

Microgrid solutions and best practices in Germany

Victor

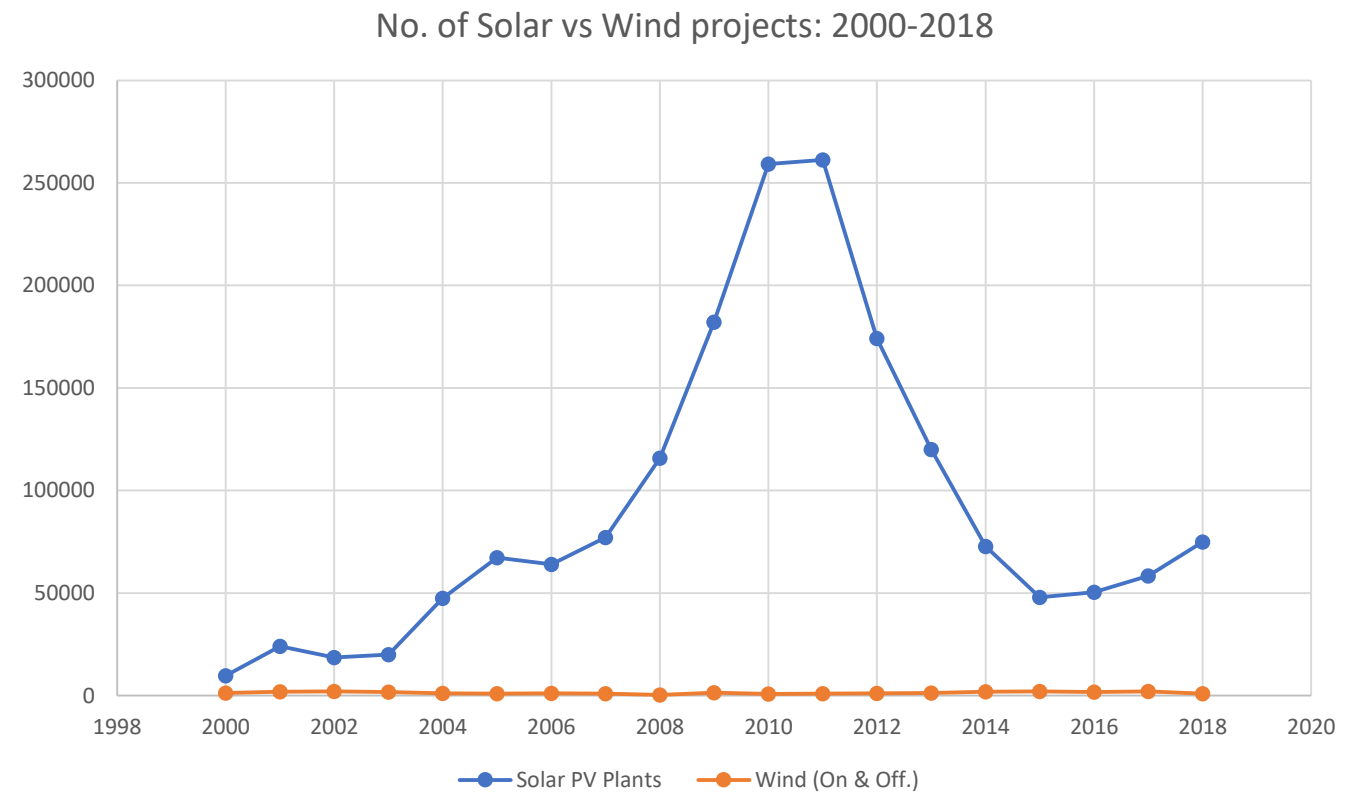


The German energy sector

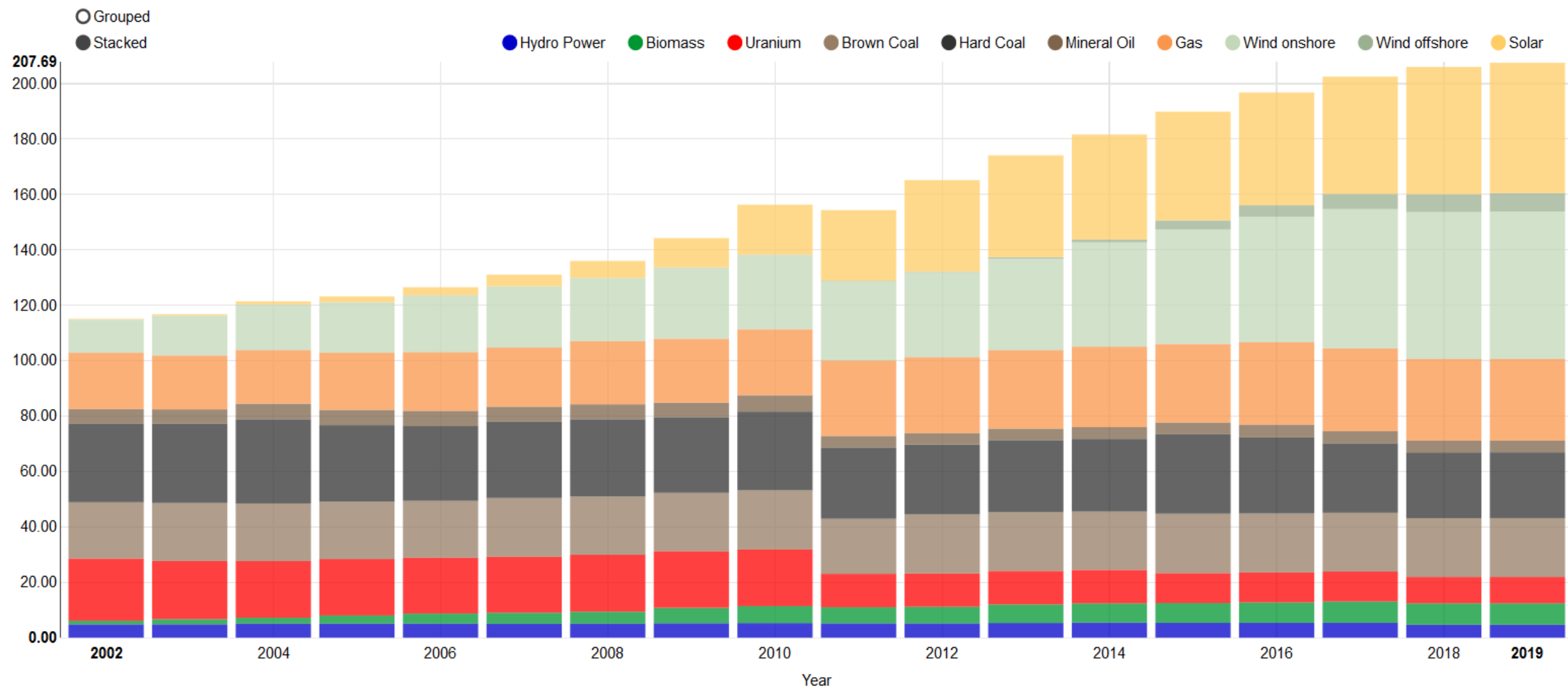
- Decentralization
- Liberalization
- Digitization

