DANUBE REGION strategy Energy

EnBW

Energie
braucht Impulse

The consequences of high RES-E Penetration on the Transmission and Distribution Grids in Germany

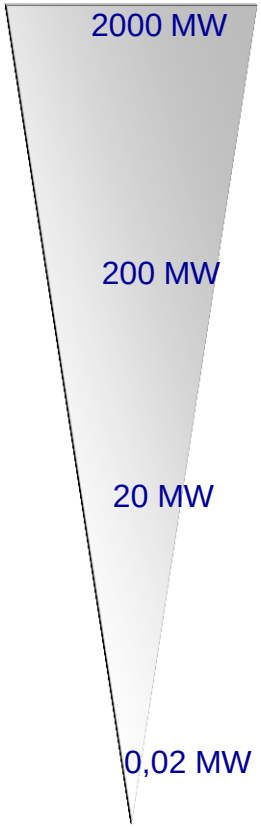
Regional Workshop on Smart Grid Deployment in the Danube Region
Brussels, 18th November 2013

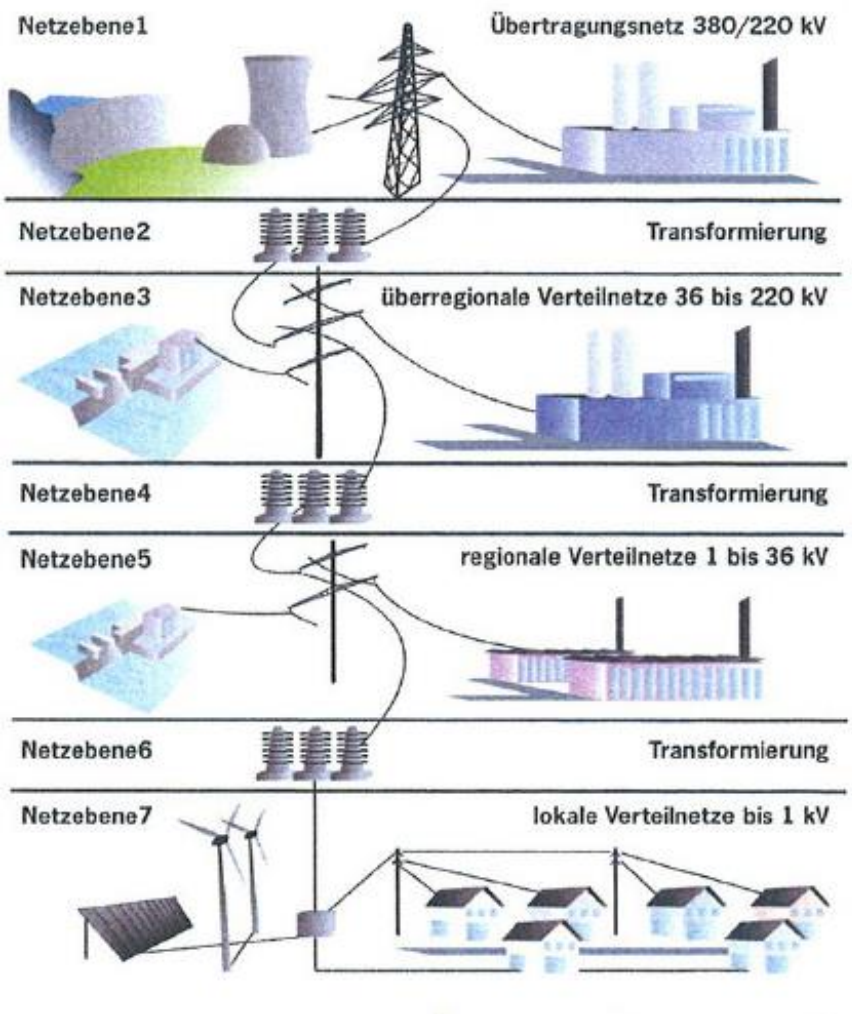
Christian Schorn
EnBW Energie Baden Württemberg AG

