

# Key Note: Renewable Integration in Japan 2030

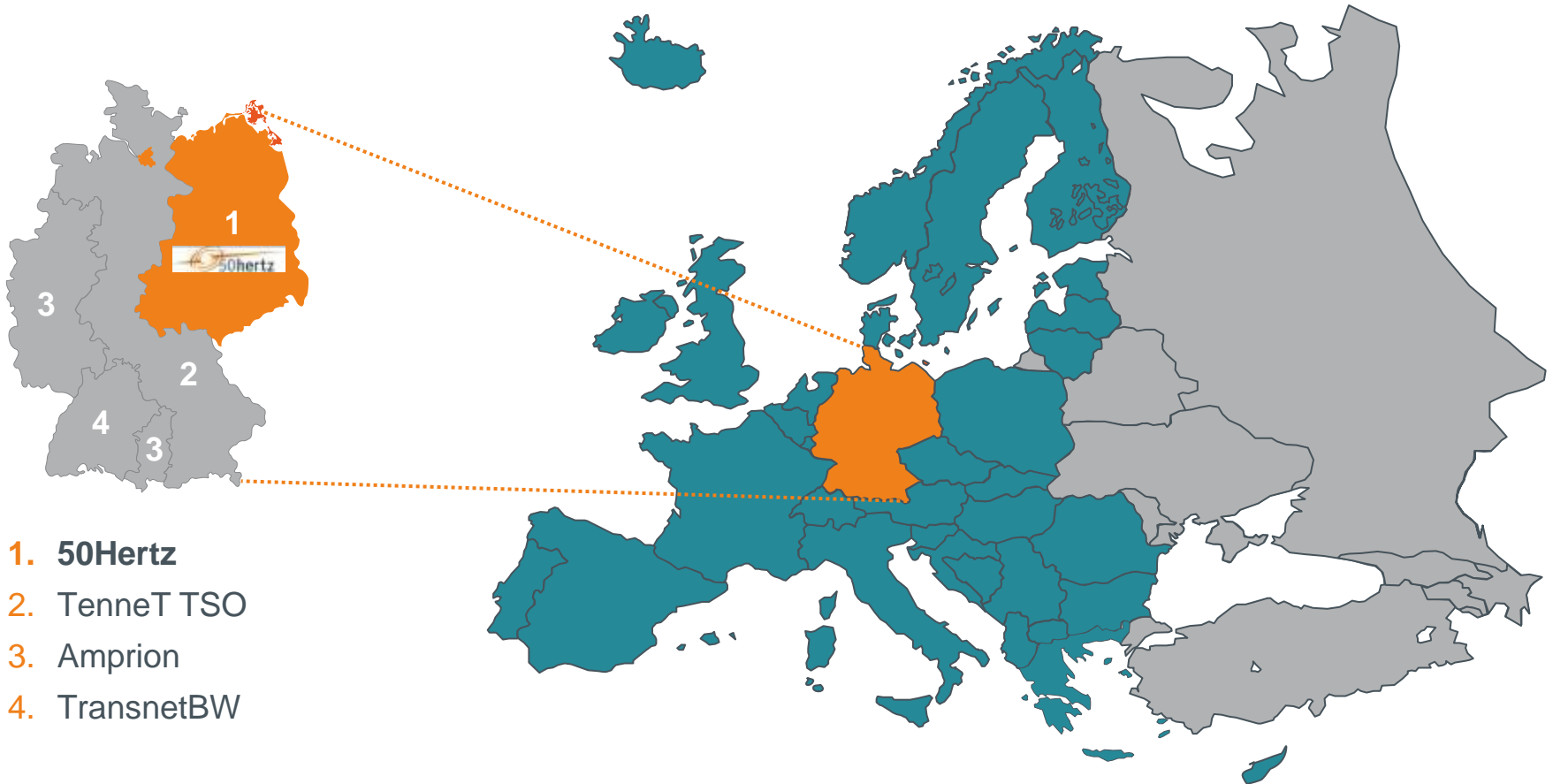
Lessons Learned from the German Energy Transition



2018/17/12  
Gunter Scheibner

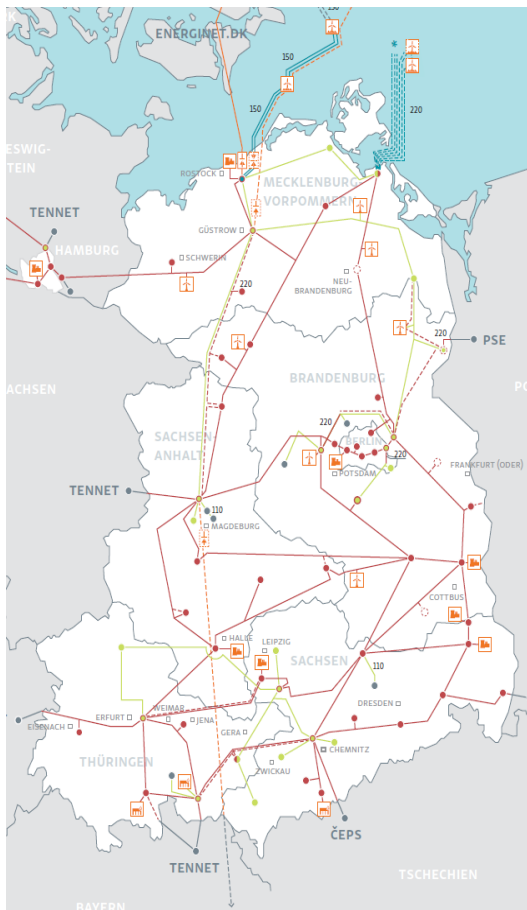
Ensuring quality and security of supply under high shares of renewable energies is possible

