ENERGIE INTELLIGENT VERNETZEN!

SMART GRIDS

ENERGIE intelligent vernetzen!

Daran arbeiten wir.

www.smartgridssalzburg.at

Wissenschaftliche Partner:

fhs Fachhochschule Salzburg University of Applied Sciences

AIT Austrian Institute of Technology

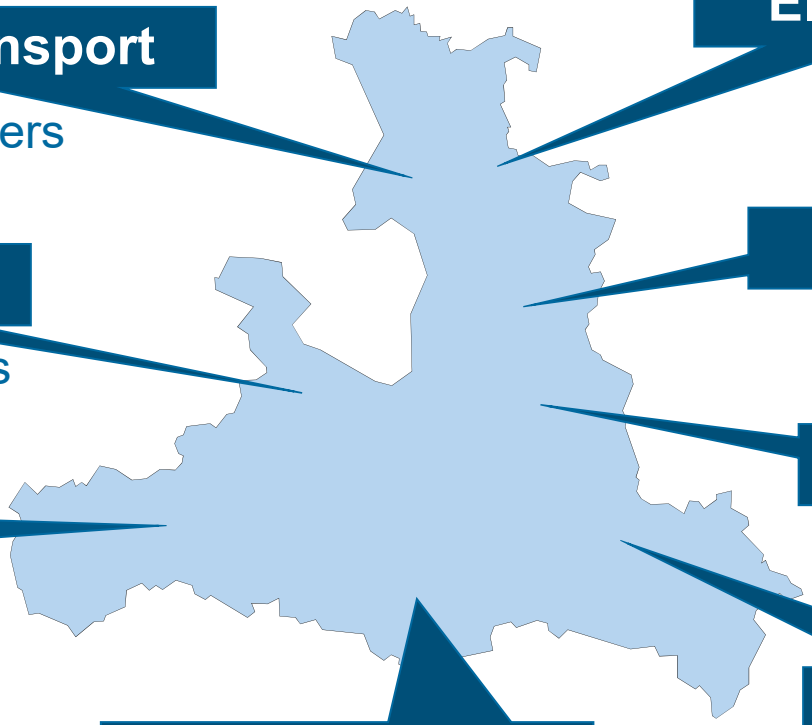
SMARTGRIDS Modellregion Salzburg

SALZBURG AG

SALZBURG WOHNBAU WIR BAUEN VOR

SIEMENS

Multi Utility Company Salzburg AG
Business Fields & Customers



Public Transport
50 Mio. Passengers

Electricity
430,000 Customer installations

Internet
76,000 Customers

Gas
36,000 Customers

District Heating
16,000 Customers

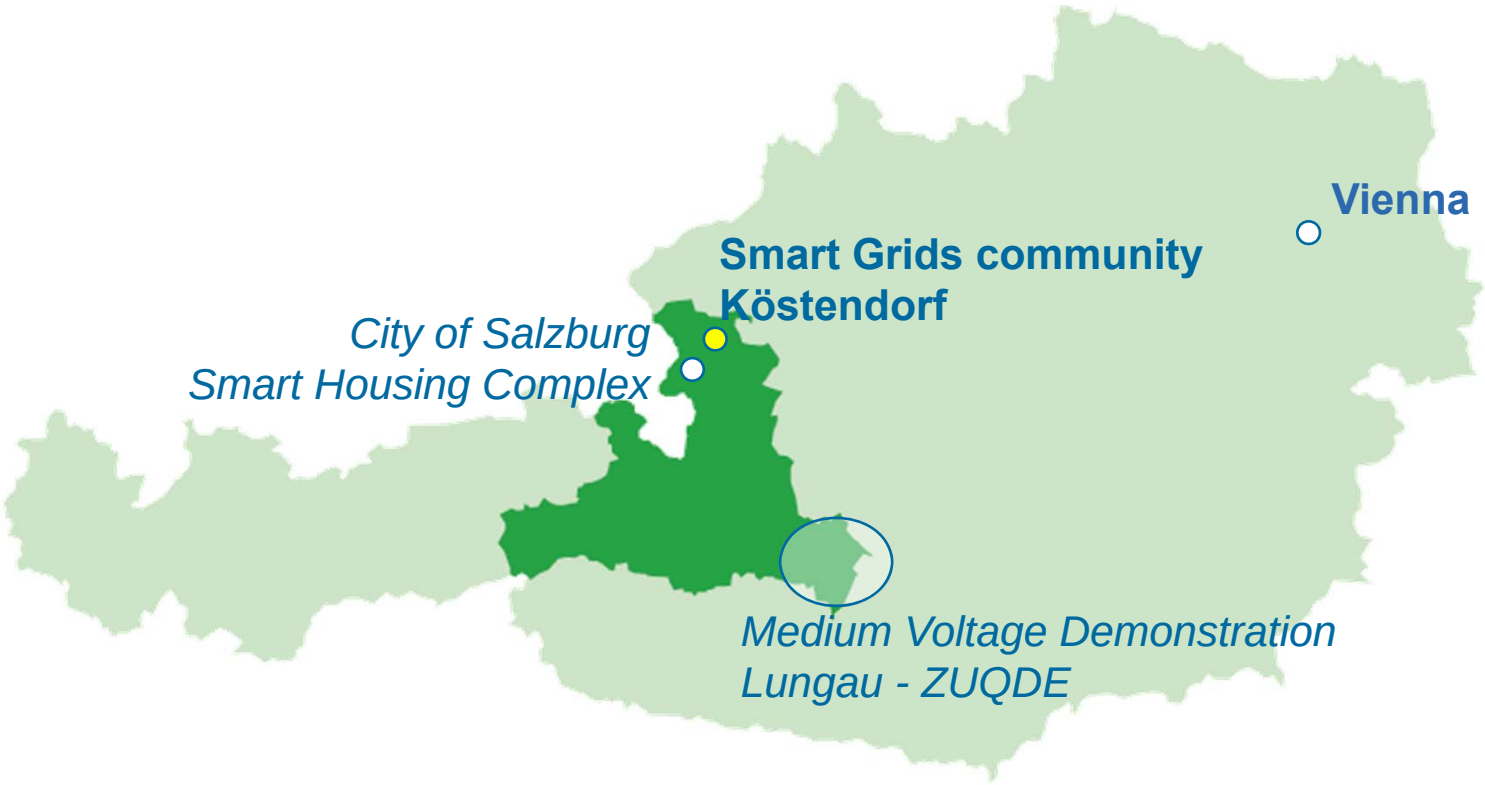
Cabel-TV
135,000 Customers

Telephony (VoIP)
24,000 Customers

Water Supply
156,000 Inhabitants
20,000 Customer installations

Business Volume 2016: 1 060 Mio €
Employees 31.12.2016: 2 062

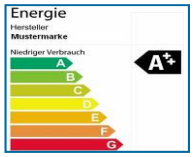
Province of Salzburg – Smart Grids Model Region



Wissenschaftliche Partner:

Why Smart Grids?