Solar & Wind (no. Of registered plants under the EEG scheme)

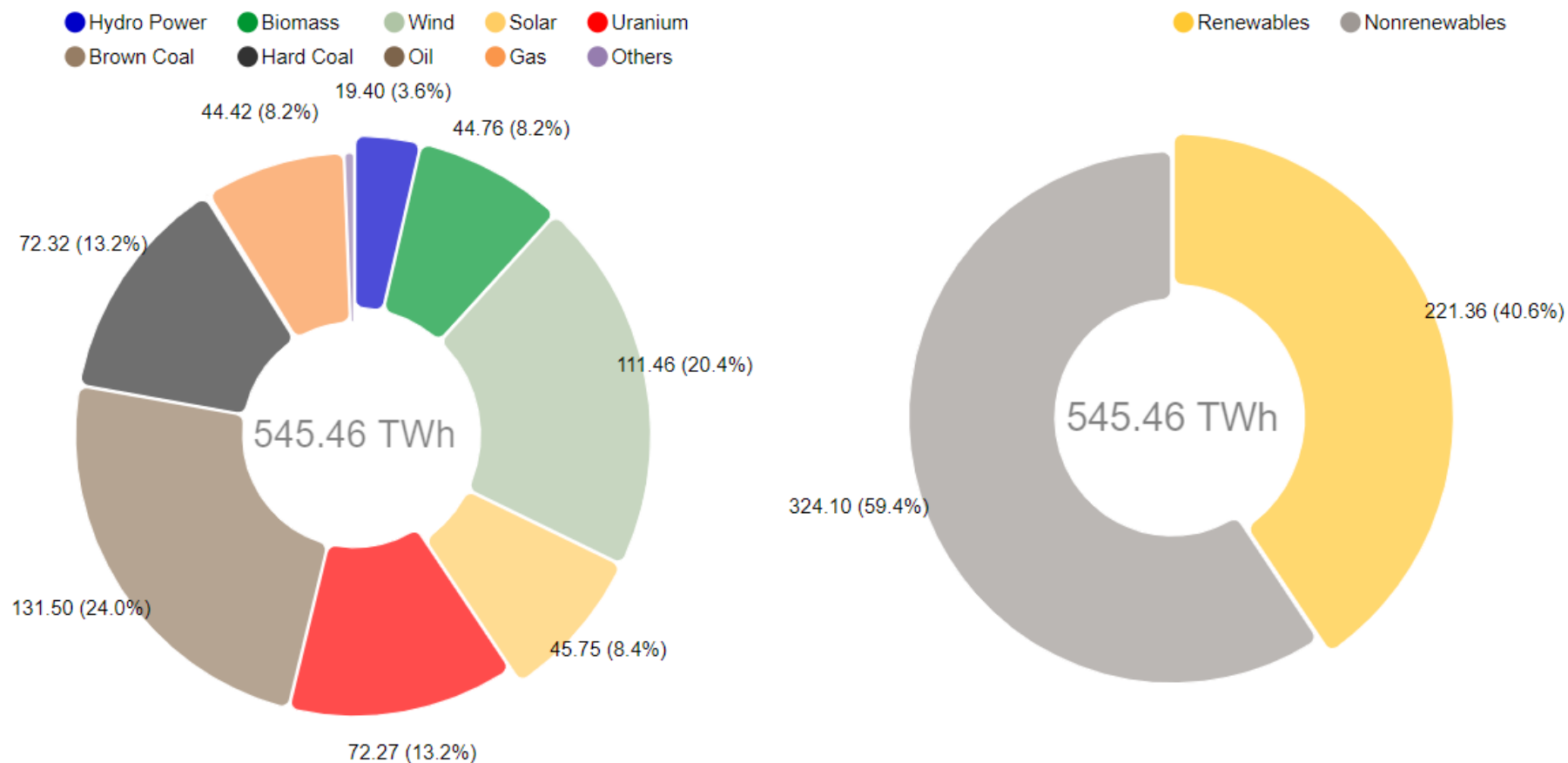
Year	Number of powerplants	
	Solar PV Plants	Wind (On & Off.)
2000	9708	1295
2001	24104	1903
2002	18602	2099
2003	19974	1688
2004	47409	1145
2005	67301	1002
2006	63975	1173
2007	77098	872
2008	115717	387
2009	182118	1381
2010	259233	764
2011	261302	972
2012	174206	1159
2013	119966	1313
2014	72688	1945
2015	47972	1976
2016	50416	1760
2017	58359	2028
2018	74913	886
Total	1,745,061	25,748