# 50Hertz as part of the interconnected European Electricity System



1. 50Hertz
2. TenneT TSO
3. Amprion
4. TransnetBW

# 50Hertz at a glance

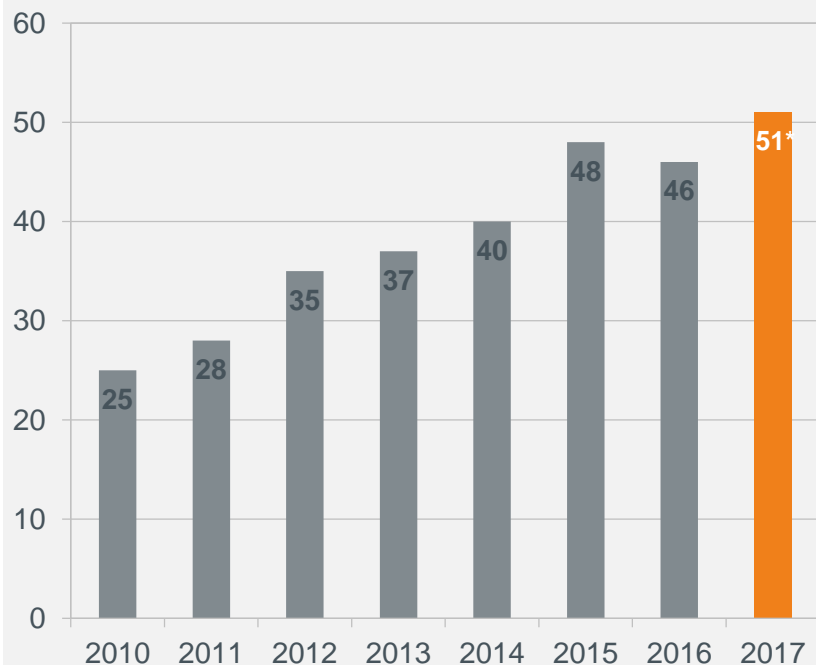


	2010 (share Germany)	2017 (share Germany)
<b>Grid area</b>	109,589 km <sup>2</sup> (~31%)	109,589 km <sup>2</sup> (~31%)
<b>Length of lines</b>	9,800 km (~30 %)	10,200 km (~30 %)
<b>Max. load</b>	~ 17 GW (~20 %)	<b>~ 16 GW (~20 %)</b>
<b>Power consumption</b> (based on electricity supplied to end-consumers in acc. with Renewables Energy Law „EEG“)	~ 98 TWh (~20 %)	<b>~ 96 TWh (~20 %)</b>
<b>Installed capacities</b> - of which Renewables - of which Wind	38,354 MW (~35%)* 15,491 MW (~30%)* 11,318 MW (~40%)*	54,069 MW (~26%)* <b>31,177 MW (~30%)*</b> <b>18,556 MW (~34%)*</b>
<b>RES share in power consumption</b>	~ 25 %	<b>53.4 %</b>
<b>Turnover</b> - of which Grid	5.6 bn. € 0.6 bn. €	9.9 bn. € 1.3 bn. €
<b>Employees</b>	643	1,043

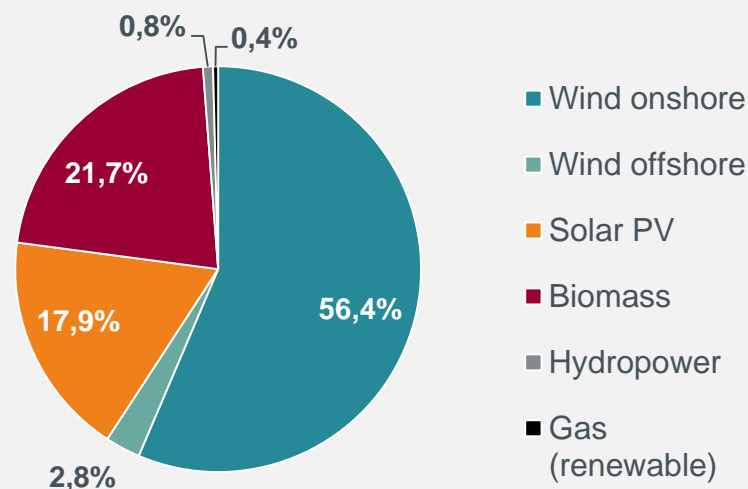
Source: 50Hertz; \*preliminary data; as of 06/03/2018

# Feed-in of renewable energies within the 50Hertz grid area

50Hertz grid area: development of RES feed-in (TWh)

