

Facilitating the electricity market by TenneT

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Arnhem, 17 July 2014

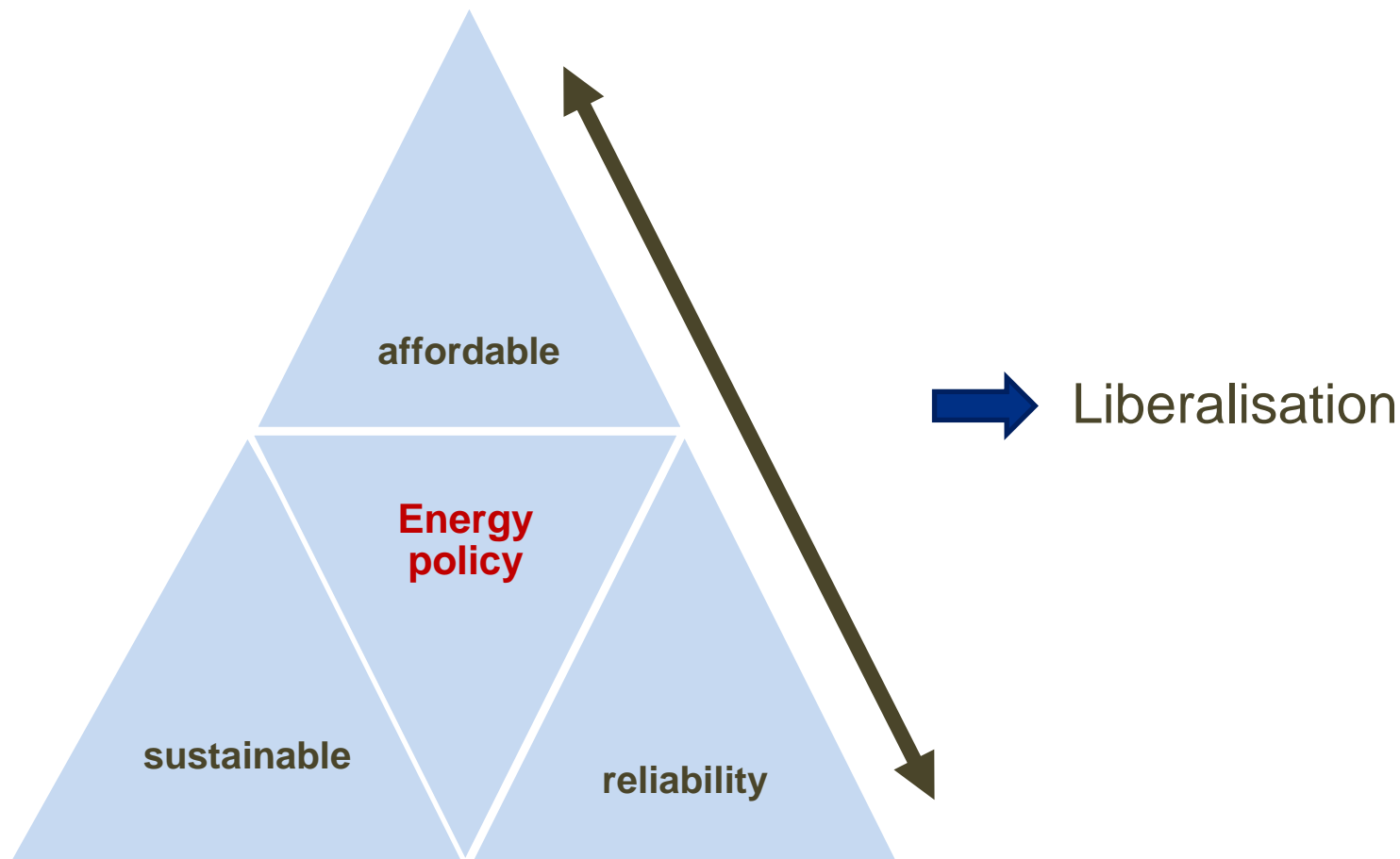


Content

- Cornerstones electricity market
- Balancing the grid
- Market integration
 - Congestion management
 - Cross border capacity allocation → Market coupling
 - Cross border capacity calculation
- Future developments & challenges
 - Integration of Renewable Energy Sources

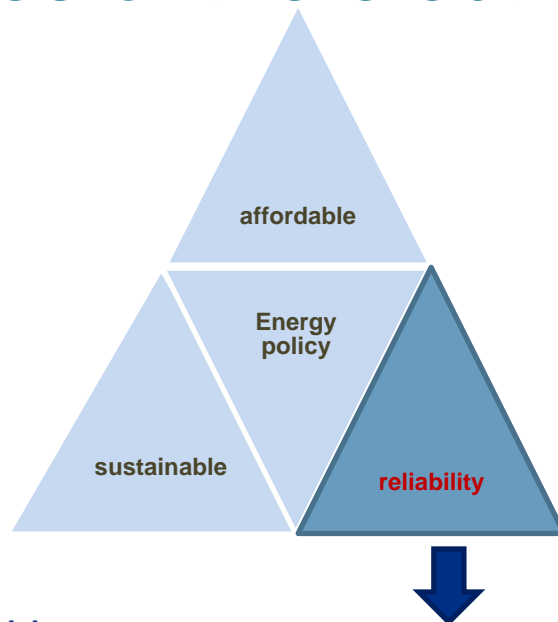
Principles of the electricity market

cornerstones



Principles of the electricity market

role TenneT



● Regulated activities

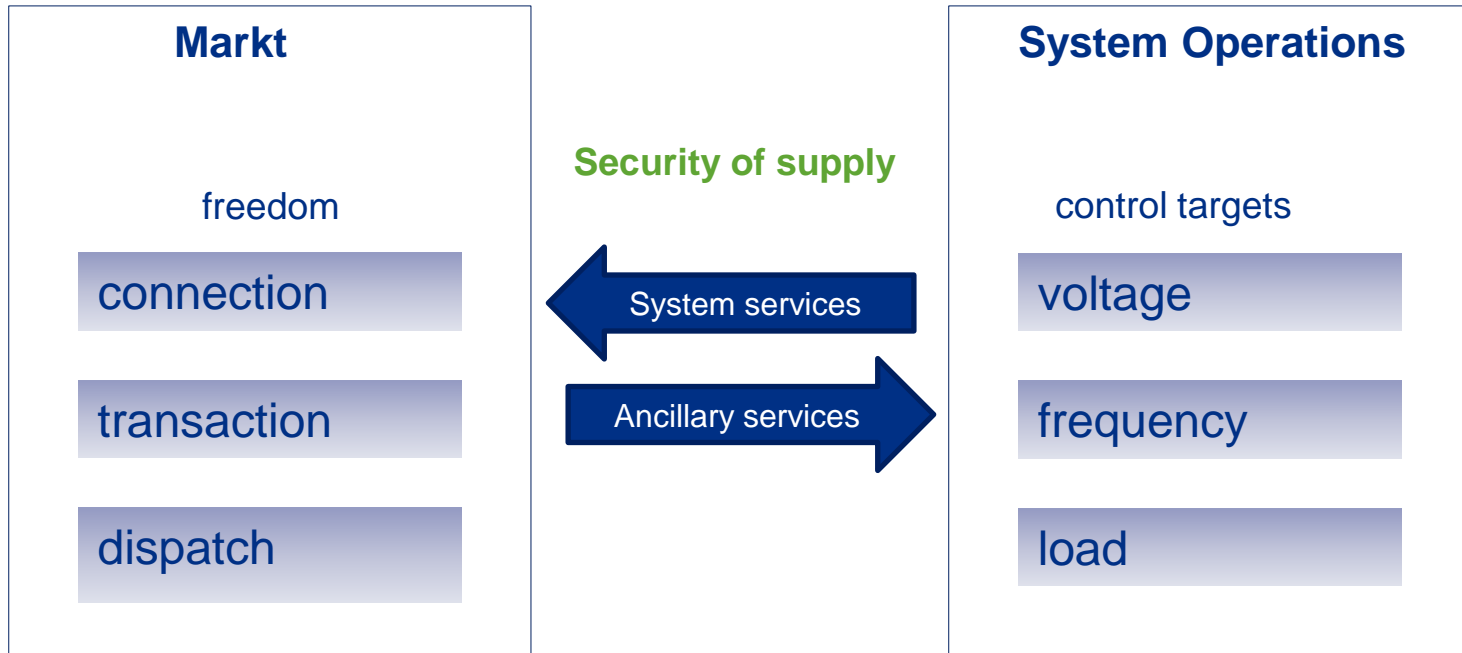
- Transport services:
 - Reliable transmission of electricity
 - (newly)build and maintain electricity grid
- System services:
 - Maintain balance between demand and supply of electricity 24 hours per day, 7 days per week

● Mission TenneT

- Security of supply
- Facilitating renewable targets
- Facilitate (European) market integration

Principles of the electricity market

market design



Freedom of the market is limited by:

