

# SECLIFIRM Collaboration Forum

Added Value of seasonal climate forecasting

June-7-2018

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# Topics overview

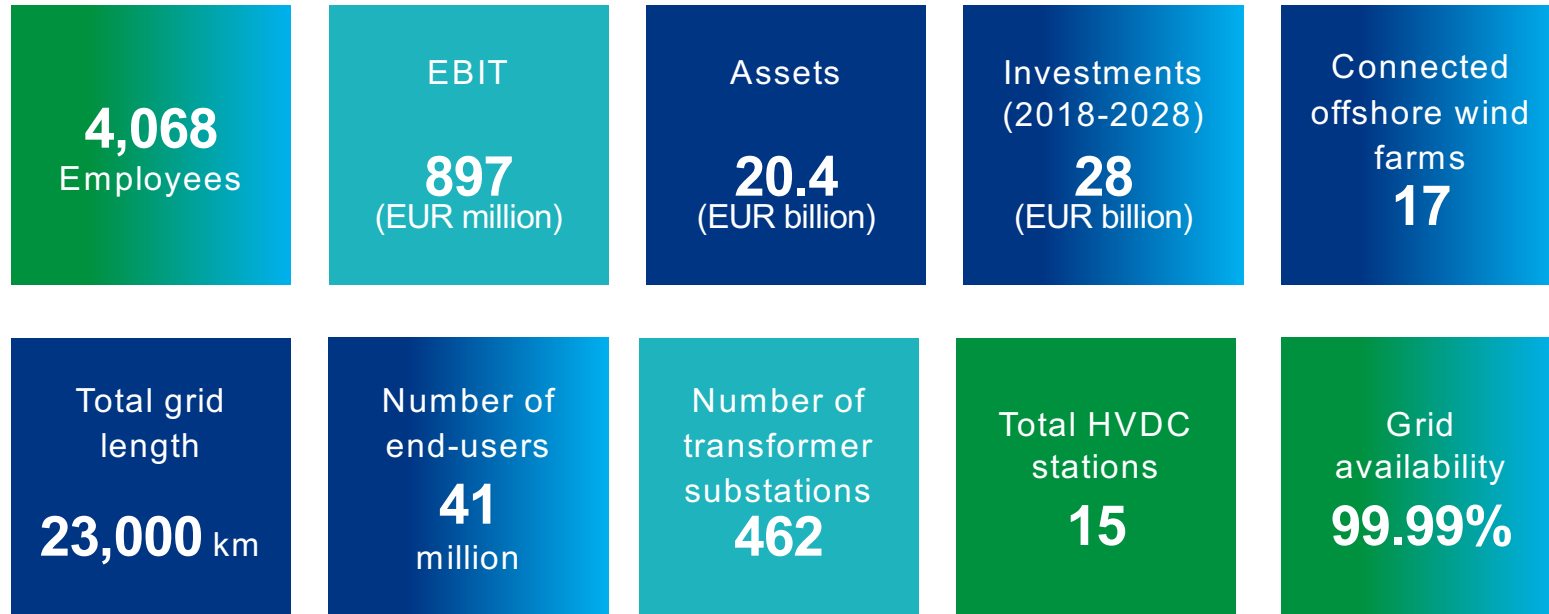
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- TenneT short overview
- Key tasks of a TSO
- The Energy market is changing
- Offshore Wind program TenneT
- Forecasting processes to secure electricity supply

# TenneT at a glance 2017



Europe's first cross-border grid operator



# TenneT at a glance



## The Netherlands



### Facts & figures

Employees (internal):	Approx. 1,320
Assets:	EUR 4.3 billion
Imports:	30,759 GWh
Exports:	22,013 GWh
Total grid length:	10,118 km
Number of transformer substations:	325
Number of end-users:	17 million

# TenneT at a glance



## Germany

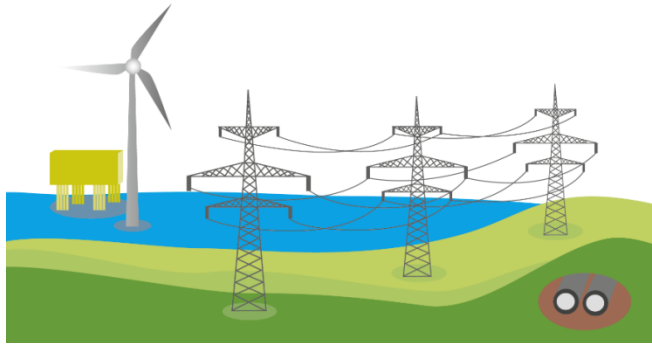


### Facts & figures

Employees (internal):	Approx. 1,650
Assets:	EUR 13.2 billion
Imports:	52,289 GWh
Exports:	54,255 GWh
Total grid length:	12,127 km
Number of transformer substations:	129
Number of end-users:	24.3 million