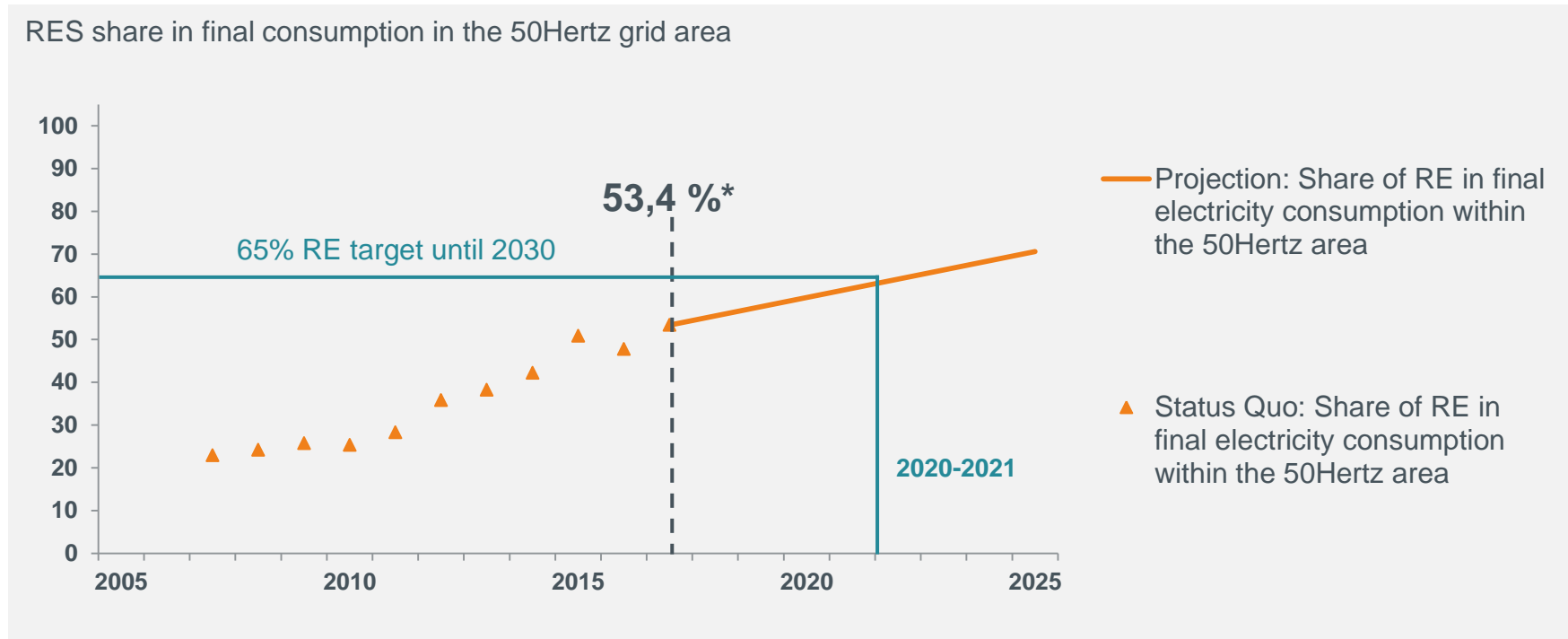


50Hertz grid area: composition of RES feed-in (2017, in %)



Source: 50Hertz; \*preliminary data, as of 03/01/2018

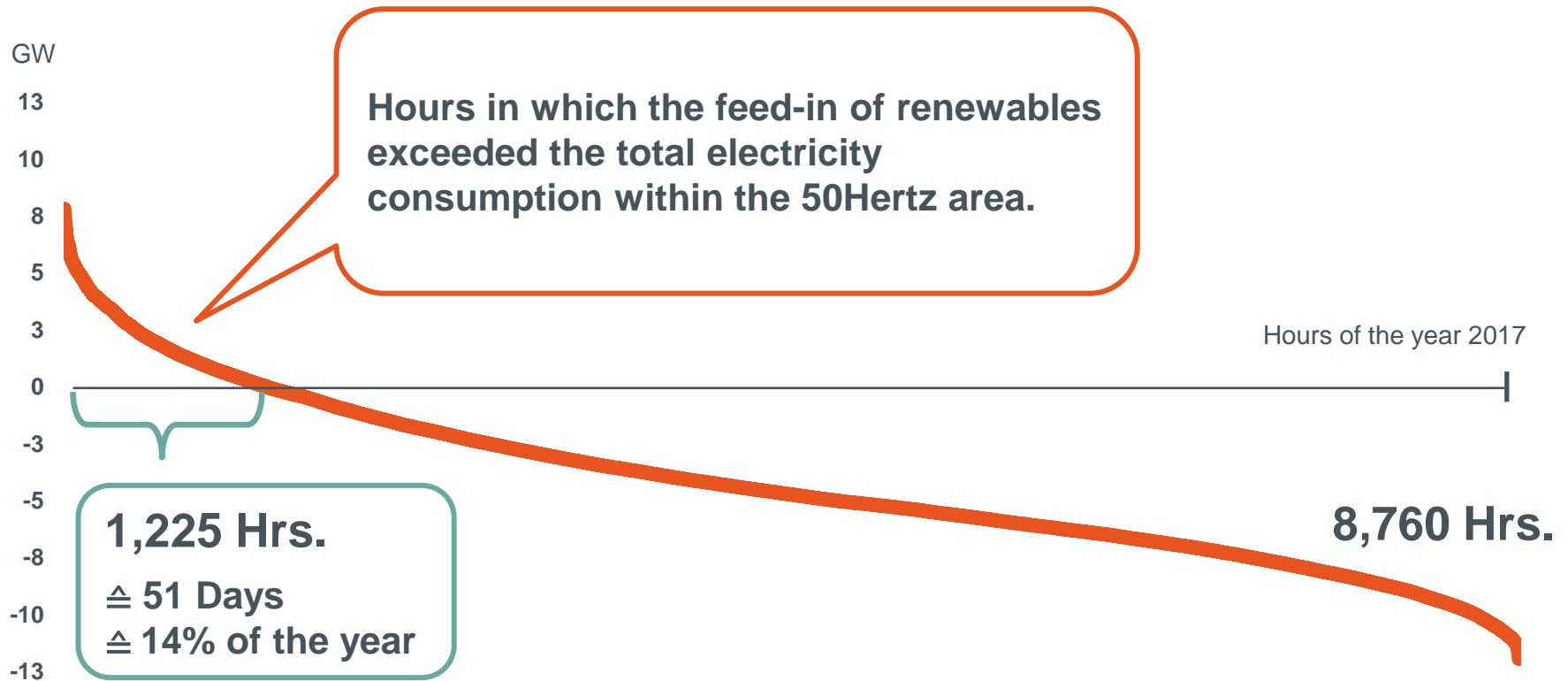
# Increasing feed-in of RES



Source: 50Hertz, \*preliminary data; as of 31/12/2017

The grid area of 50Hertz is a frontrunner in Germany and Europe in integrating renewables while maintaining high levels of supply security.