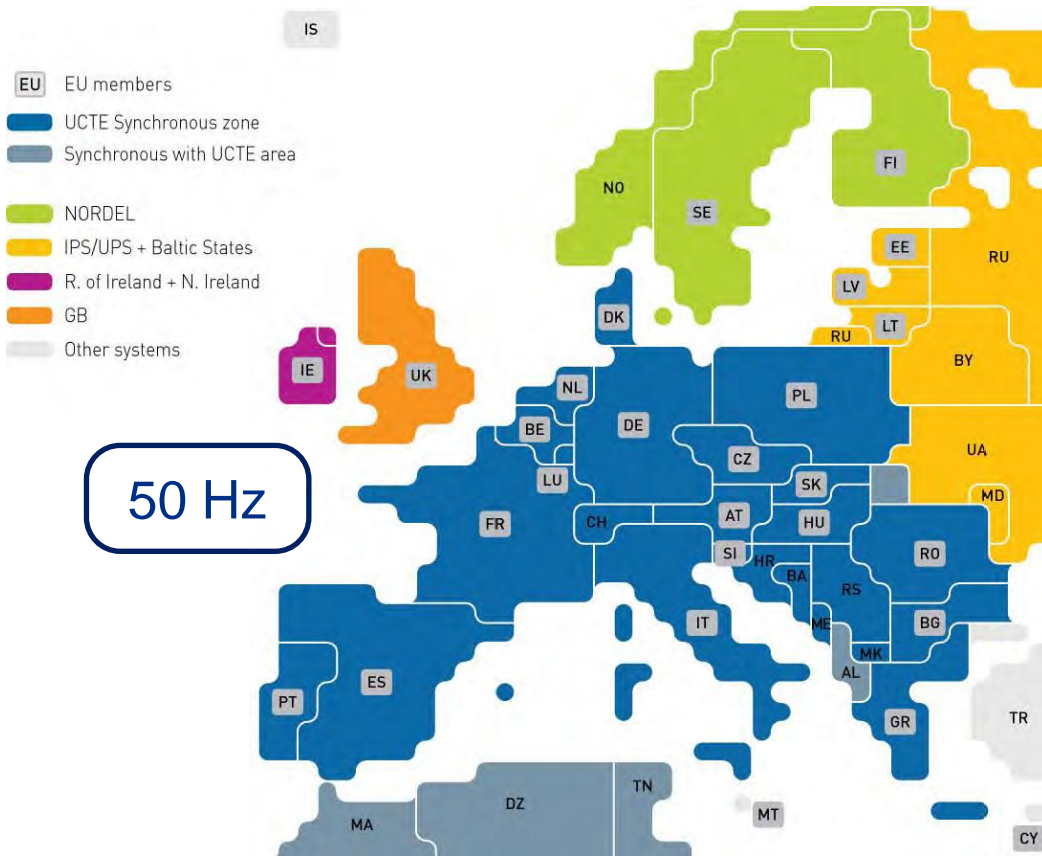
Balancing mechanism

Congestion management
of scarce (cross border)
transmission capacity

Balancing the grid

International

The European meshed grid with synchronous zones



- The Netherlands are part of the meshed grid of continental Europe
- Equal frequency with synchronous zone
- Stability of frequency is joint responsibility between TSO's
- Balancing is organised per control area
- TenneT is responsible for Control Area the Netherlands

Balancing the grid

National cornerstones

1. Program Responsibility

- Each connection is part of the portfolio of a Program Responsible Party (PRP)
- Administrative system to settle market transactions
- Physical net position of a PRP

Imbalance PRP

- Difference in consumption and supply at all connection points in the portfolio of a PRP

System imbalance

- Sum of all PRP imbalance, or: the imbalance of the Dutch control area with it the other control areas in the continental European synchronous system

Balancing the grid

National cornerstones

2. Market for frequency restoration power

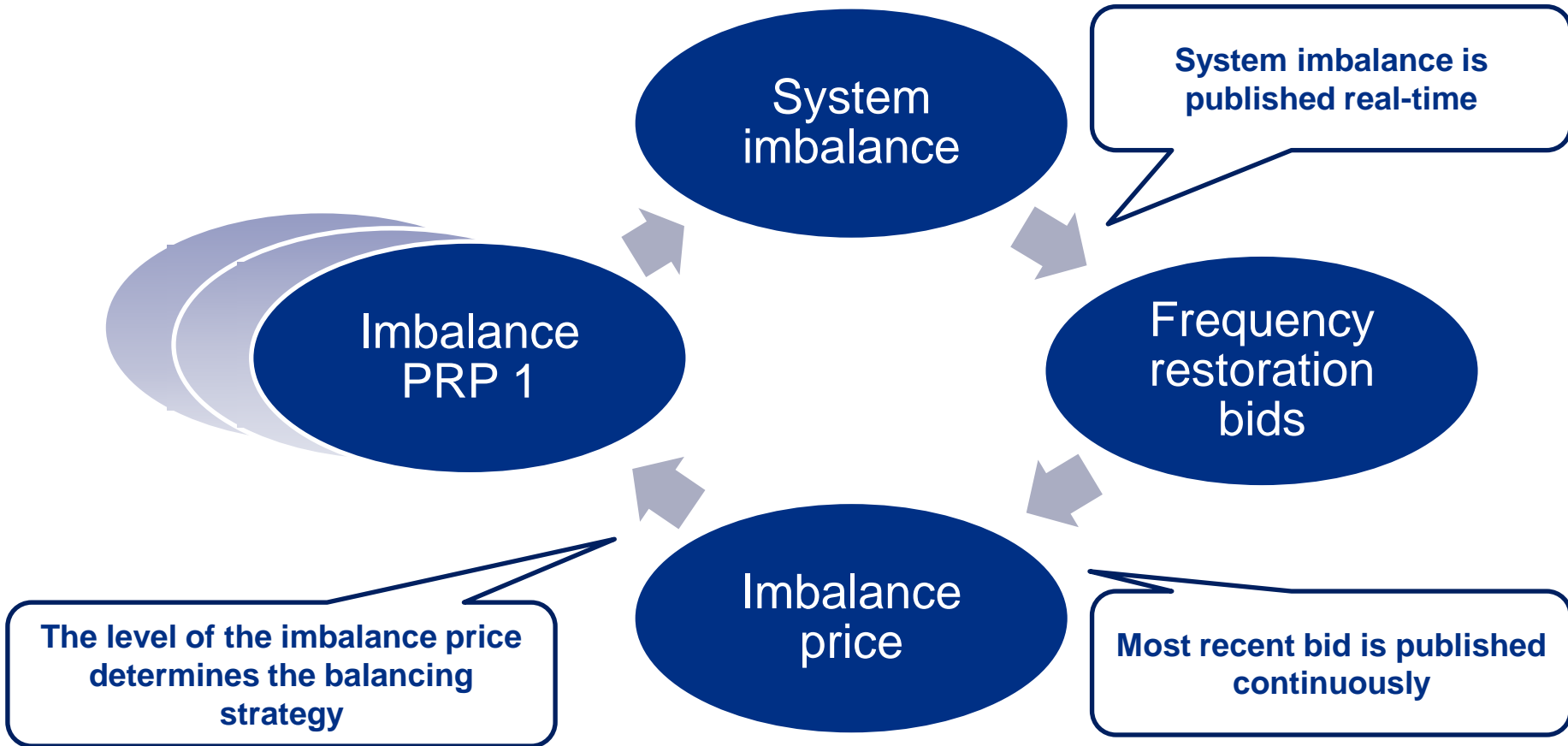
- TenneT is Single Buyer
- Bid and offers of frequency restoration power from the market

3. Settlement of imbalance

- Financial incentive for market to remain in balance, or to assist the system to restore from an imbalance

Balanshandhaving

Incentives



Balancing the grid

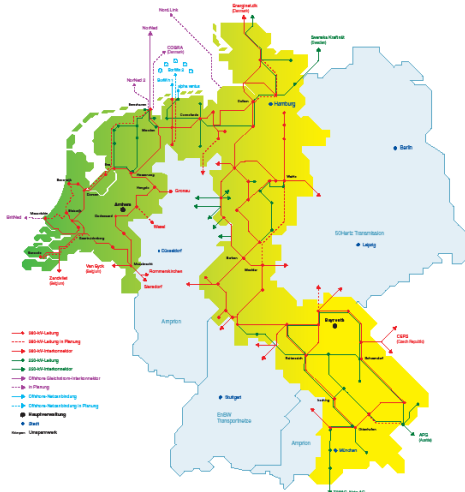
Developments

- International Grid Control Cooperation (IGCC) – to prevent counter balancing actions between Control Areas.
- Integration of European balancing markets is logical next step after the integration of the wholesale markets.
- De EU Network Code on Balancing gives framework for further harmonisation of balancing markets.
- A pilot between TenneT and Elia (Belgium TSO) studies the possibility towards integration and harmonisation of both balancing markets.

Balancing and the realtime balancing market become more and more European

High voltage grid to facilitate the European market

Statnett



nationalgrid
The power of action.