*NB: TenneT is one of the four German TSOs*

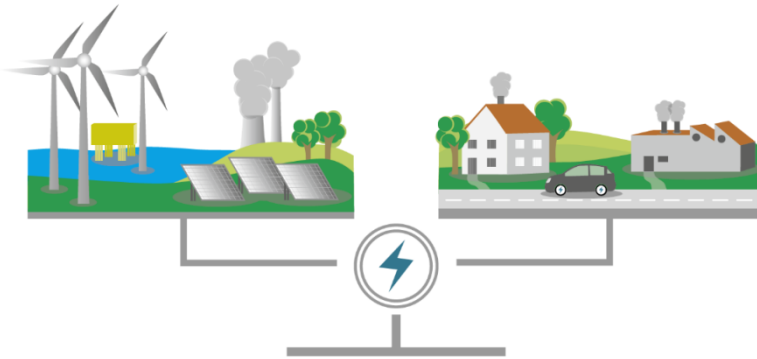
# Key Tasks TenneT



1

## Transmission services

planning, constructing and maintaining a robust high and extra high voltage grid



2

## System services

maintaining the balance between electricity supply and demand at all times



3

## Market facilitation

facilitating a smoothly functioning, efficient, liquid, and stable electricity market





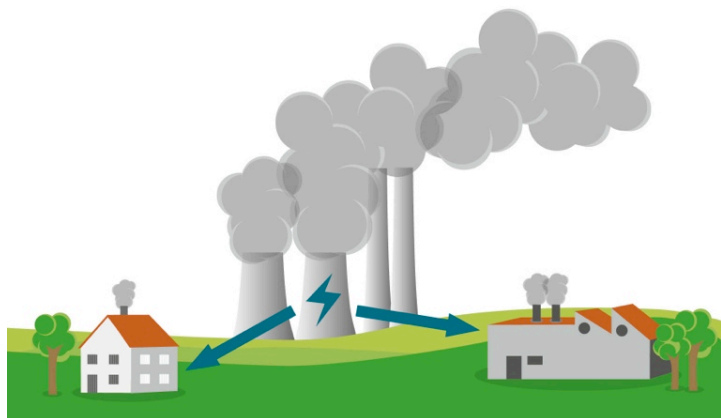
# Renewables challenge the Grid

Renewables fundamentally change how power grids work

## The old Electrical Power System



## The new Electrical Power System



**Big fossil or nuclear power plants close to the industrial centers** feed electricity into the transmission grid. The connected distribution grid supplies consumers.



**Renewable energy, produced locally, sometimes far away from industrial centers and storage facilities** provide electricity at all grid levels depending on the weather.

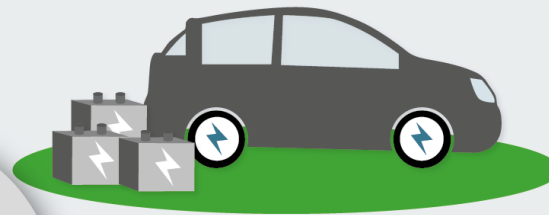
# Distributed Flexibility

With an increasing amount of volatile renewable energy in the system, an **optimal dispatch of flexibility options** is needed to guarantee security of supply and affordability.

Demand-side management (DSM)



Storage



Flexible supply



Energy efficiency/savings





# Phased development offshore wind

Three phase (parallel) development:

- |                       |               |  |
|-----------------------|---------------|--|
| Short Term (to 2023)  | NL: 3,5 GW    | ➤ Currently under development (near shore)   |
| Medium Term (to 2035) | NL: 7 – 10 GW | ➤ Use full potential near shore locations<br>➤ Prepare for large scale and international cooperation |
| Long Term (to 2050)   | 70 to 100 GW  | ➤ North Sea Wind Power Hub<br>➤ International cooperation necessary                                  |





