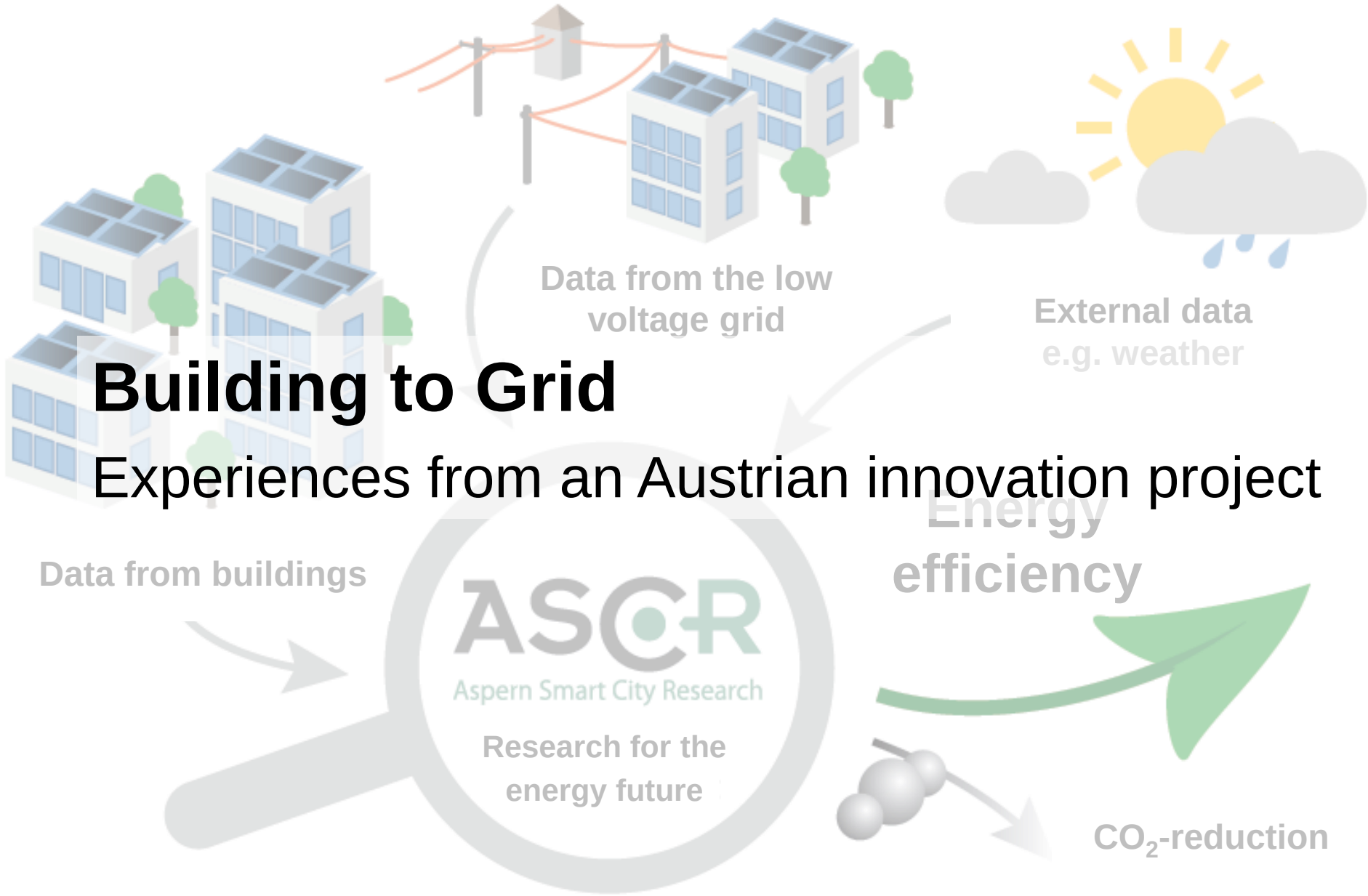


Building to Grid

Experiences from an Austrian innovation project

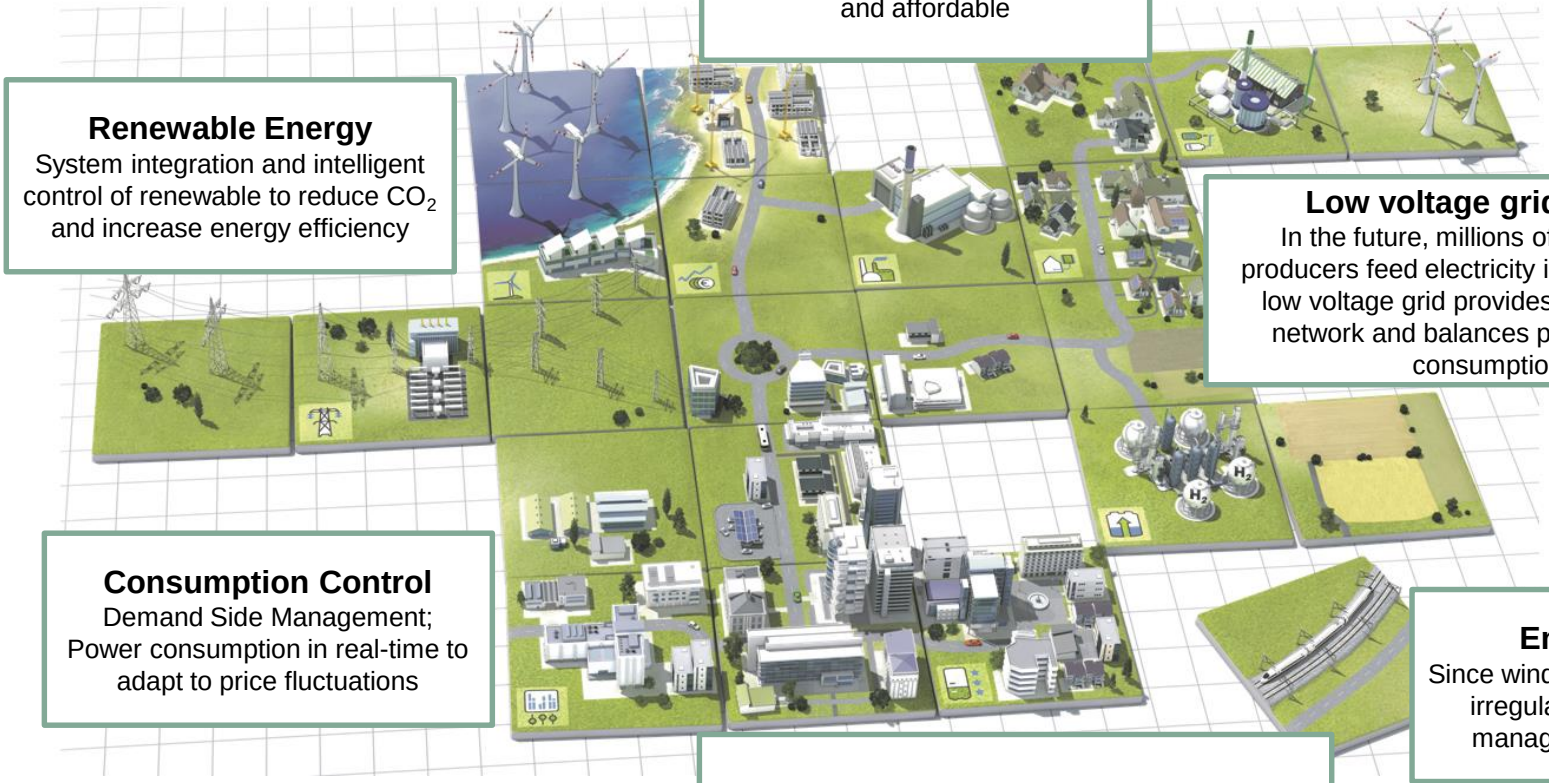
Andreas Schuster and Robert Hammerling | 26.09.2017