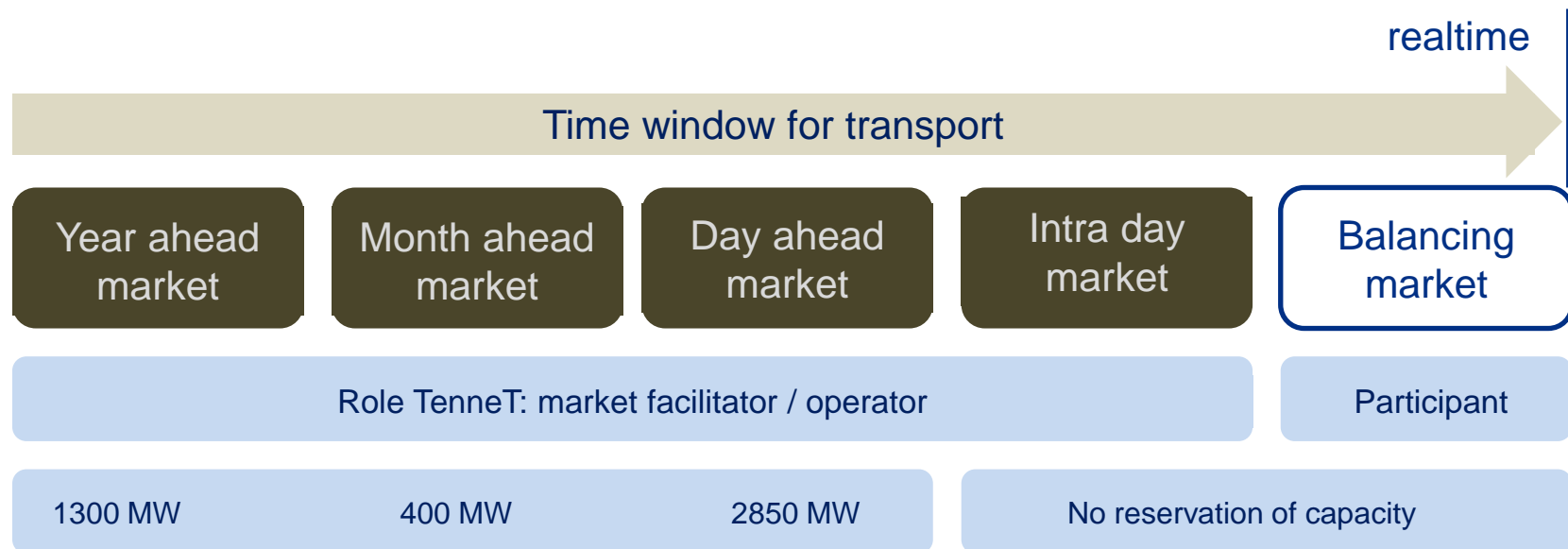
Tennet
Taking power further

amprion

elia

Tennet
Taking power further

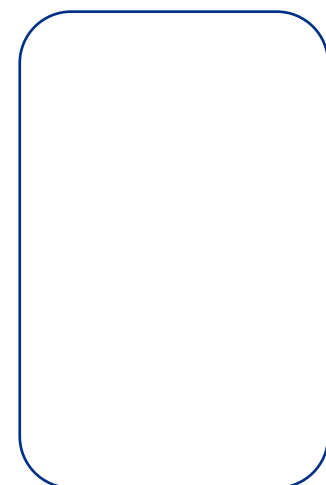
Allocation of cross border transmission capacity



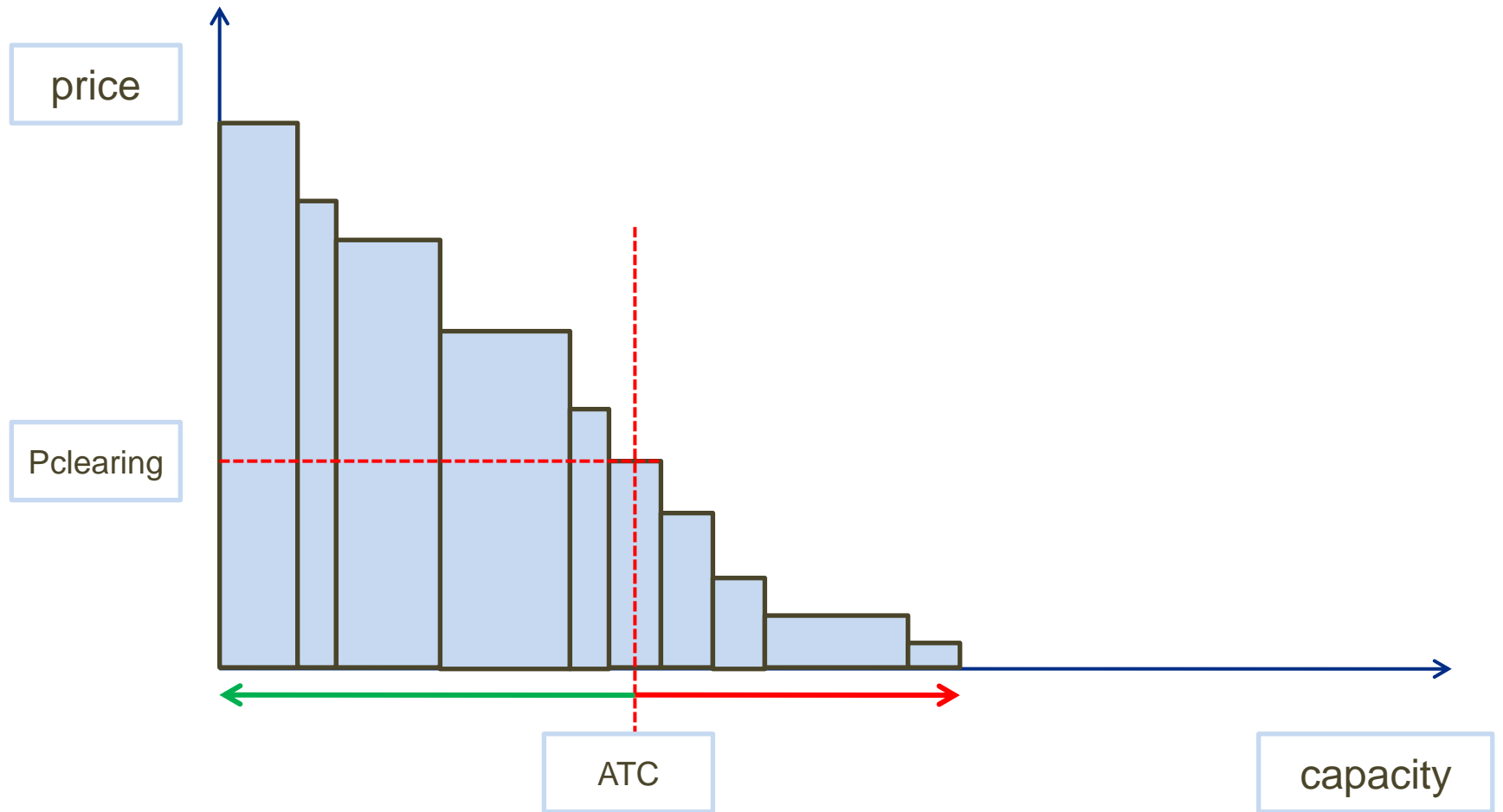
Explicit allocation of capacity by auction in long term markets

Liquid and efficient secondary market

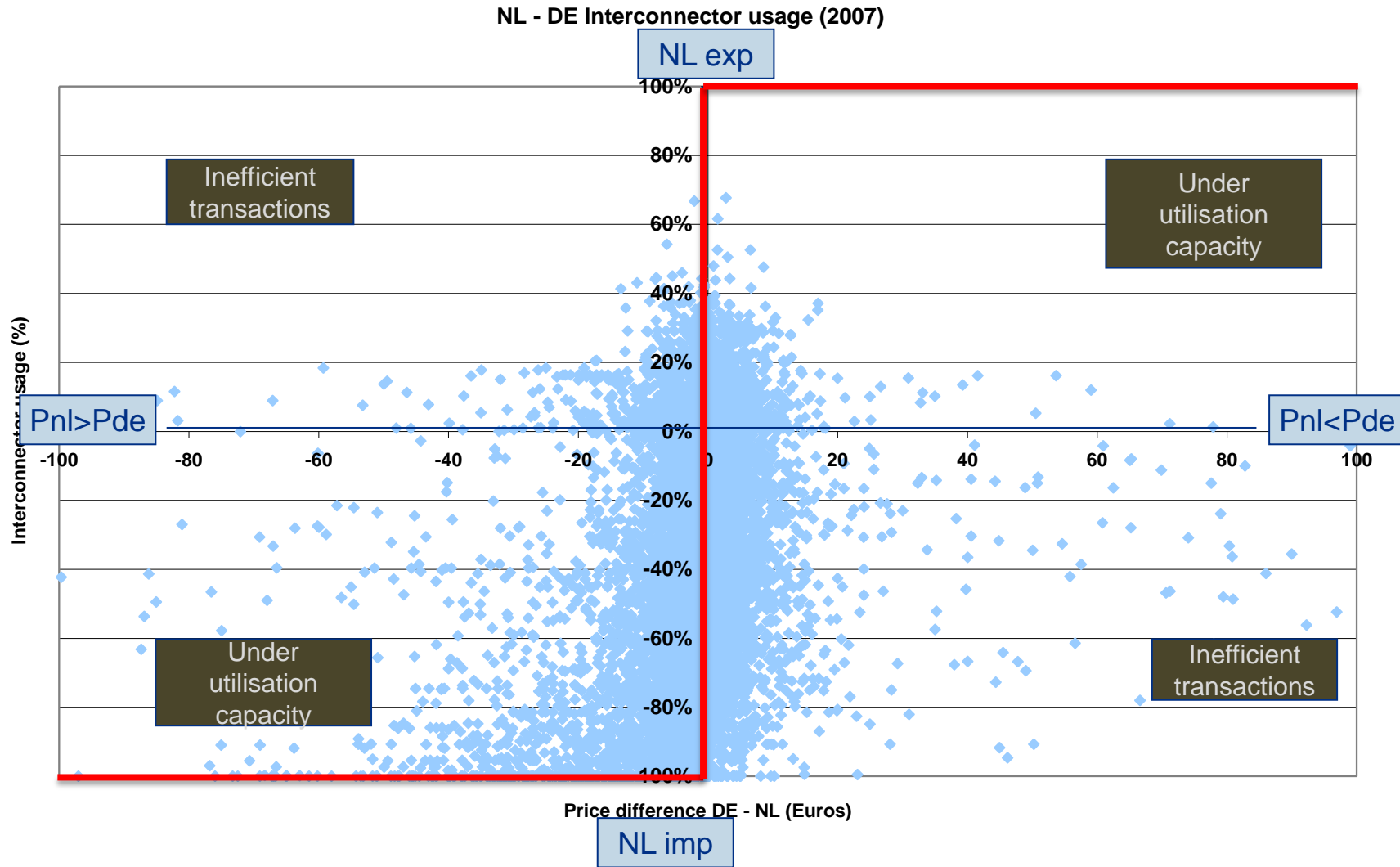
Implicit allocation of capacity. Price coupling in day ahead markets, continuous trade in intra day markets



