



1 February 2024

Towards net-zero emission of T&D grids



How to make the proper connection?

The TSO & DSO perspective



cigre

For power system expertise

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Digging it together!

The DSO perspective

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The TSO perspective

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Digging it together!

De ruimtelijke puzzel naar 2050 in beeld

Duurzame opwek
1.250-2.500 km²
wind op land
3.800-7.200 km²
wind op zee
350-580 km²
zonneweides

Bovengrondse Ruimtebehoefte
4-6 km²
voor Regionale Netbeheerders
65-75 km²
voor TenneT

Warmtetransport netten
180-400 km

Conversie en opslag
3-8 km²
Elektrolyse
23-33 km²
Grootschalige batterijen



Kabels
260-330 km²
ondergronds ruimtebeslag voor laag- en middenspanningskabels

2,5 x de aarde rond
100.000 kilometer
tot 2050 elke maand kabels leggen van Groningen naar Maastricht

Stations
Nieuw bouwen of uitbreiden
MS/LS-Stations: +48.000 (+50%)
TS/MS-Stations: +670 (+36%)

Netbeheer
Nederland

Alliander – introduction to the DSO

- 3.100.000 Electricity customers
- 5.200 Neighborhoods
- 135 Municipalities

Some facts about our networks:

- 180 substations
- ~40.000 MV/LV ring main units
- 1.650 km HV-cable (50 kV)
- 41.165 km MV-cable (20 and 10 kV)
- 51.175 km LV-cable (400 V)

Newly laid cable:

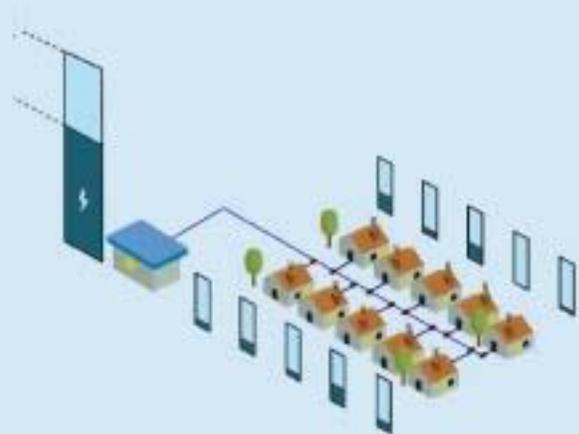
- 2.500 km LV+MV in 2023 (2.6%)