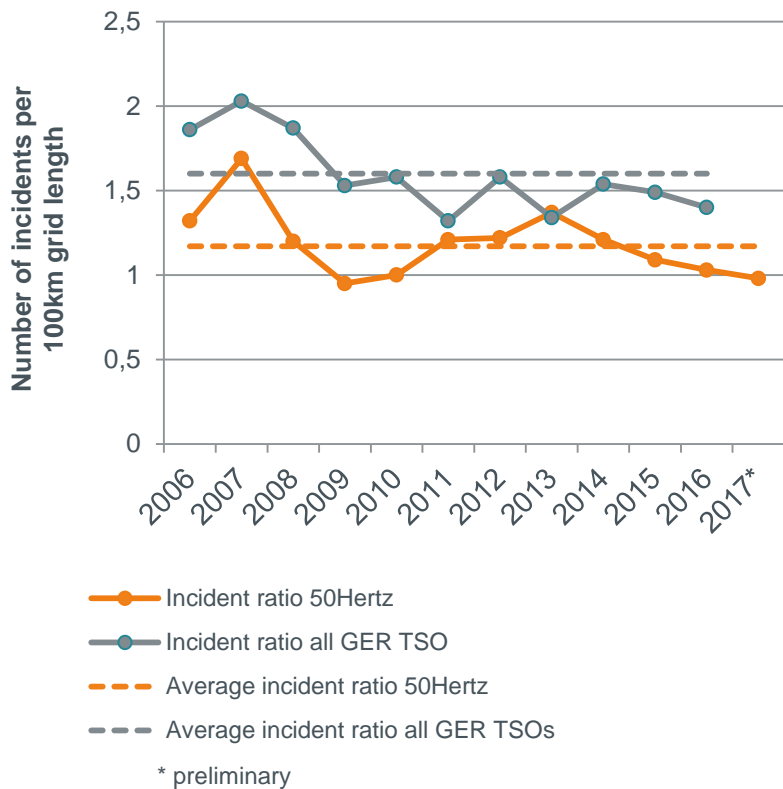
# Fulfilment of demand by renewable energies



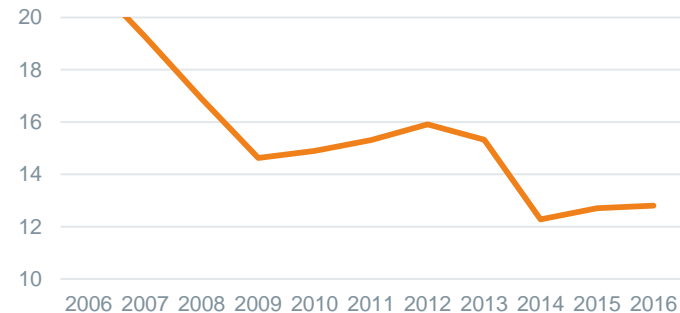
**In 2017, the feed-in of renewable energies exceeded total electricity consumption on 51 days.**

# The 50Hertz grid area proves that a combination of high share of RES and high quality of supply is possible

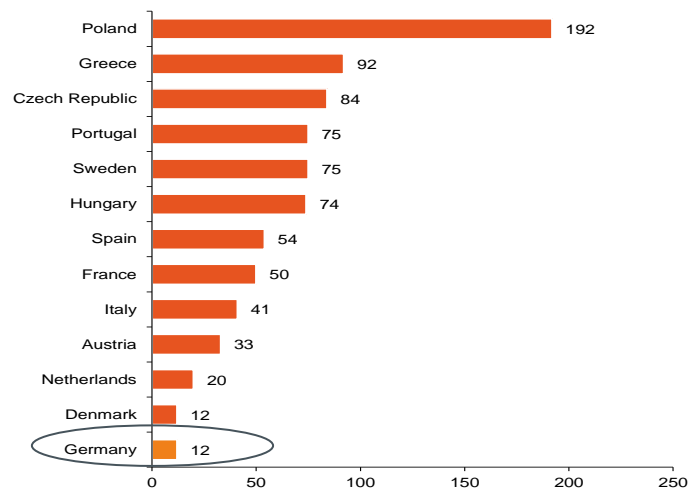
**UHV INCIDENT RATIO OF 50HERTZ IN COMPARISON WITH GERMAN TSOs**



**SAIDI<sup>(1)</sup>**



**SAIDI EUROPEAN COUNTRIES IN 2014**

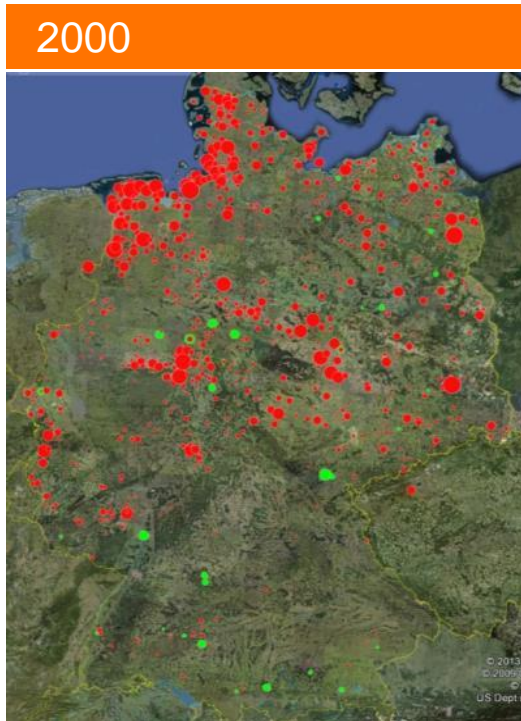


<sup>1</sup>System Average Interruption Duration Index in minutes  
Source: Bundesnetzagentur (BNetzA)