Future energy infrastructure of Smart Cities

… require smart energy distribution and usage concepts

Security of supply
Energy must always be reliable and affordable

Renewable Energy
System integration and intelligent control of renewable to reduce CO_2 and increase energy efficiency



Low voltage grid control
In the future, millions of small power producers feed electricity into the grid. The low voltage grid provides stability in the network and balances production and consumption.

Consumption Control
Demand Side Management; Power consumption in real-time to adapt to price fluctuations

Energy storage
Since wind and solar energy supply irregular, power storage and management are necessary

Efficient use of Energy
Intelligent control of distribution networks and buildings will lead to energy savings

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aspern – Vienna's Urban Lakeside

Embedded in the Smart City Framework Strategy of Vienna

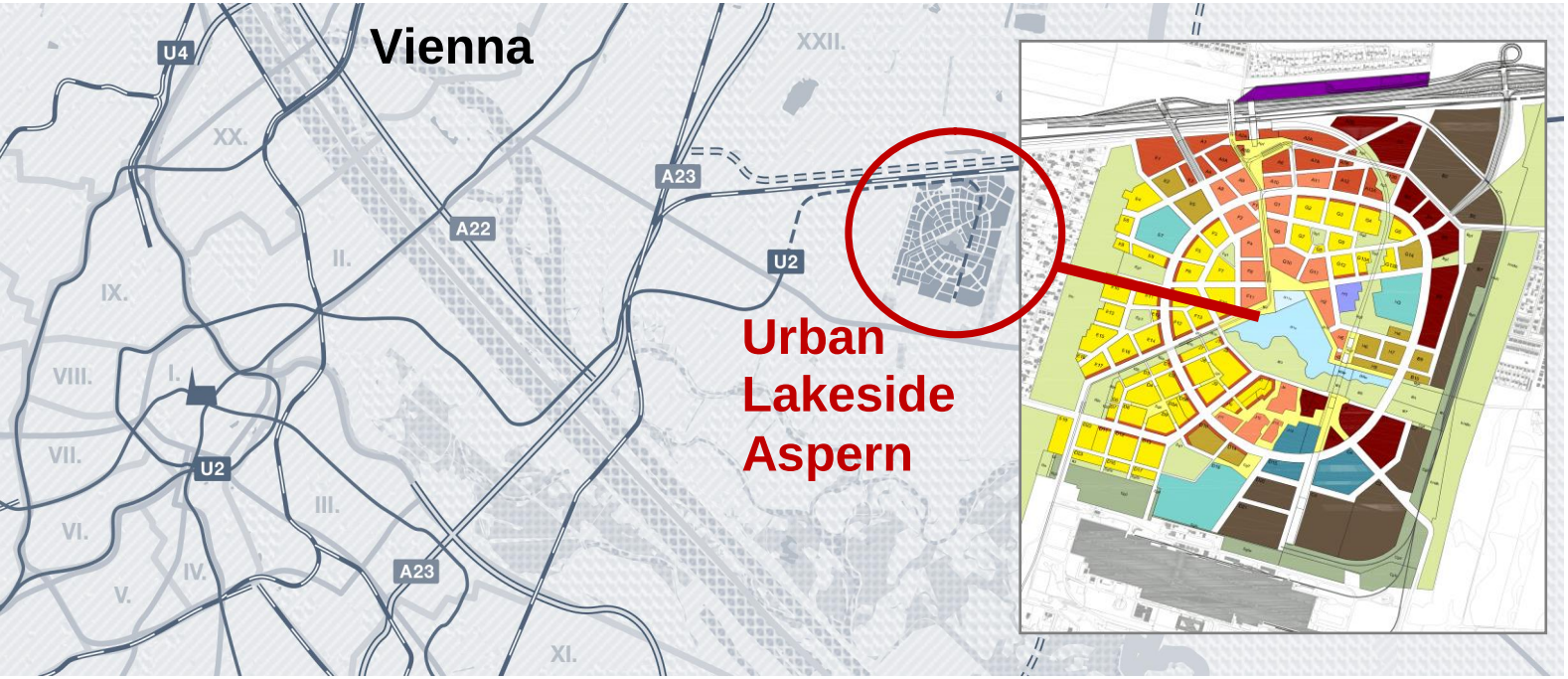
- The vision – Smart City Wien 2050
- Smart City Framework Strategy – Fundament for the guidance of Vienna
  - Resources (energy, mobility, infrastructure, buildings)
  - Quality of life (social inclusion, participation, health, environment)
  - Innovation (education, economy, research, technology)
- Resolution of the Vienna City Council
- Vienna's position as solution provider with social responsibility

aspern – Vienna's Urban Lakeside

Facts

- 2,4 million m² area
- 2,2 million m² gross floor space
- 20.000 workplaces
- 20.000 residents
- 10.500 apartments

- Offices, production and service business, science, research and education
- More than 20.000 m² area for shops, pubs and small businesses in the whole Urban Lakeside area



