

Recent Wind Integration Activities in Germany

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ISET e.V.

Overview

Study: dena II grid integration study

Demonstration: Renewable virtual power plant

Law: New Renewable Energy Law

dena grid integration study II – Aim

Long-term plan for the integration of RES, especially wind
Time horizon ca. 2020

High penetration (20%)

=> novel technical and organizational solutions required

dena grid integration study II – Scope

- ☐ **Flexible electricity generation of RES**
- ☐ **Demand-side management**
- ☐ **Provision of balancing and reserve power by wind turbines**
- ☐ **Use of storage technologies**
- ☐ **Reliability of electricity supply**
- ☐ **Situation dependent capacity of overhead lines (temperature and wind monitoring)**

dena grid integration study II – Wind power time series

First step in the study:

- ☐ scenario for the year 2020
- ☐ time series of wind power production
- ☐ time series of wind power forecast

Spatial resolution:

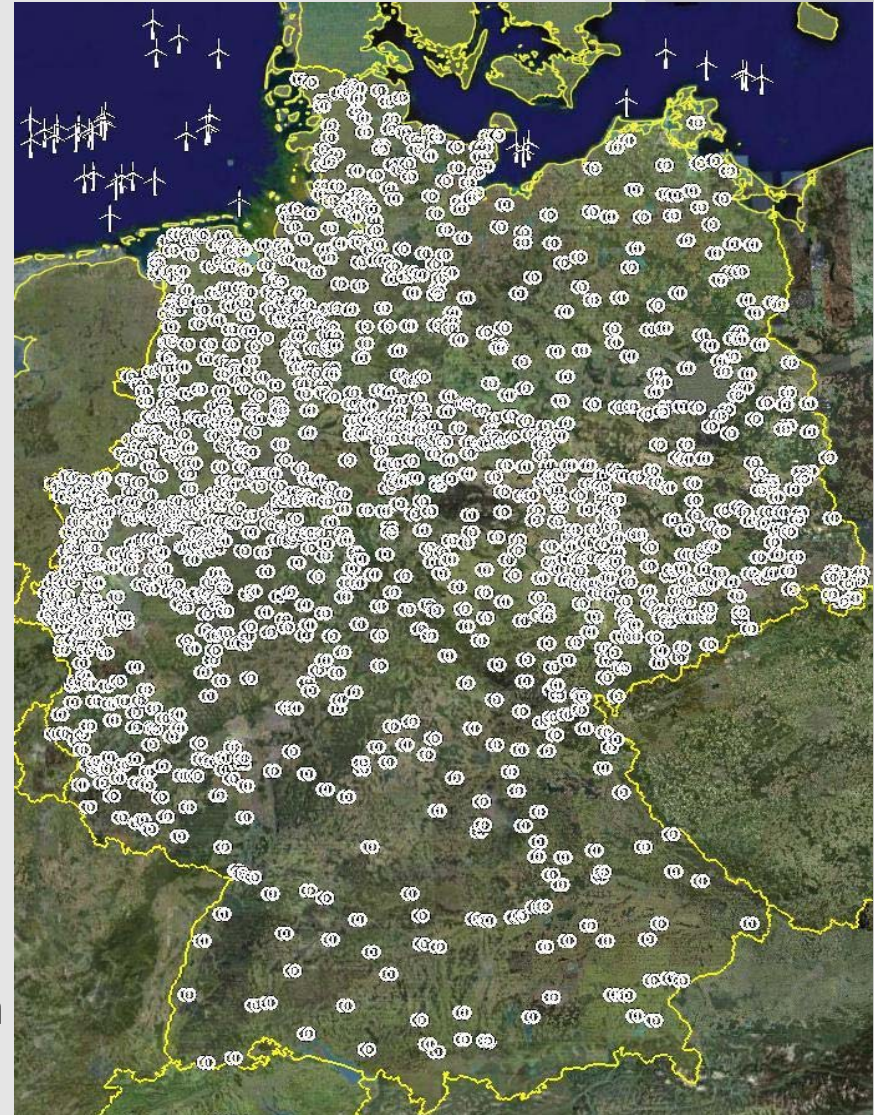
- ☐ ca. 1200 onshore grid nodes (110kV)
- ☐ all offshore wind farms

Temporal resolution:

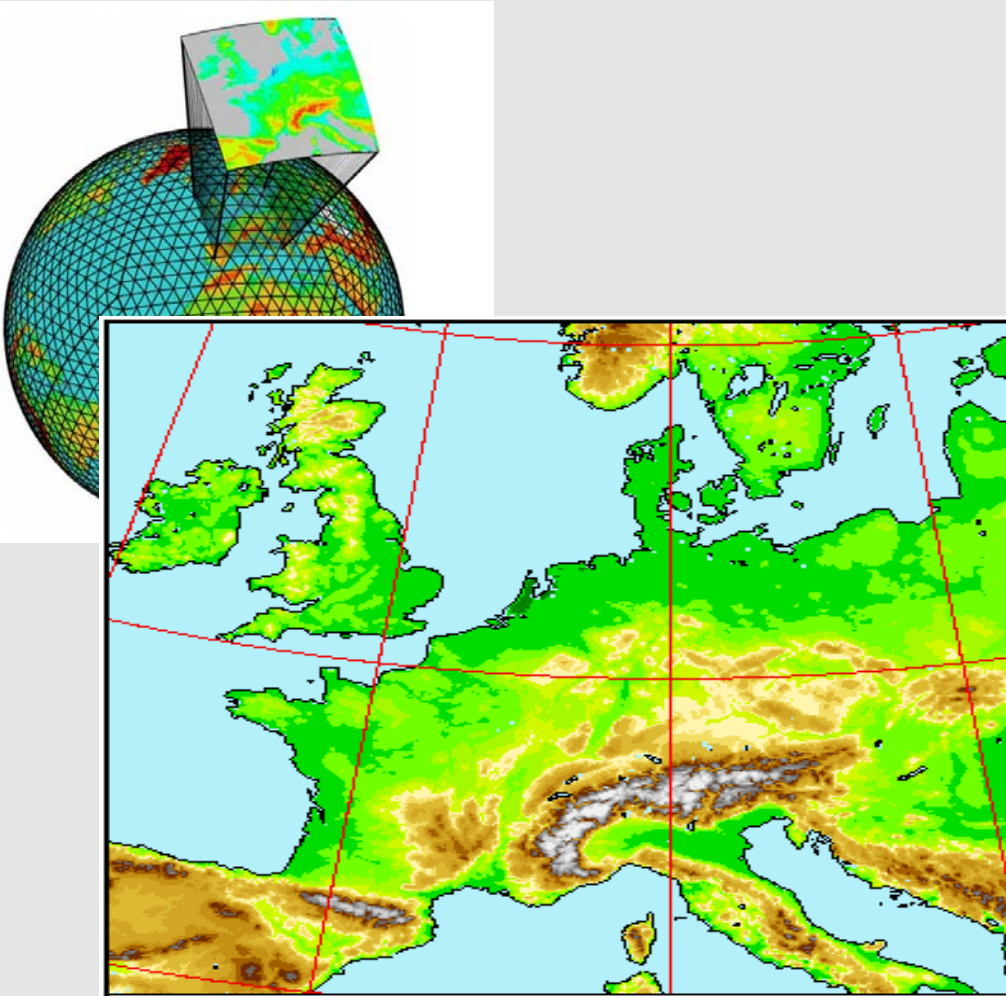
- ☐ 15 minutes

Length of time series:

- ☐ 4 years (based on weather data from 2004-2007)



dena grid integration study II – Input weather data

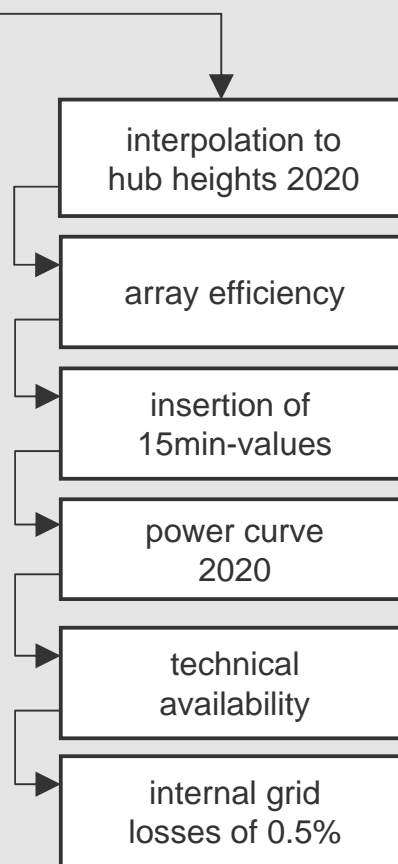
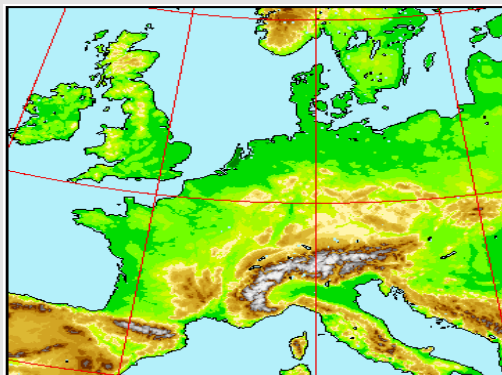