Energy and climate policy
EU-20-20-20 targets;
Energy Roadmap 2050: -80% CO2

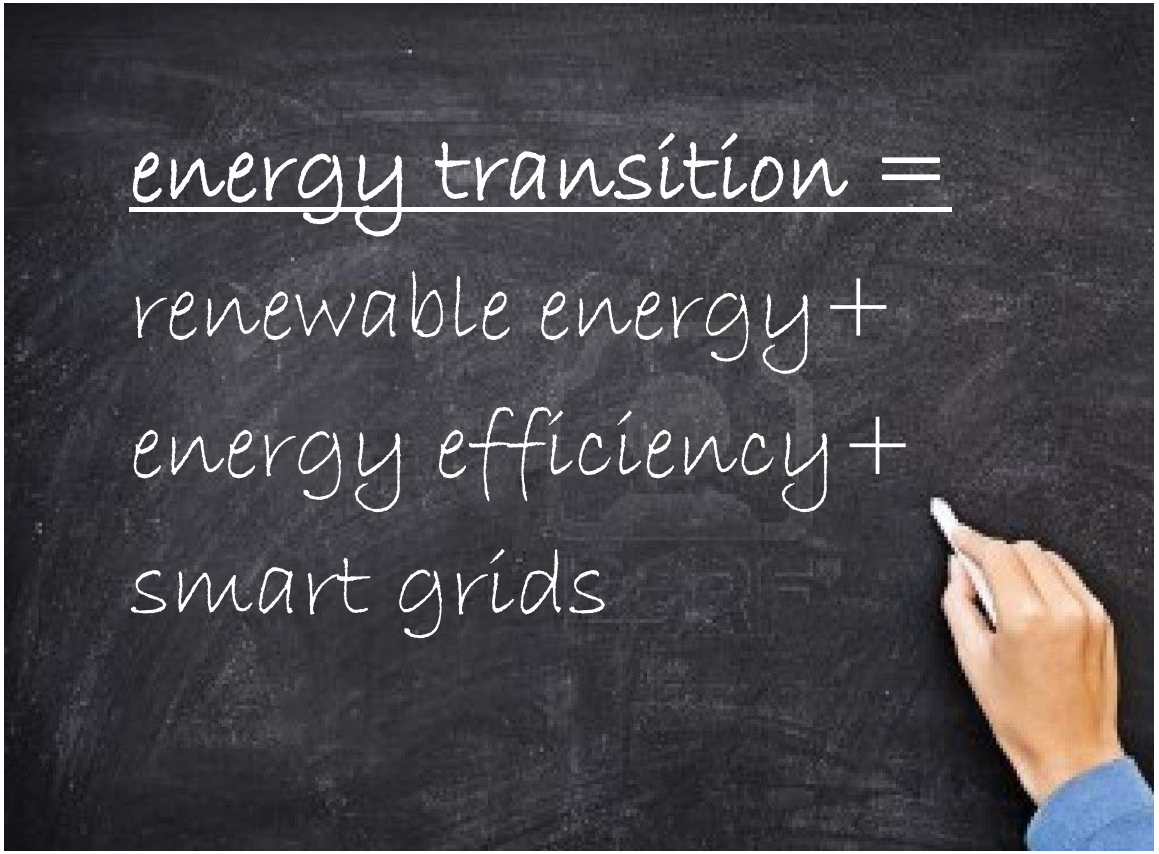


Energy system transition

ICT revolution,
Internetisation,
Internet of Things,
miniaturization,
networking

Social Trends
Individualisation,
ambition to be
self-sustaining,
environmentalism

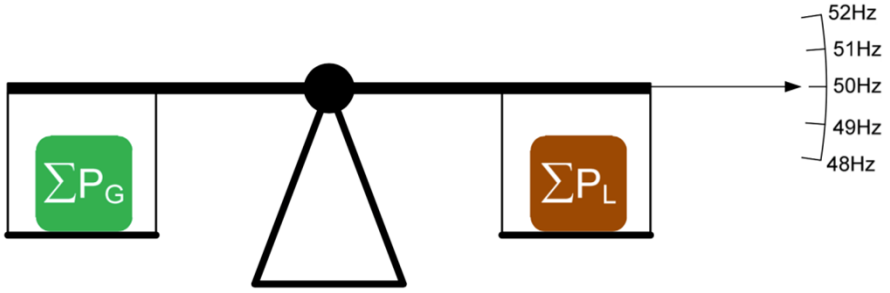
The traditionell structure of the energy industry will be turned upside down!



The Challenge

Balance of electricity generation and demand

- „real time“
  - Inertia
  - virtual inertia
- balance energy (primary, secondary and tertiary)
  - pumped hydro storage
  - controllable power plants
  - virtual power plants (VPP)
- day- night balance
  - pumped hydro storage
  - battery storage
  - Demand Side Management
- seasonal balance
  - Hydro annual storage
  - Thermal power plants
  - Power-to-Gas

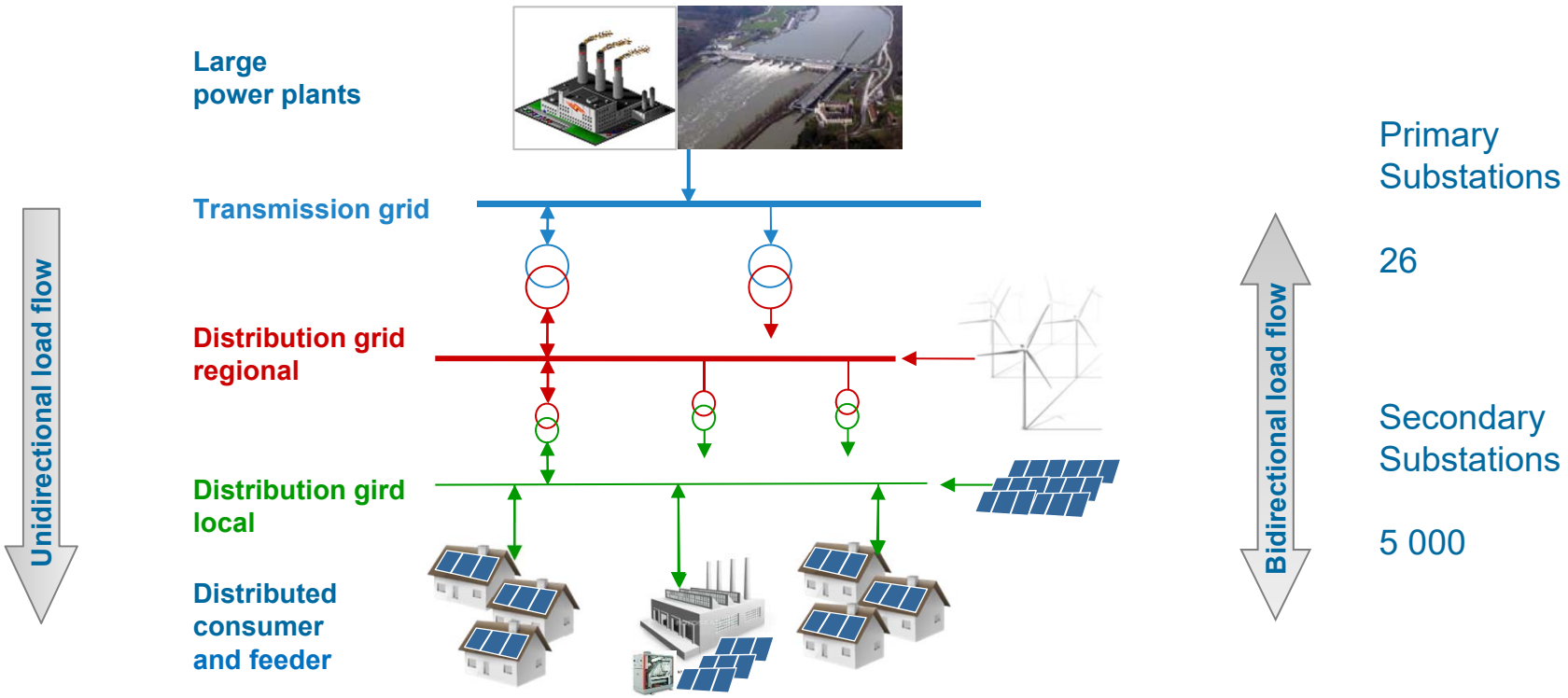


source: TU Vienna, Gawlik

Challenges for the network operator

Classical structure
Distribution networks were originally designed primarily for consumers

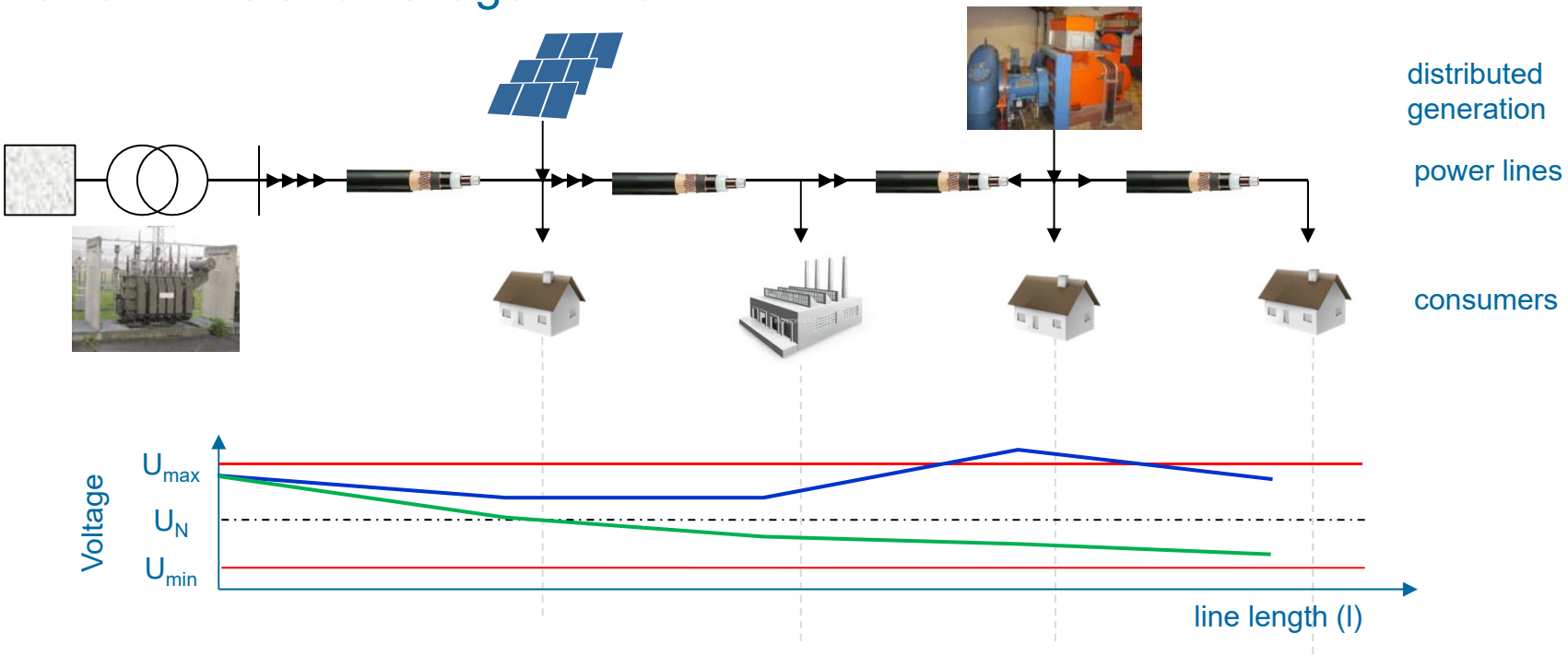
Increase of renewable energy
integration of distributed generation in the distribution network