# Forecasting Processes to secure electricity supply 1/3

**Scenario's of wind production** and other electricity sources are used for Analysis of grid data in many different time frames and in different scale or geographical area:

- Starting Ten year ahead with a “Capacity and quality plan” for our own TSO area and on EU scale “Ten Year Network Development Plan” (TYNDP) to link all the national plans
- Yearly outlook for summer and winter worst case scenario's per TSO and for EU
- Regional coordinated outage plans for generation and grid to secure safe transport yearly and / or quarterly
- Week ahead operational plan to allign new developments



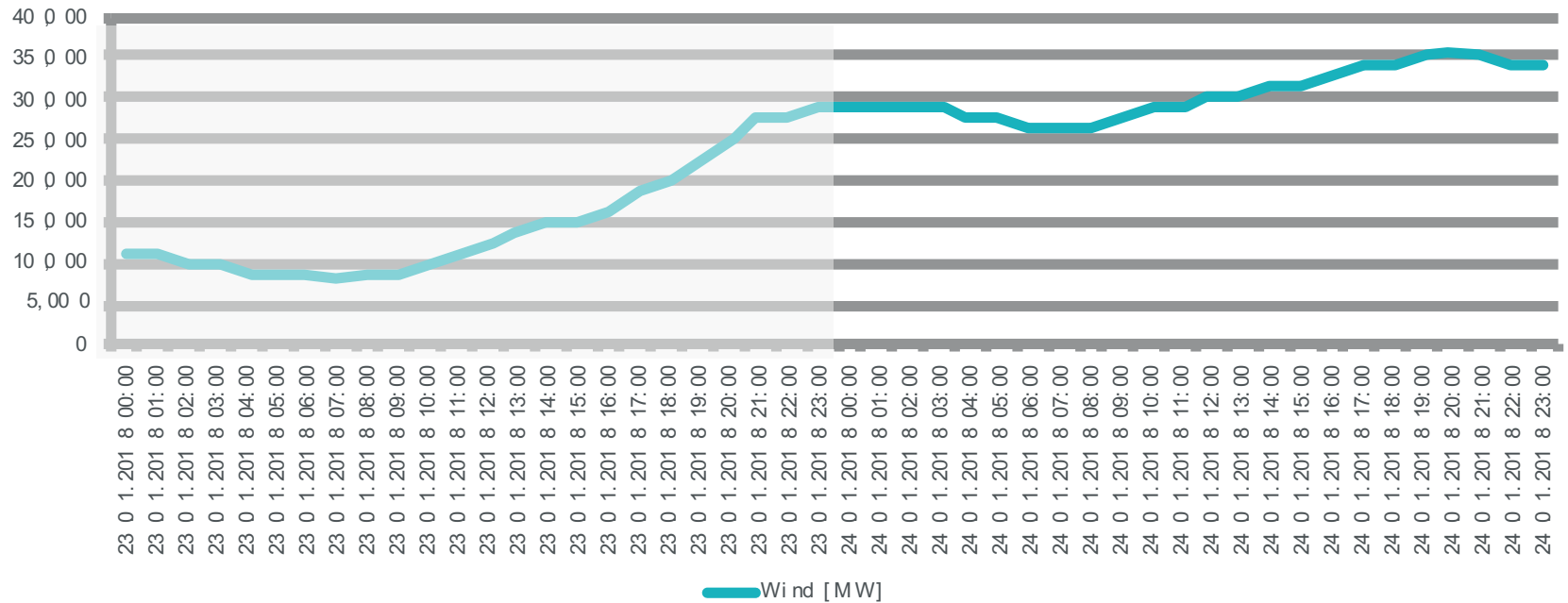
# Forecasting Processes to secure electricity supply 2/3

**Forecasts of wind production** and other electricity sources are used for Analysis of grid data in many different time frames and in different scale or geographical area:

- Week ahead “Short and medium term Adequacy plans” per TSO and for EU
- Two days ahead Market coupling capacity calculations  
Based on forecasted load and based on the generation shift between renewables and conventional generation and between the countries,
- Day ahead congestion forecast calculations per TSO and merged results per region and for EU with local measures to reach a safe transport forecast per TSO and regional coordination of these measures and merging of all these results.