The Energy Turnaround means new Tasks for Network Infrastructure

Historical

Directed transmission of Energy from big Powerplants to customer





Current additional

Generation in all network levels with infeeding backwards

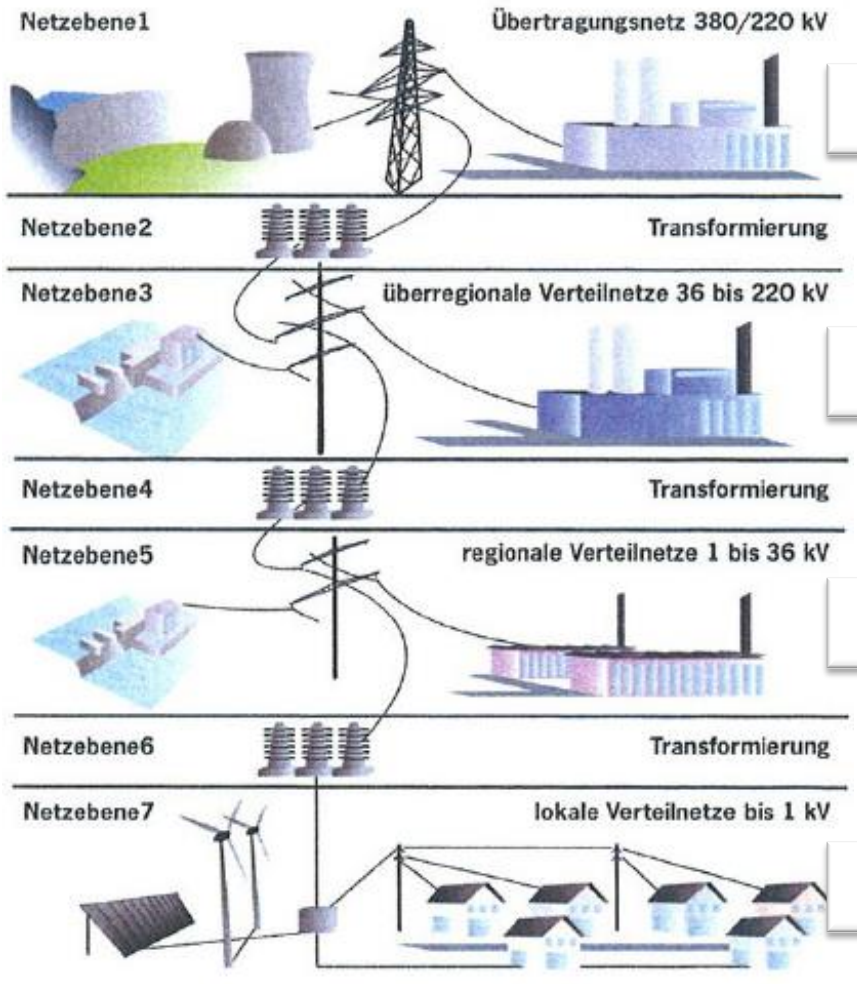
X MW z.B. Offshore Wind

50 – 100 MW

0,2 – 0,5 MW

Location of Generators

Situation in Baden Württemberg



Grafik: Arosa Energie; http://www.arosaenergie.ch/Strommarktoeffnung/Netzebenen/JnQ9ODImbD1kZXU.html

Extra High Voltage (Transmission Grid, 380/220 kV)

Function: Transport (europaen area)

???

High Voltage (Distribution Grid, 110kV)

Function: ...ibution

Ca. 5 GW Wind and others

Fu... ...p to 20 km)

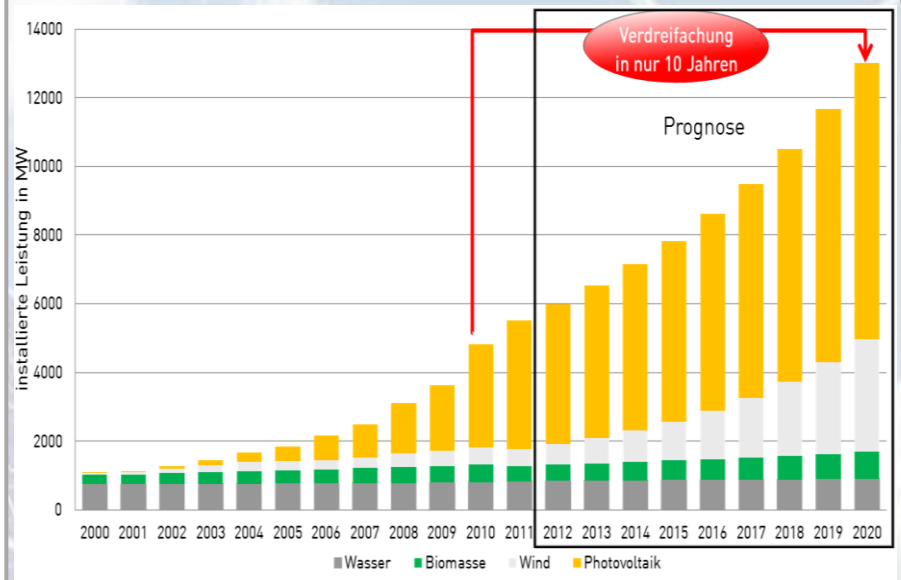
Lo... ...d, 0,4 kV)