Net installed electricity generation capacity



Net public electricity generation in 2018



Net electricity generation of power plants for public power supply.
Datasource: 50 Hertz, Amprion, Tennet, TransnetBW, Destatis, EEX
Last update: 13 Mar 2019 11:44

The need for Multi Utility Companies (Stadtwerke)





Peter Breuning

Head of department: grid control & engineering services at Stadtwerke Schwäbisch Hall GmbH (multi utility)

Lecturer University Heilbronn & Harz

Speaker IDS User Group --52 Multi Utility Companies

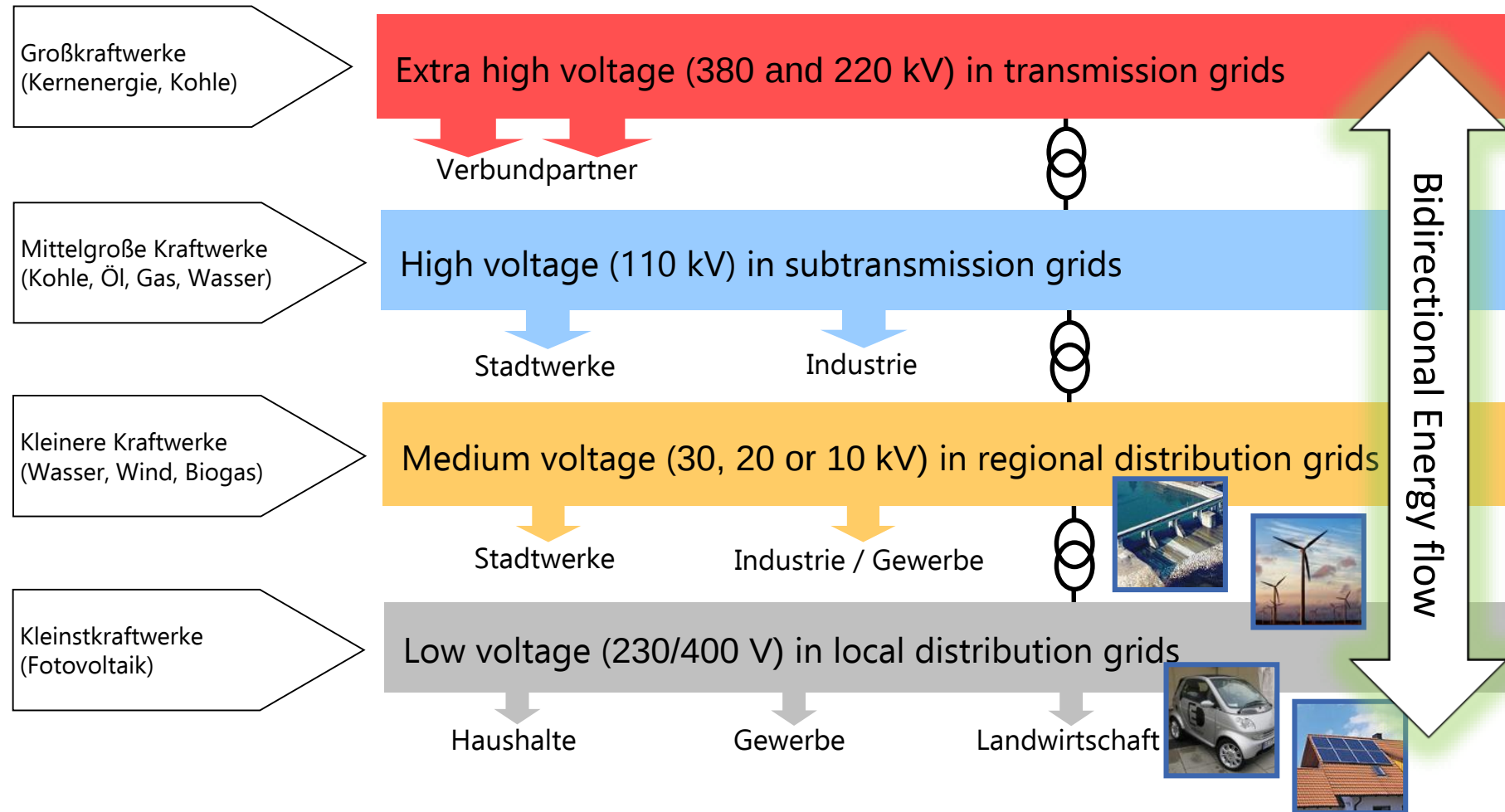
Member working group FNN (VDI)
(directive for power plant connections, HV-grids)

Technical Direktor "power grids" - Smart Grid platform BaWü

Decentral RE supply side management



Energy flows in between the voltage levels with (renewable) DER



Benchmarking Germany - Tamil Nadu

Country	Area	Per person Consumption	Number of Utility Companies	Population
Germany	357,021km ²	7081 kWh/year	> 800	80,767,000
Tamilnadu, India	130,058 km ²	684 kWh/year	1	72,138,958

Multi utility control room at Stadtwerke Schwäbisch Hall



Multi utility Company



Electrical power supply

365 Mio. kWh/a grid
1.145 Mio. kWh/a trade

Natural gas supply

552 Mio. kWh/a grid
3.350 Mio. kWh/a trade

Water supply

2,7 Mio. m³/a
13 % self water procurement
4 spring water facilities

District heat supply

122 Mio. kWh/a

Baths „Schenkensee“

459.000 visitors/a
indoor and outdoor pool, sauna

Parking

5 parking decks (1.533 parking positions)
2 car parks (325 parking positions)