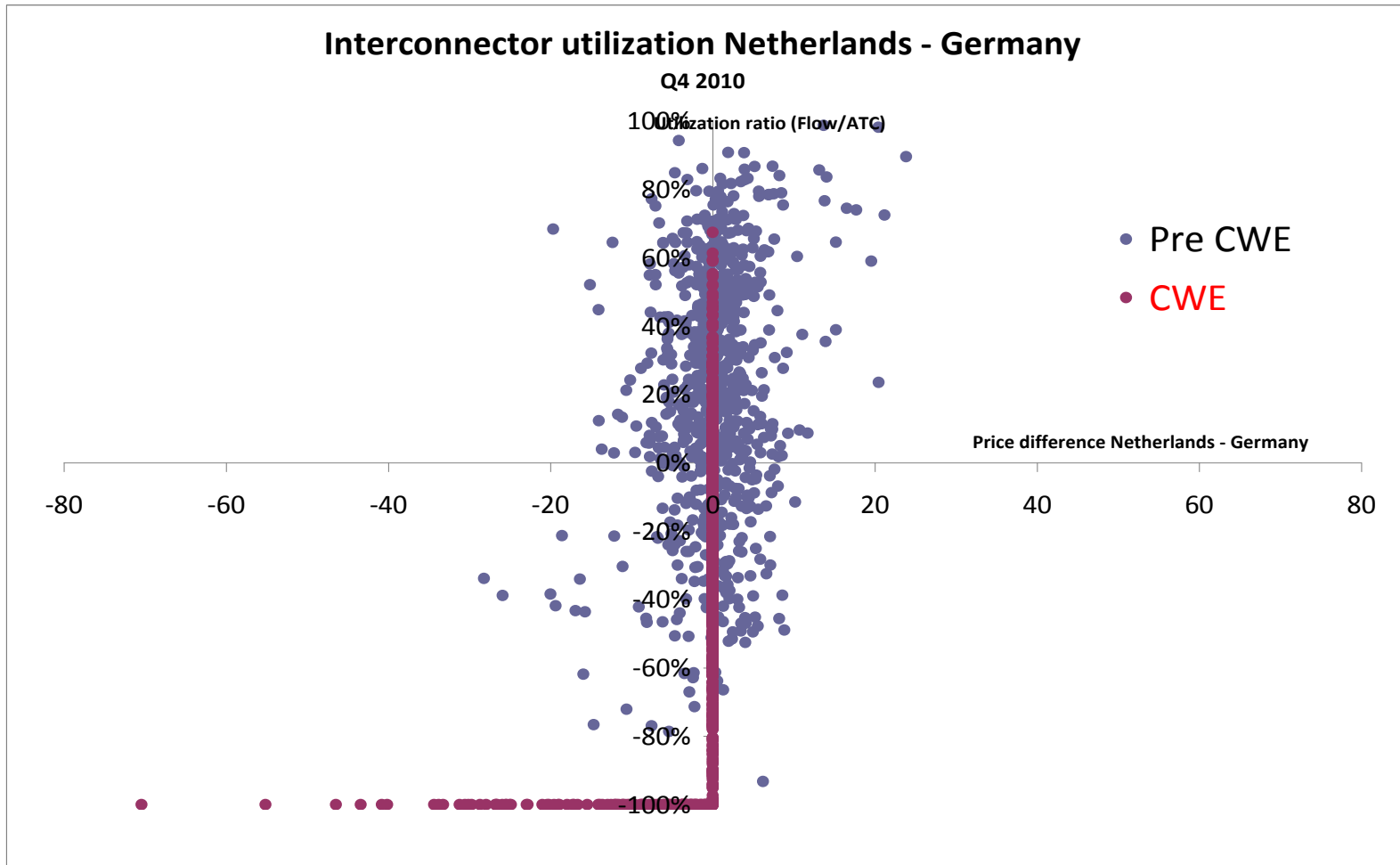
Explicit allocation of cross border capacity: Auction



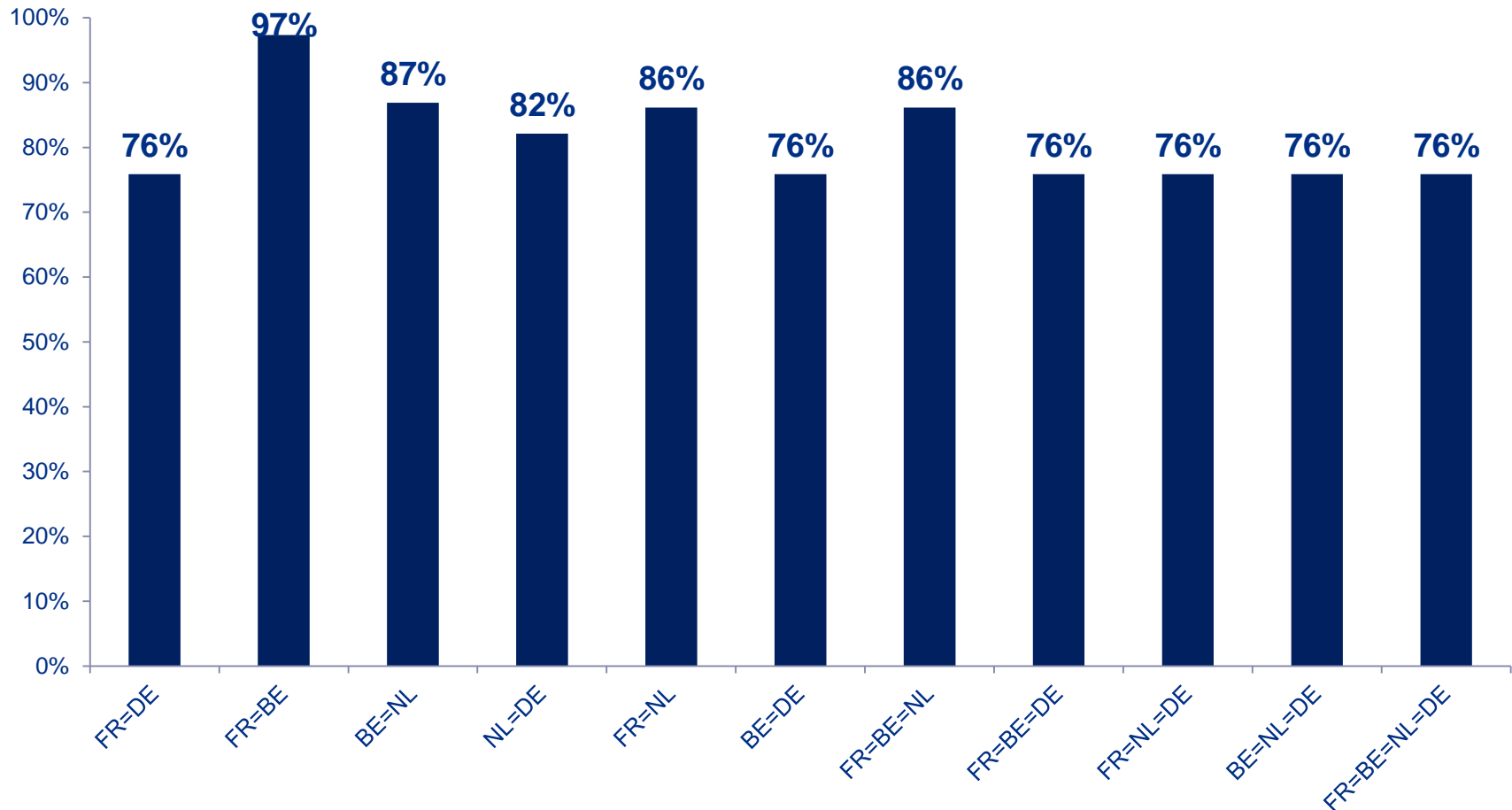
Limitations of explicit auction at day ahead