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ASCR Structure

Partner of the ASCR joint venture

SIEMENS	WIEN ENERGIE	WIENER NETZE	wirtschaftsagentur wien	wien3420 aspern development AG
44,1 %	29,95 %	20,0 %	4,66 %	1,29 %

ASCR Aspern Smart City Research

38,5 mEUR

Smart Infrastructure	9,7 mEUR
Operation and maintenance	6,5 mEUR
Research	14,1 mEUR
ASCR staff	5,6 mEUR
Miscellaneous (marketing, office,…)	2,4 mEUR

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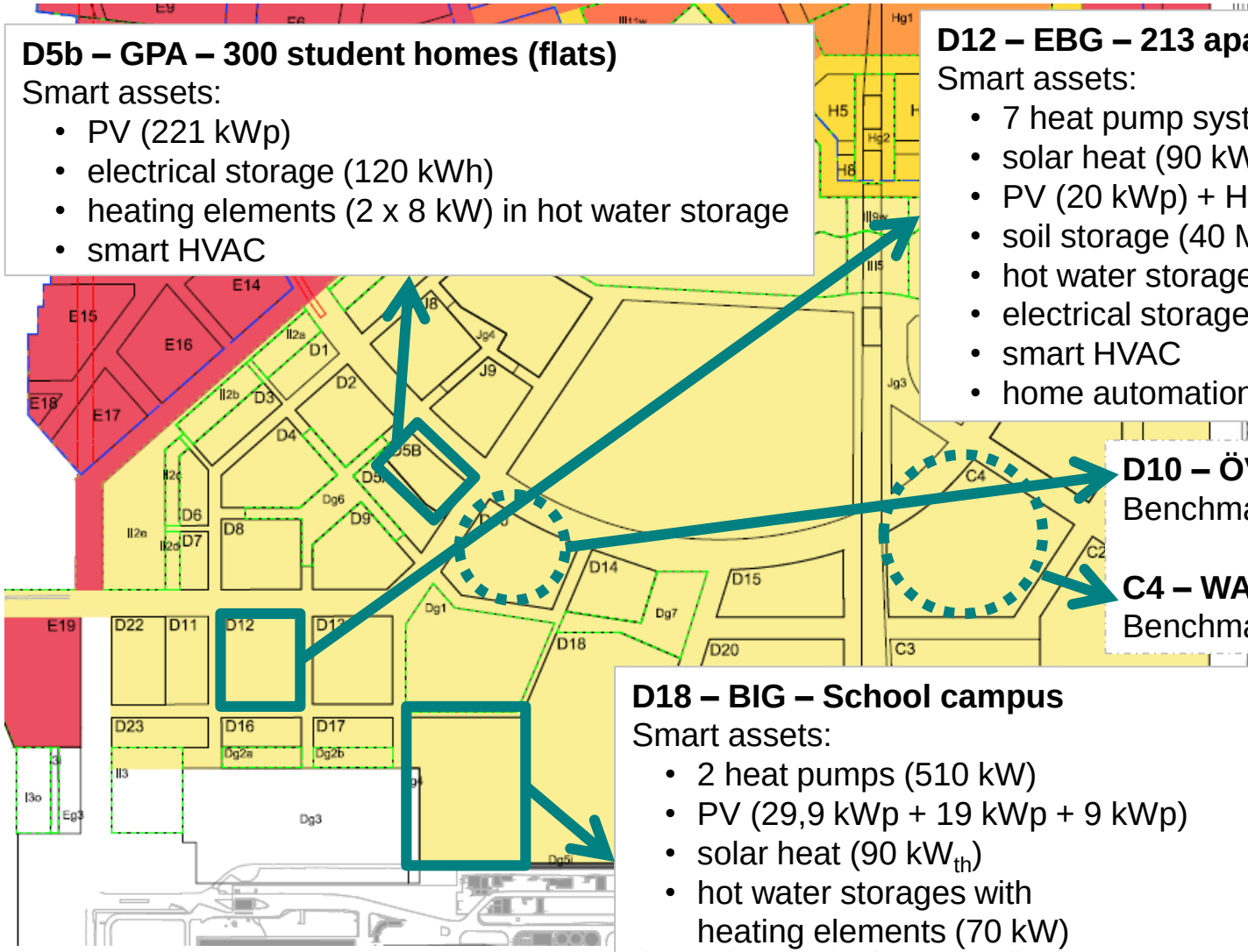
ASCR Testbed Smart Building

Map of the testbed and description of the infrastructure components



D5b – GPA – 300 student homes (flats)
Smart assets:

- PV (221 kWp)
- electrical storage (120 kWh)
- heating elements (2 x 8 kW) in hot water storage
- smart HVAC

D12 – EBG – 213 apartments
Smart assets:

- 7 heat pump systems (800 kW)
- solar heat (90 kW) + Hybrid (60 kWp_{th})
- PV (20 kWp) + Hybrid (16 kWp_{el})
- soil storage (40 MWh)
- hot water storages (6 X 2000 L)
- electrical storage (2 kWh)
- smart HVAC
- home automation (111 households)

D10 – ÖVW/EGW – mixed use
Benchmark object

C4 – WAB – offices
Benchmark object

D18 – BIG – School campus
Smart assets:

- 2 heat pumps (510 kW)
- PV (29,9 kWp + 19 kWp + 9 kWp)
- solar heat (90 kW_{th})
- hot water storages with heating elements (70 kW)
- smart HVAC