Public Services Schwäbisch Hall GmbH

- ~500 employees, there of
17 trainees

- 258 Mio. € total revenue

Energiedienstleistungen

Contracting
SHERPA
distant meter-reading of energy
meter and EDM
process control of DD4al facilities

Facility-Management

224 stations
18.900 data points

Energieerzeugung

48 BHKW-modules
1 combined-cycle plant
8 Biomass CHP plant
3 wood-fired power station
6 hydro station
7 wind engine

Renewable Energy

photovoltaics:	59,0	MW
water power:	2,5	MW
wind power:	46,0	MW
biomass:	27,0	MW
landfill-/biogas:	0,2	MW



Grid stability: Measures taken up by the Stadtwerke

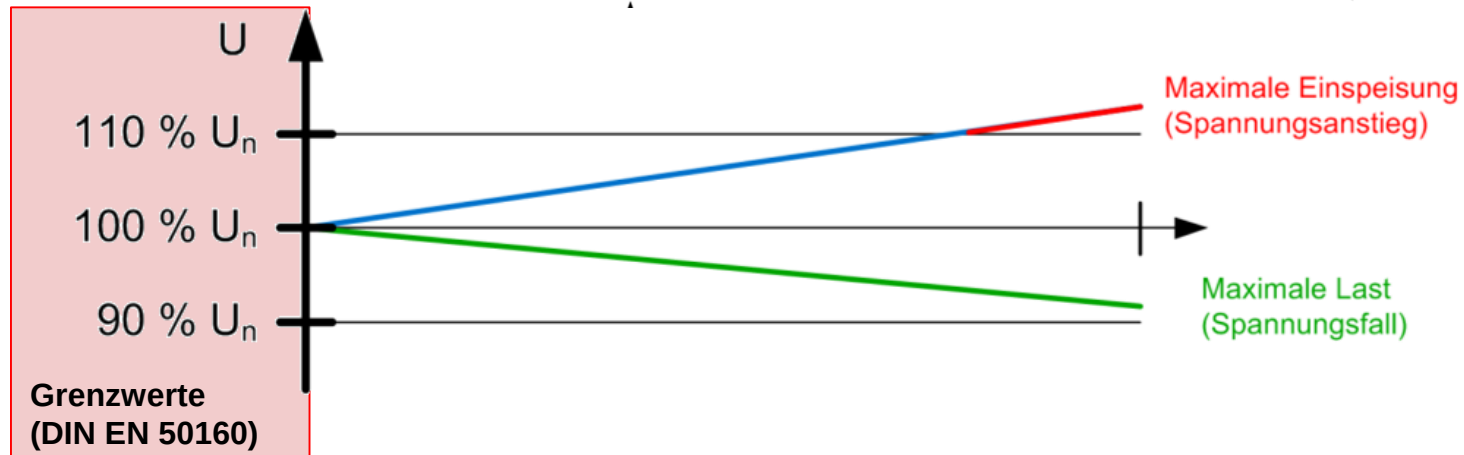
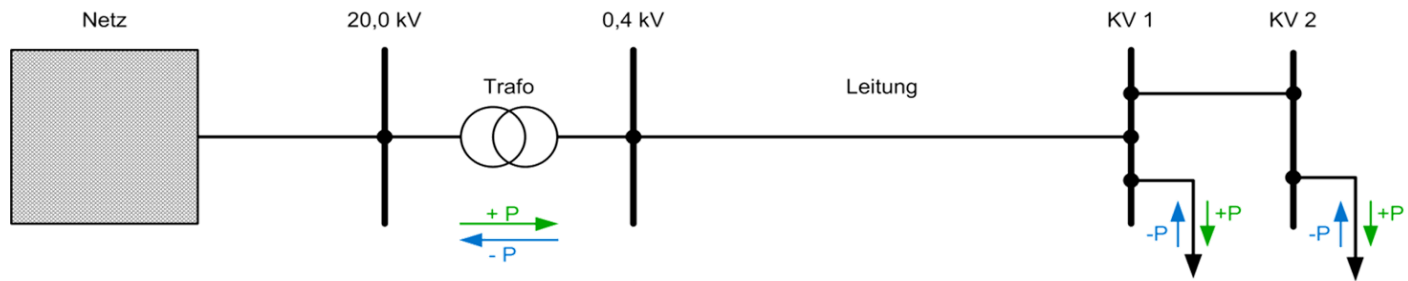
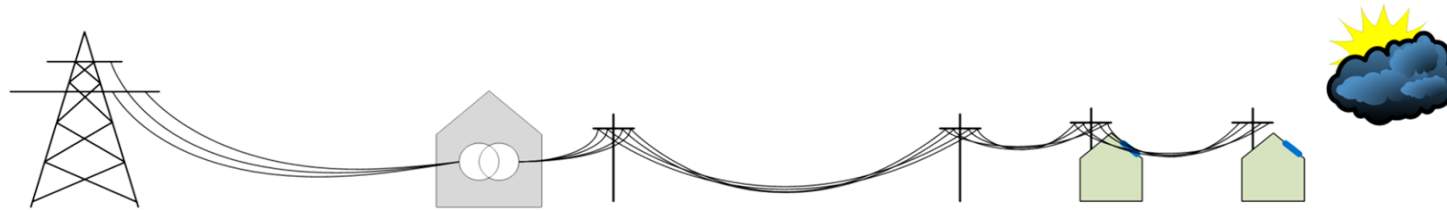
Challenges

- not enough electrical power in the local grid
- electric powered cars (e mobility)
- the customer now a Prosumer

Solutions

- Voltage stabiliser
- Phase shifter
- Smart meter bidirectional information (customer behaviour)
- Battery / storage

