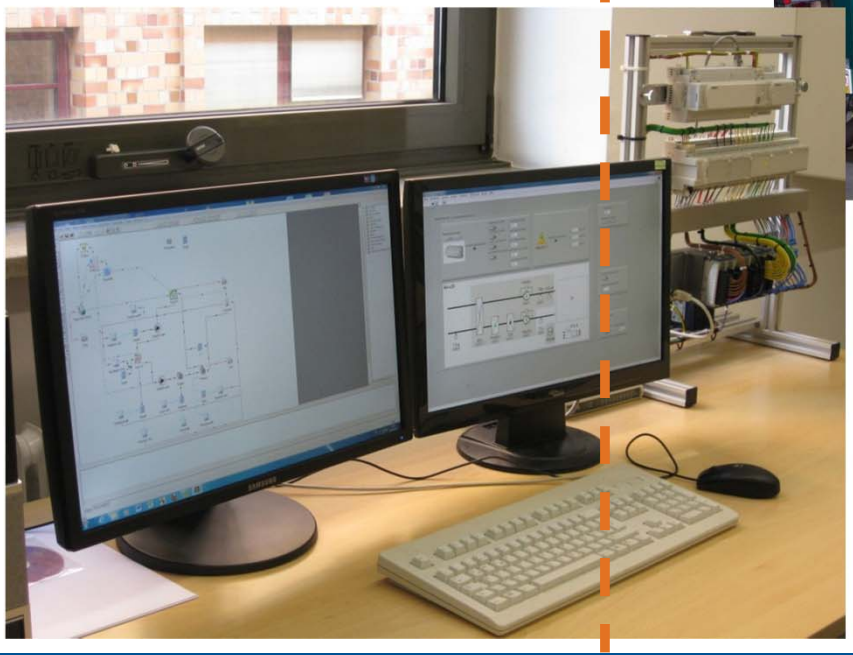

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