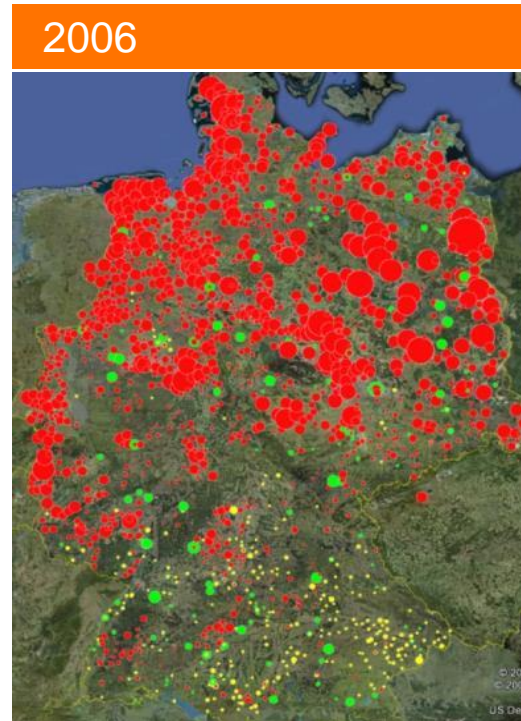


# RES development in Germany

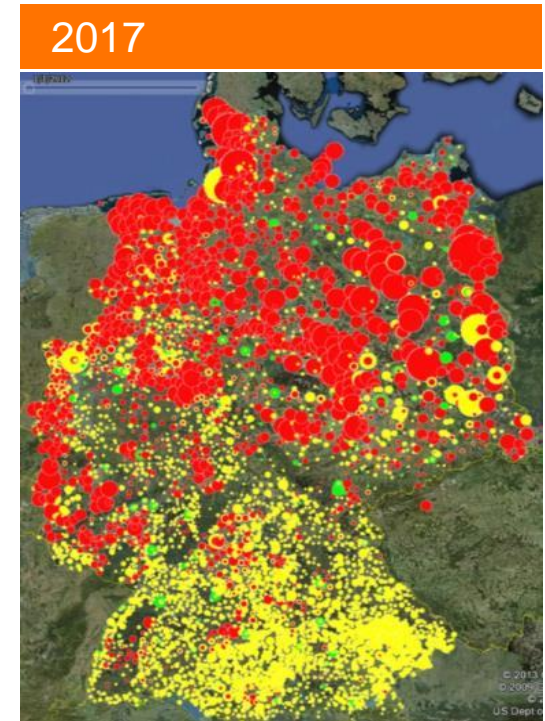
Area proportional to the installed capacities



- ~ 30,000 plants
- 1,665\* MW inst. wind in Germany



- ~ 221,000 plants
- 2,233\* MW ins. wind in Germany

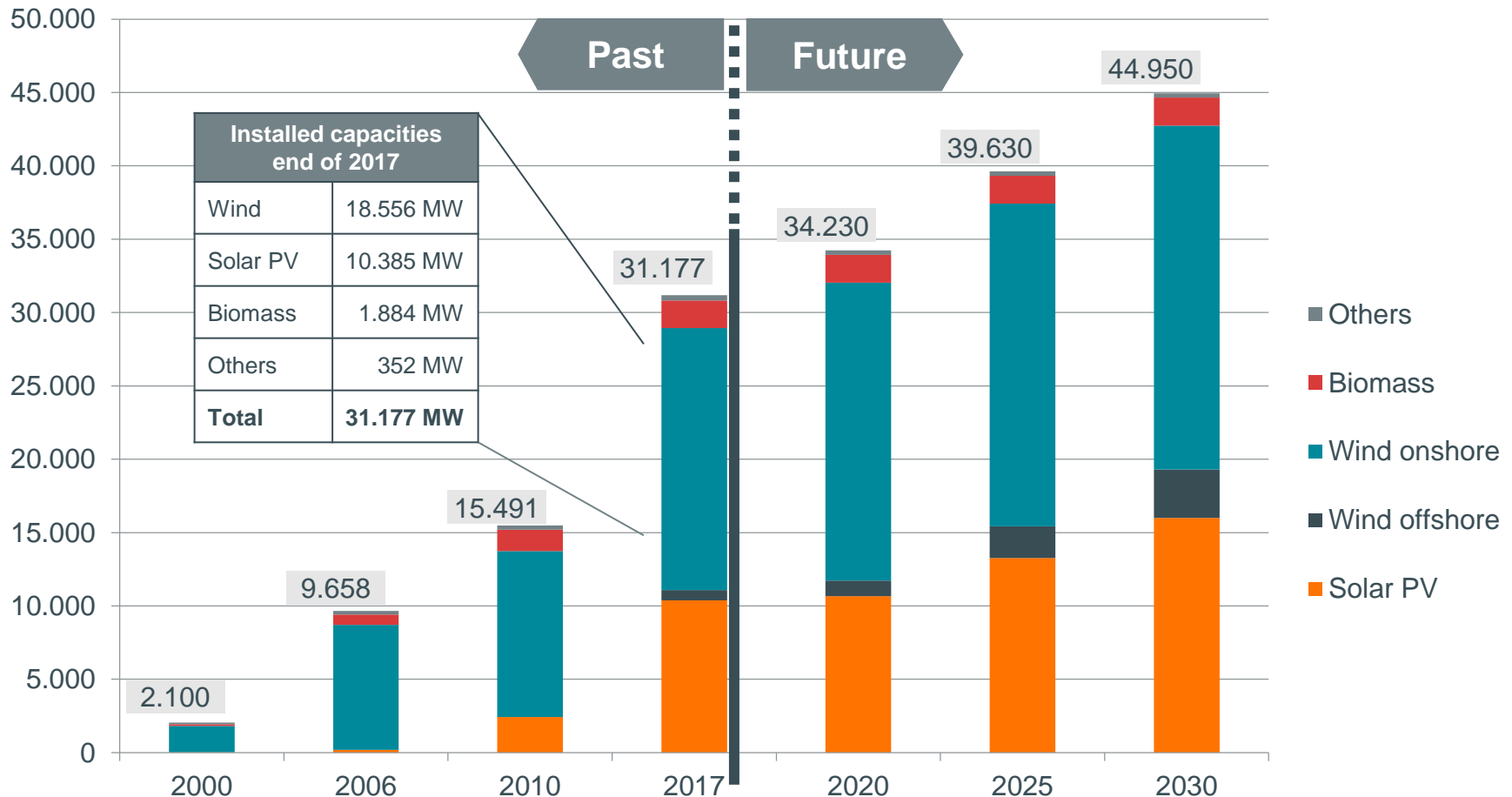


- > 1,600,000 plants
- **49,628\* MW inst. wind in Germany**
- **42,980\* MW inst. PV in Germany**