Issue: high voltage in the end of the grid



Grid stability solution 1: Voltage regulation with transformers

Benefit

- proven technology
- low maintenance
- save cost

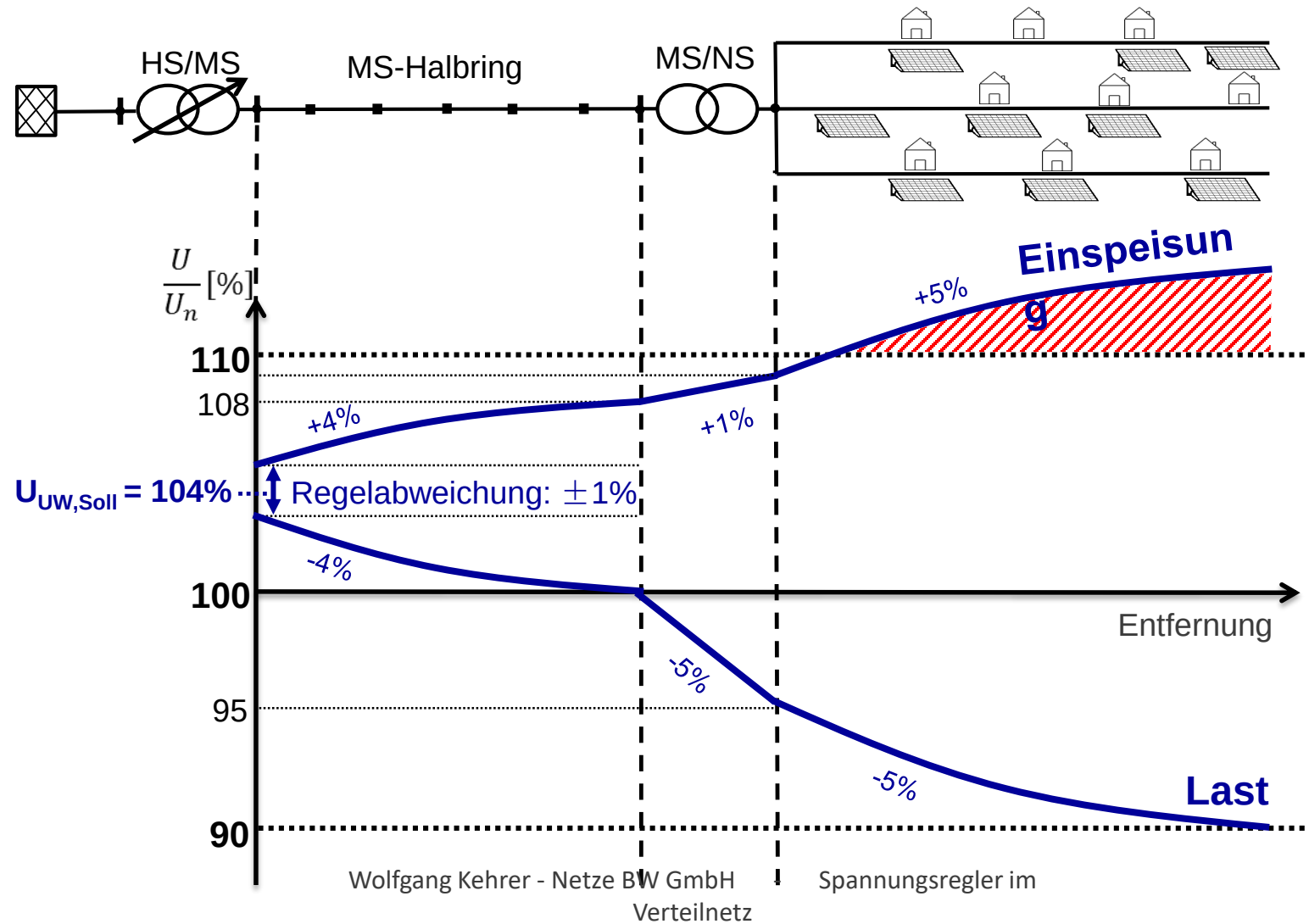
Weakness

- initial investment (3:1)



**GRIDCON® Transformer (Trafo) &
iTAP® (Regeleinheit)**
von Maschinenfabrik Reinhausen GmbH
Quelle: MR GmbH

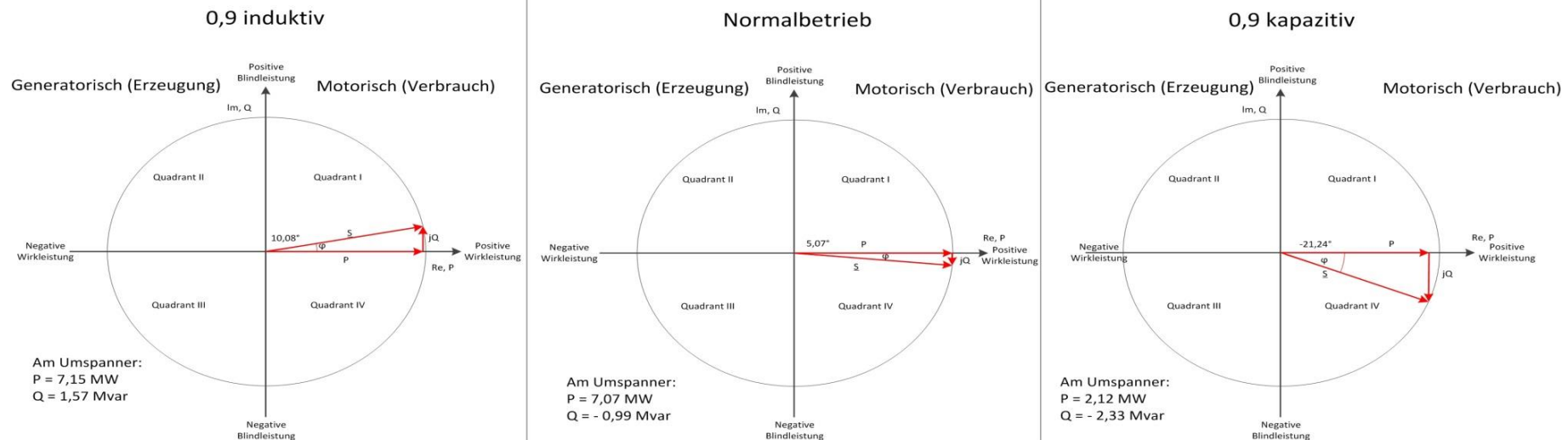
Case: Line voltage drop in Distribution Network