Ca. 9 GW PV-Generation

...300 m)

The Energy Turnaround is located at the Distribution Grid

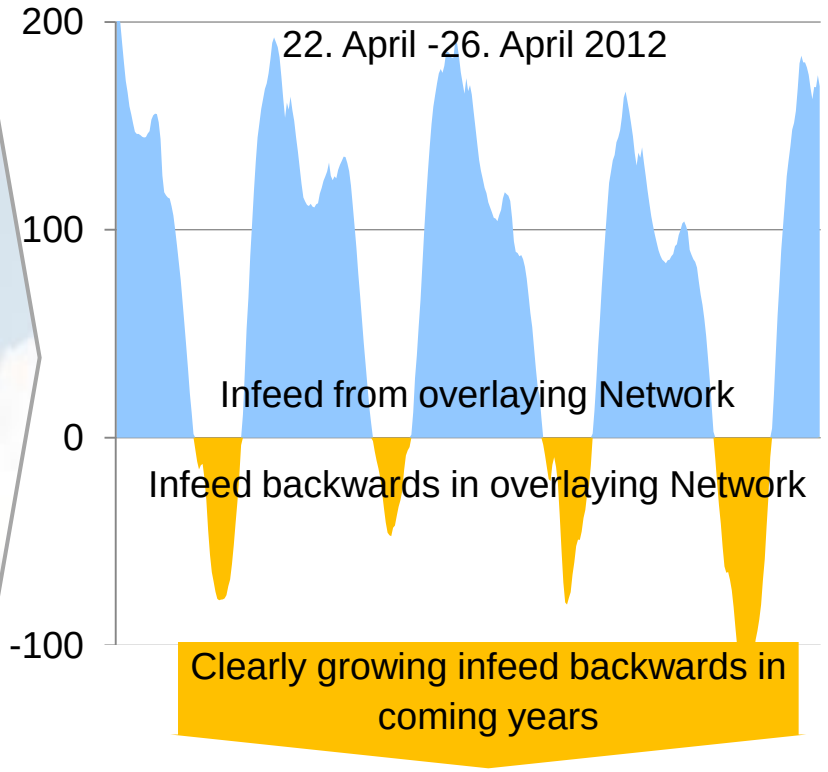
Decentralized renewable Generation in Baden-Württemberg …



Quellen: Ministerium für Umwelt, Klima und Energiewirtschaft Baden-Württemberg 2011, Studie „Aktivitäten von Energieversorgern im Bereich EE-Anlagen in Baden-Württemberg, Trend Research 2011
DENA, Arbeitsgruppe Netzentwicklungsplan 2011
Ausbauziele der Landesregierung Baden-Württemberg 2011

Challenge for Distribution Grids

Dezentralized Generation (in MW)