Wissenschaftliche Partner:

Integration of renewables in distribution networks

Power limits and voltage limits



Integration of renewables in distribution networks

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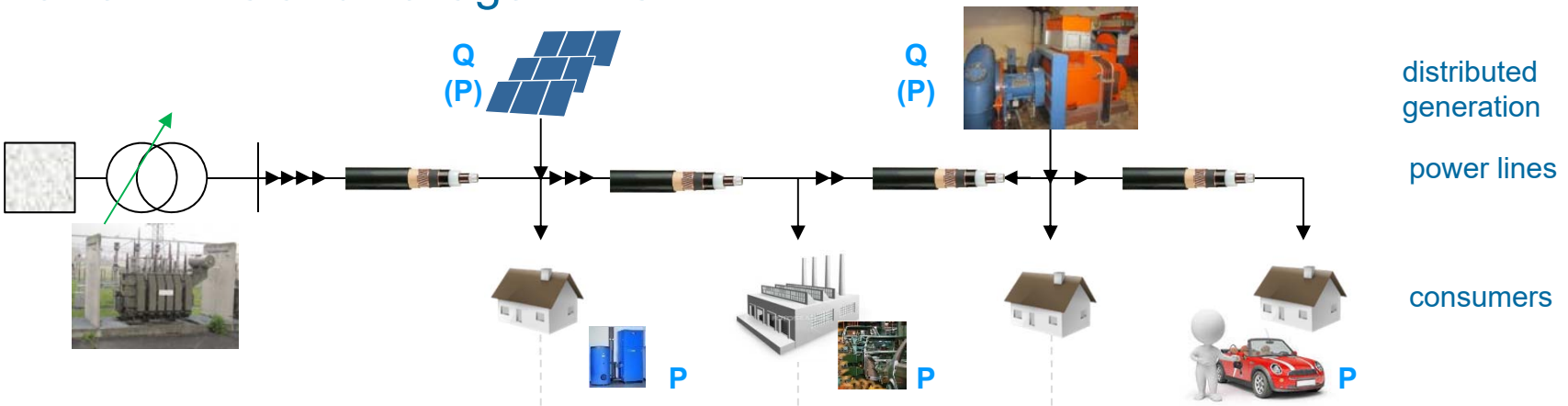


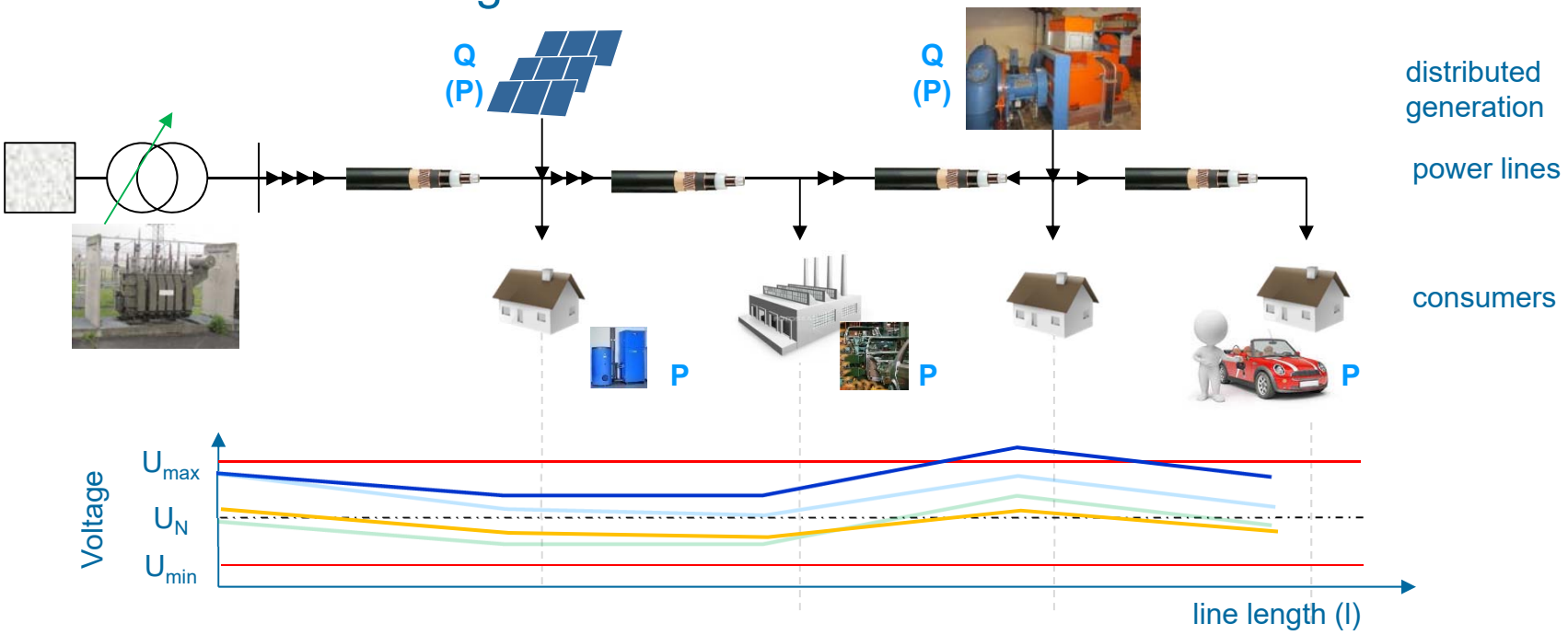
consumers + distributed generation without automatic control

consumers + distributed generation with variable transformer

consumers + distributed generation with power control

Integration of renewables in distribution networks

Power limits and voltage limits



consumers + distributed generation without automatic control

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consumers + distributed generation with power control

consumers + distributed generation with variable transformer and power control

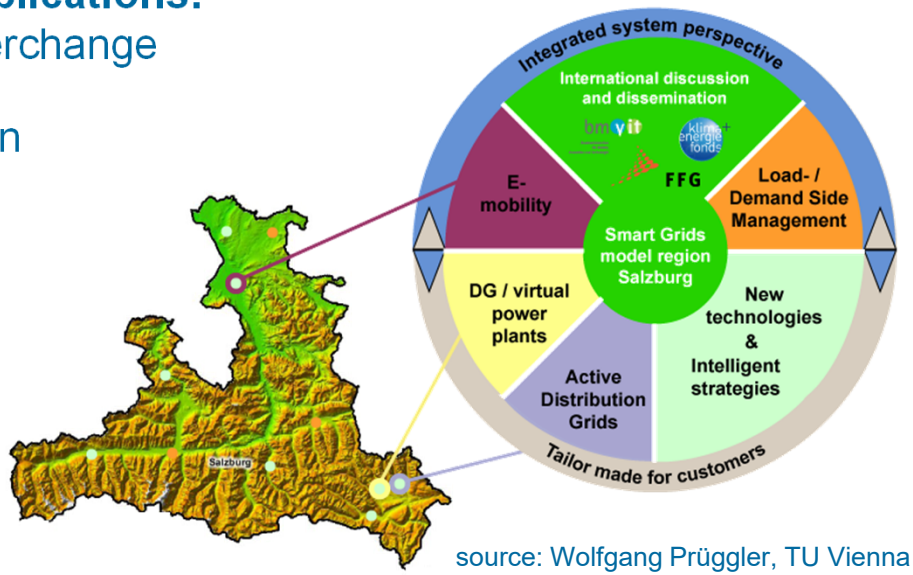
Wissenschaftliche Partner:

Smart Grids Model Region Salzburg

In December 2009 Salzburg was awarded „1st Austrian Smart Grids Model Region“ by the Austrian Climate and Energy Fund.