**Local Model (LM) of the German
Weather Service**

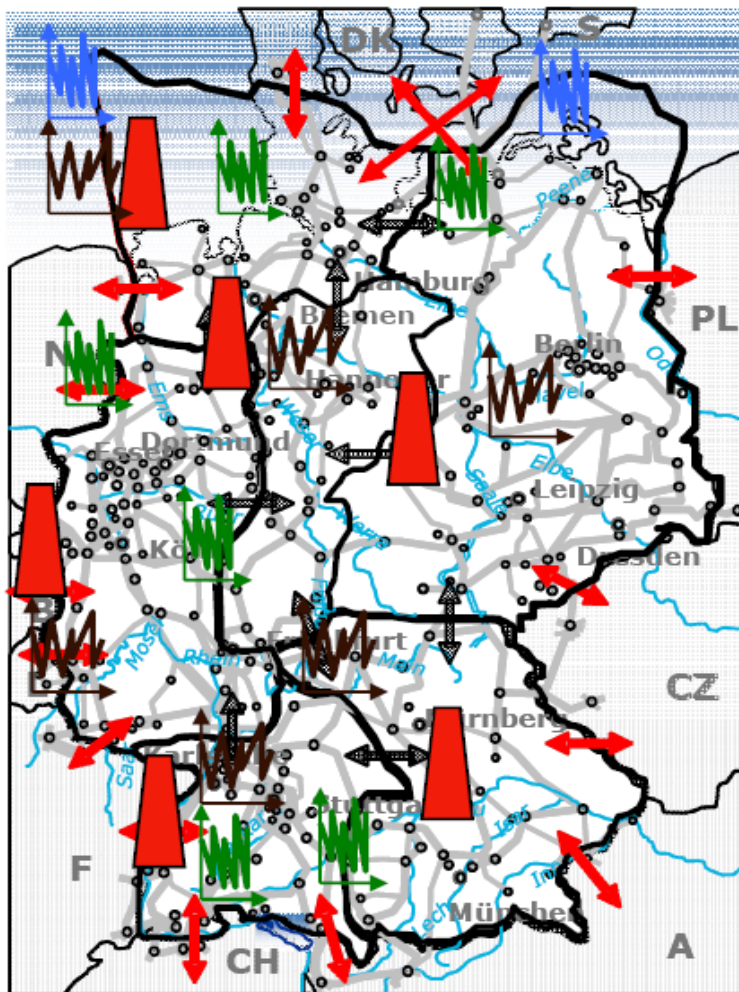
analysis mode

hourly temporal resolution

spatial resolution: 7 x 7km



dena grid integration study II – Grid calculations



**Demand curve taking into account
RES and CHP feed-in**



**Offshore wind power feed-in by
wind farm**



**Onshore wind power feed in by
grid node**



Cross-border exchange



**Installed conventional power
plants**

Renewable virtual power plant

Demonstrate the possibility of an electricity supply with 100% renewable power for Germany

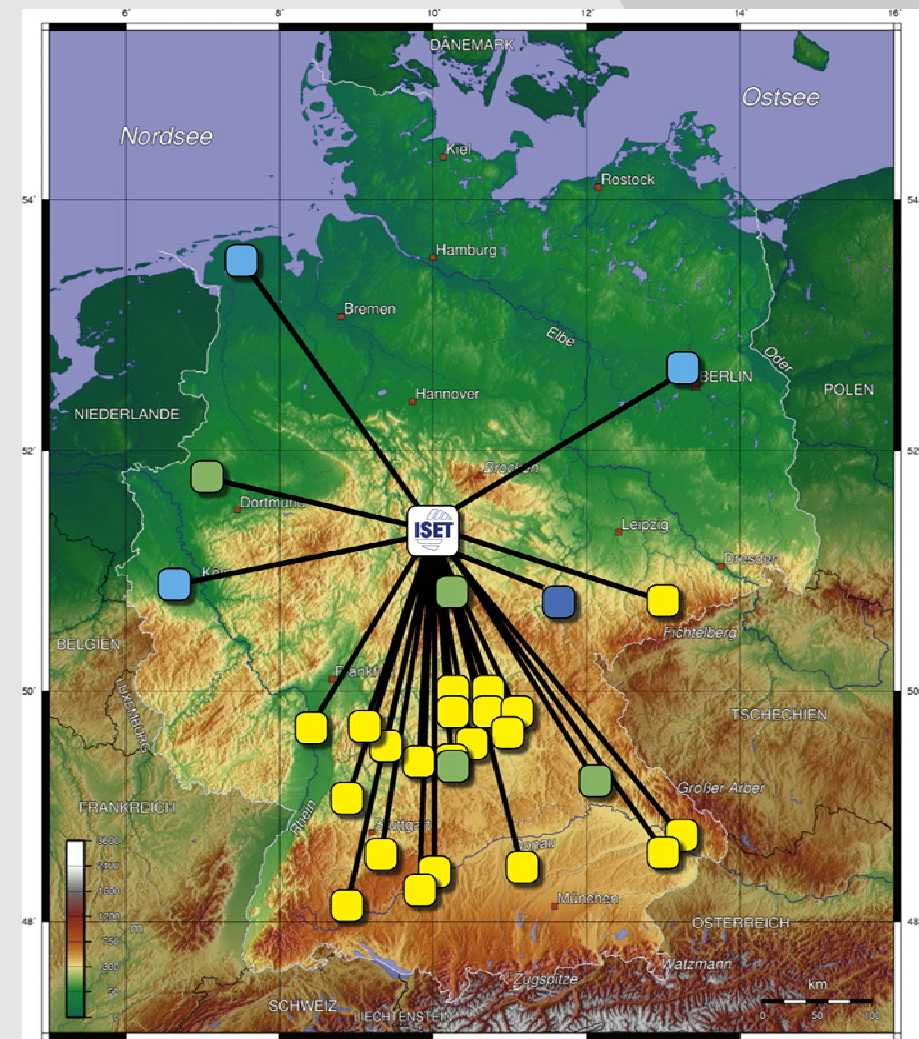
Real power – virtual plant:

Optimised control of

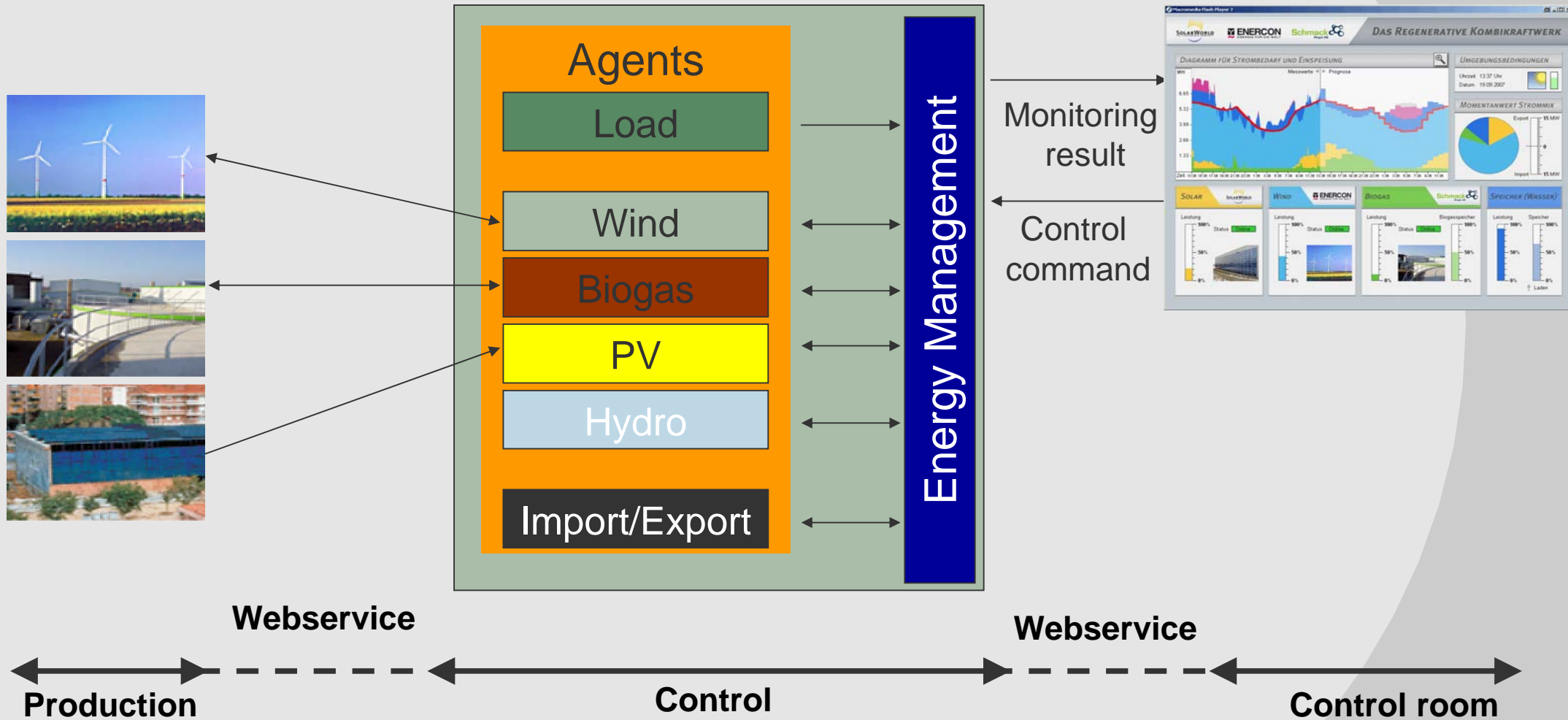
- ☐ actually existing renewable energy power plants (wind, PV, biogas)
- ☐ In combination with (simulated) storage and cross-border flow