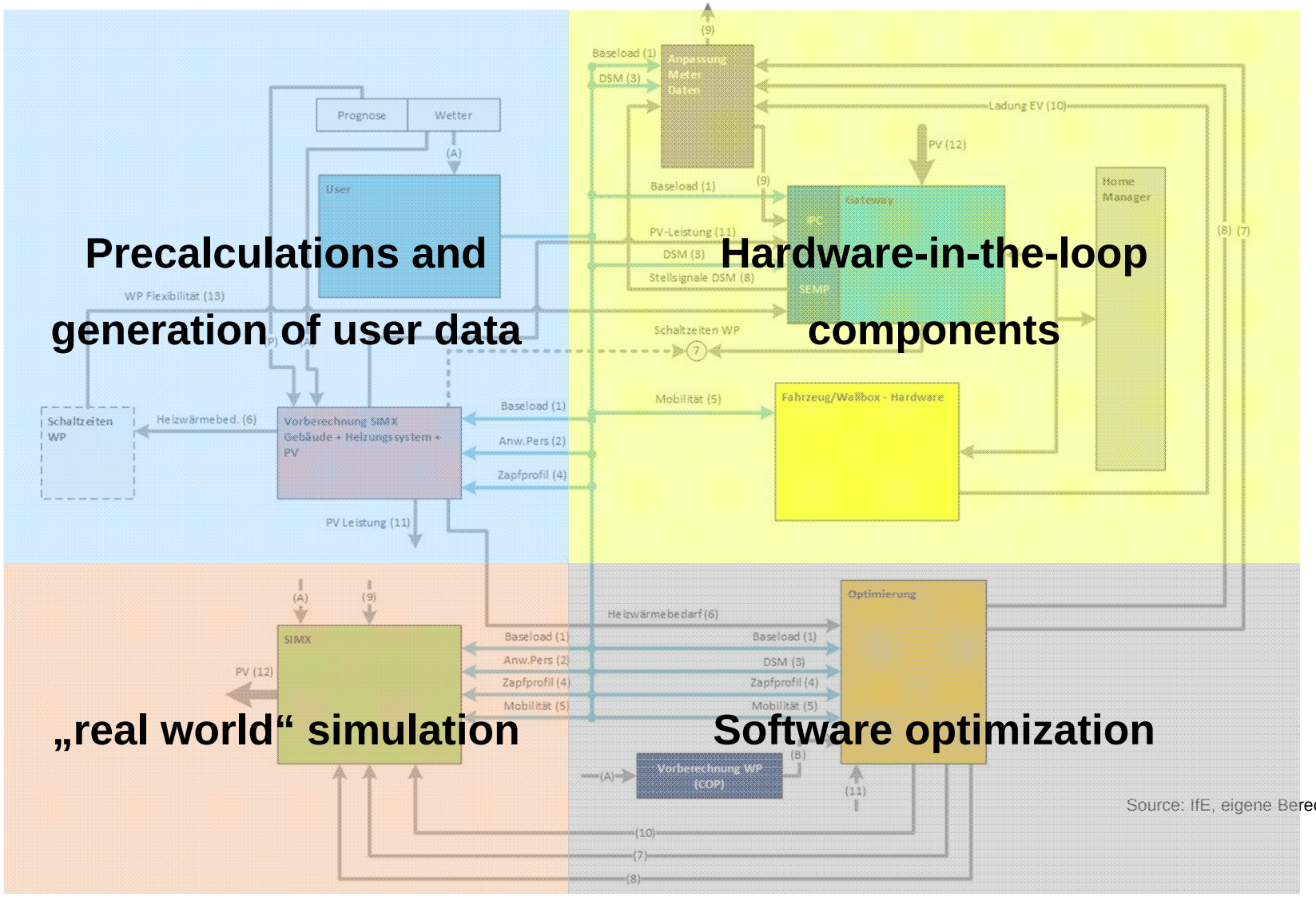
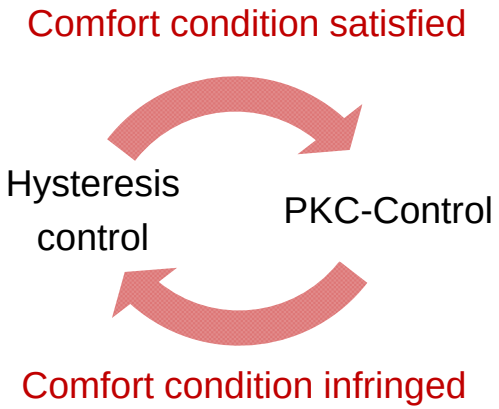