Objectives of the Model Region program

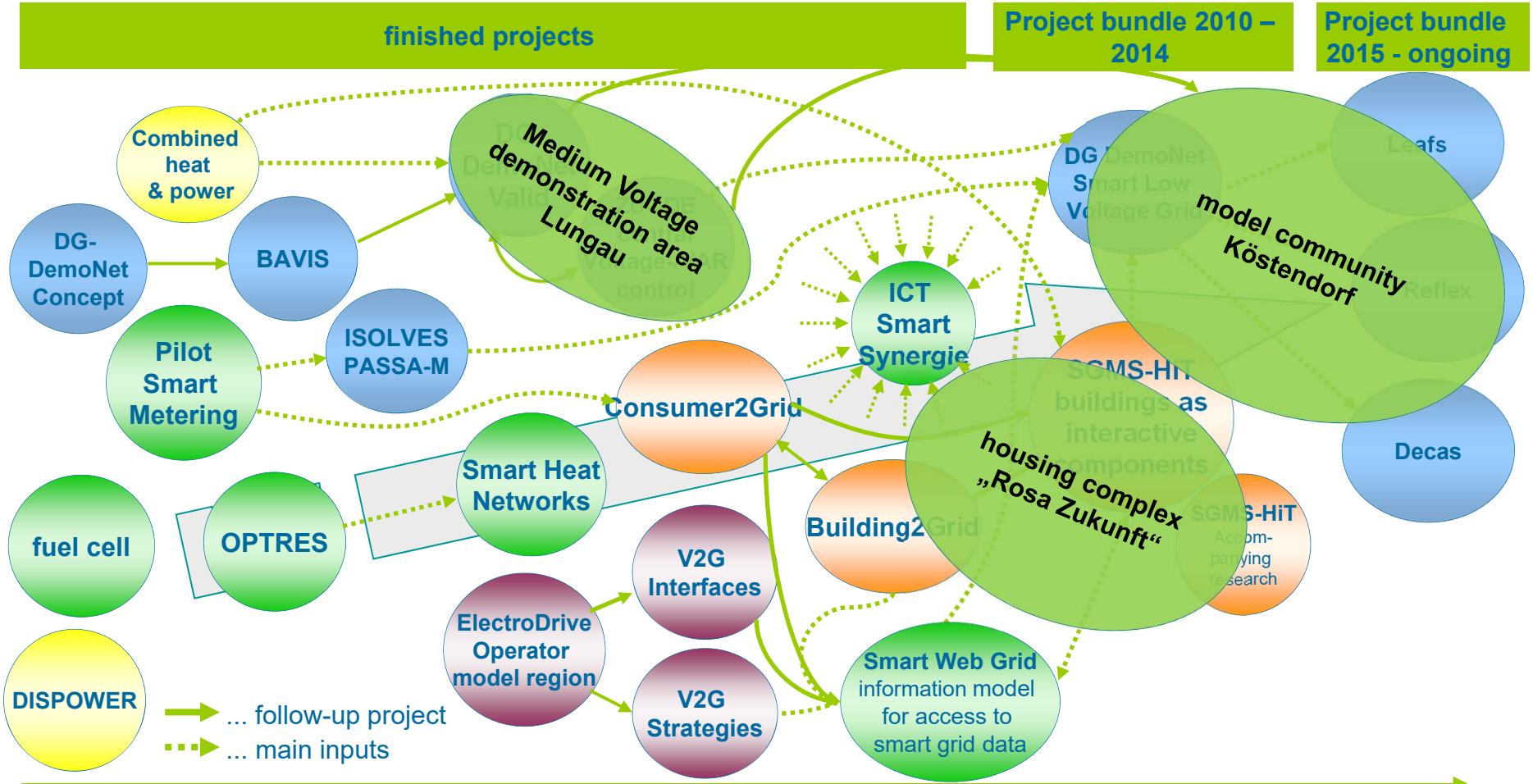
- Gather a **critical mass** of **Smart Grid applications:** analyze synergies, dependencies and interchange
- Integrate challenges from different areas in **an integrated system solution**
- Realisation in network segments with **real-world challenges** & **customers**
- Implementation of **Flagship Projects**, where many applications and their synergies become visible



source: Wolfgang Prüggler, TU Vienna

Awarded several times at national and European level!

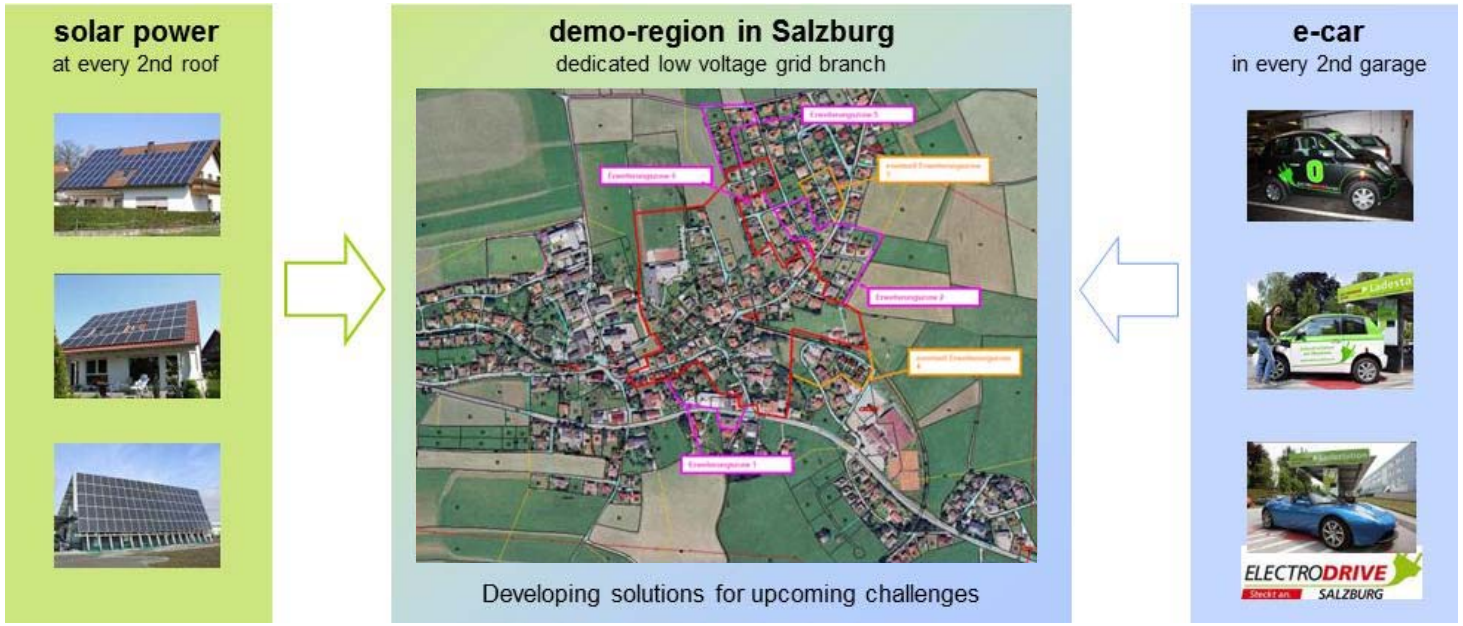
Projectoverview
of the Smart Grids Model Region Salzburg



Wissenschaftliche Partner:

Smart Grids Model Community Köstendorf

- In a dedicated test area the energy future is field-tested: It is demonstrated that despite 50% distributed generation (PV-systems) and 50% density of e-cars supply and demand can be balanced by an intelligent smart grid solution without affecting supply quality for customers!