Resultats implicit auction CWE region: utilisation of cross border capacity



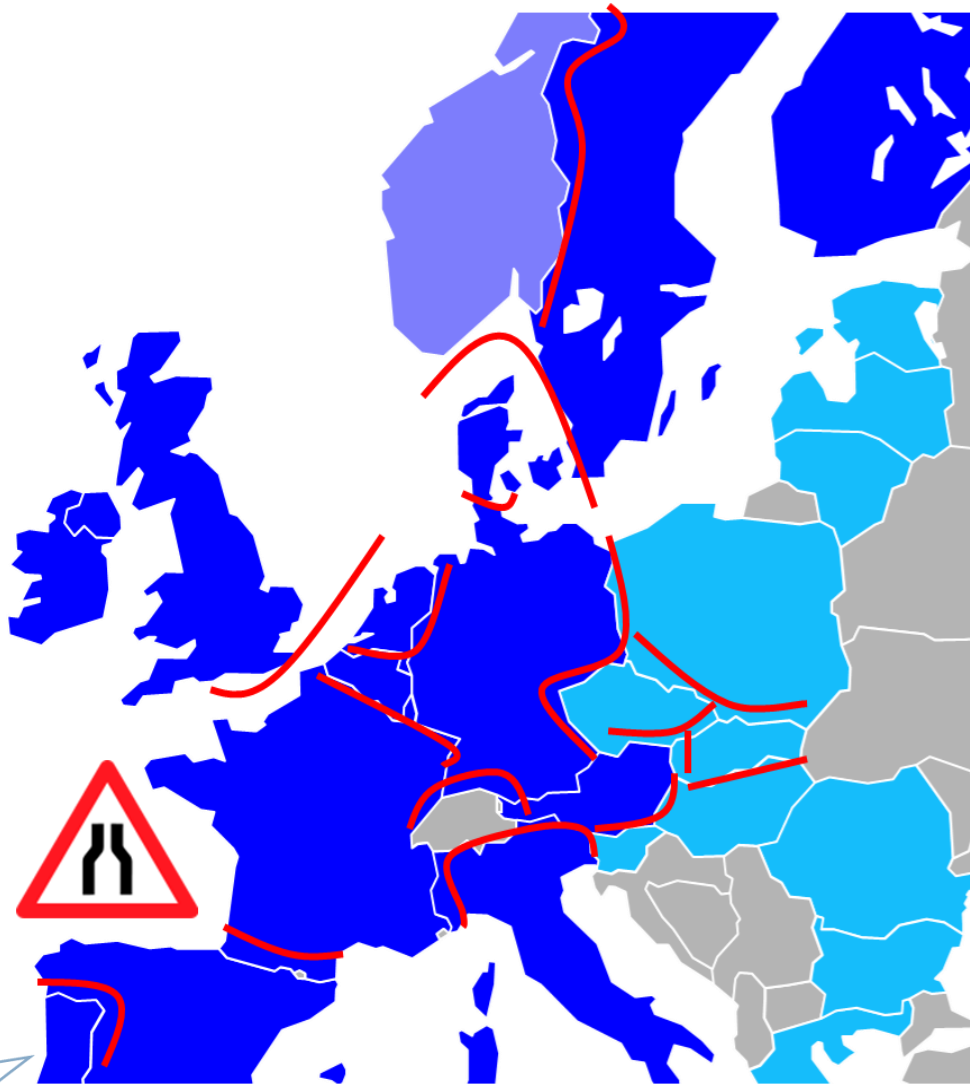
Results implicit auction CWE region: high level of price convergence



February 2011

Calculation of cross border transmission capacity

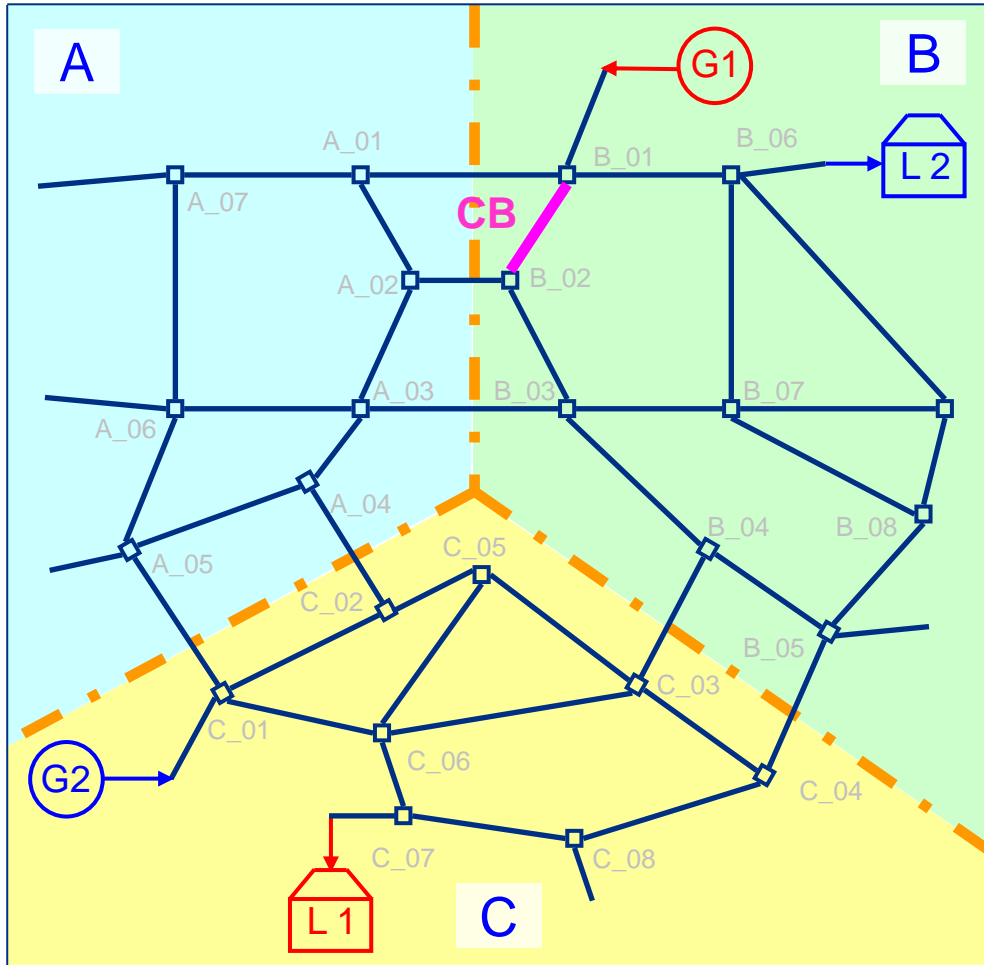
ATC methodology



- Zonal model
- Zonal borders are established historically by country borders
- Capacity is calculated on a bilateral basis on borders between bidding zones → ATC methodology

Calculation of cross border transmission capacity

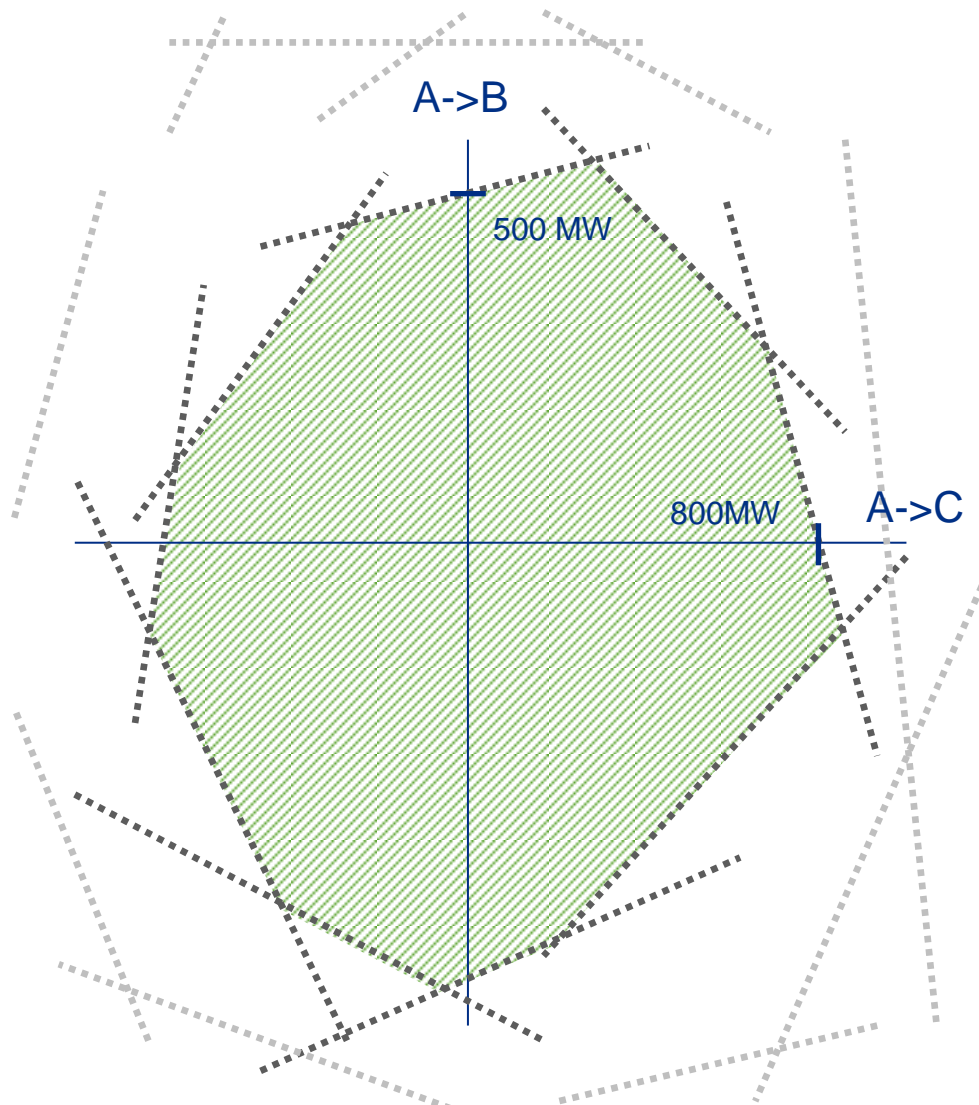
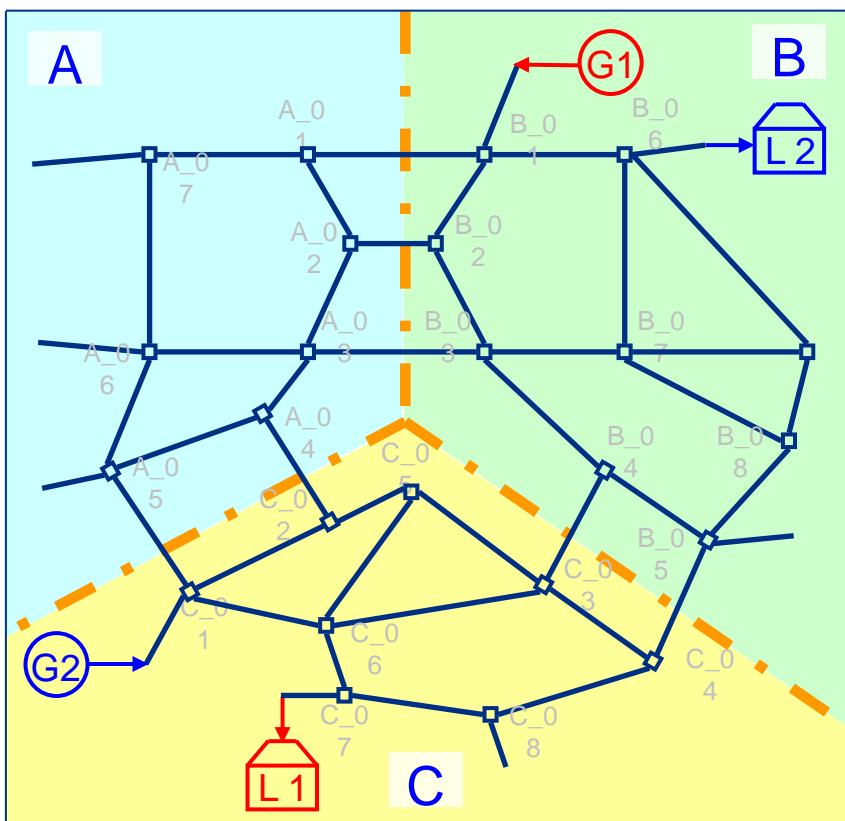
Flow based methodology