Quelle: EnBW ODR AG

Expecting Growth of renewable Energy in Germany

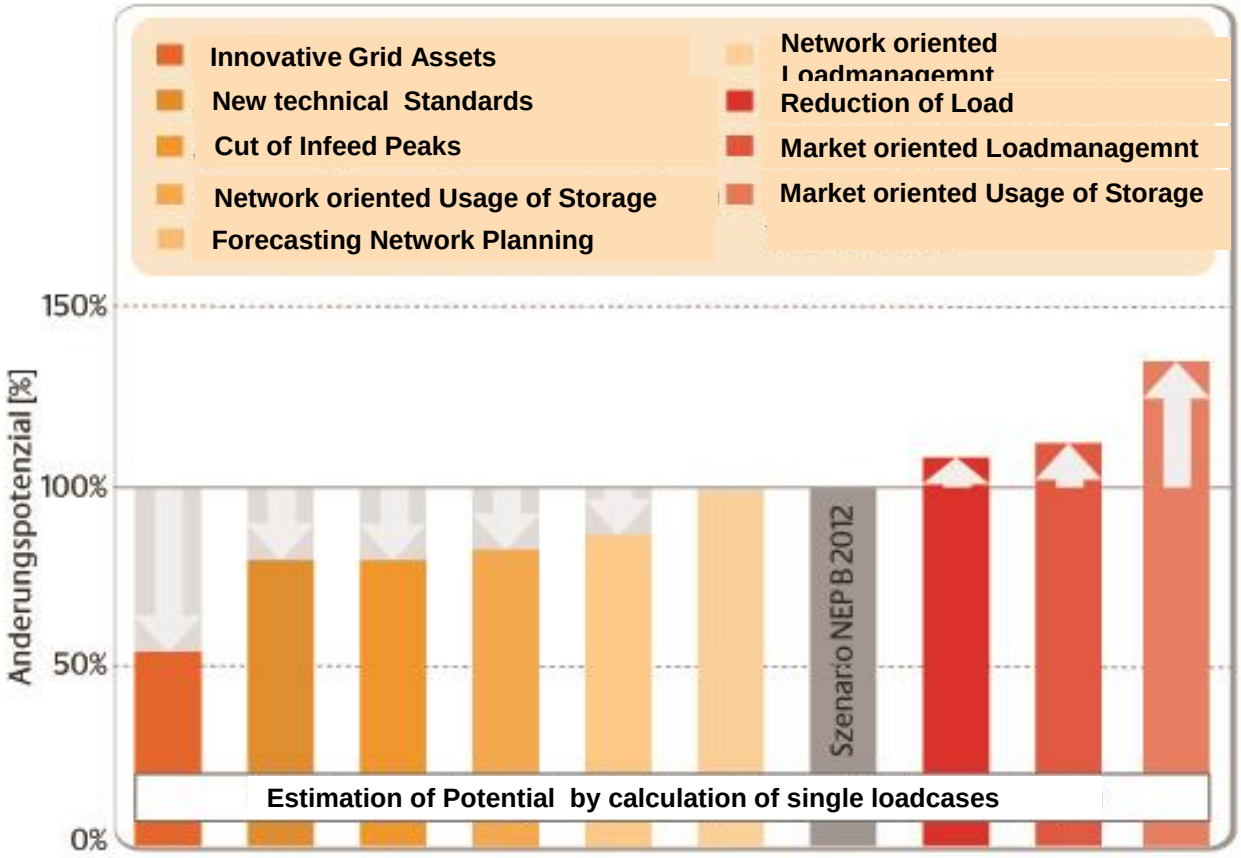
Installed Capacity [GW]	Scenario NEP B 2012			Scenario of German states		
	2015	2020	2030	2015	2020	2030
Wind	35,6	44,1	61,1	53,0	77,0	107,9
Photovoltaics	38,4	48,0	62,8	37,8	52,0	71,7
Biomass	6,4	7,8	9,2	5,6	6,9	8,7
KWK	19,6	20,7	21,4	19,6	20,7	21,4

	Total of installed Capacity in 2030*	Percentage of Brutto-Consumption in 2030*
Scenario NEP B 2012	166 GW	62 %
Scenario of German states	222 GW	82 %

* Numbers under consideration of all REN-Technologies

Quelle:
dena Deutsche Energie-Agentur
Verteilnetzstudie

Possible Reduction of Investment by using Smart Technologies .



Quelle:

Verteilnetzstudie

EnBW is creating a „Toolbox“ including smart Measurements for a future reliable Distribution Grid

Stable Voltage Level U

- Stepable Transformer x/0,4 kV
- Reactive Power from decentralised Generators Q/U
- Linecontroler in Low Voltage Grid
- Conventionel Increasing „Parallel Networks“

Current I

- New Materials for higher temperatures
- Load- and Infeedmanagement
- Storage of Energy
- Conventionel Increasing „Bigger Profile“