Digging operations in every other street

Traditional households

~135 households per LV-cable

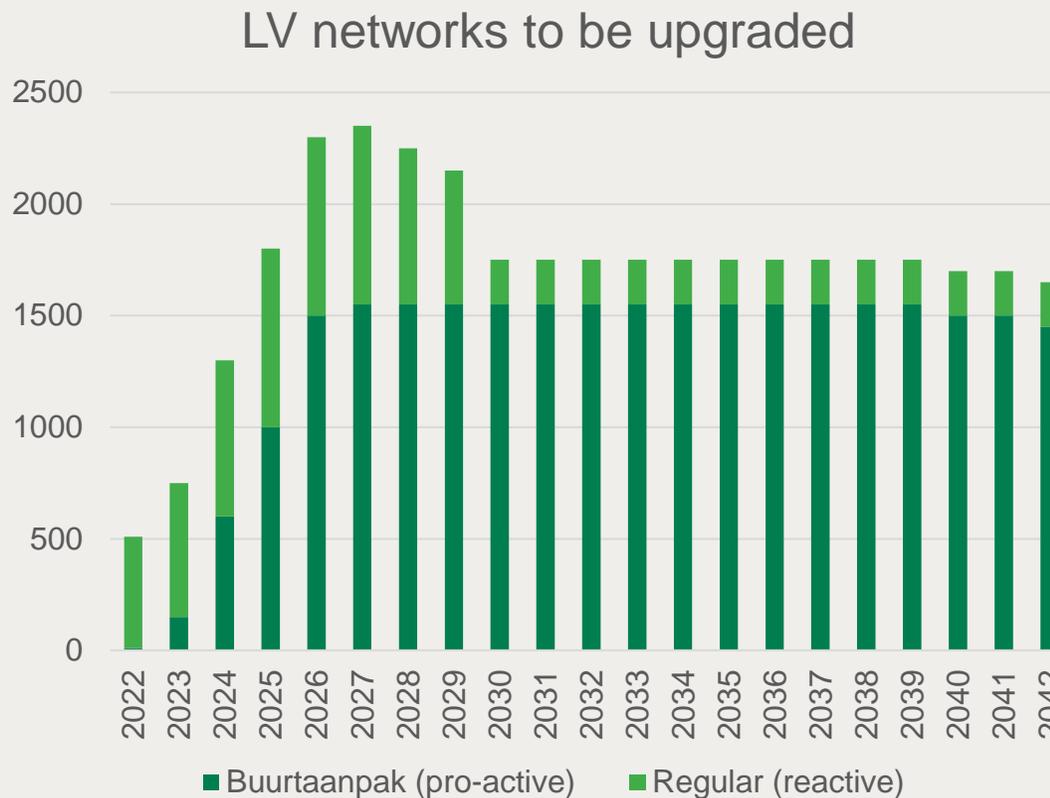
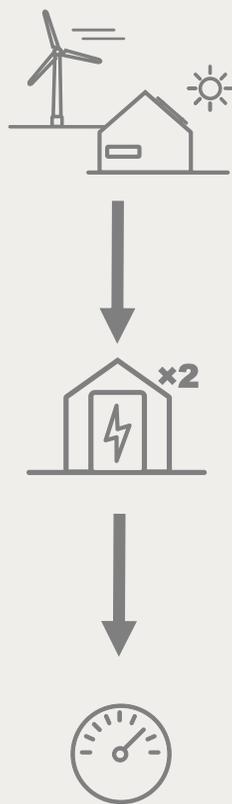


Future households

~ 25 households per LV-cable

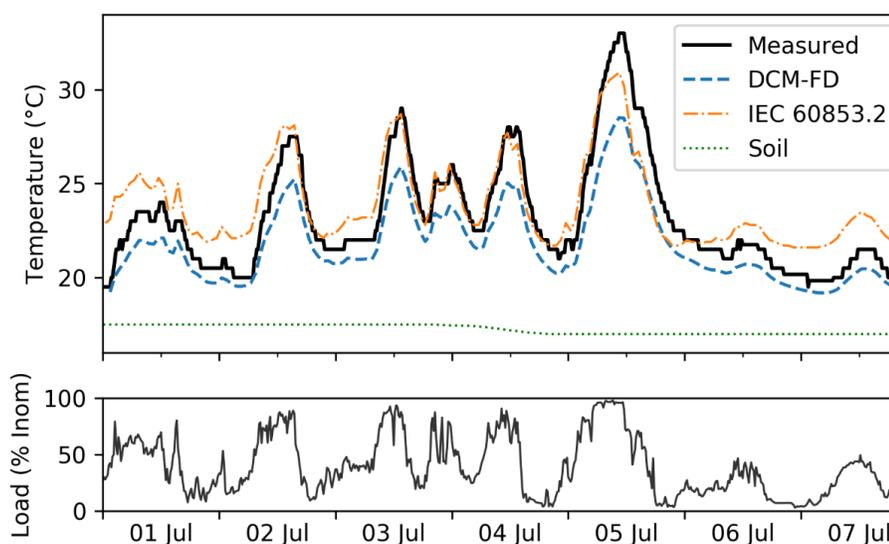
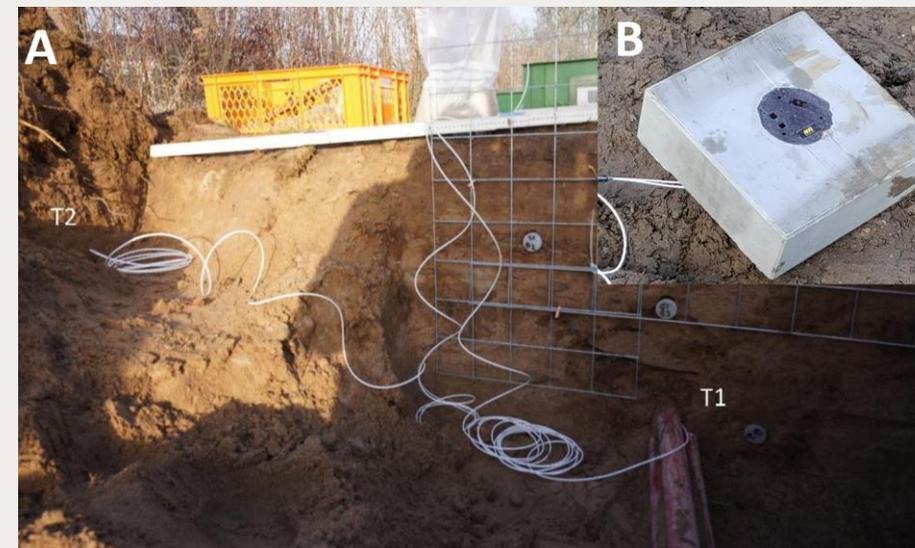