- Zonal model
- Coordinated capacity calculation based on common grid model of all TSOs.
- Capacity is calculated on all 'critical' components in the grid, so called 'critical branches'
- Critical branches can be:
 - Crossborder interconnections
 - Internal components

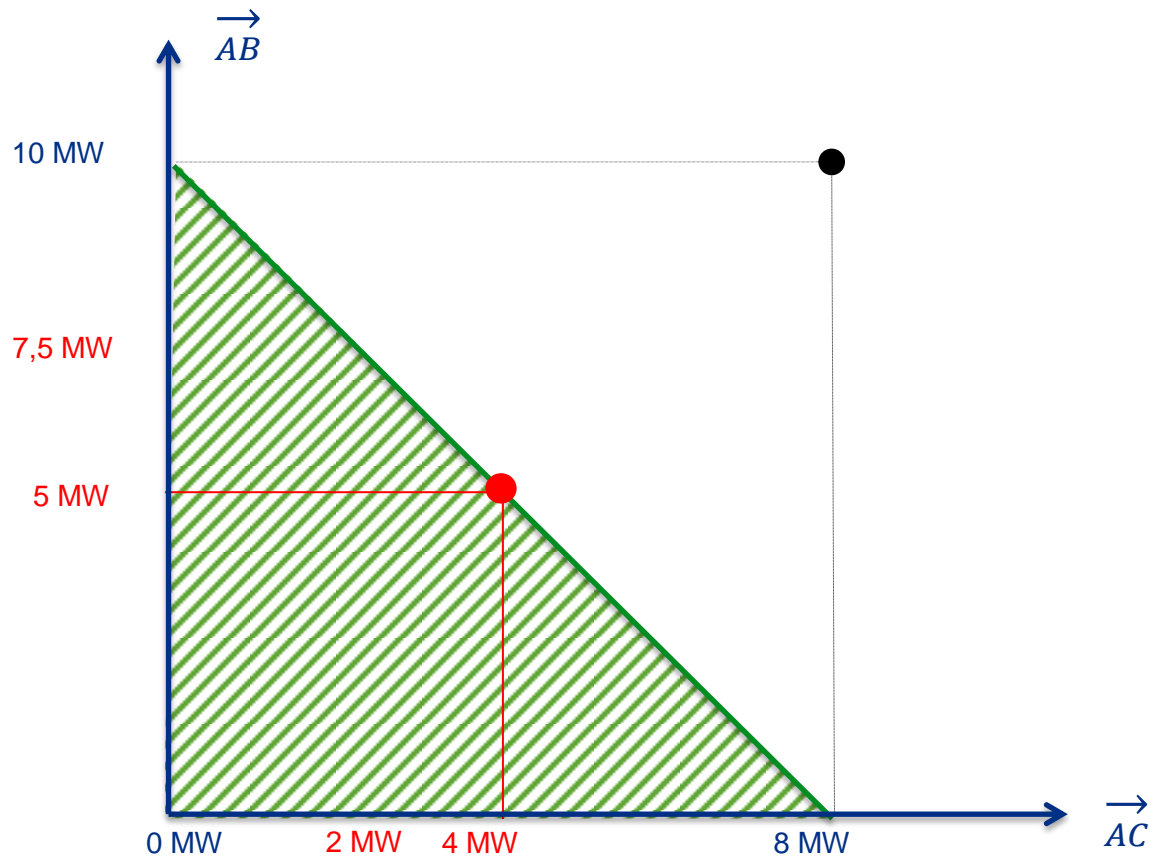
Calculation of cross border transmission capacity