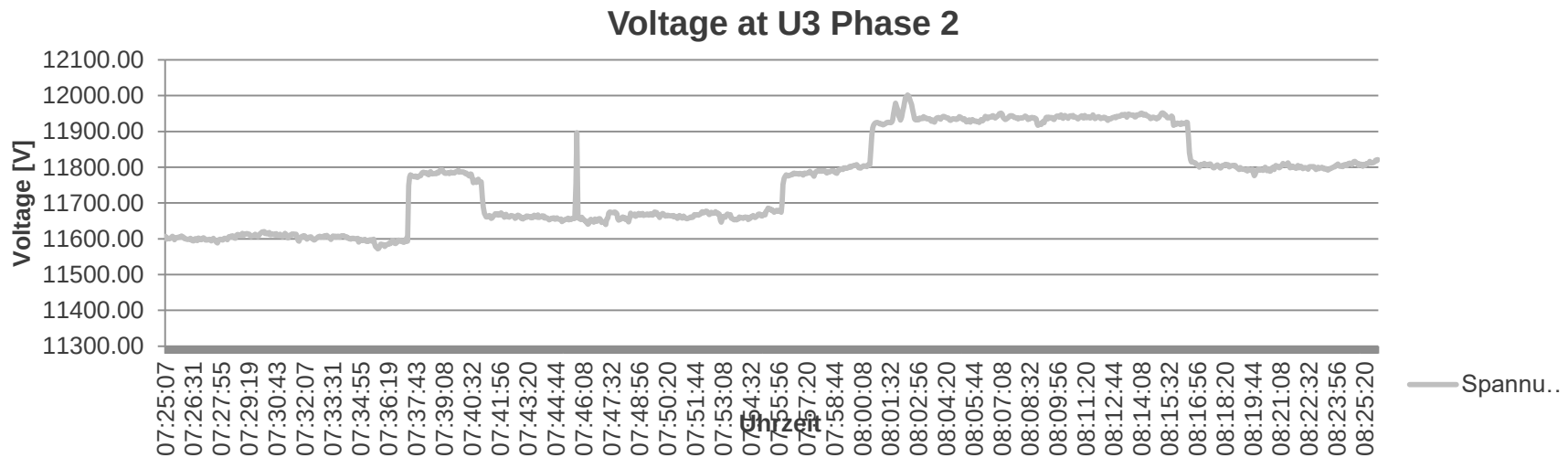
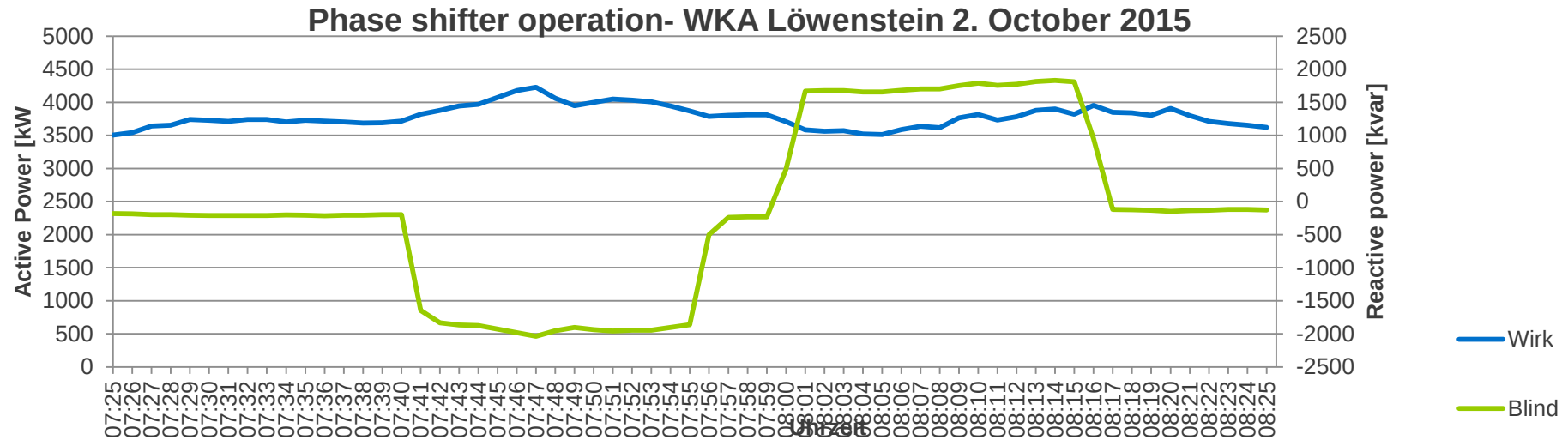
Grid stability solution 2: Phase shifter