Acceleration by going neighborhood by neighborhood



What about the existing network?

- Newly laid cable only small amount of total network length
- Possibilities in better utilization of existing network
- Small amount of increased capacity of a cable adds up quickly
- Example: measurement tiles on MV/HV-cables
- Impact on ageing
 - Mainly PILC



Stay tuned for the
2024 session paper!
(10530)

Steps towards circular distribution cables

- Conductor
 - Use of ASI certified aluminum
- Earth wire screen
 - Going from 50 mm² to 35 mm²
- Outer sheath
 - Use of recycled MDPE
- Standardized Life Cycle Analysis
- Towards Design for Disassembly

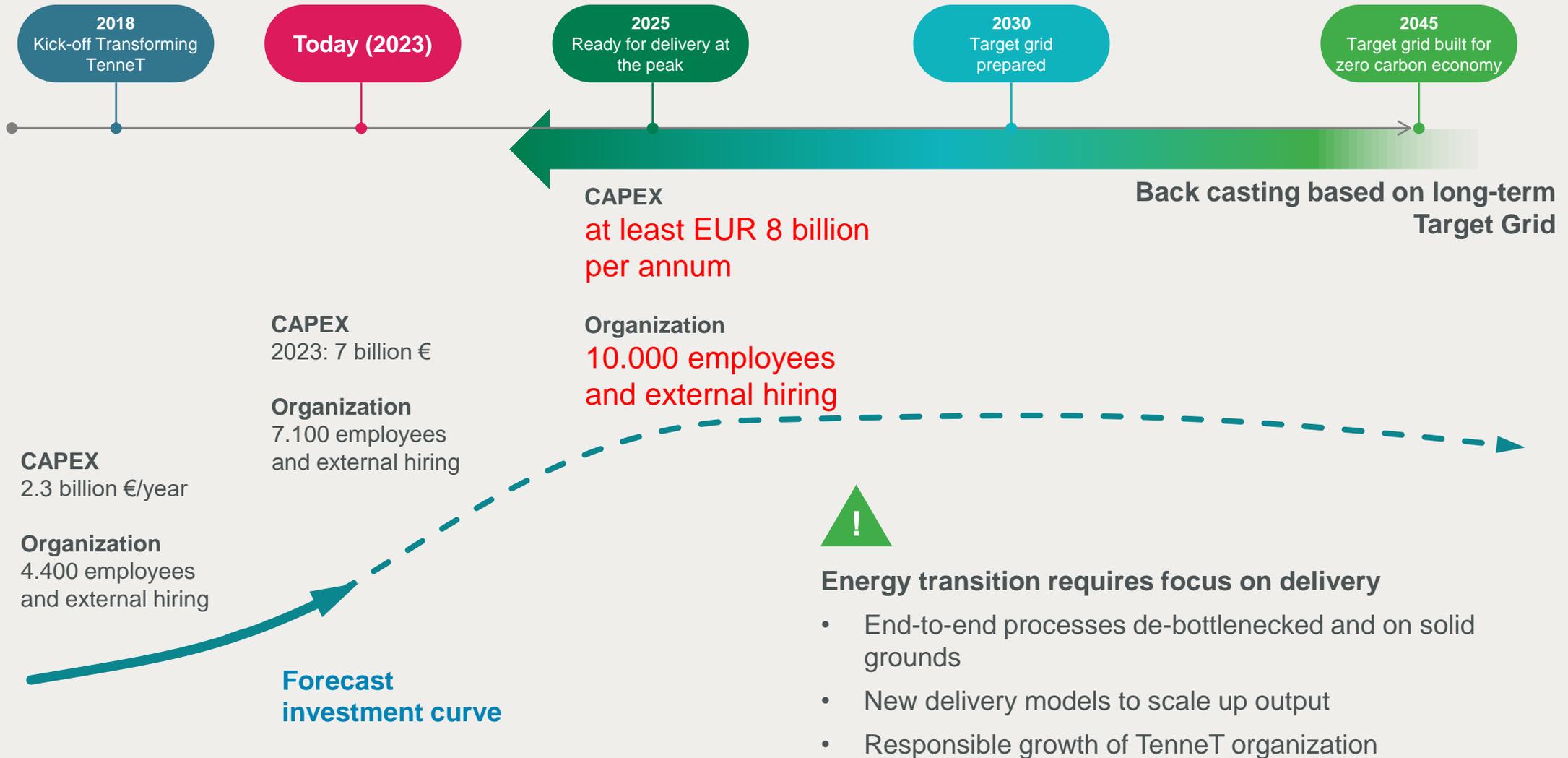


TenneT - Large scale integration of renewables



Double or Triple National Electrical Highways

Be ready for peak production by 2025 heading towards the 2045 target network



Bill of quantities

- AC cabling in Netherlands : > 4500 km until 2027
- AC cabling in Germany : > 1000 km until 2026

- DC cabling Netherlands : > 2000 km for the 2 GW North sea projects
- DC cabling Germany : > 6000 km for the 2 GW on shore corridors