## Prognosis Wind DE





# Forecasting Processes to secure electricity supply 3/3

**Forecasts of wind production** and other electricity sources are also used for:

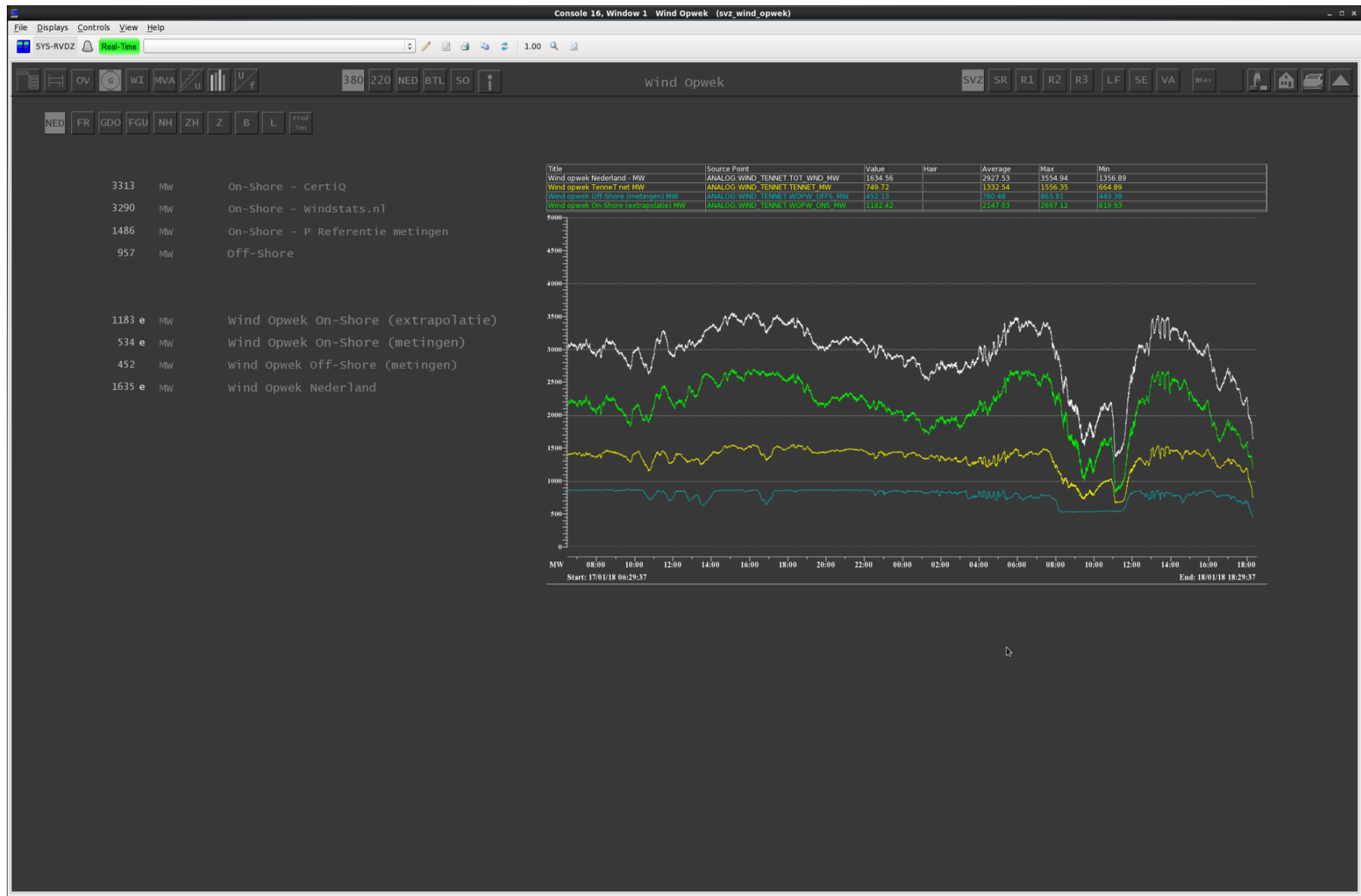
- During the day, hourly updates of the congestion forecast and Local intra day measures to reach a safe transport forecast per TSO and regional coordination of these measures and merging of all these results

**Real time measurements of wind production** and other electricity sources are used for:

- Real time load flow calculations based on TSO wide measurements (every few seconds)
- Grid safety calculations (at least every few minutes) for the contingencies in the TSO's grid and the neighboring "Observability area" where outages would have significant influence
- Real time measurements of the frequency and activation of corrective fast reserves to stabilize the frequency with Real time calculation of the imbalance of the TSO area.