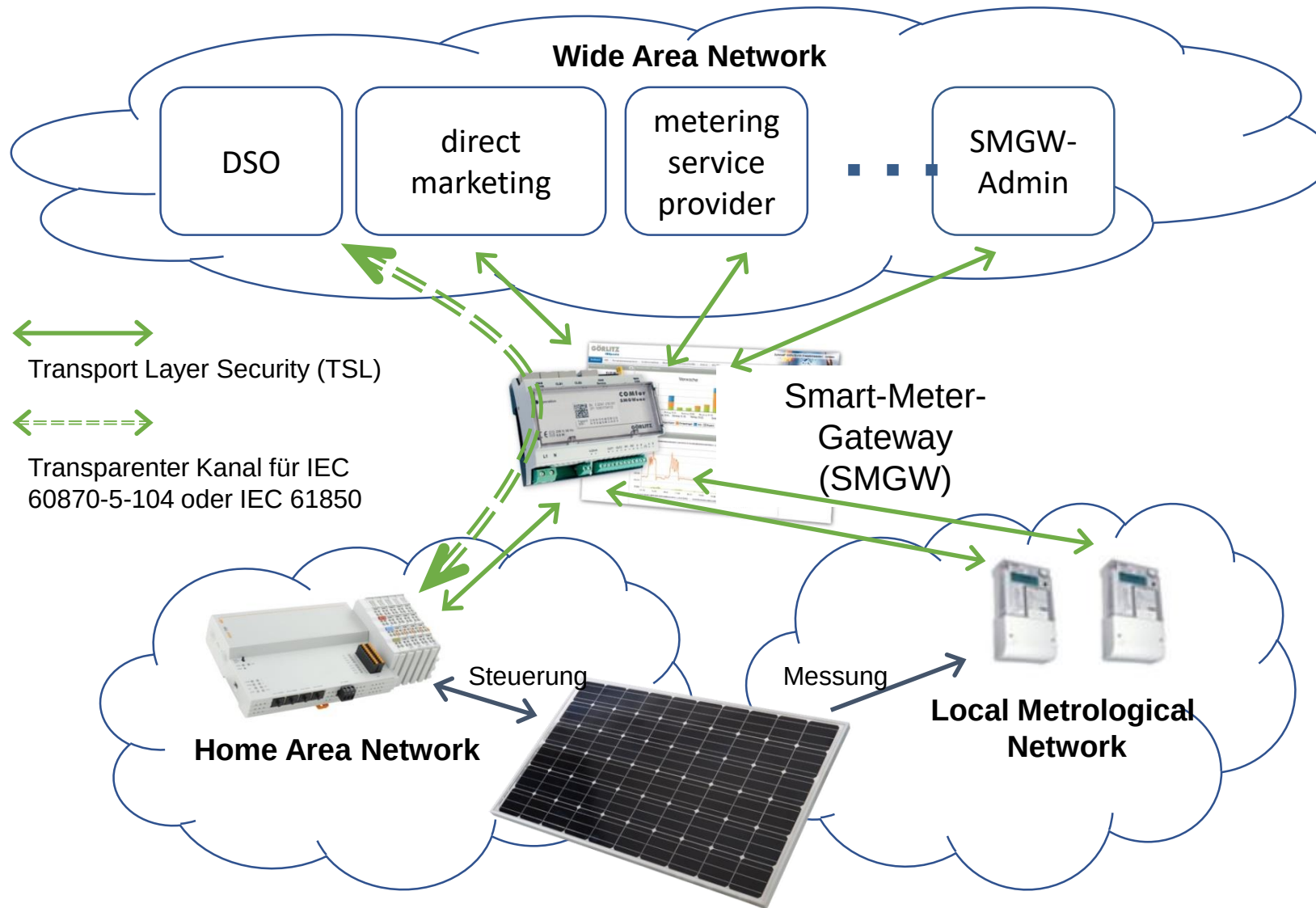
Verbraucherzählpfeilsystem (4 - Quadranten) 2. Oktober 2015



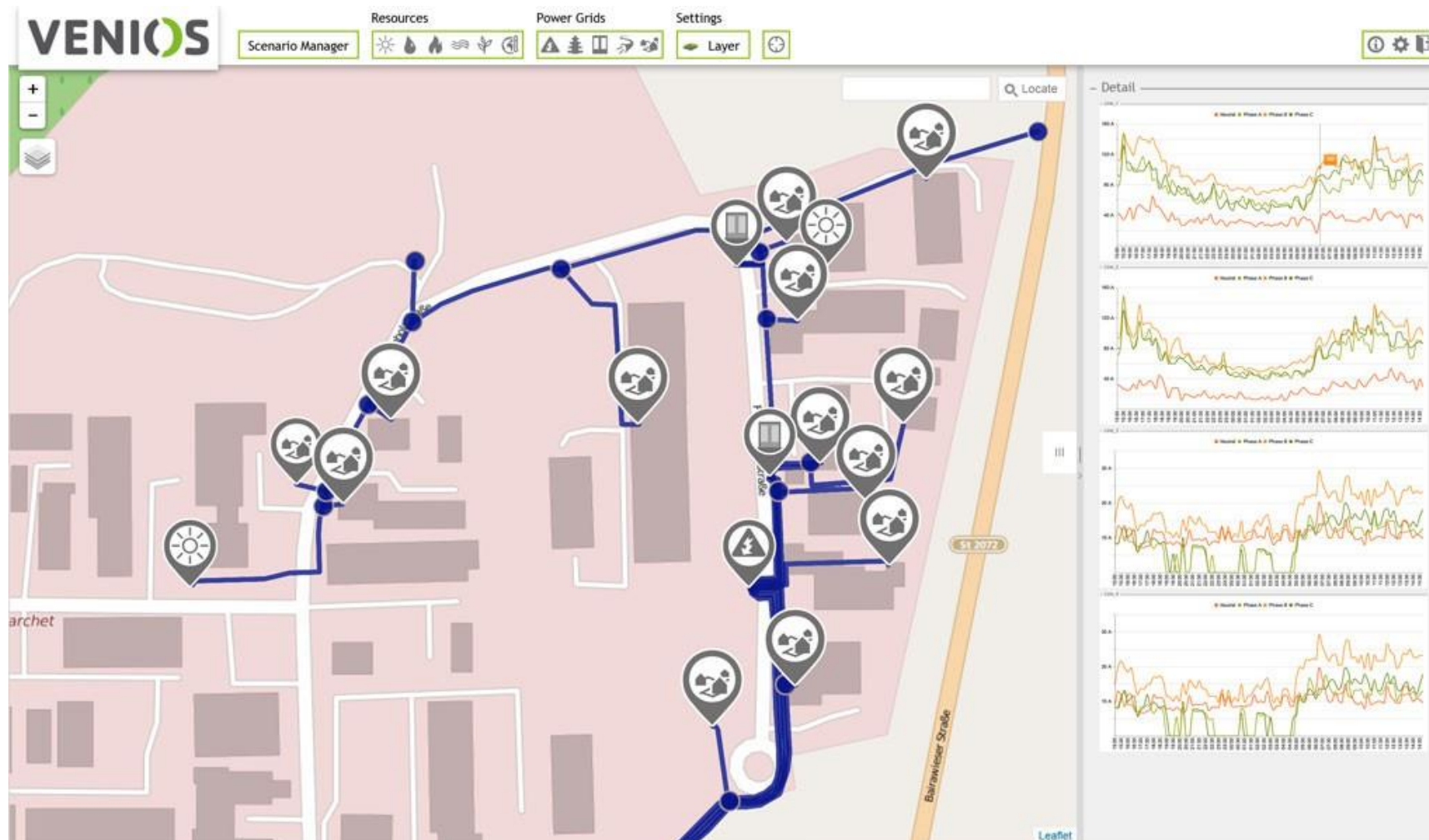
Phase shifter: Possibility of 300V (11.6 to 11.9kV)