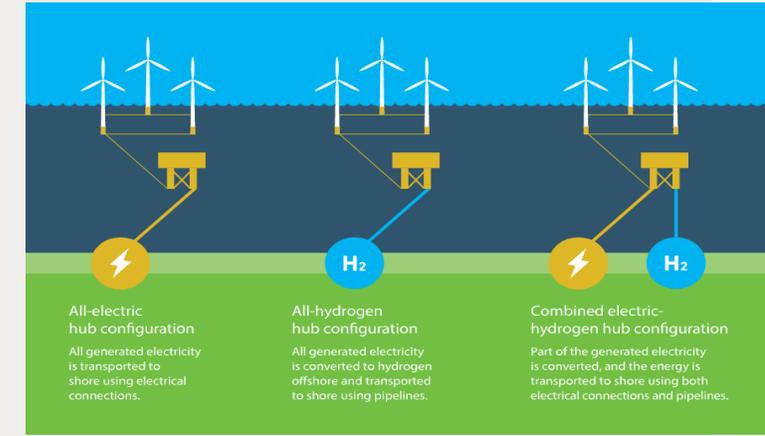


- From mother earth : Aluminum 1200 # times better retrievable than Copper
- Pricing : Copper > 8.500 USD per ton
Aluminum > 2.200 USD per ton
exp. price rise copper towards 2030: 16.000 USD per ton

Future TSO outlook



The principle



The support

A dark blue banner containing logos and text. On the left is the North Sea Wind Power Hub Programme logo, featuring a sun icon and the text 'North Sea Wind Power Hub Programme' and 'info@northseawindpowerhub.eu'. On the right are the logos for the Consortium members: ENERGINET, Gasunie, and Tennet. At the bottom left is the European Union flag logo, followed by the text 'Co-financed by the Connecting Europe Facility of the European Union'.

The 1st proof



Future outlook

- Minimizing overall cable project planning



- Speeding up cable cable installation: Trenchless technologies



- Circularity: reducing fossil usage from earth AND less CO2 emission

**WHERE WILL
THE CLIMATE GO
WHEN IT NEEDS
A HOLIDAY**

Loeje



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