Source: IfE, eigene Berechnungen

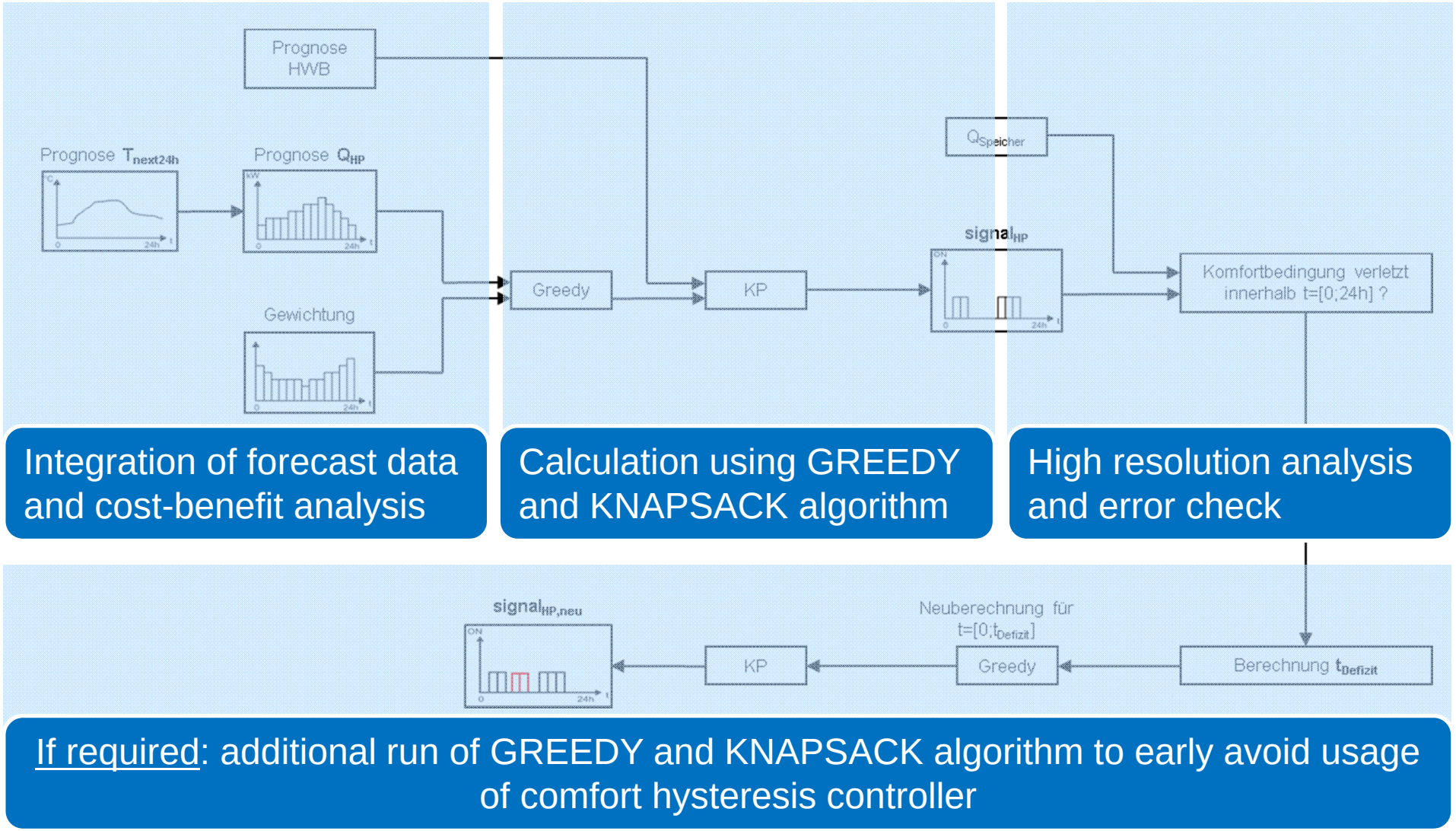
Hysteresis control

- Depending on room temperature
- Active on violation of comfort conditions
- Goal: keeping T_{Room} in specific borders



PKC-Control (PKC = Predictive Knapsack Control)

- Predictive and adaptiv strategy
- Robustness to uncertainties of weather forecast
- Using appropriate weighting (electricity price, PV feed-in)
- Goal: better integration of heat pumps into home energy system



Source: IfE, BA Hitzelberger

e-MOBILie

Demonstration Case (Location & Building)

Technische Universität München

Dynahaus®

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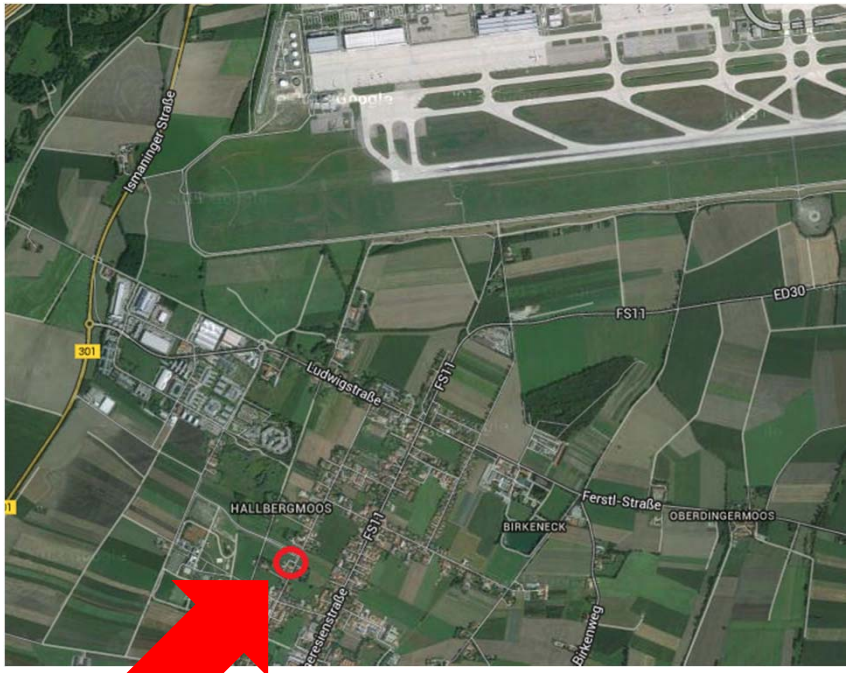