to supply the scaled (1/10000) demand curve of Germany at any time

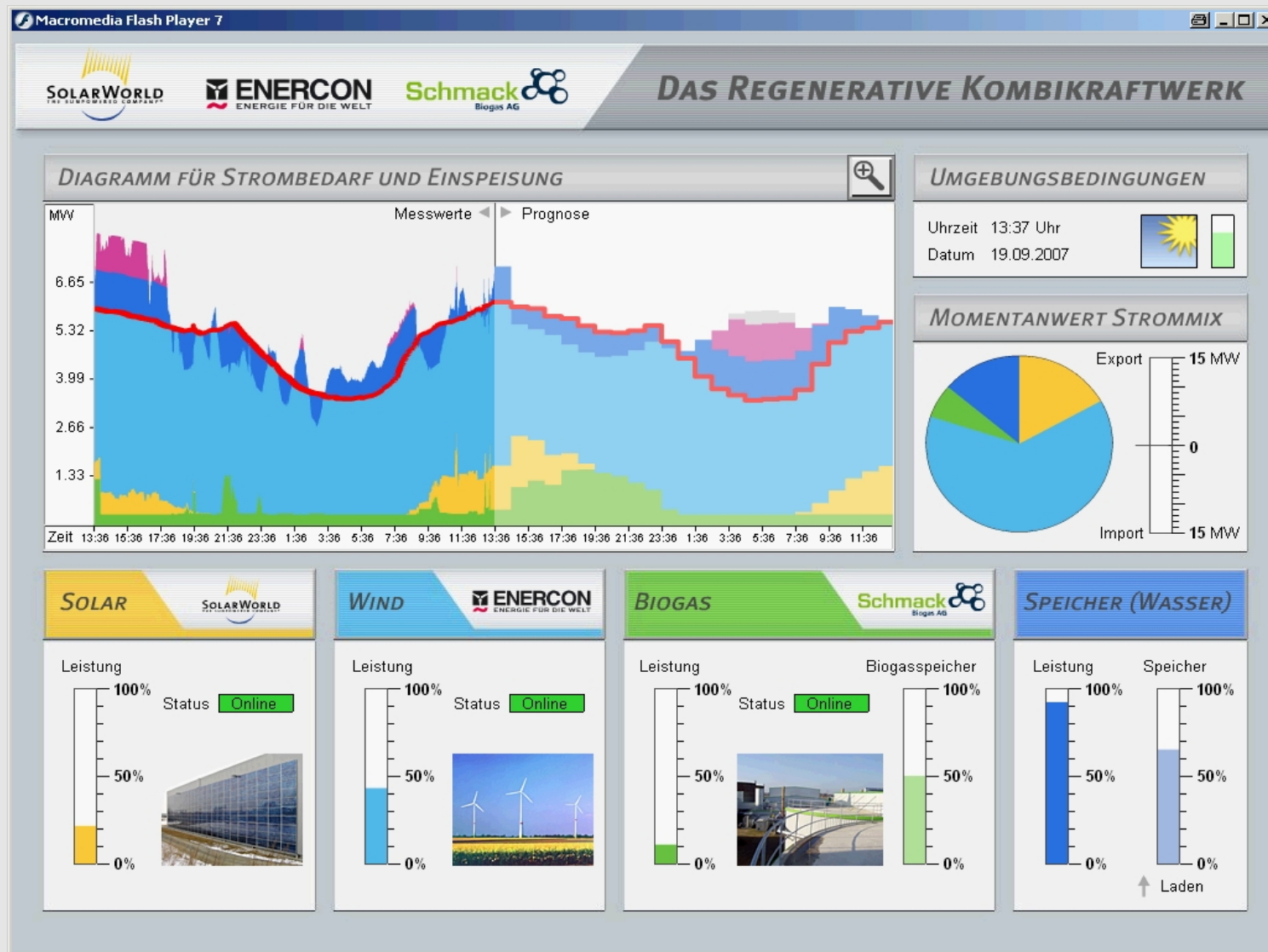
Wind	Solar	Biogas	Hydro	Import /Export