**The implementation of the German Renewables Energy Law (EEG) led to a massive growth of RES in Germany.**

# RES in the 50Hertz grid area: Present situation and forecast of installed capacities

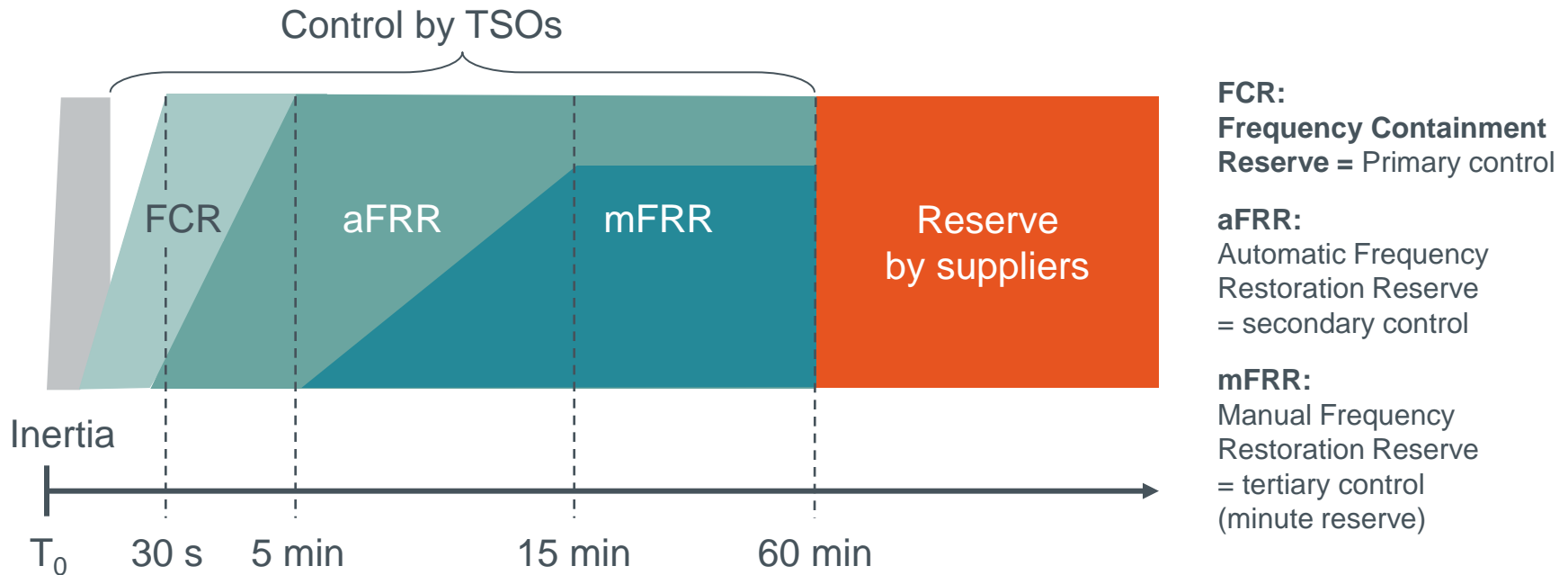
Installed capacities in MW



Source: 50Hertz; \*preliminary data; as of 06/03/2018

# Efficient use of ancillary services serves as an enabler for renewable integration

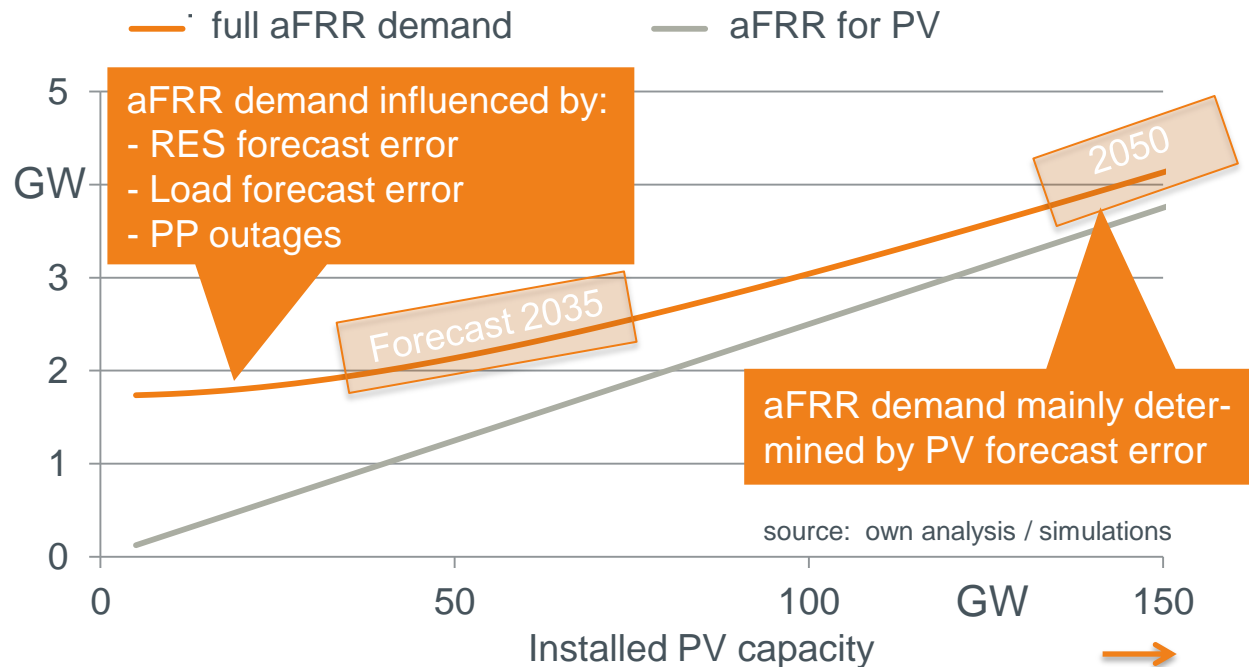
# Three control power types exist to keep frequency at 50 Hz



No need so far to significantly change control power products since control power prices have steadily decreased in last years.