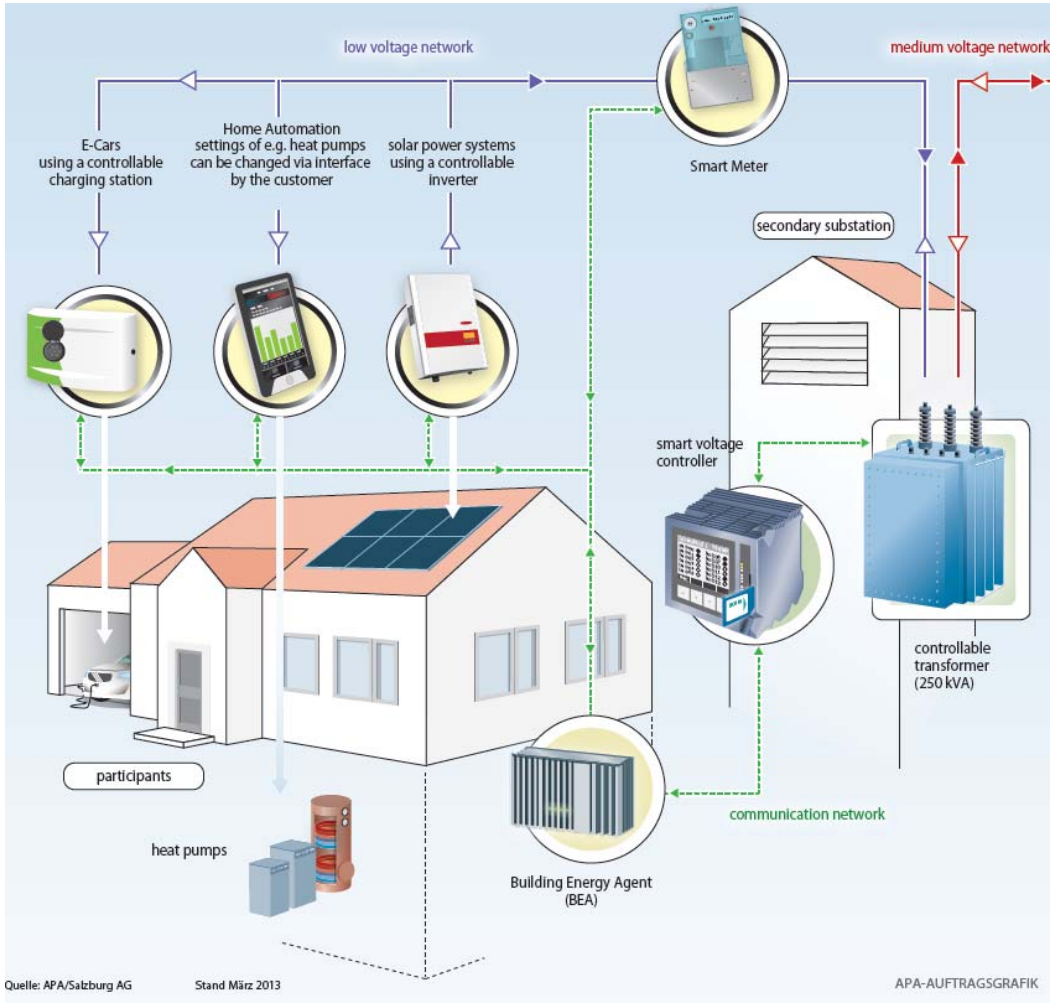
We demonstrate the electrical energy system of tomorrow!

Wissenschaftliche Partner:

Smart Grids Model Community Köstendorf

Monitoring
Smart Meter
as „eyes in the grid“

OLTC transformer
250 kVA, 5 taps



Wissenschaftliche Partner:

Smart Grids Model Community Köstendorf

Monitoring
Smart Meter
as „eyes in the grid“

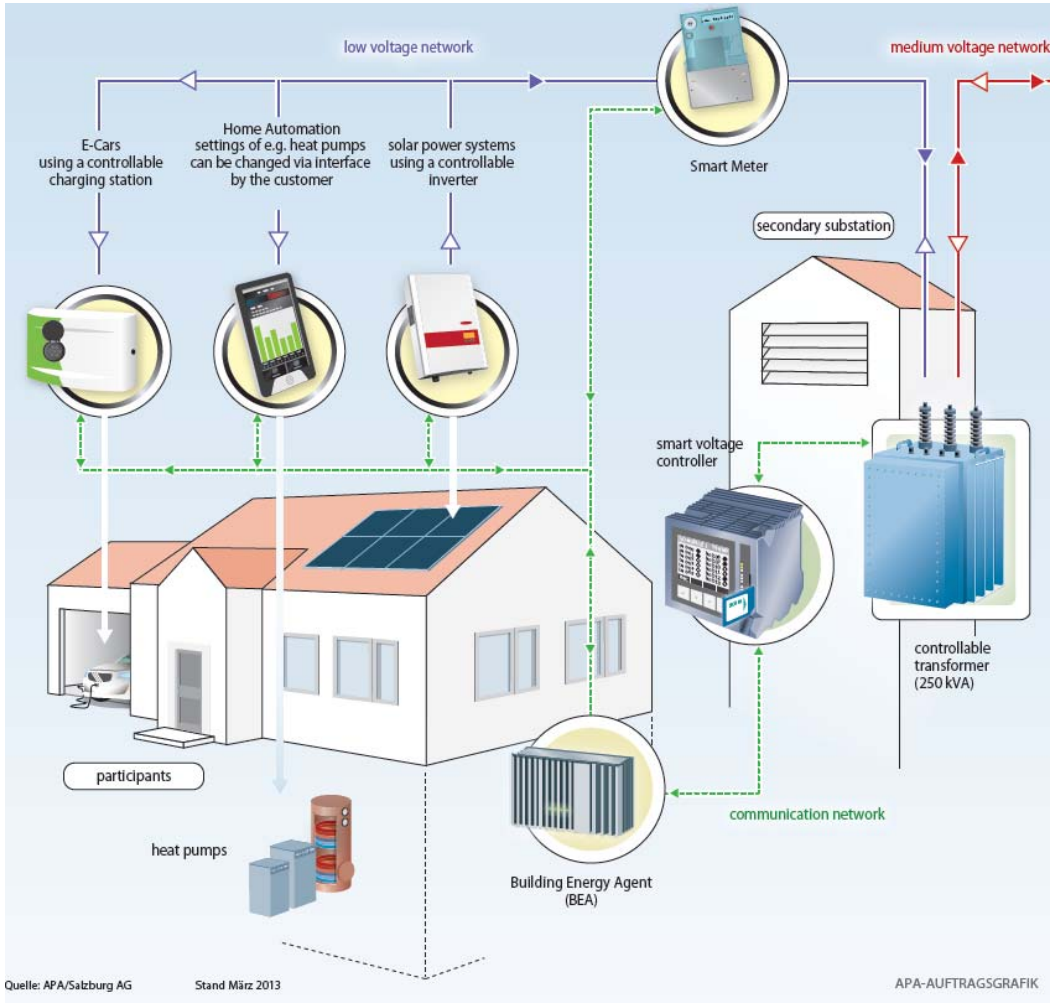
OLTC transformer
250 kVA, 5 taps

33 E-Cars with controllable charging stations
i-MieV:
0 – 8 – 12 – 16 Ampere

45 PV-systems (225 kWp) +
41 use a **controllable solar inverter**
active- and reactive-power control

5 “Home Storages”
4-5 kWh
(running “lead” project)