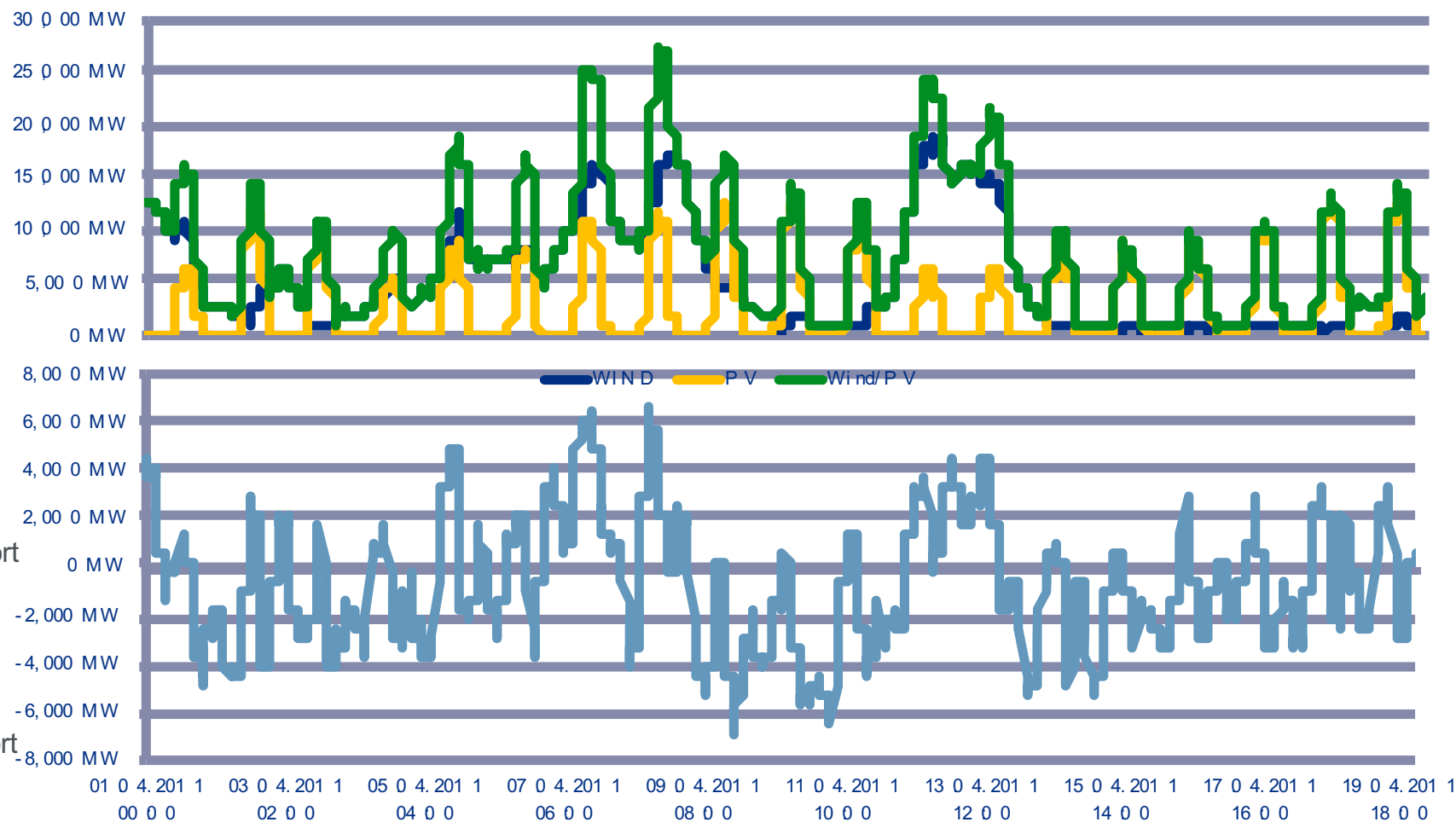
# Realtime measurements of wind production

## And switching off during Storm on 18th January 2018





# Increased volatility of Renewables infeed





# Questions?



# Disclaimer

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TenneT is a leading European electricity transmission system operator (TSO) with its main activities in the Netherlands and Germany. With approximately 22,000 kilometres of high-voltage connections we ensure a secure supply of electricity to 41 million end-users.

**Taking power further**