12,6 MW	5,5 MW	4,0 MW	1,0 MW	1,0 MW



Renewable virtual power plant



Renewable virtual power plant



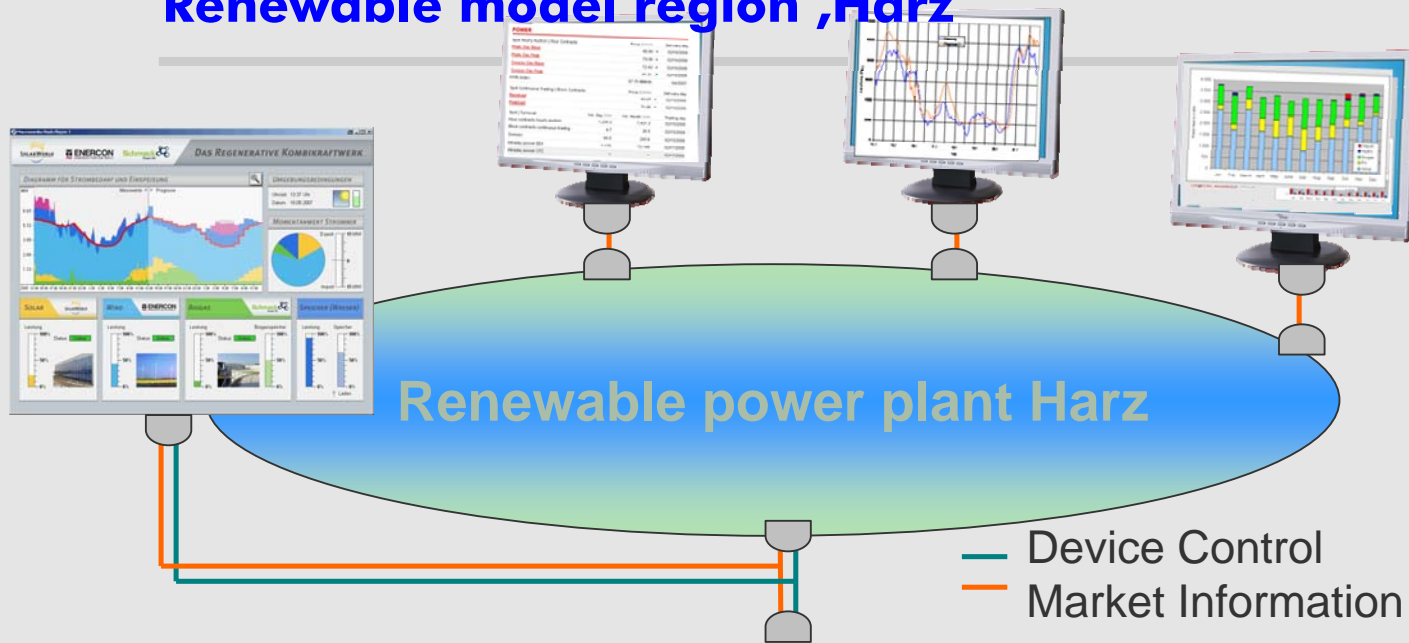
Renewable model region ,Harz'