Flow based methodology

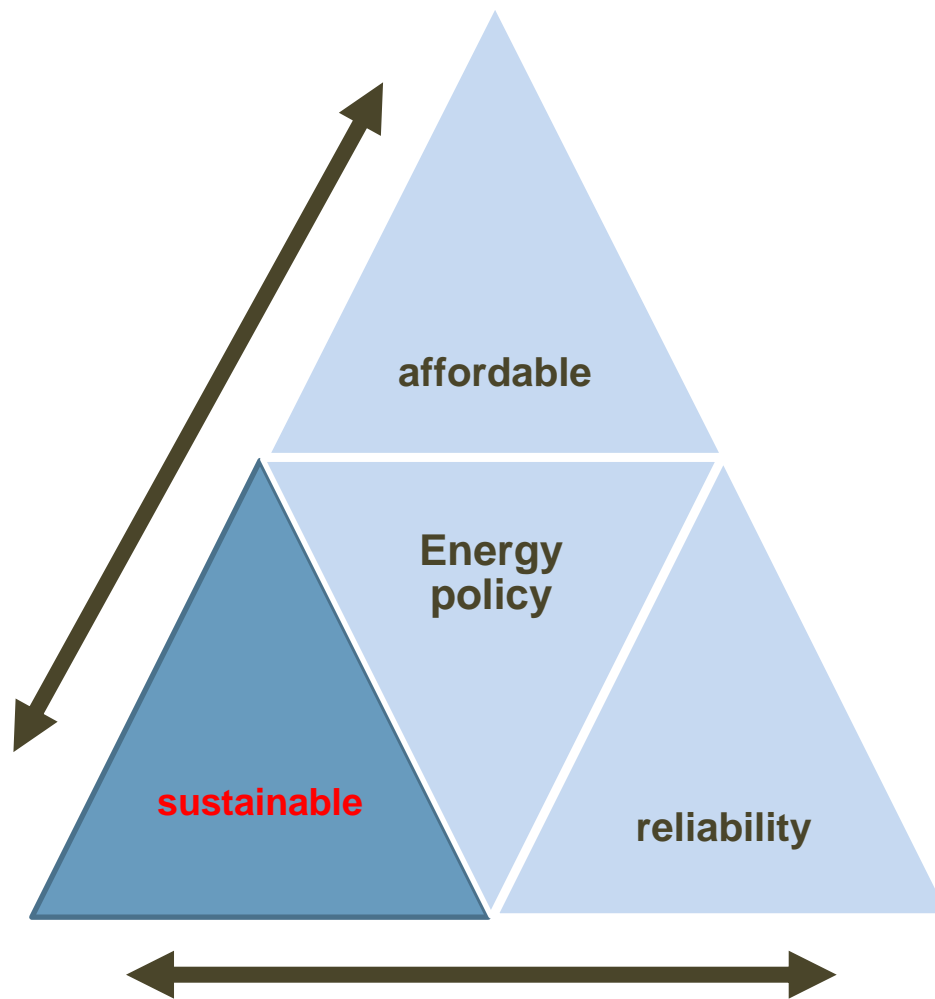


Calculation of cross border transmission capacity

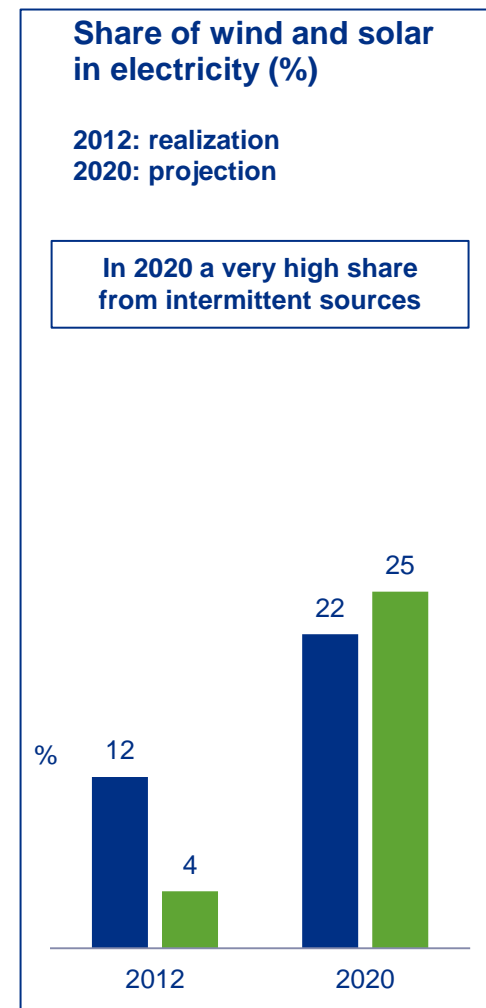
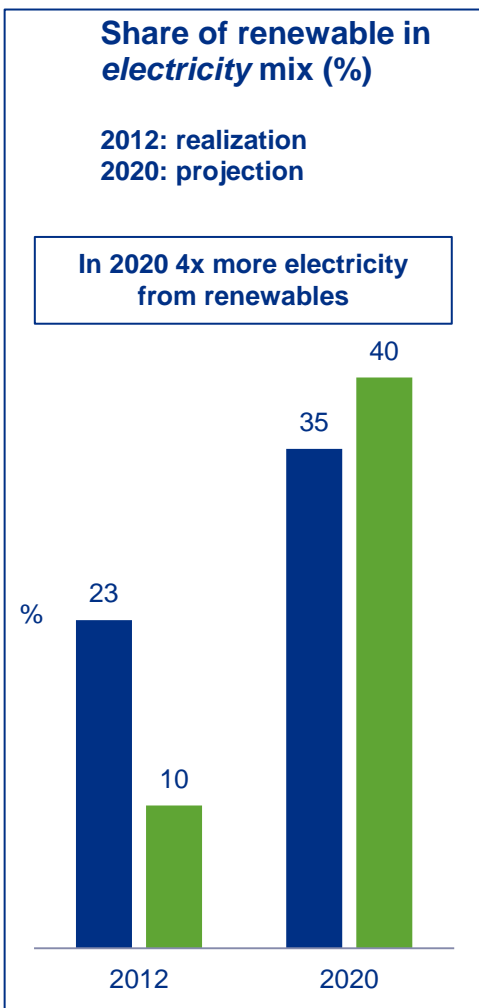
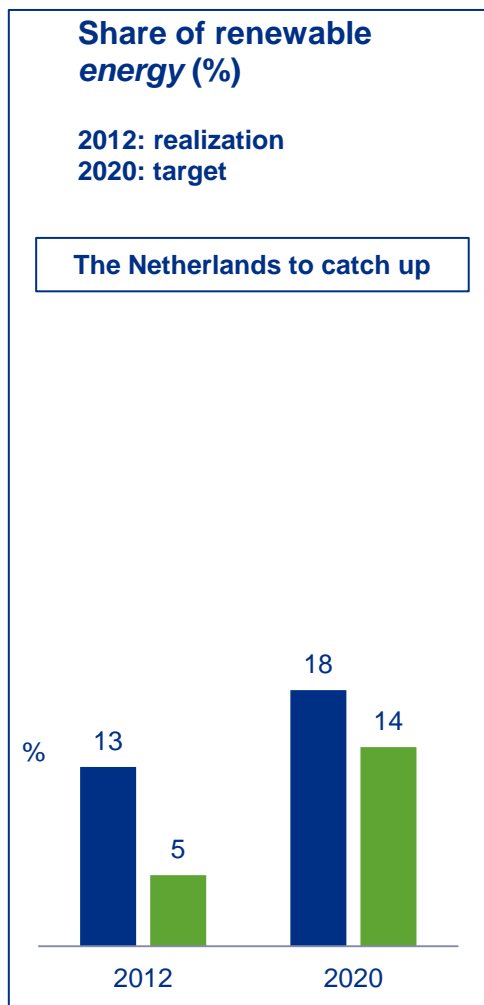
Flow based methodology



Challenges in the coming years



Sustainable goals of NL and DE

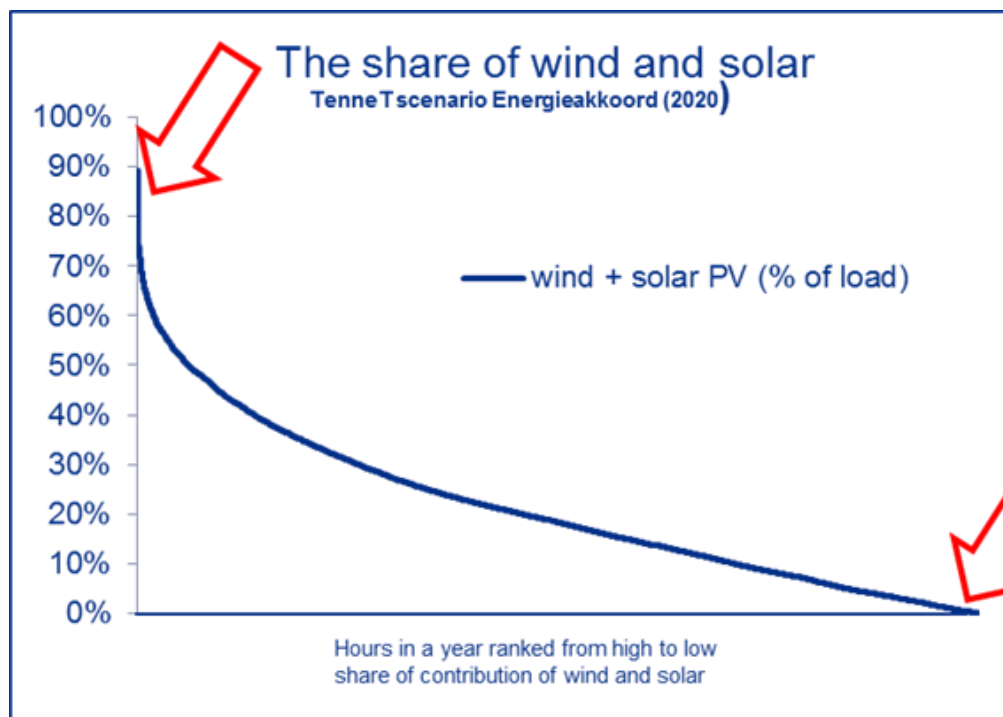


Germany The Netherlands

The meaning of intermittency

- Integration of intermittent sources creates two serious challenges:
 - Having sufficient generation capacity when wind and solar do not contribute
 - Operating a stable system when conventional does not contribute

System stability



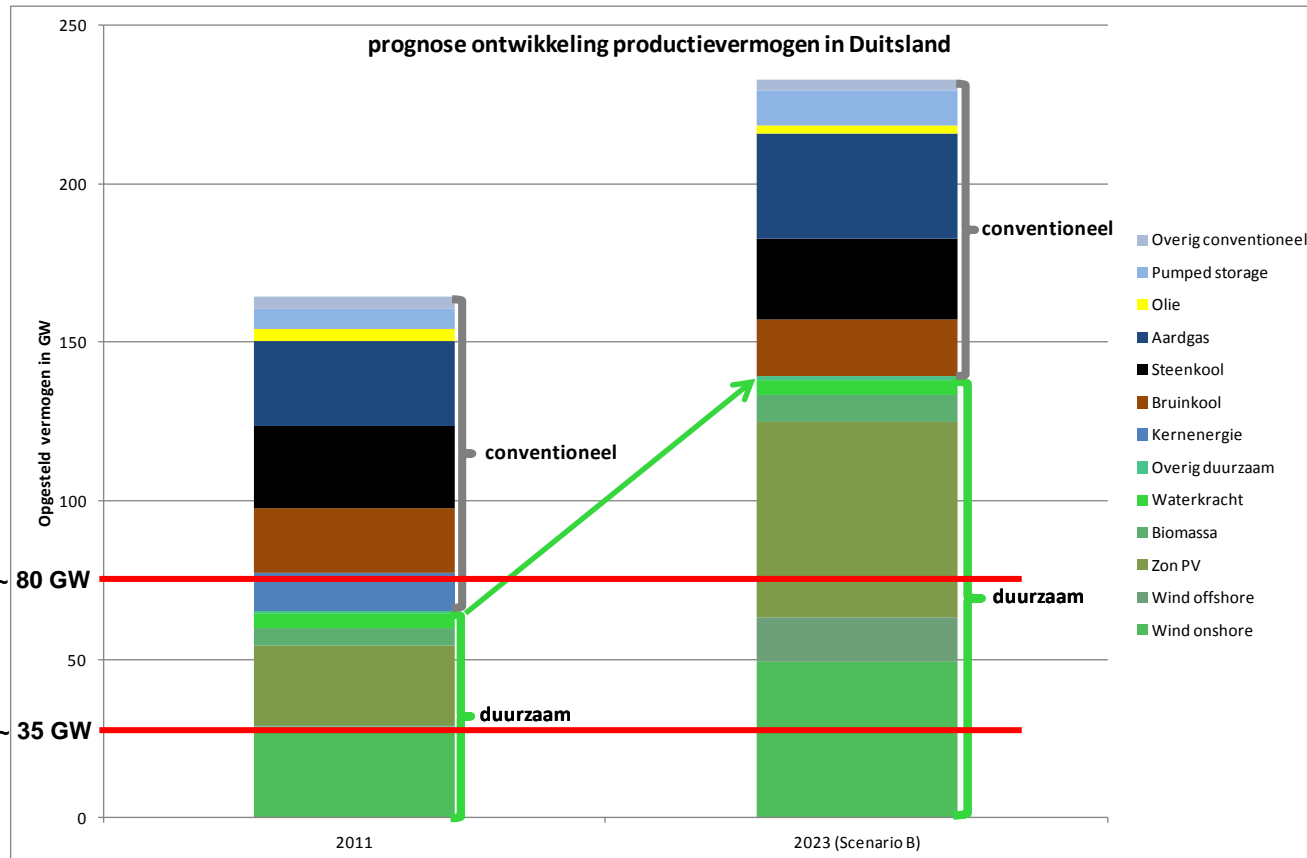
Generation adequacy

Impact on system stability

Product:	Conventional units	Wind	Solar	Needed for:
Active power	• Yes	• Yes	• Yes	Commodity
Reactive power	• Yes	• Possible	• No	Voltage control
Flexibility	• Yes	• Possible	• Limited	Balancing
Inertia	• Yes	• Limited	• No	Frequency stability

