Current grid integration of wind turbines and remaining challenges

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Overview

- ENERCON Wind Energy Converter Concept

- ENERCON Control Features supporting the Grid

- Further Challenges on the way to full grid integration

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Power Plant Character of Wind Energy Converters contributes to grid stability

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WECs with power plant character

Wind energy converters

380 V

Centre of gravity earlier:
Grid compatibility

Transmission substation

Service-centre

DFÜ — ENERCON

Leit-technik — Owner (P, Q)

EVU — Grid
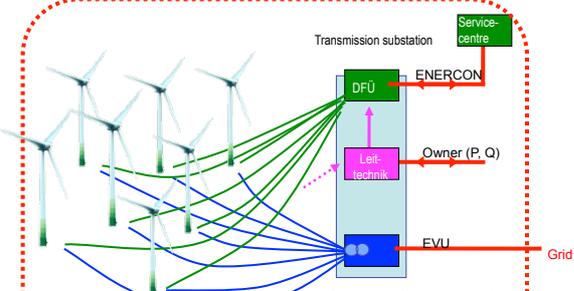
Centre of gravity today:
•Wind farm performance controllable

•Collective operation control for wind farms in different regions

•Combination with other power plant types (e.g. hydropower)

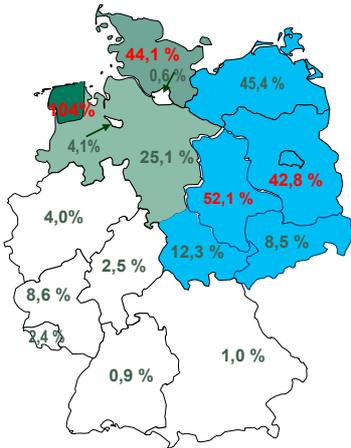•Generation of positive and negative reserve power, where needed (Ireland)

Energy demand

Time

3

Limits to Wind Energy in the Grid?

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44,1 %
0,6 %
45,4 %
4,1 %
25,1 %
42,8 %
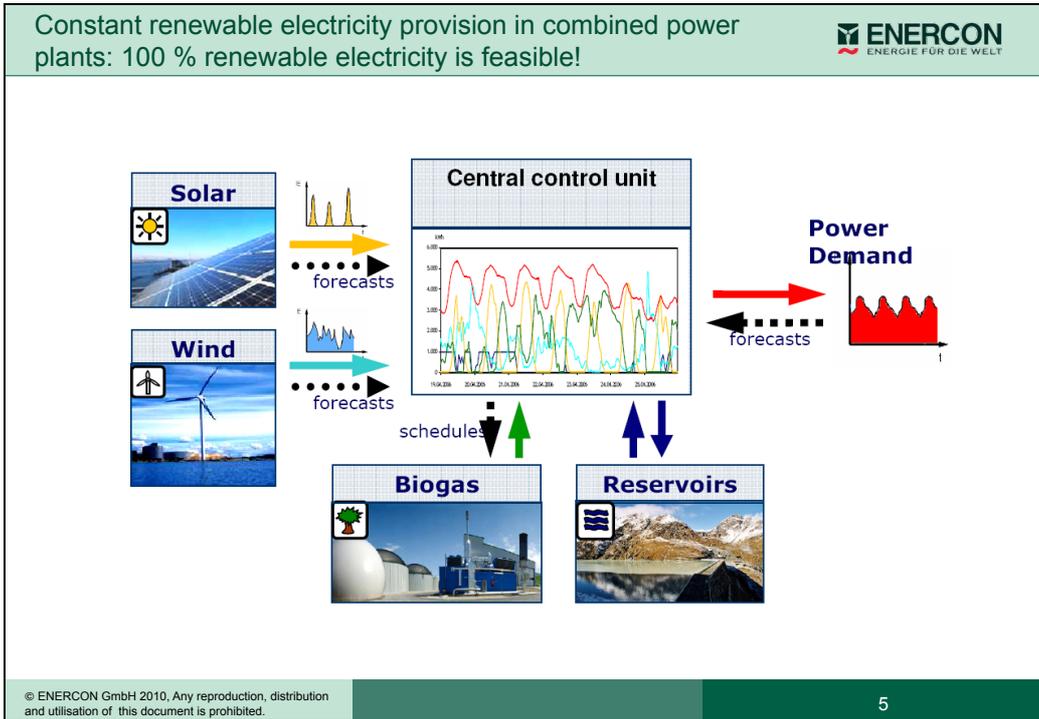4,0 %
52,1 %
2,5 %
12,3 %
8,5 %
8,6 %
2,4 %
1,0 %
0,9 %