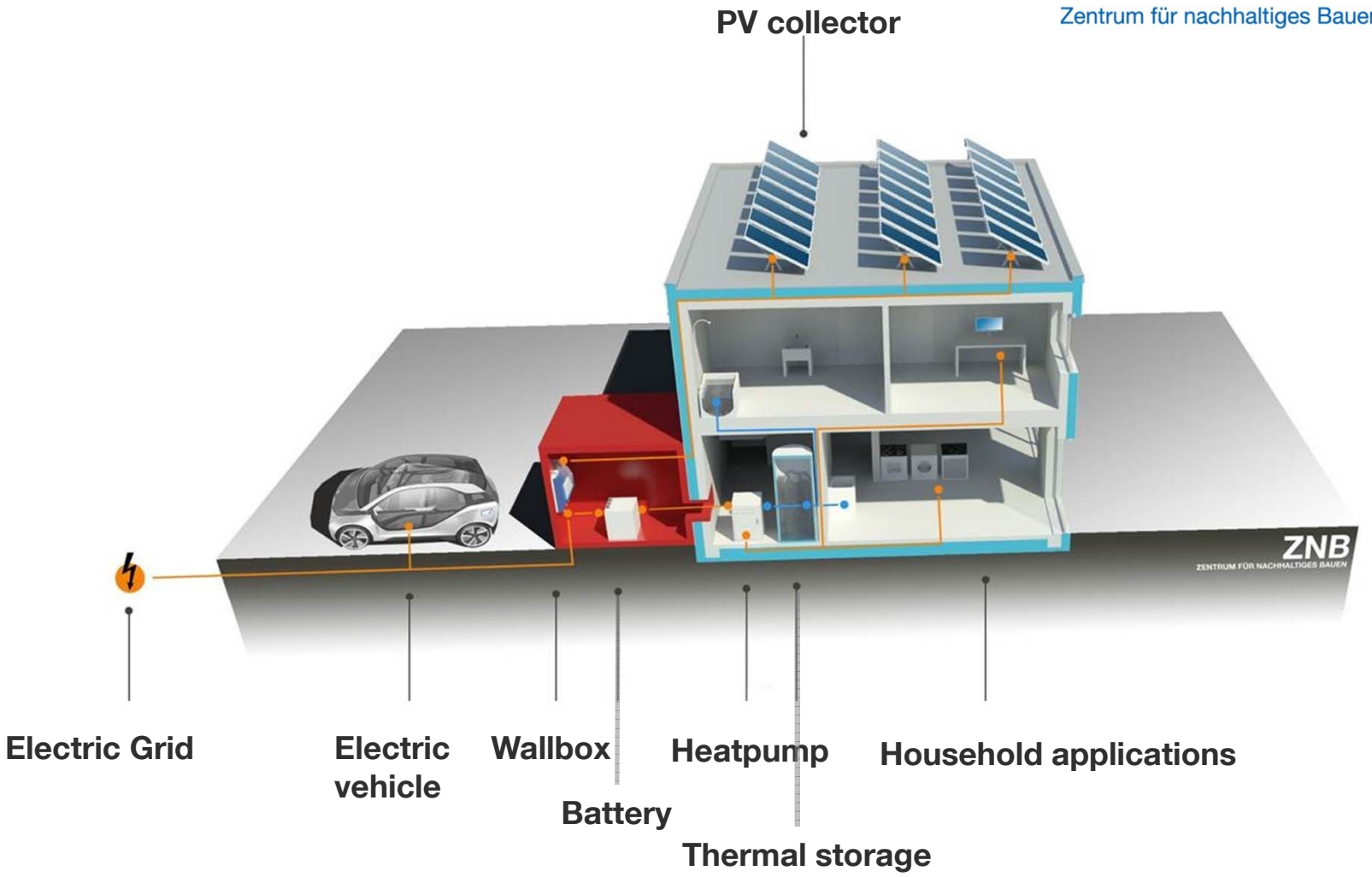
PV collector
ZNB
ZENTRUM FÜR NACHHALTIGES BAUEN
Electric Grid
Electric vehicle
Wallbox
Battery
Heatpump
Thermal storage
Household applications

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