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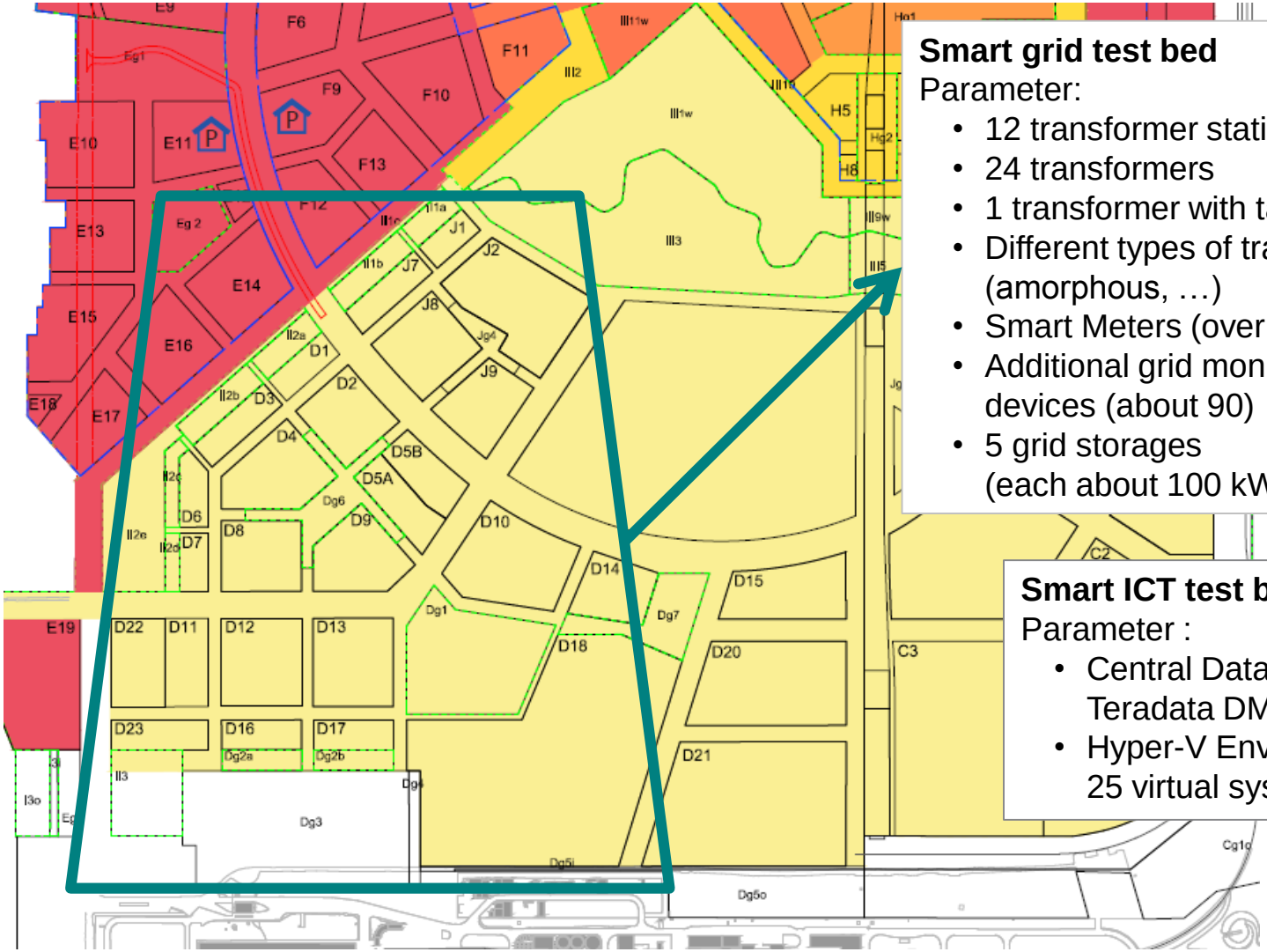
ASCR Testbed Smart Grid and Smart ICT

Map of the testbed and description of the infrastructure components



Smart grid test bed
Parameter:

- 12 transformer stations
- 24 transformers
- 1 transformer with tap changer
- Different types of transformers (amorphous, …)
- Smart Meters (over 500)
- Additional grid monitoring devices (about 90)
- 5 grid storages (each about 100 kW(h))

Smart ICT test bed
Parameter :

- Central Data Warehouse: Teradata DM670C
- Hyper-V Environment with 25 virtual systems

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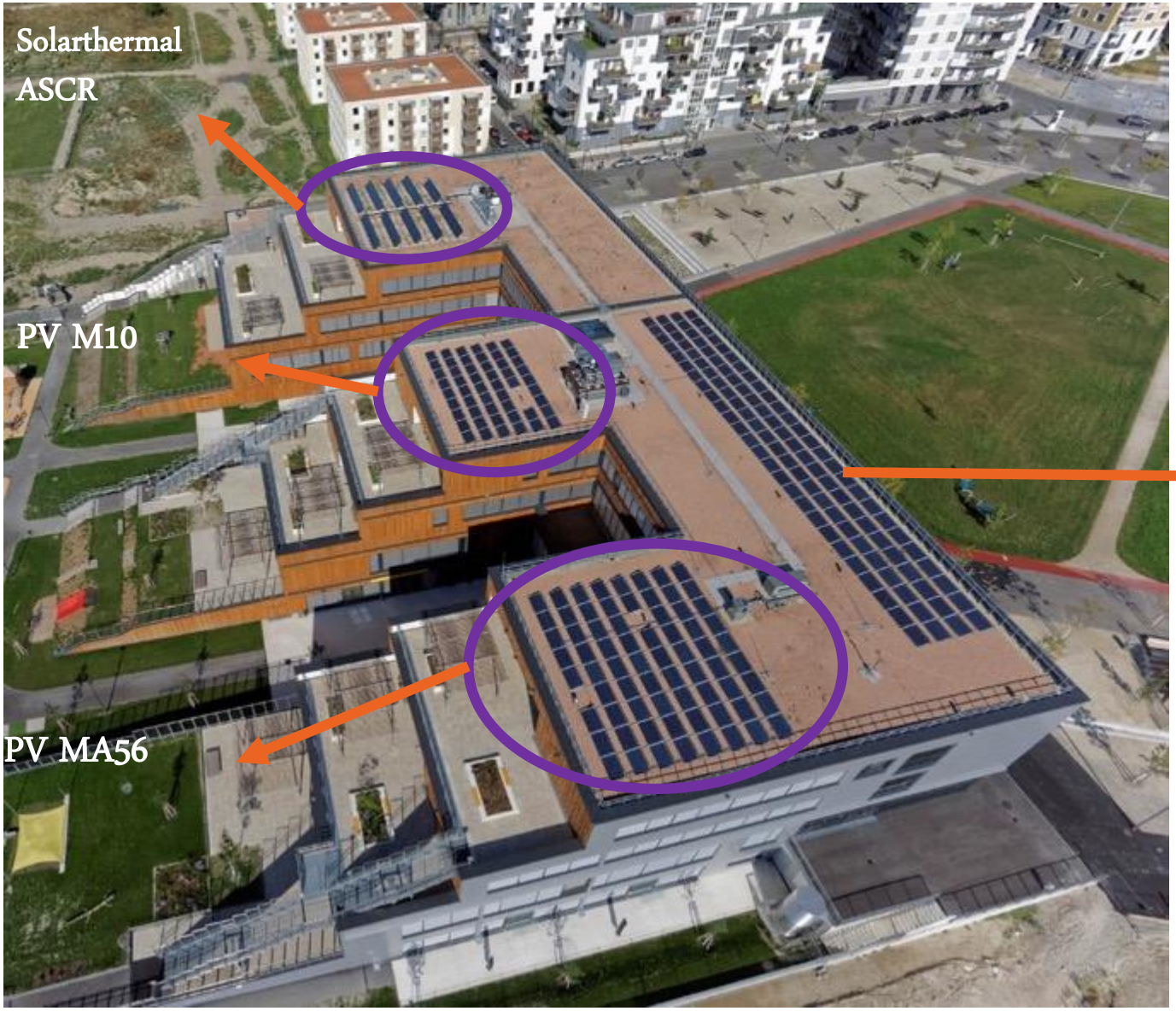
The Start in April 2014