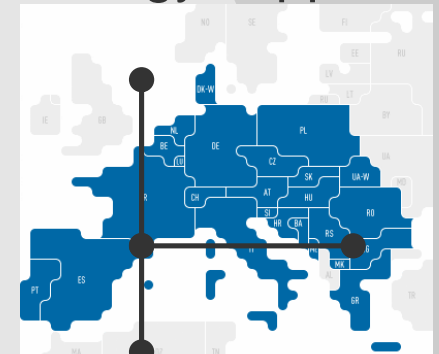
	Number	Inst. Power
PV	118 (500)	2 (10)
Wind	135 (185)	250 (350)
CHP	52 (100)	12 (25)
Storage	1 (2)	80 (180)
Households	100	0,5 (5)
Industry	20 (40)	100 (200)
E-Cars	3 (100)	0,03 (1)

current (future)

Renewable model region ,Harz

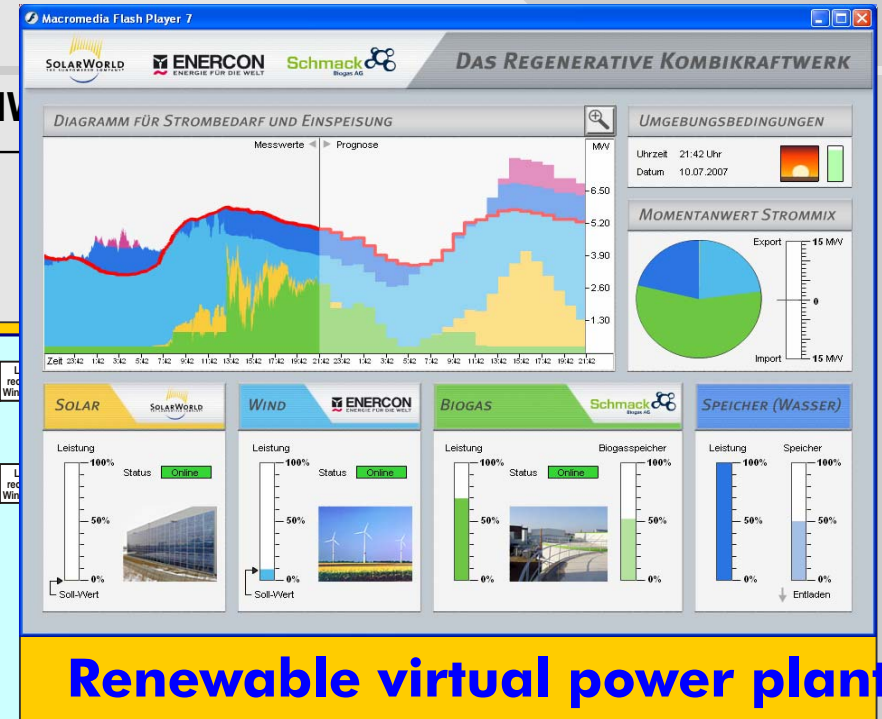


Energy market,
grid operators,
energy supplier

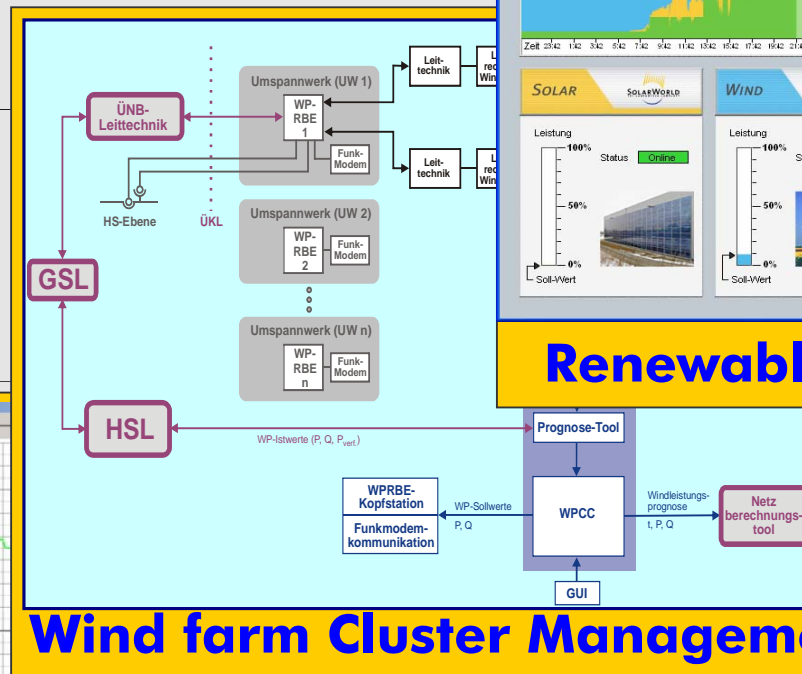


Tools for system integration of wind power

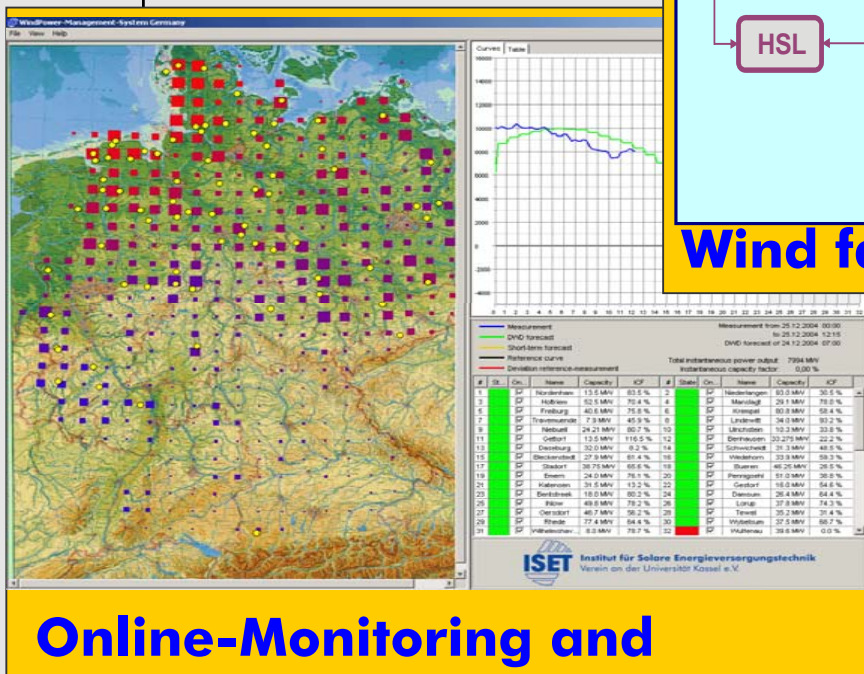
Nennleistung [MW]