Building Energy Agent (BEA)
decentralised optimisation



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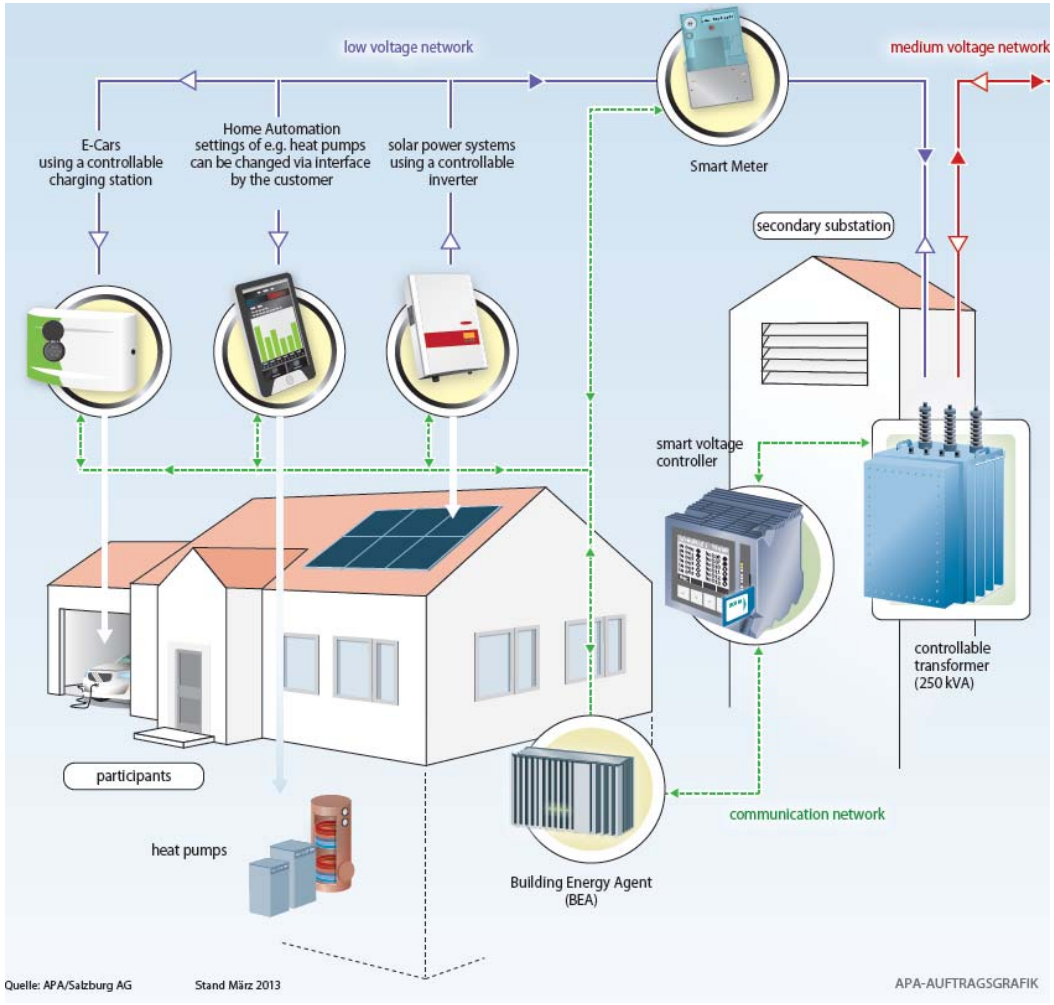


Smart Low Voltage Grid Controller

Grid optimization
by using the voltage data received from **smart meters**,

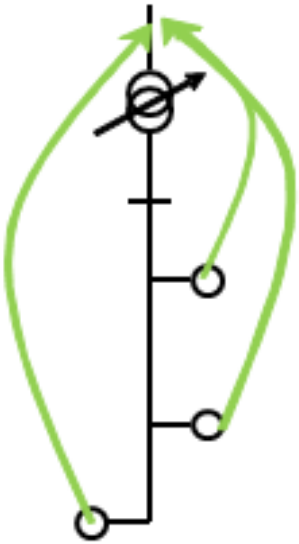
generating a grid status and sending optimized characteristics to the **smart grids actors**
(e.g. solar inverter and charging station) via BEA

Orchestration
of the system!

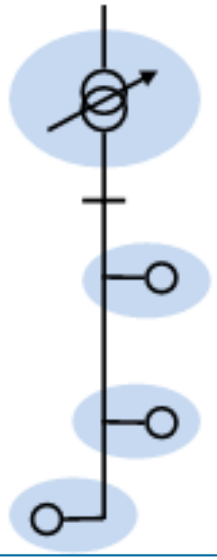
Wissenschaftliche Partner:

Control concept

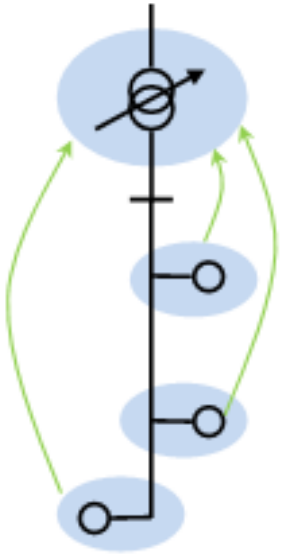
S0: reference scenario



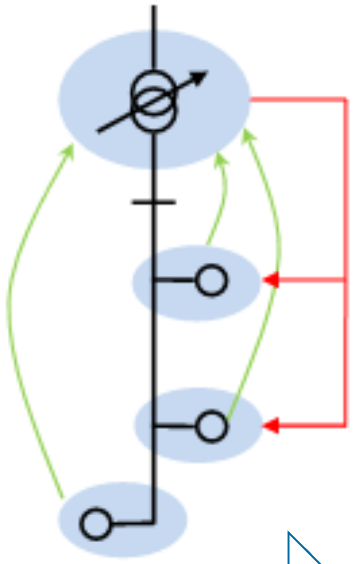
S1: autonomous control



S2: local autonomous control



S3: coordinated control



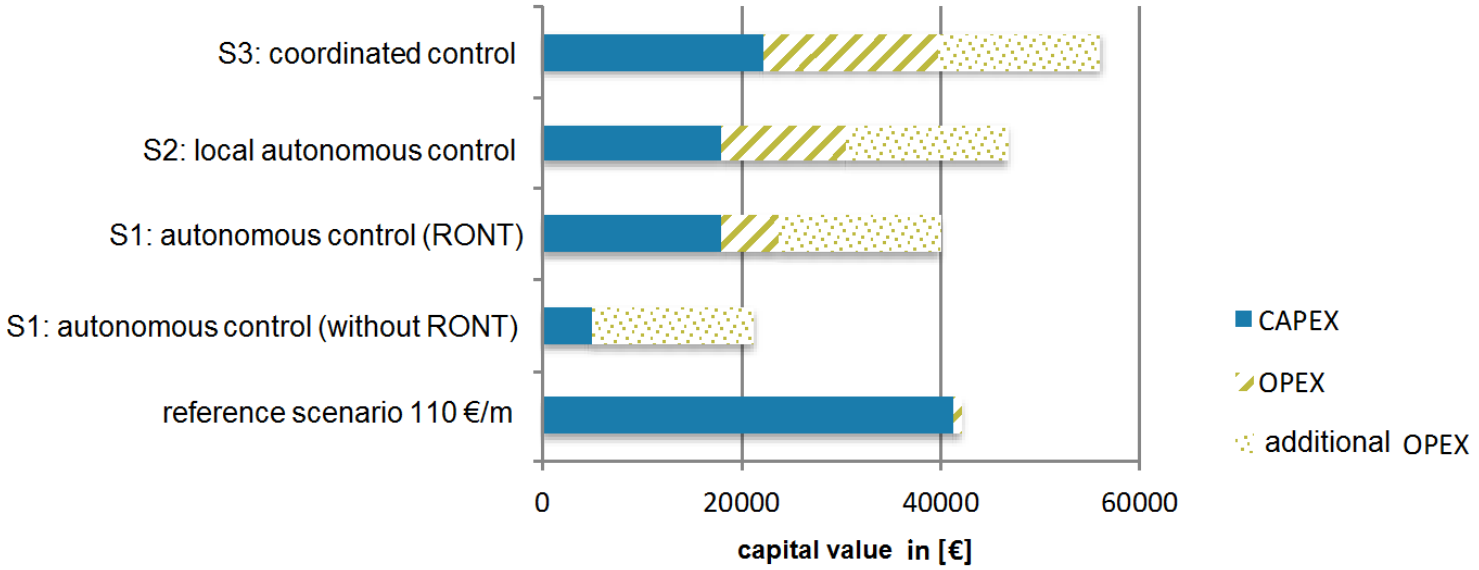
rising complexity and costs

boundaries of local control

measurement data transmission

central control data transmission

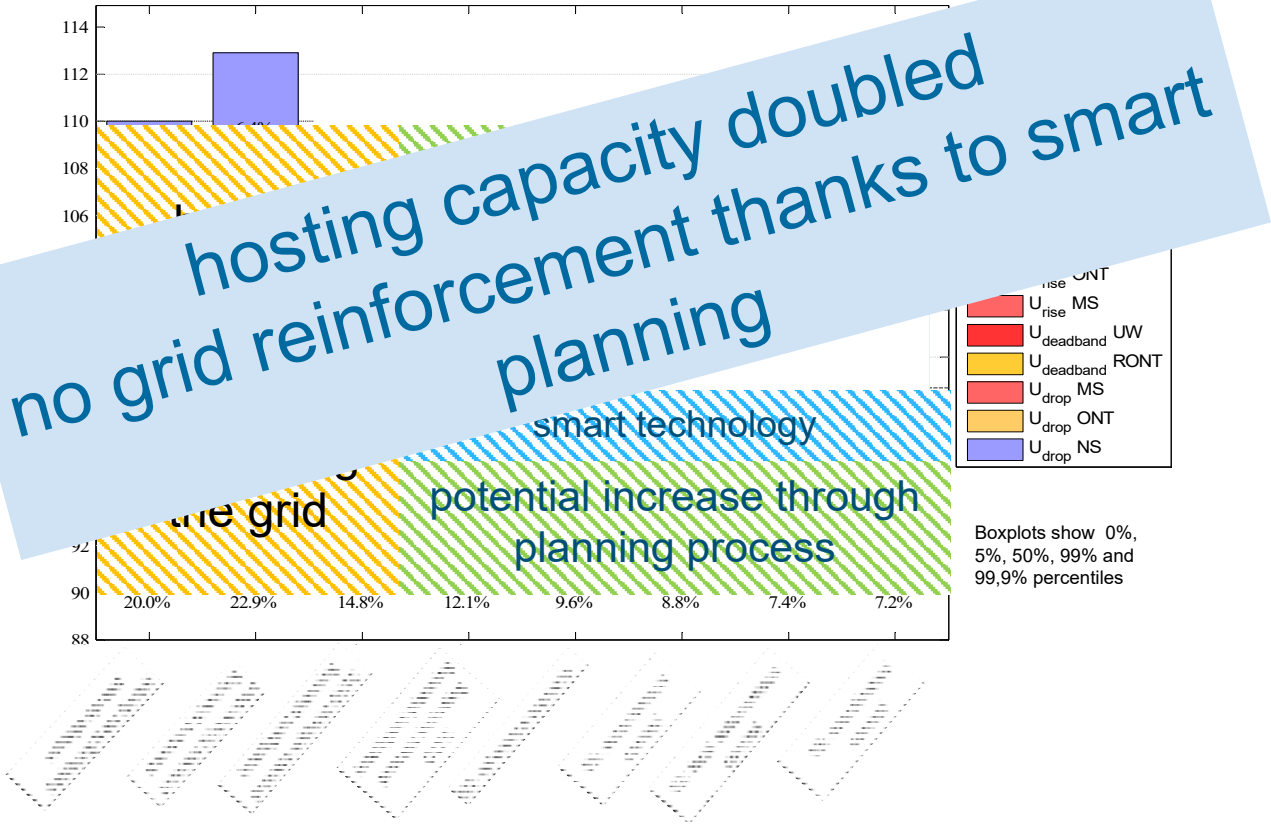
Smart Grids Model Community Köstendorf



- Smart Grid Solutions can be the cheaper solution
- shift of costs from CAPEX to OPEX