Block of 213 Apartments August 2015

School Campus PV + Solar Thermal September 2015



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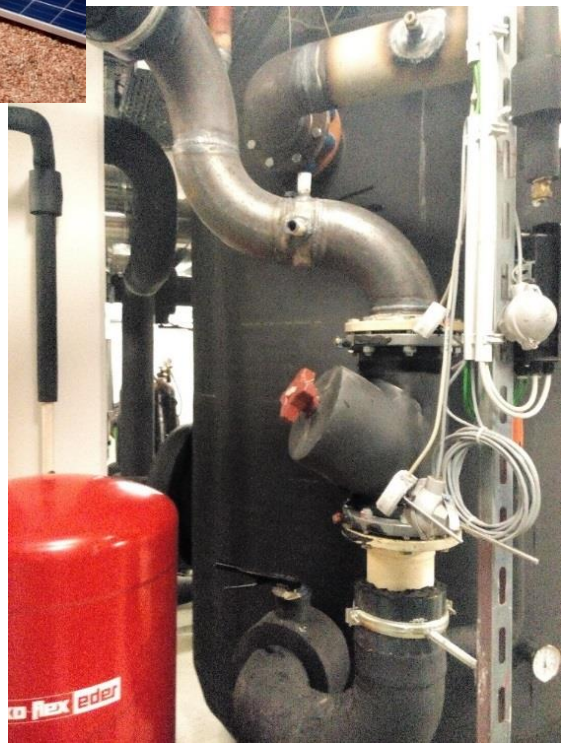
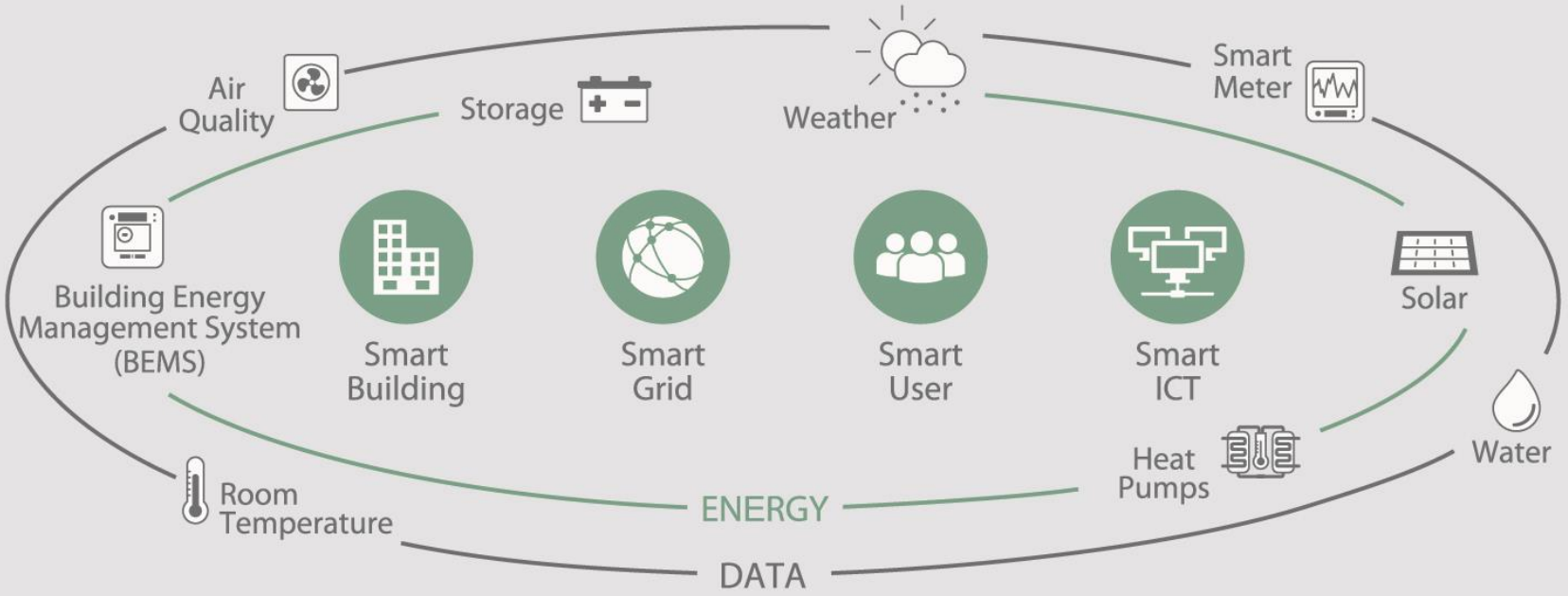
Students Homes PV + Hot Water Storage



OVERVIEW OF THE

ASCR RESEARCH FIELDS



OPTIMAL HARMONISATION OF:

GENERATION ✓ DISTRIBUTION ✓ STORAGE ✓ CONSUMPTION ✓

ENERGY EFFICIENCY

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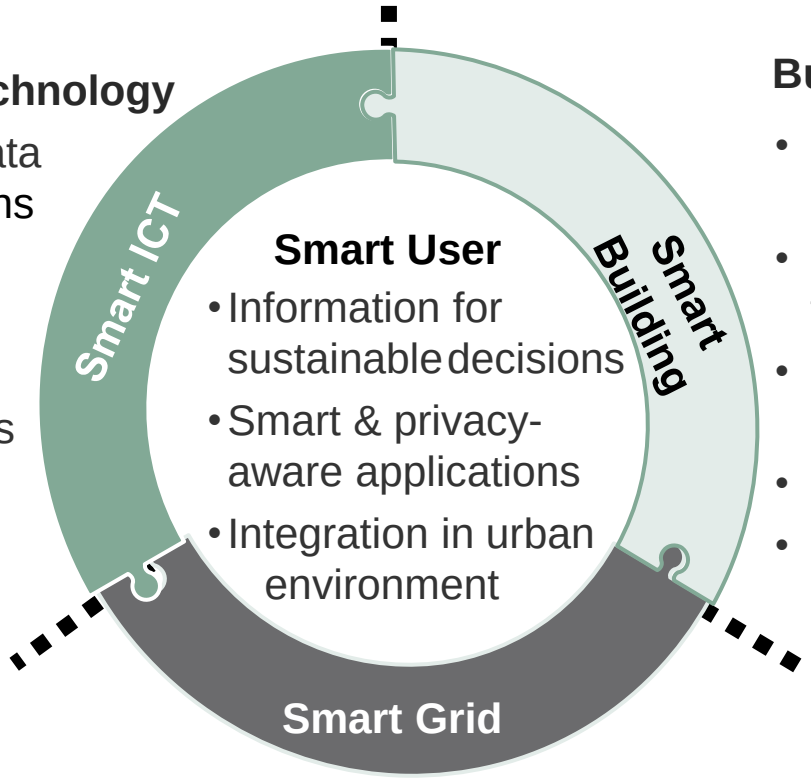
ASCR Program

The fundament of future Smart Cities

Information-/ communication technology

- Cross-domain data driven applications
- Modern data integration solutions
- Big data analytics
- Multitenant data aggregation and provisioning



Building

- Decentralized renewable generation of power & heat
- Innovative energy storage technologies
- Intelligent optimization of self consumption
- Participation in energy markets
- Context / situation specific home automation

Urban Grids

- Effective solutions for grid monitoring and alarm handling
- Adaptive LV grid management
- Operative and strategic grid planning

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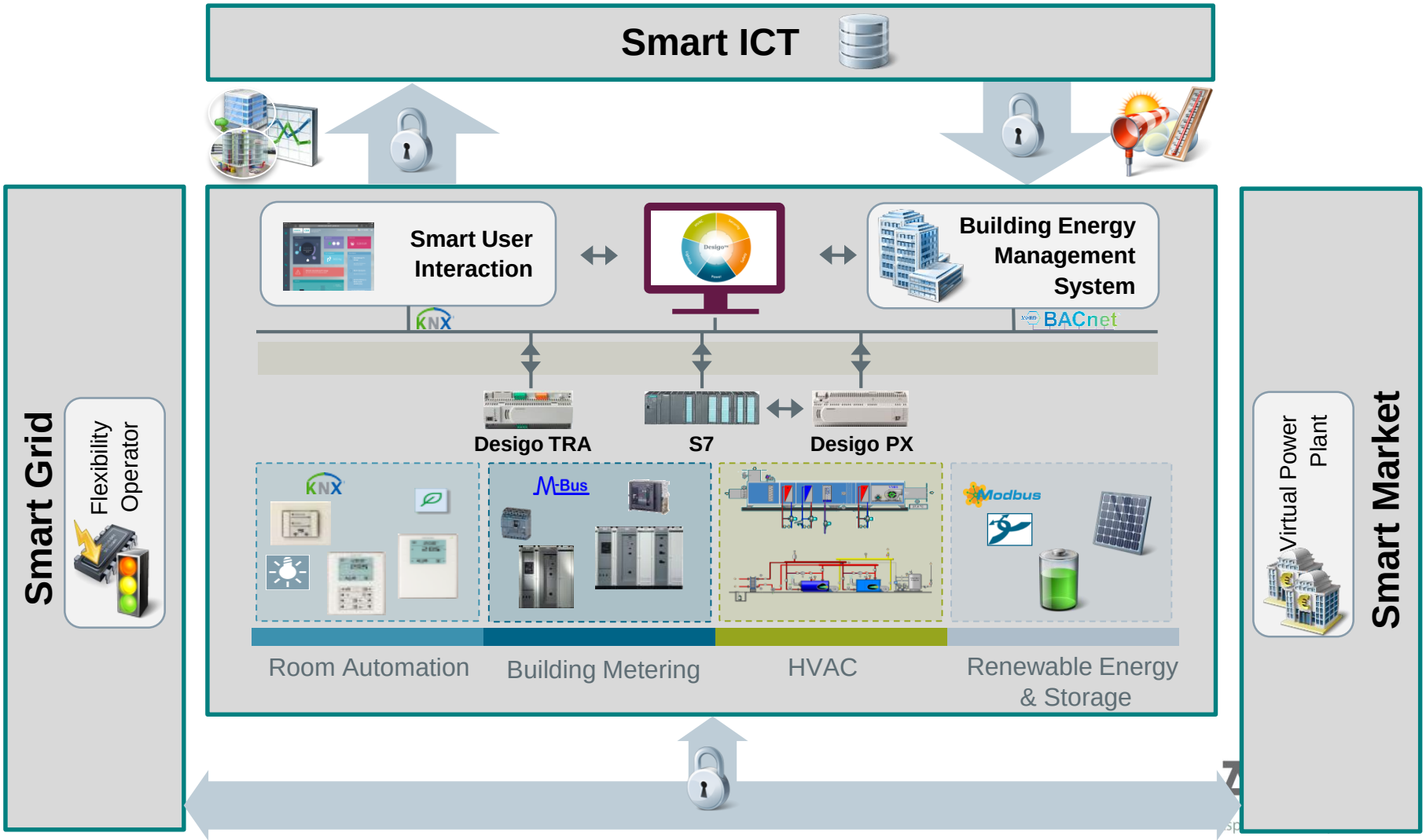
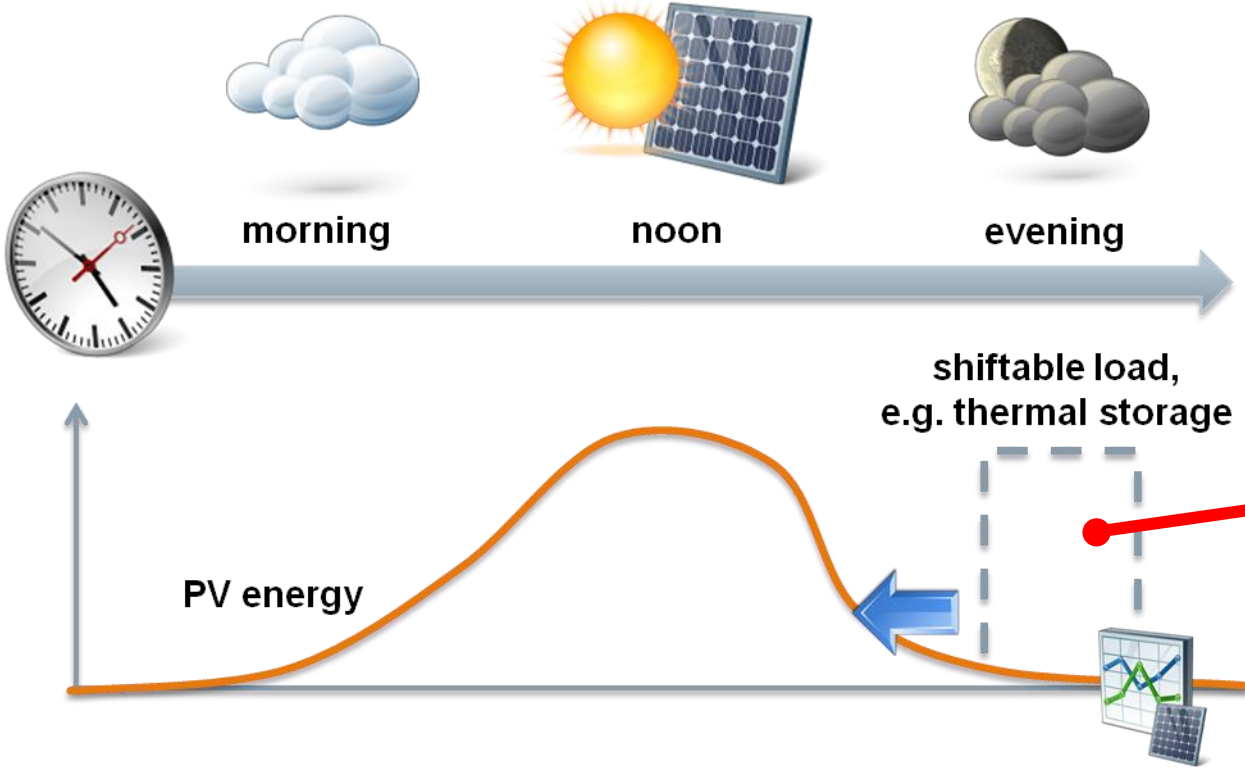
Interaction between Building, Grid and Market

