

TenneT's Target Grid Ambitions, Strategy & Challenges

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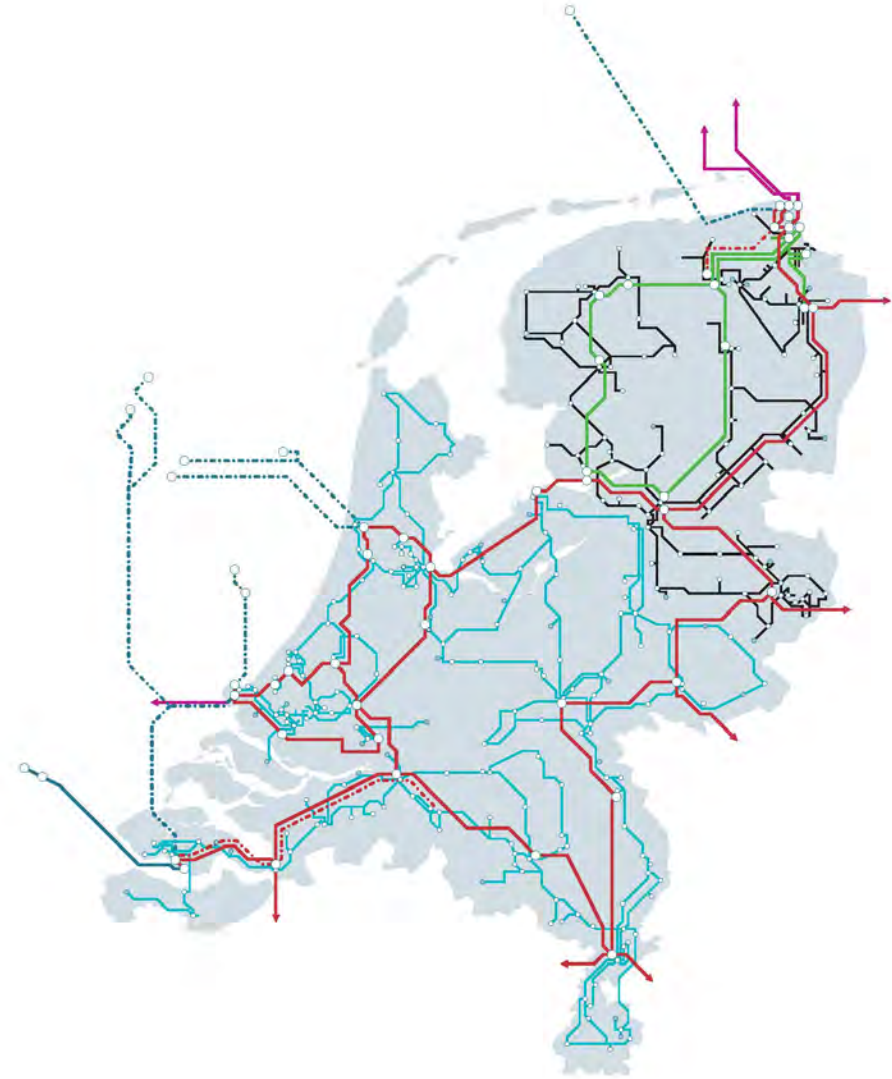


TenneT at a glance

The Netherlands

■ Facts & figures

- Employees
3,517
- Total grid length
11,470 km
- Transformer substations
349
- Number of end-users
18 million