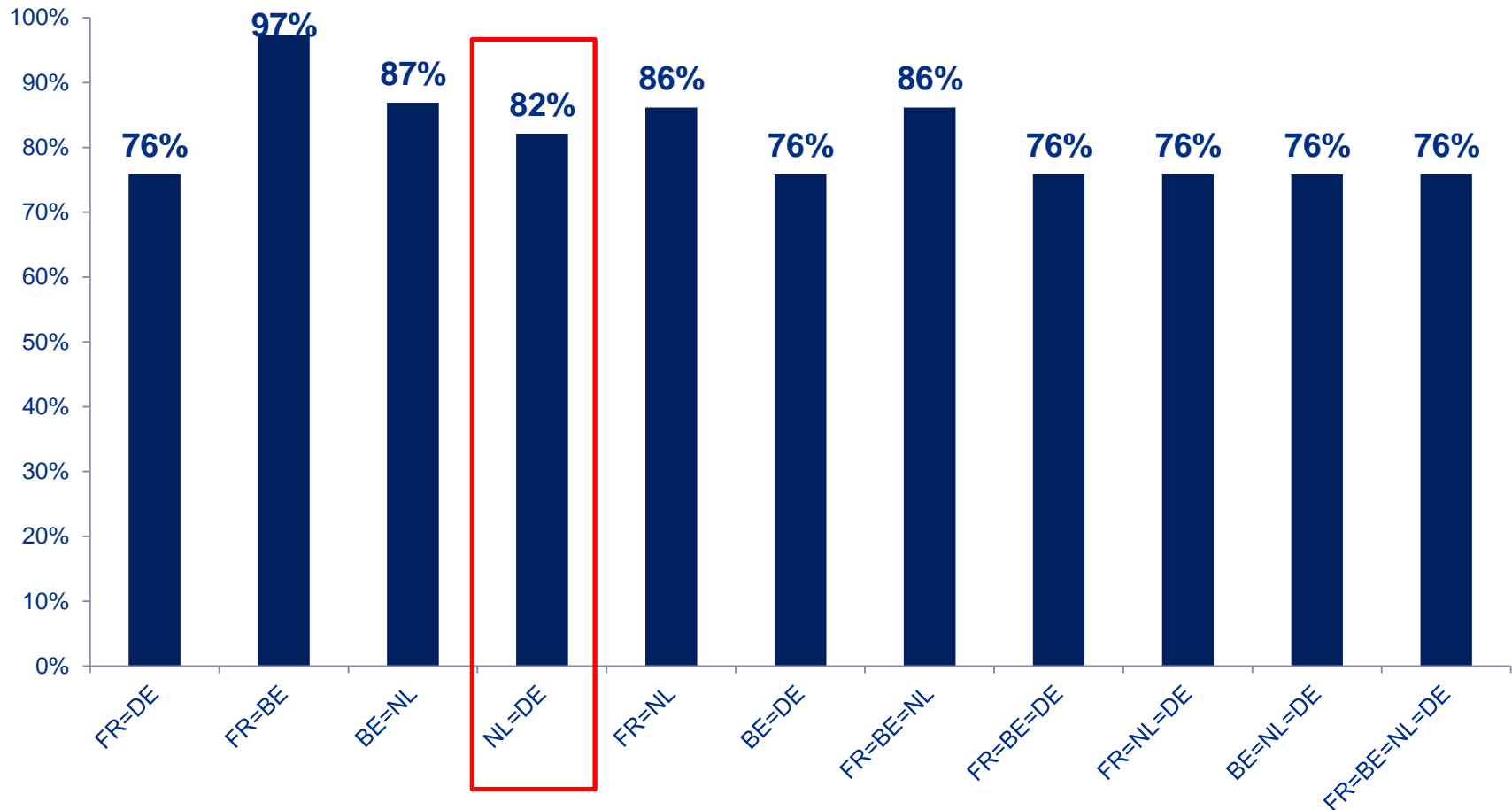
Key challenge: having the right generator at the right time

Increase in RES in Germany

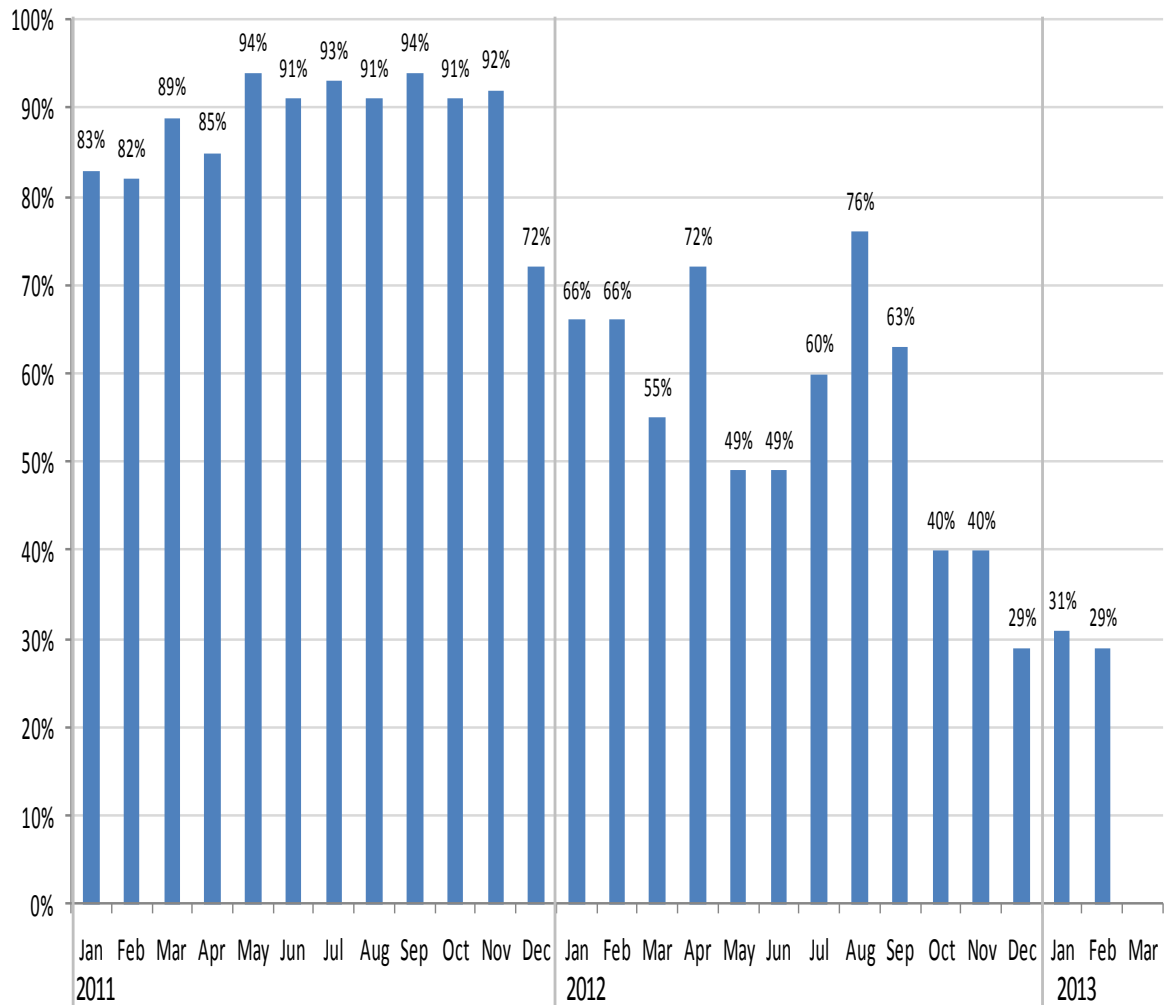


- Peak load Germany ~80 GW. Off-peak ~35 GW.
- More and more hours per year RES fulfills complete demand... or even more
- Conventional power will produce less and less, but remains needed for back-up

Results implicit auction CWE region: price convergence February 2011



Priceconvergence DE-NL



- Lowering prices in Germany, even negative prices.
- In 2011 94% of the time equal prices in NL and DE (pricesconvergence)
- Today: 29% of the time
- Almost always import from Germany
- Shift in merit order in the Netherlands.
- Conventional power plants more often 'out-of-the money'

Thanks for your attention

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TenneT is Europe's first cross-border grid operator for electricity. With approximately 20,000 kilometres of (Extra) High Voltage lines and 36 million end users in the Netherlands and Germany we rank among the top five grid operators in Europe. Our focus is to develop a north-west European energy market and to integrate renewable energy.

Taking power further

www.tennet.eu