In Detail



Self-consumption optimization

Use Case in Detail



Customer benefit

Reducing total energy costs at building level by maximizing self-consumption of generated energy

- **Thermal storages**
- **Soil storages**
- **Building envelope**
- **…**

Innovation

- Integration of own generation
- Forecasting of energy generation and consumption at building level
- Predictive optimization of self-consumption using energy storage models

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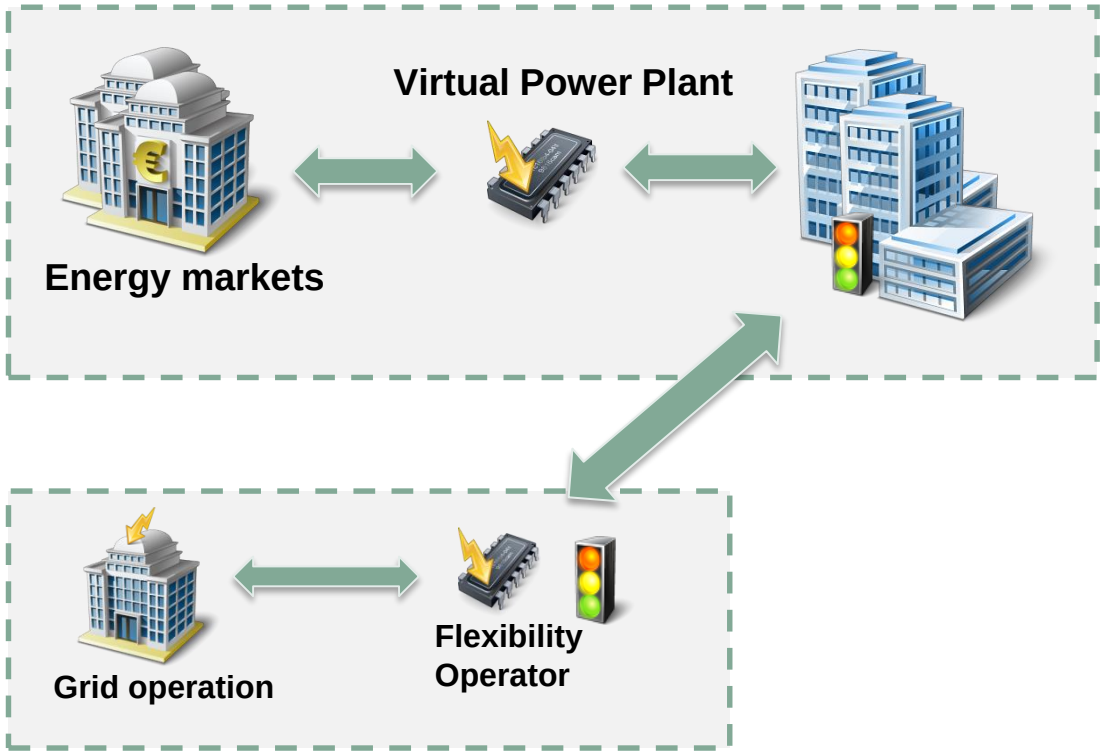
Interaction between Building, Grid and Market

Overview of the stakeholder



Customer benefit

- Reducing total energy costs by gaining additional revenues for providing flexibilities
- Readiness for future changes in the energy market

Innovation

- Active market participation (e.g. tertiary control reserve power)
- Using different types of storages for providing flexibilities
- Predicting and communication power profiles