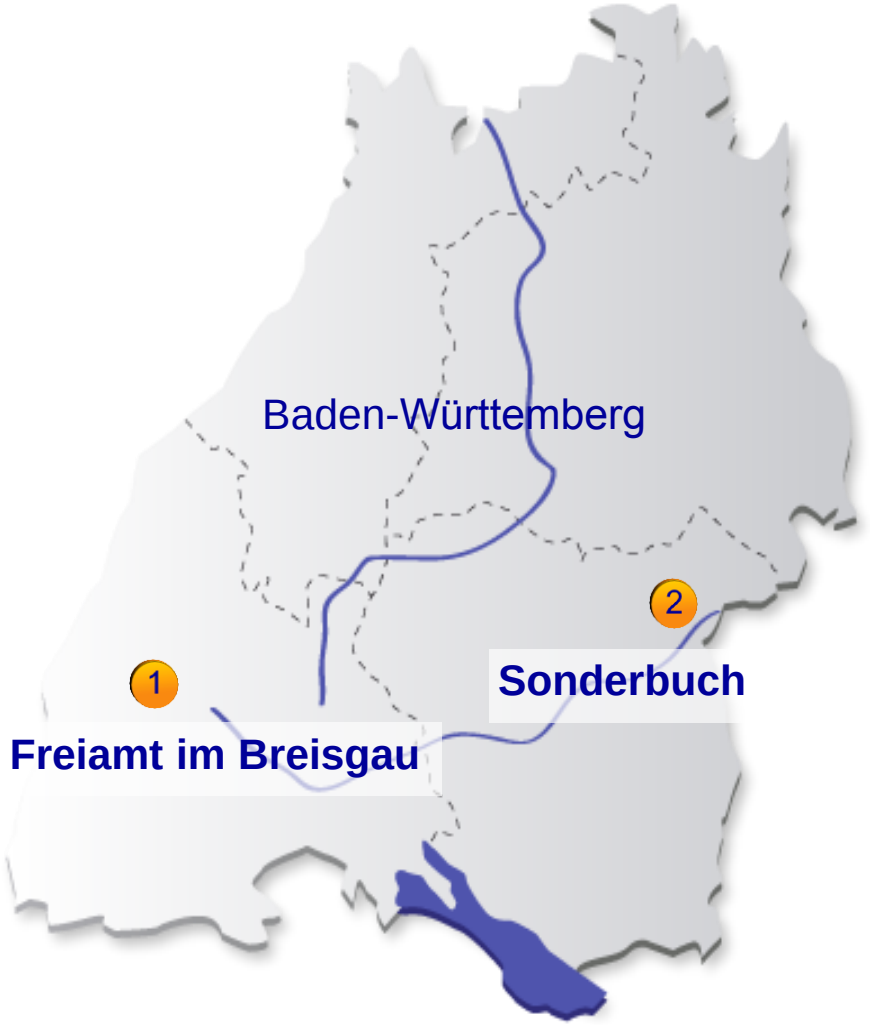
Stability of Frequency f (Today Task of Transmission Grid)

- Loadmanagement incl. Controlled Cutoffs
- Big Storage for Support of Frequency
- Infeednetworks (z.B. Windplugin)
- µEMS, Energymanagementsystems for independent Networks

Supporting all Tools the Development and usage of new Technologies like IT-Systems, Sensors for Condition Monitoring, Transmission and Storage, remote Connections and Control is

The Netlab of EnBW Regional AG

The Distribution Grid of Tomorow already today



1 Freiamt

- Inhabitants 4264
- Renewable installed Capacity 13,5 MW
- Load 1,9 MW
- Number secondary Substations 71