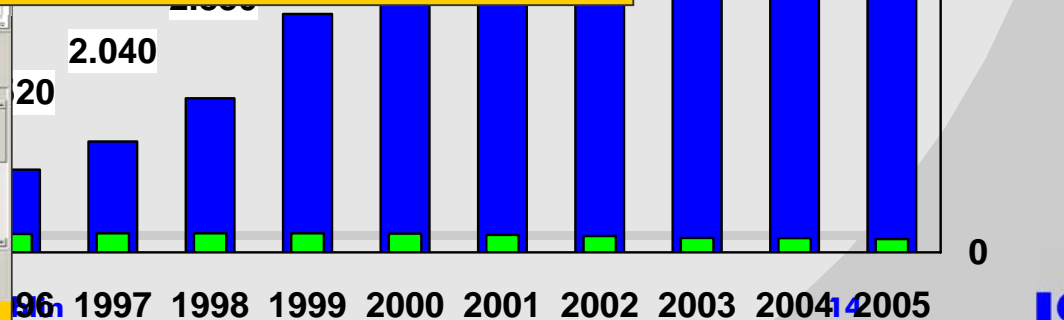
Renewable virtual power plant



Wind farm Cluster Management



Online-Monitoring and Forecast



Datenquelle: ISET, IWET



Tools for system integration of wind power

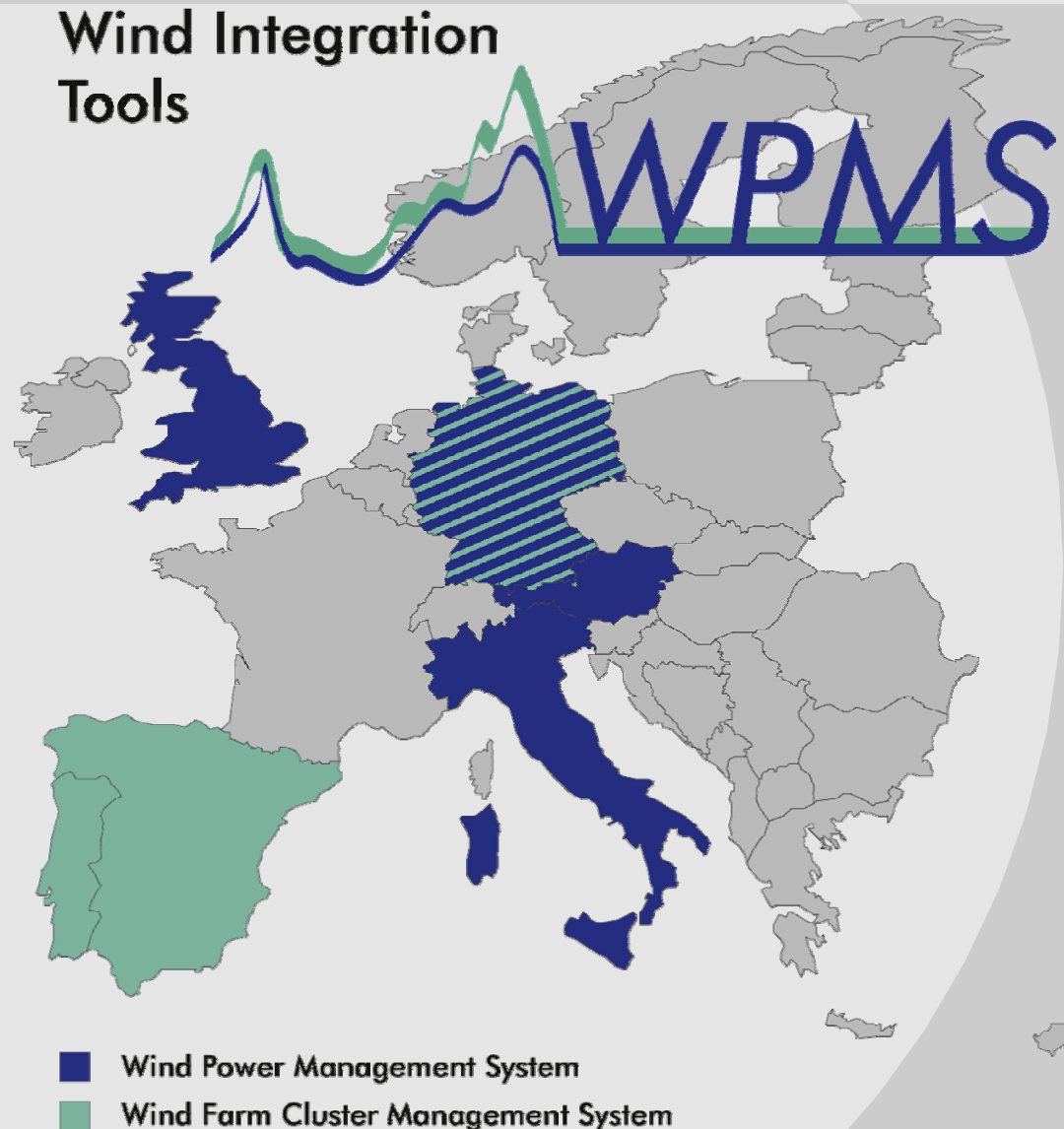
Forecast system WPMS

E.ON Netz,
Vattenfall Europe Transmission,
RWE Transportnetz Strom,
EnBW Transportnetze,
Verbund Austria,
TERNA Italy,
Egypt,
National Grid, Great Britain
Jilin, China

Wind Farm Cluster Management WCMS

Demonstration Projects in
Germany, Spain, Portugal

Wind Integration Tools



New renewable-energy-law (EEG) (start 1.1.2009)

Includes regulation to improve wind integration:

Direct marketing of wind power (§ 17)

- ☐ **Wind farm operators can opt to sell the power on the market (i.e. EEX) instead of selling for the fixed feed-in tariff**
- ☐ **Decision has to be taken one month ahead and for a complete month**

Reimbursement for power management by TSO (§§ 11, 12)

- ☐ **In case of power generation (RES) above grid capacity or demand DSO/TSO is allowed to regulate the generation (§ 11)**
- ☐ **Prevented power generation from RES is to be paid (§ 12)**

Bonus for system services of wind power plants (§§ 29, 66)

- ☐ **Bonus for system services (compliance with new grid code)**
- ☐ **0,5 €ct/kWh for new / 0,7 €ct/kWh for old wind power plants on top of feed-in tariff for 5 years**

Bonus for improved system integration (§ 64)

Bonus for improved system integration (§ 64)

Financial incentives to improve system integration

Rules still to be defined:

- ☐ **most likely: market integration bonus to cover risks of direct marketing (low prices, fluctuating generation)**
- ☐ **if necessary: system integration bonus for RES producers**
 - ☐ **Reducing grid bottlenecks**
 - ☐ **Adapting power generation to demand**



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**Thanks for
your attention!**

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