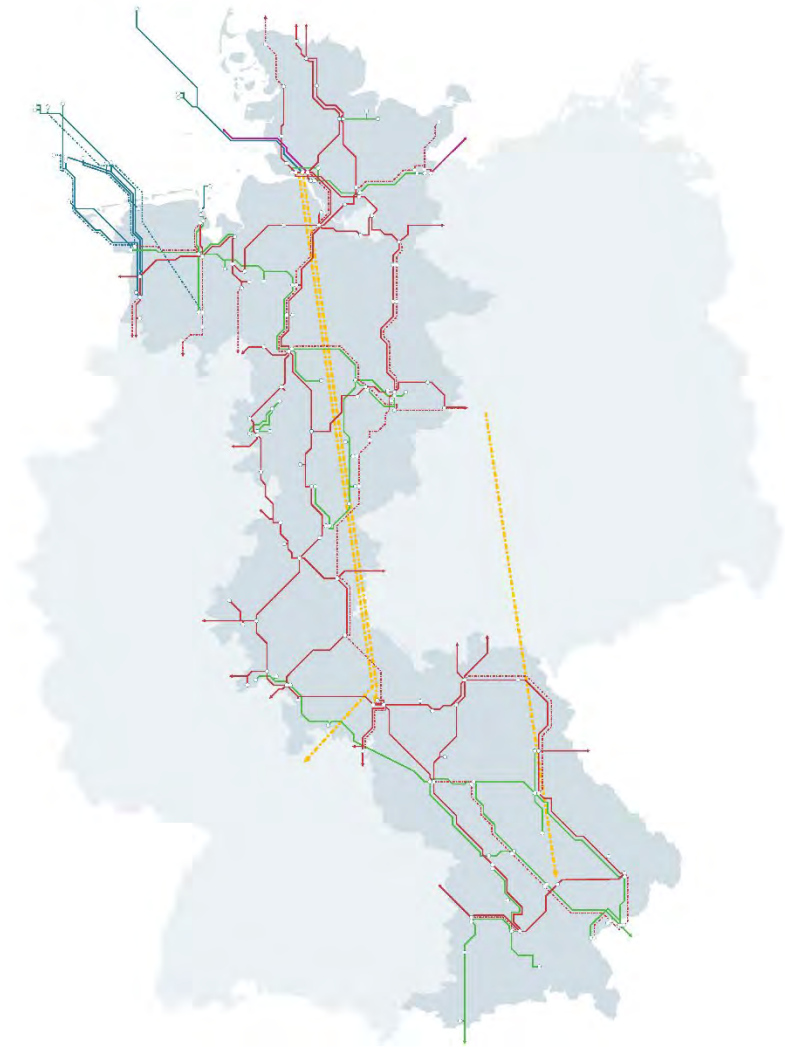


TenneT at a glance

Germany

■ Facts & figures

- Employees (internal)
4,132¹
- Total grid length
13,965 km²
- Transformer substations
134²
- Number of end-users
25,5 million³



Source: 1) TenneT Internal Integrated Annual Report 2023
2) internal calculation status 2023
3) internal calculation status 2023/2024

TenneT at a glance

2023



Workforce

8,300

Employees



EBIT

1,817

EUR million



Assets

45

EUR billion



Investments in 2023

7,7

EUR billion



Grid

99,99%

Availability



Grid length

25,000

Km



Dutch State

100%

Shareholder



Footprint

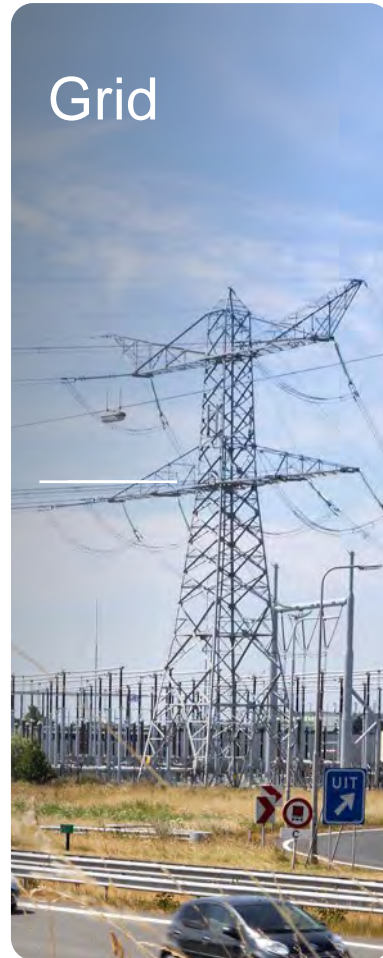
33%

Greened

Source: TenneT Internal Integrated Annual Report 2023

Target Grid

The way towards climate-neutrality



Scenario

- Ambitious political targets for electrification and generation from renewables
- Powerhouse: North Sea development in DE and NL



Energy Transition

Ambitious goal to achieve various societal tasks



Reduce energy dependence

Internationally linked DC grid



Make industry more sustainable

Expand national grid and further connect with neighbouring countries



Make the region more sustainable

Further divide regional grid into subnets



Realise green growth

Sustainable infrastructure is prerequisite for healthy economy and competitiveness