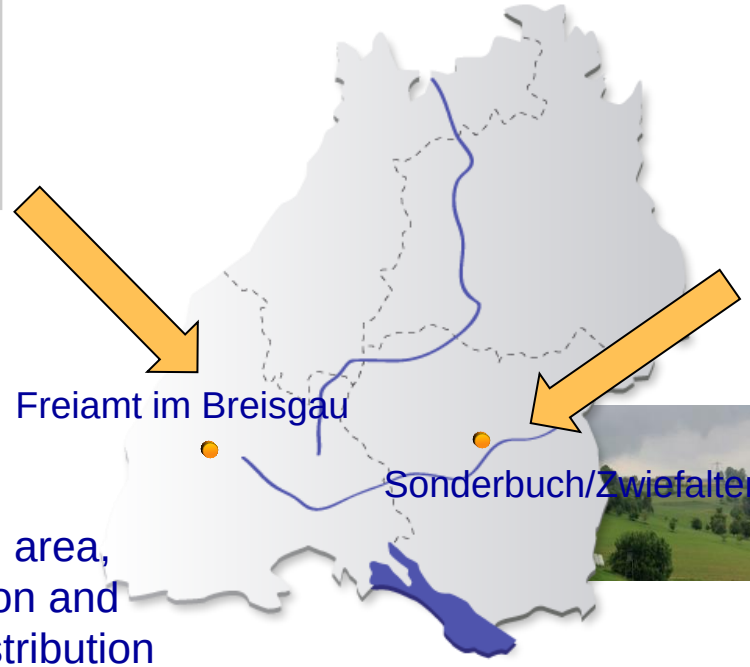
2 Sonderbuch

- Inhabitants 190
- Renewable installed Capacity 1,2 MW
- Load 0,2 MW
- Number secondary Substations 3

The Netlab of EnBW Regional AG

Solutions for Medium- and Low-Voltage Grid

For Devlopment and test of new technologies for the toolbox EnBW Regional AG startet already in 2009 to build and develop a netlab in two special locations in Baden Württemberg aufgebaut und weiterentwickelt.



Municipality with a big area, broad mix of generation and charakteristic rural distribution grid