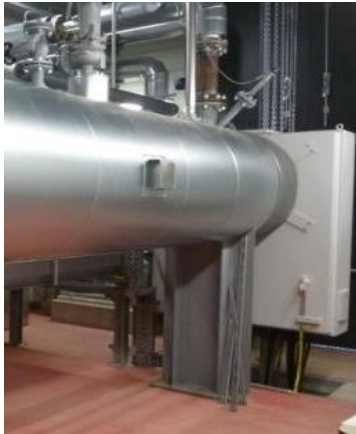
# Future development of control power capacities depends on installed volatile RES

## ➔ Dependency simulation of the aFRR-needs and installed PV



**Without significant higher and more extensive involvement of RES and demand surces future control power needs can not be met.**

# Examples of new of control power providers



- Three electric boilers prequali-fied for **secondary control** (aFRR) provision
- Up to **10 MW** aFRR
- Start of aFRR marketing in December **2013**



- Battery Technology: Lithium-Ion Sodium-Sulphur
- Power: 1 MW
- Capacity: 6.2 MWh
- Commissioning: **01/2012**
- Usage: **primary control** (FCR)



- Project of LichtBlick Energie und Innovation GmbH and German TSOs
- Start in 2014 with **5 MW secondary control** (aFRR)
- **up to 100 MW** aFRR possible
- Utilisation of storage potentials of the so-called "Home power plants"



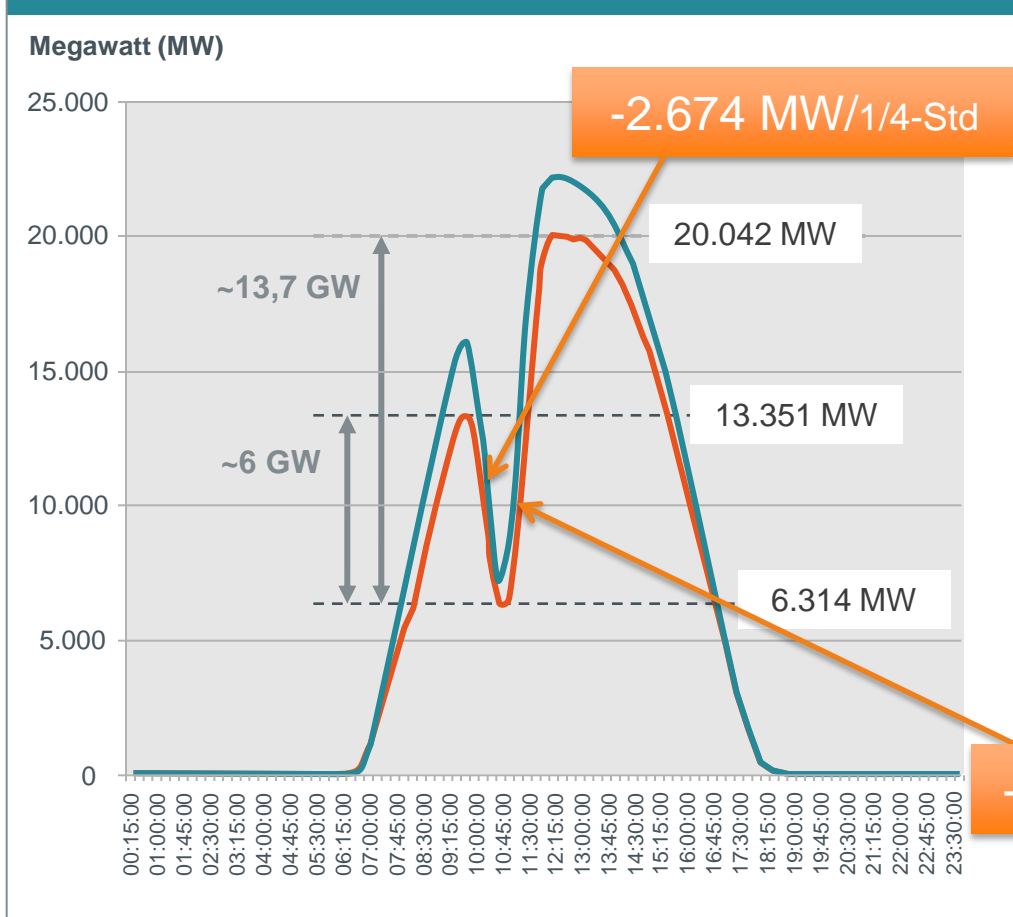
- Provision of **30 MW primary control** by TRIMET Aluminium AG via aluminium electrolysis
- Start of FCR marketing in **2011**



Currently are 7.709 RES-Units of 34 different owners prequalified for negative mFRR

# Solar eclipse 2015 March 20 – No Problem

## PV-forecast – Live extrapolation Germany



### Lessons learned:

- The market products developed and introduced in the last years worked properly
- TSOs properly secured the system via additional security measures
- Need for increased flexibility shown by this kind of situation as we will face similar needs on a more regular basis in the future