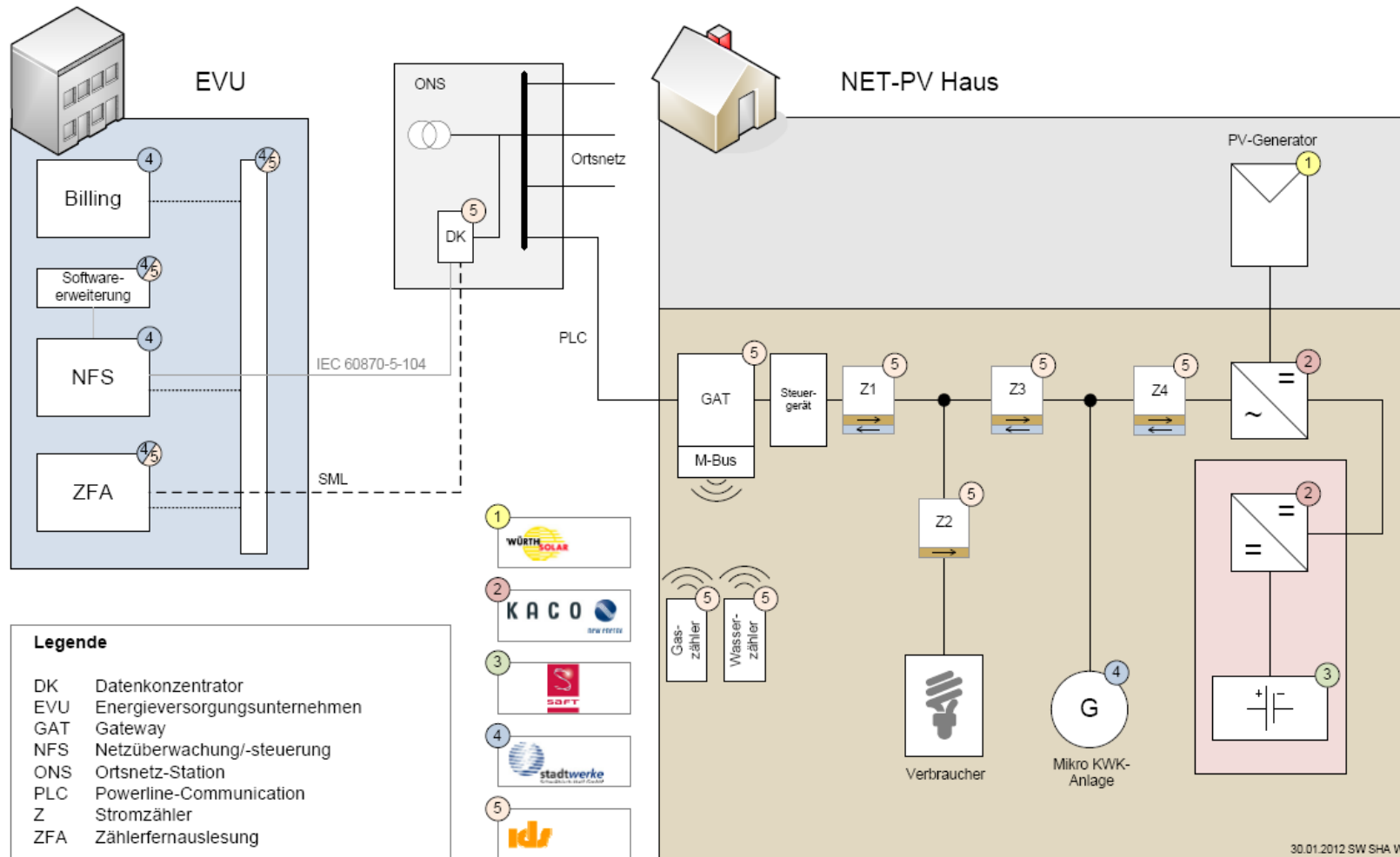
Grid stability solution 3: Smart meters



Information from low voltage grid (smart meter)



Grid stability solution 4: NET-PV research project funded by the German Government



Battery systems



Building with batteries



iPLON KFW-DEG Grid stability workshops- 2015



Thank you

தனயவாட் நுண்றி

Vielen Dank