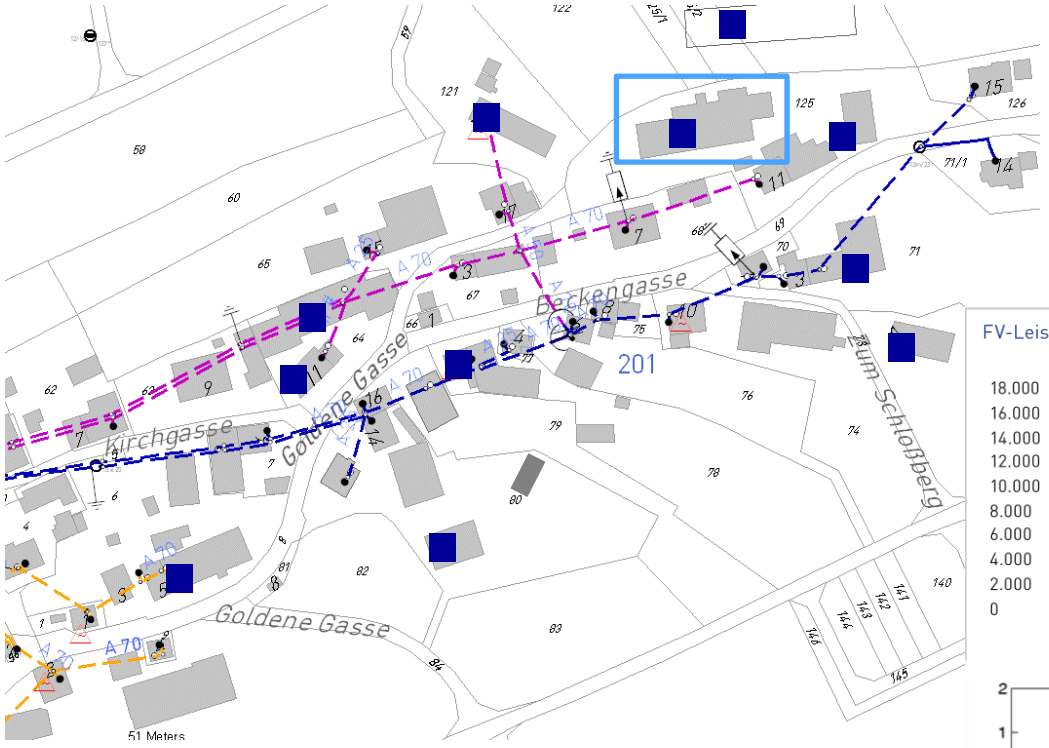
Focus Medium-Voltage Grid

Small municipality with massive growing of PV-generation

Focus Low-Voltage Grid

Example: Dezentralized Storagesystem

Integration of Storage to Low-Voltage Grid



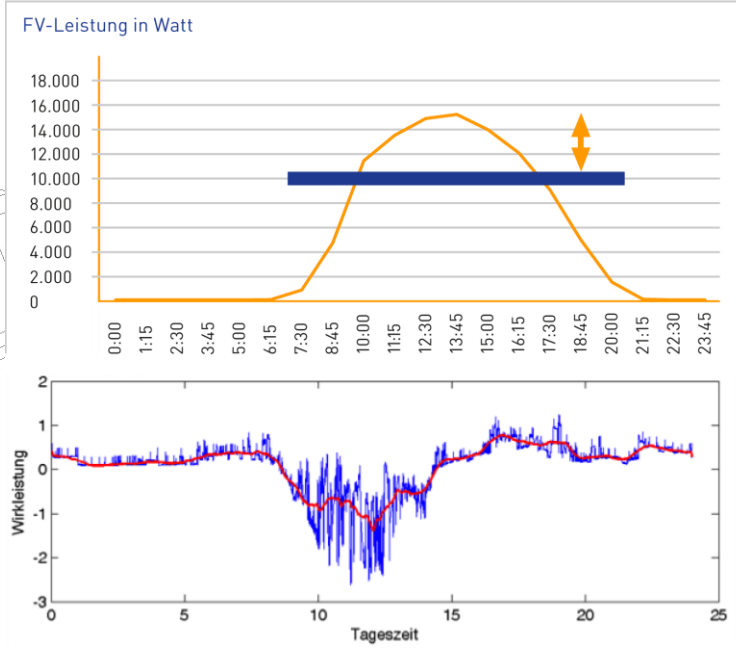
Battery

~ 30 kWh

Charge-/Discharge Capacity
~ 30kW

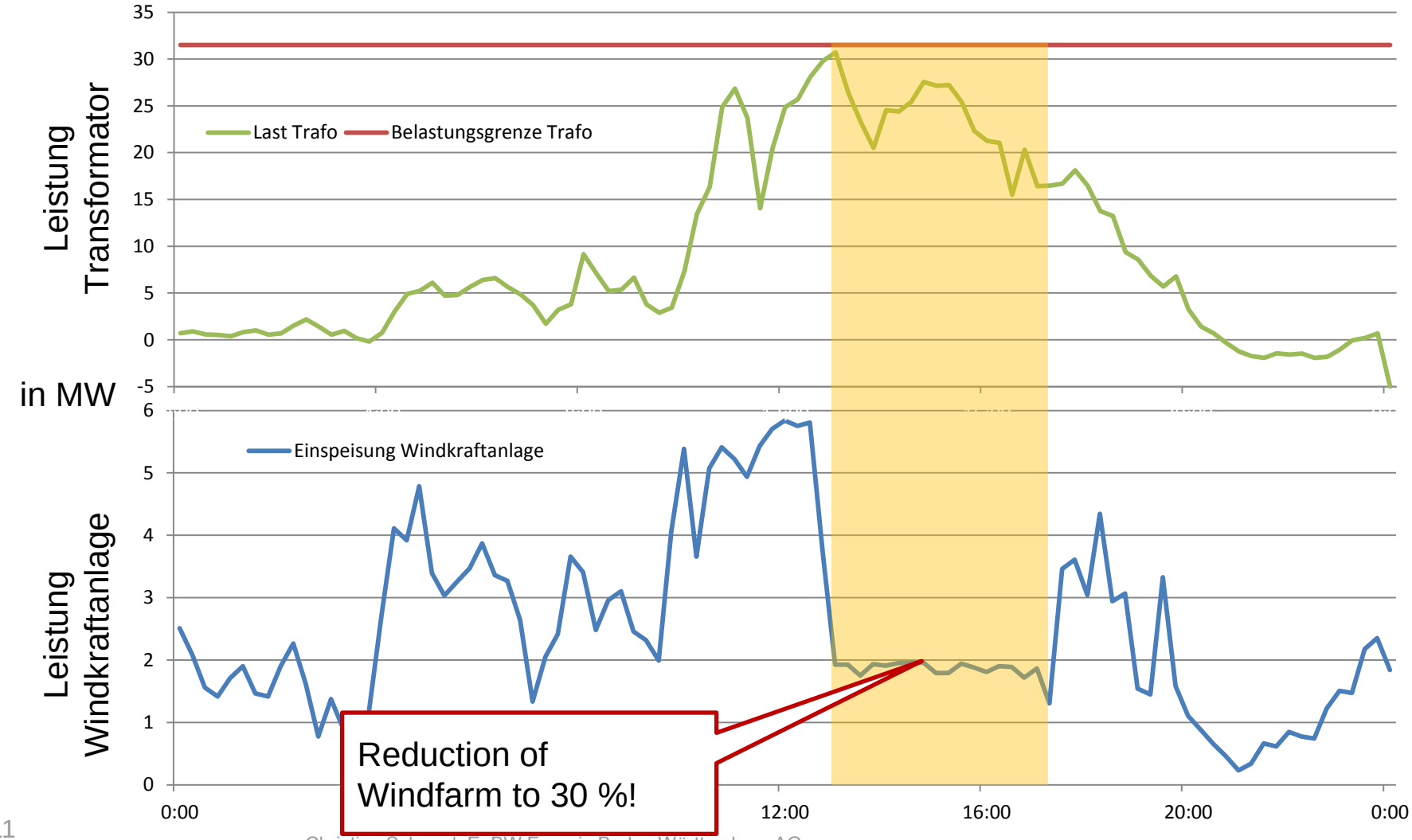
Loadreaction < 1s

Measurement << 1s



Example: Infeedmanagement

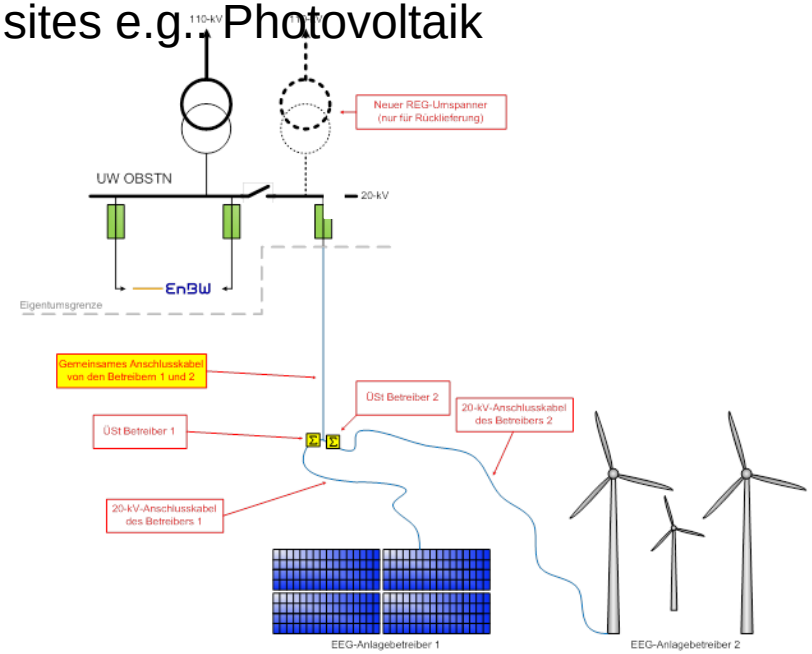
14. Juli 2012 – Reducing Generation of a Windfarm



Infeed Grid as Solution for Generation

Challenge: „110-kV-Windplugin“

- Simple construction and operation of a sperated transformer station just for collecting generation sites (no „n-1“-Security)
- Avoiding techical problems of voltage stabilisation
  → bigger potential for delivery of reactive power
- Release of regulated grid and creating new capacity for very small generation sites e.g.: Photovoltaik



- Positiv results for Loadmanagement:
  - Less generation → Avoiding Blackout
  - Rolling cutoff in medium-voltage grid
    → all integrated generators affected
  - Direct connection to 110-kV-level:
    Sites are available in the grid witout restrictions

Summary

- Because of the energy turnaround we are facing e.g. in Baden-Württemberg a generation capacity of nearly 14 GW in the distribution grid

- Medium- and low-voltage grids will be used up their thermal limits and if available smart network technologies should be used before increasing networks convetionally

- 110-kV-Grid will be increased for infeed backwards. Parallel with Windplugins we ask the regulator BNetzA vor convetional projects. Confirmed standards for network planning and forecasting are strictly necessary!

- Local und national extremal scenarios will be controlled by load- and infeedmanagement

- The increase of generation plants has to be synchronized with the ability of network increase and development. We have to get the view for the whole system icluding new challenges especially from smart markets or E-mobility.

DANUBE REGION strategy Energy

EnBW

Energie
braucht Impulse

Thank You

Christian Schorn
Energie Baden Württemberg AG
Durlacher Allee 93
76131 Karlsruhe

Phone: +49 721 63-12180
E-Mail: c.schorn@enbw.com