+4.111 MW/1/4-Std

— PV-Kombi, 50Hertz, Dayahead Forecast  
 — PV-Kombi, 50Hertz, Extrapolation

**German TSOs can count on market mechanism for basic balancing.**

# IGCC Cooperation with neighbour TSOs

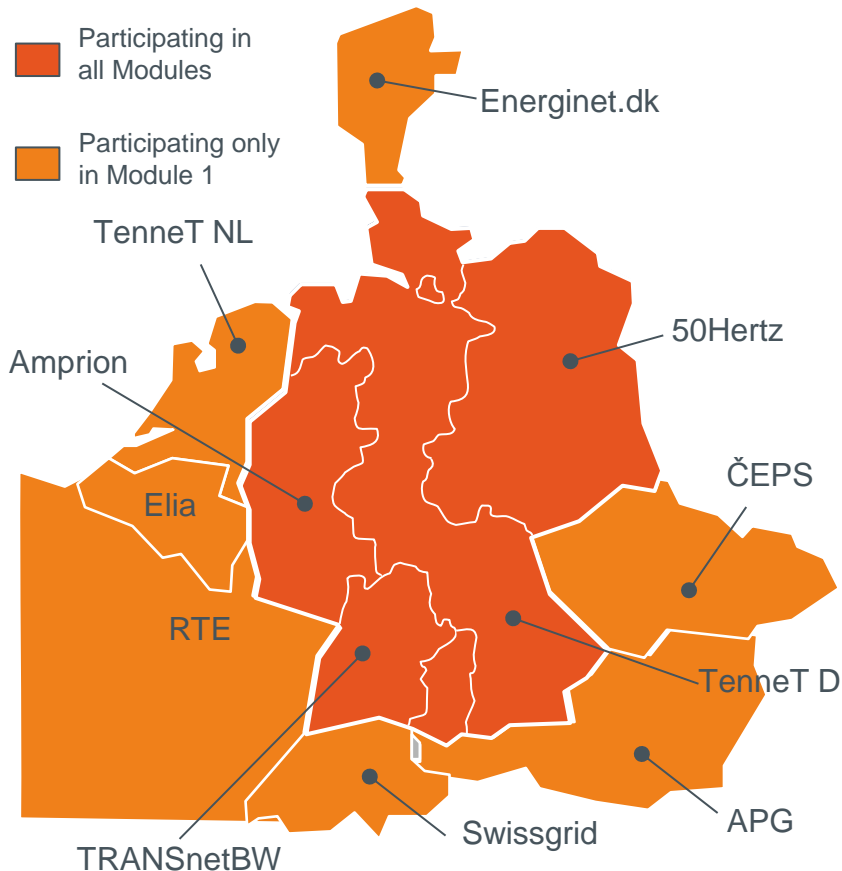
In May 2010, all four German TSOs have launched the so called **Grid Control Cooperation (GCC)** to optimize secondary control procurement and activation.

Many aspects of the GCC system are open for a contribution of TSOs from neighboring countries, so called **International Grid Control Cooperation (IGCC)**.





# International grid control cooperation (IGCC)



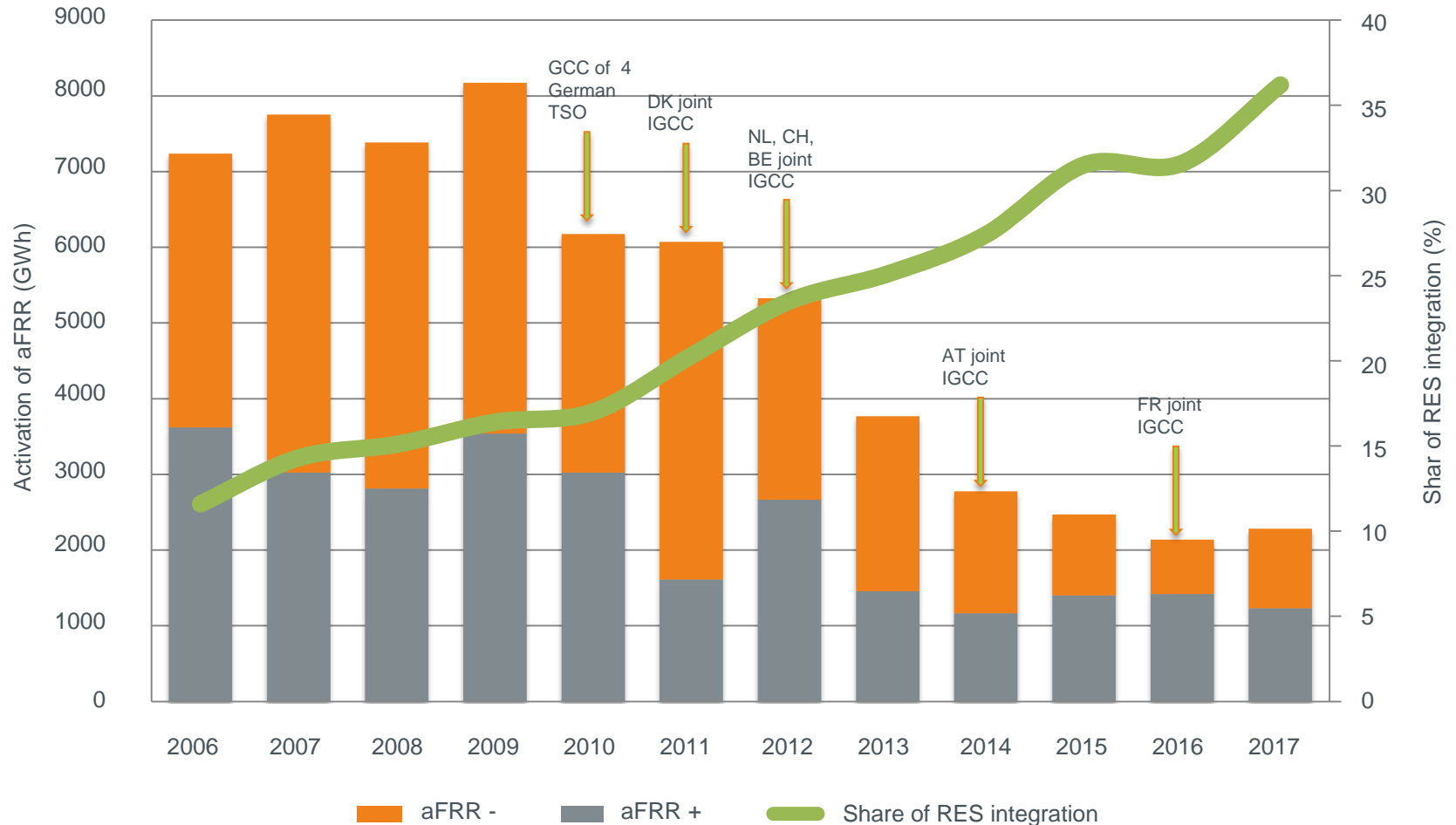
## Grid control cooperation (GCC) functioning in four modules

- **Module 1:** Avoid activation of secondary control power (aFRR) in the opposite direction  
 → reduction of secondary control energy
- **Module 2:** Joint dimensioning and mutual support with secondary control power among participating TSOs  
 → reduction of secondary control power
- **Module 3:** Joint activation procedures: Activation signal will be provided by that TSO where the generator is connected  
 → one common market area
- **Module 4:** Common Merit Order List or common control energy prices  
 → further cost optimization

Technical solution via connection of Load-Frequency Controllers.

# Development Secondary Control Reserve Activation

## Bild noch in besserer Qualität Bereitstellen



# Thank you for your attention!

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