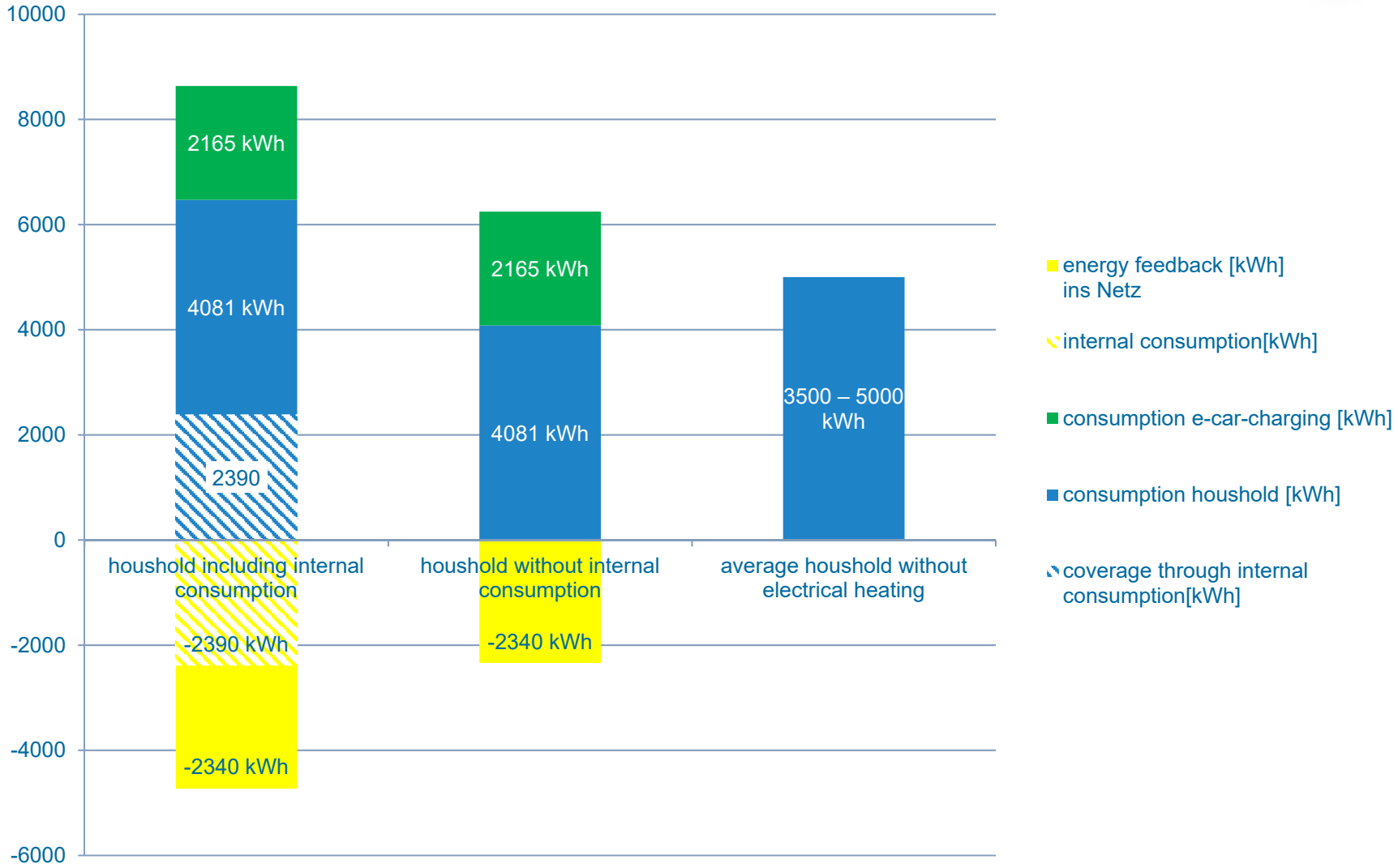
SGMG Köstendorf – results w.o. storage

smart planning vs smart technologies

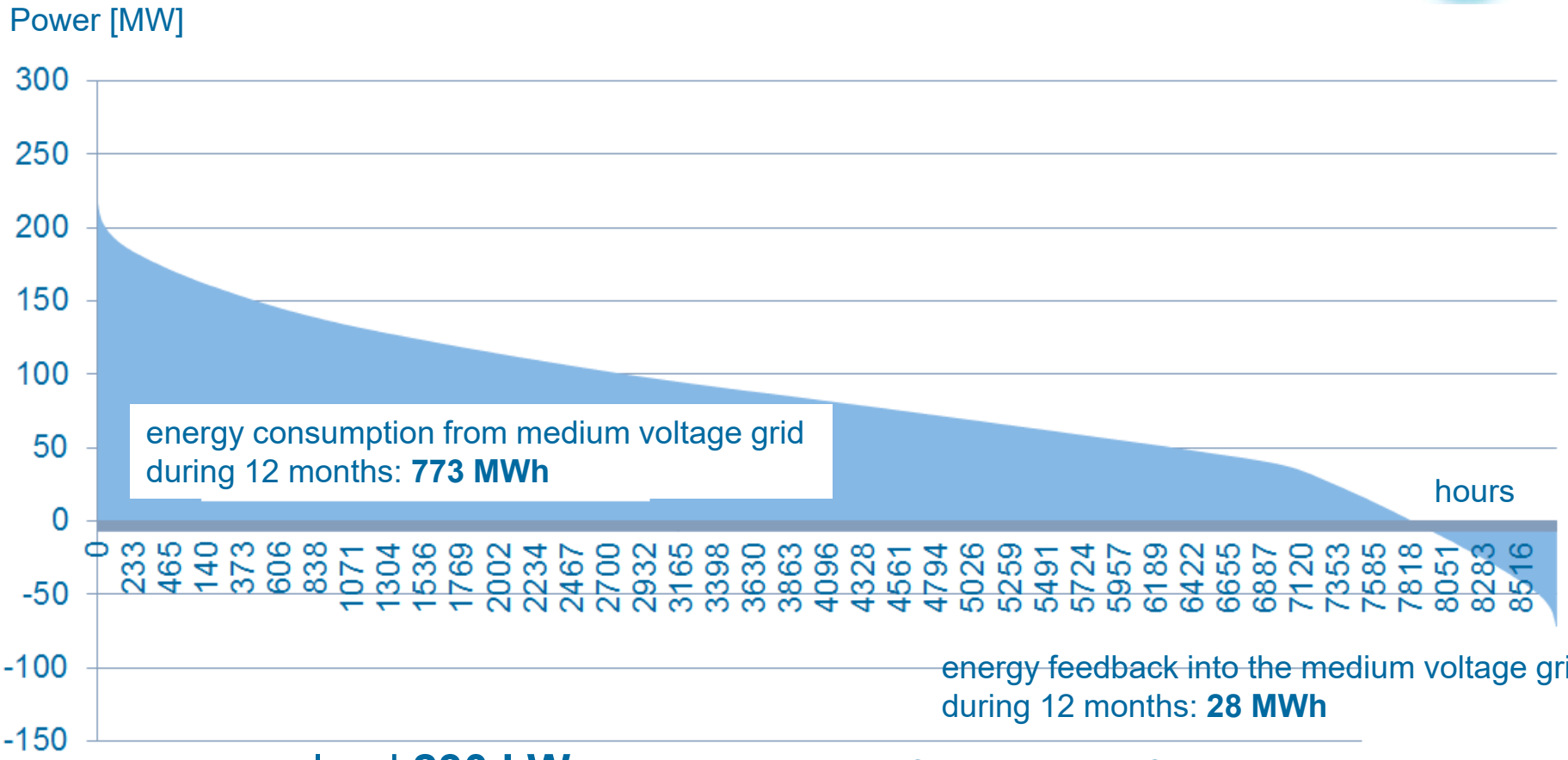


increase in hosting capacity through smart planning process: ~100%

Average electrical energyconsumtion per participant [kWh]



Energybalance of Köstendorf

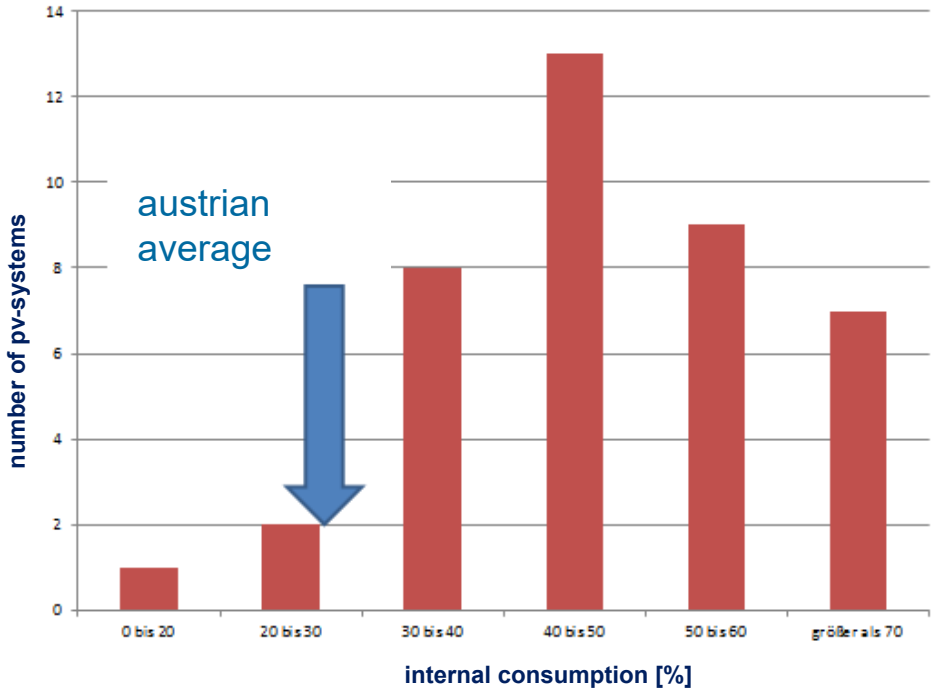


- max. load **230 kW** with a nominal transformerpower of 250 kVA
- max. feedback **95 kW** ~ 50% of the power installed pv-systems
- self coverage through the installed pv-systems: 18,5%

Assessment September 2017

- total internal consumption per year: ~120,6 MWh
- fed back energy per year: ~124 MWh
- average internal consumption: 50%
- e-car usage:
  ca. 1.170.000 km → 139,9 t CO_2
- e-car usage per year:
  ca. 290.000 km → 38 t CO_2
- time of evaluation: 48 months

internal consumption of the participants[%]



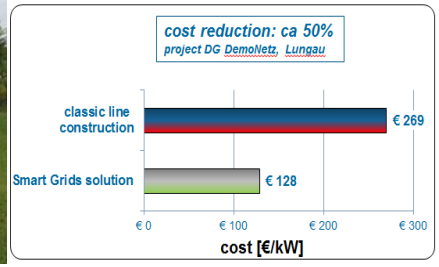
Wissenschaftliche Partner:

Smart Grids Model Region Salzburg

We will continue…!

AIM: Preparation for the Future Energy System

- **Findings Model Region 1.0 & 2.0:**



- ☑ Smart Grids are technically working!
- ☑ Smart Grids solutions cost approximately 50% less than the classical approach!
- ☑ Smart technologies increase internal consumption & profitability of PV
- ☑ High national and international visibility!

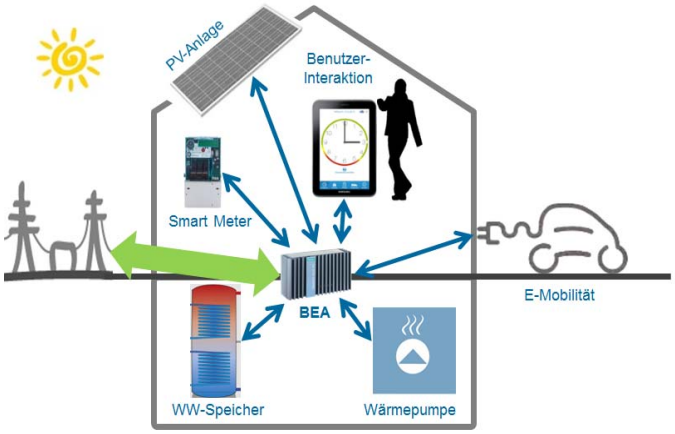
- **Outlook Model Region 3.0:**

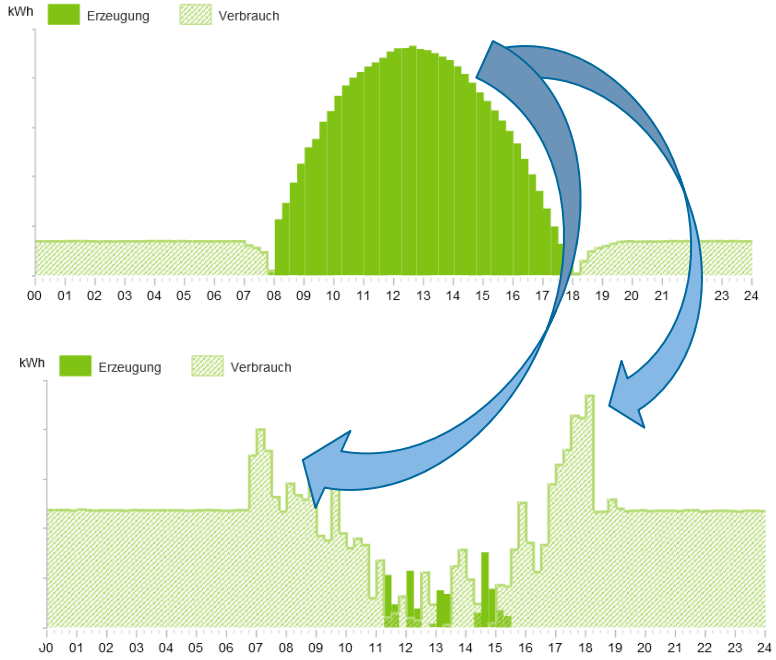
- ⓘ Hybrid Grid
- ⓘ New Business- & Tariff Models / Regulatory Framework
- ⓘ Digitization → „Information Utility“
  → Digital Grid Operator
- ⓘ Internationalization

Wissenschaftliche Partner:

Next steps: Hybrid grids at local level

Balancing of generation and load at any time of the year:





sunny day in summer

cloudy day in fall/winter

Day / night shift with battery storage, Power2Heat
Summer/Winter shift with Power2Gas

Wissenschaftliche Partner:

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http://www.salzburgnetz.at

Key findings of the **S**mart **G**rids **M**odel region Salzburg

www.smartgridssalzburg.at

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