Share of Wind Energy in the electricity consumption of the German counties (Länder) in a year with an average amount of wind using the wind turbines installed until the end of 2010
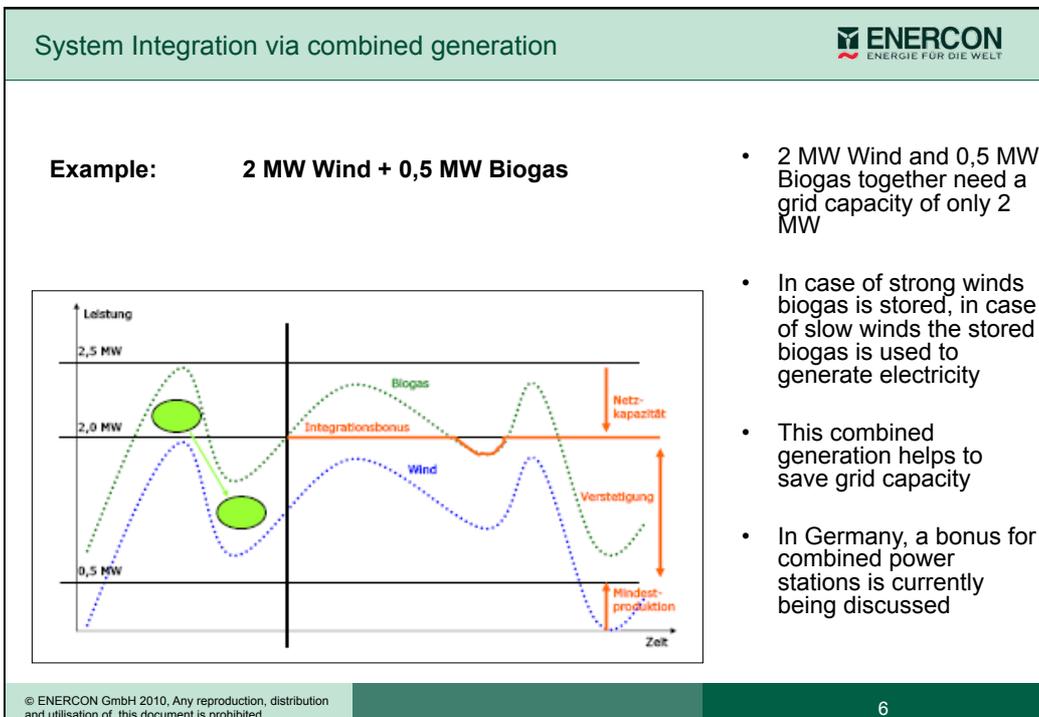
The blue parts show the range of the 50-Hertz-grid

In the future grid extension alone will not be sufficient because too much wind electricity will be produced in the wrong moment.

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Constant renewable electricity provision in combined power plants: 100 % renewable electricity is feasible!

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System Integration via combined generation

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Example: **2 MW Wind + 0,5 MW Biogas**

- 2 MW Wind and 0,5 MW Biogas together need a grid capacity of only 2 MW

- In case of strong winds biogas is stored, in case of slow winds the stored biogas is used to generate electricity

- This combined generation helps to save grid capacity

- In Germany, a bonus for combined power stations is currently being discussed

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Stabilisation of the grid via inertia emulation

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Quelle: EWEC2005/Study on Variable Speed Wind Turbines' Capabilities for Frequency Response

ST1   ST2   HT   Tripped

P_{load}

WF   ST2   HT   Tripped

P_{load}
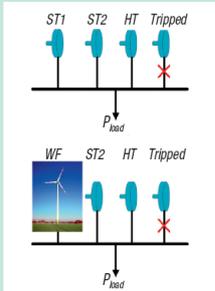
Erzeuger	Massenträgheit	
ST1 = Dampfturbine (100 MVA)	H=3,5	Summe
ST2 = Dampfturbine (150 MVA)	H=6	Nennlast =
HT = Wasserturbine (50 MVA)	H=5	250 MW
Tripped = Ausfall von 50 MW	-	
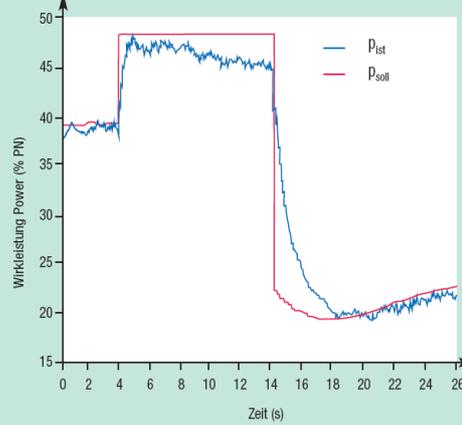
Abb. 1: Ein 100 MVA-Windpark mit einem Wirkungsgrad von 30 % könnte bei einer plötzlichen Abschaltung von 20 % Kraftwerksleistung am Netz die Massenträgheit von ST1 (H = 3,5) ersetzen.

Abb. 2: Beispielmessung des Wirkleistungsverlaufs einer WEA mit Inertia Emulation.

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Summary

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- ENERCON's intelligent and flexible grid management system provides an occasion to integrate high shares of wind energy into the grid
- Nevertheless, further grid extension is needed
- Incentives are needed for system integration of renewable electricity generation
- On the longer run further technical features like inertia emulation will be needed

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Many thanks for your attention!

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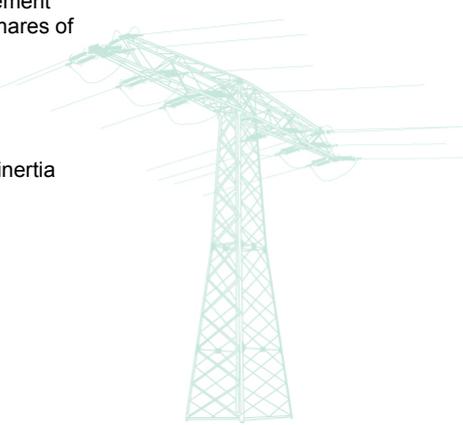
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