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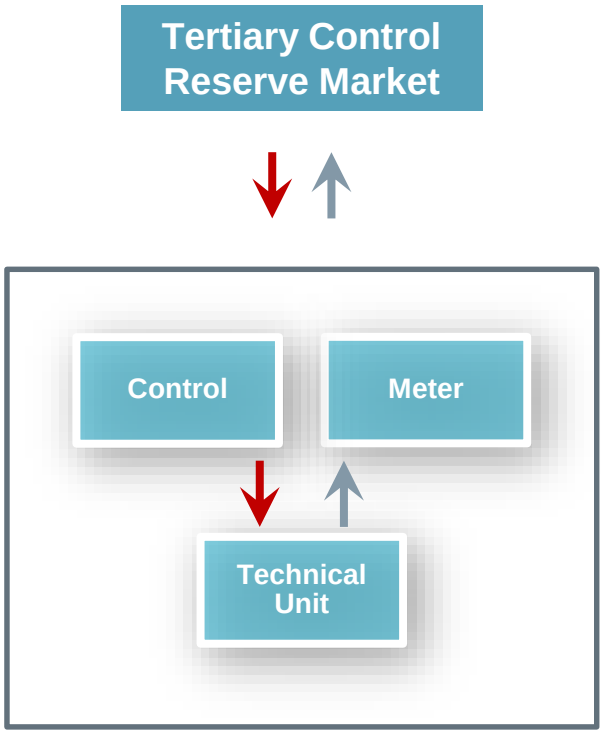
Prequalification of Buildings

Tertiary Control Reserve

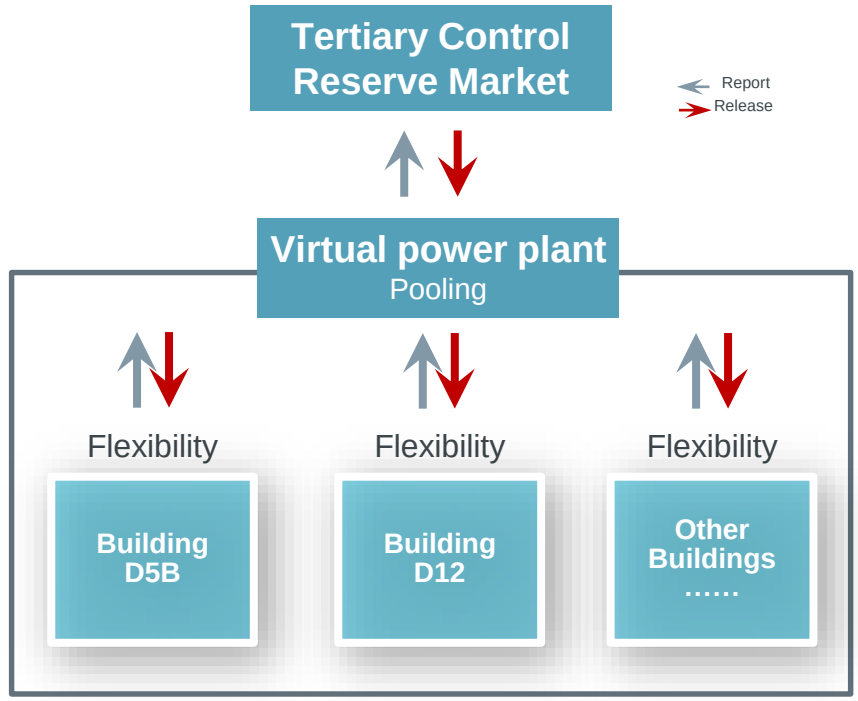
Prior Model

- Each technical unit is individually controlled and measured
- Reference point can be easily specified



New Model

- Building has to be prequalified as a whole
- Precise measurements only at the point of common coupling
- Reference point is based on forecasts



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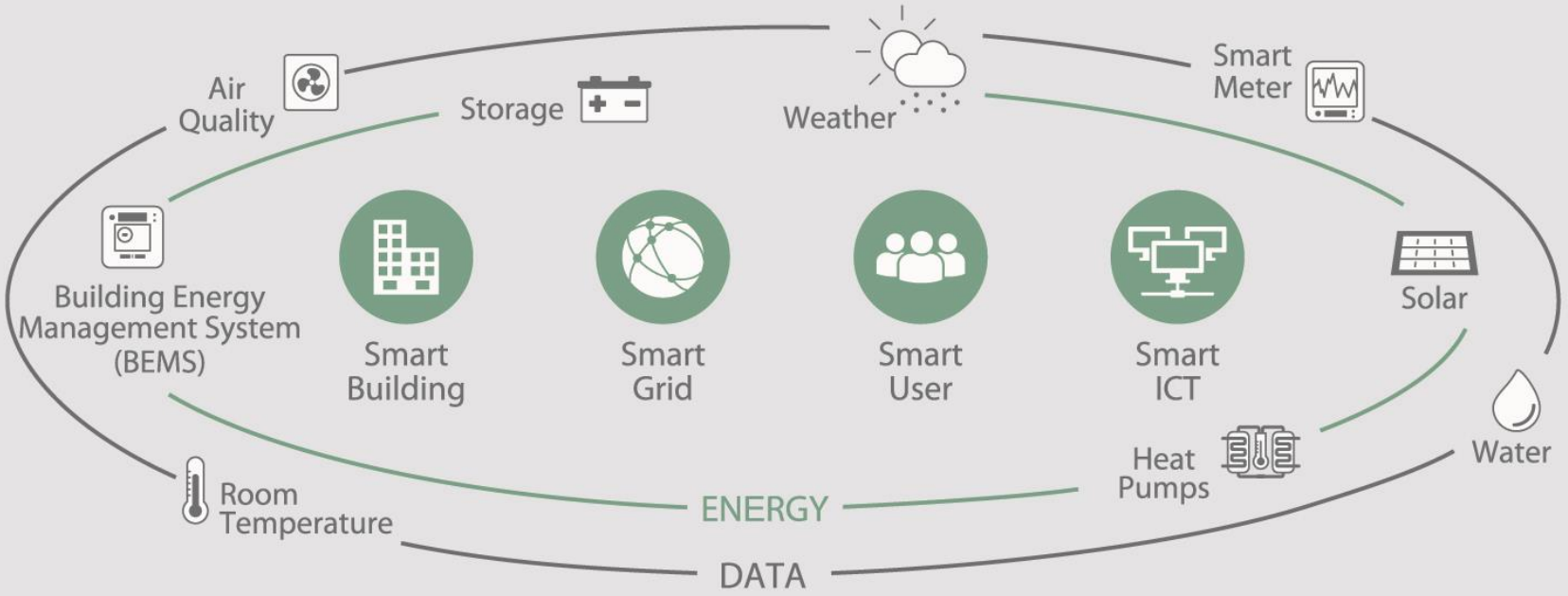

OPTIMAL HARMONISATION OF:

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