Affordable energy system

Smart and timely preparation as well as standardisation save money

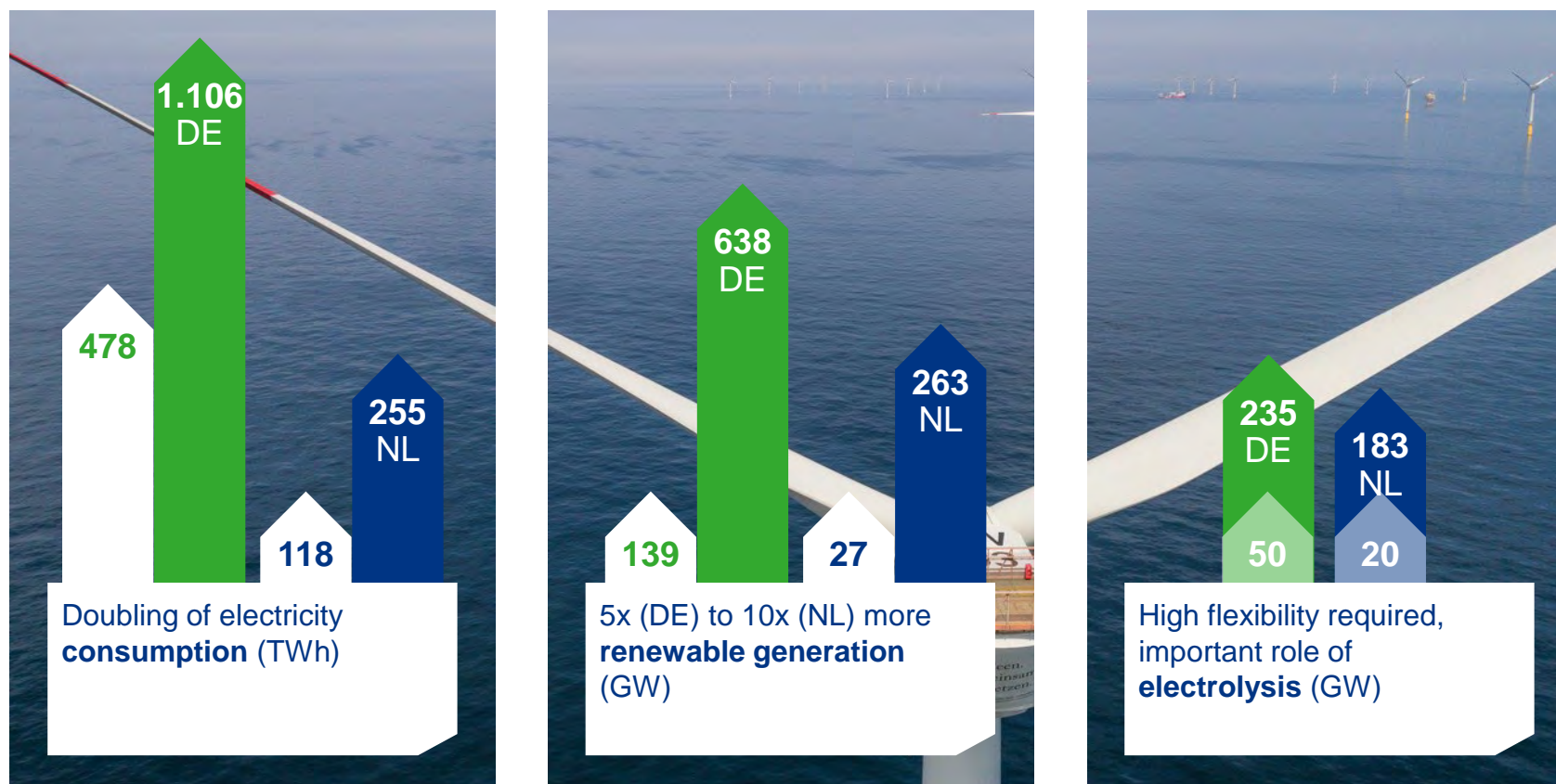


Solve and prevent congestions

Regional grid further divided into subnets
Expanding the national grid

Scenario

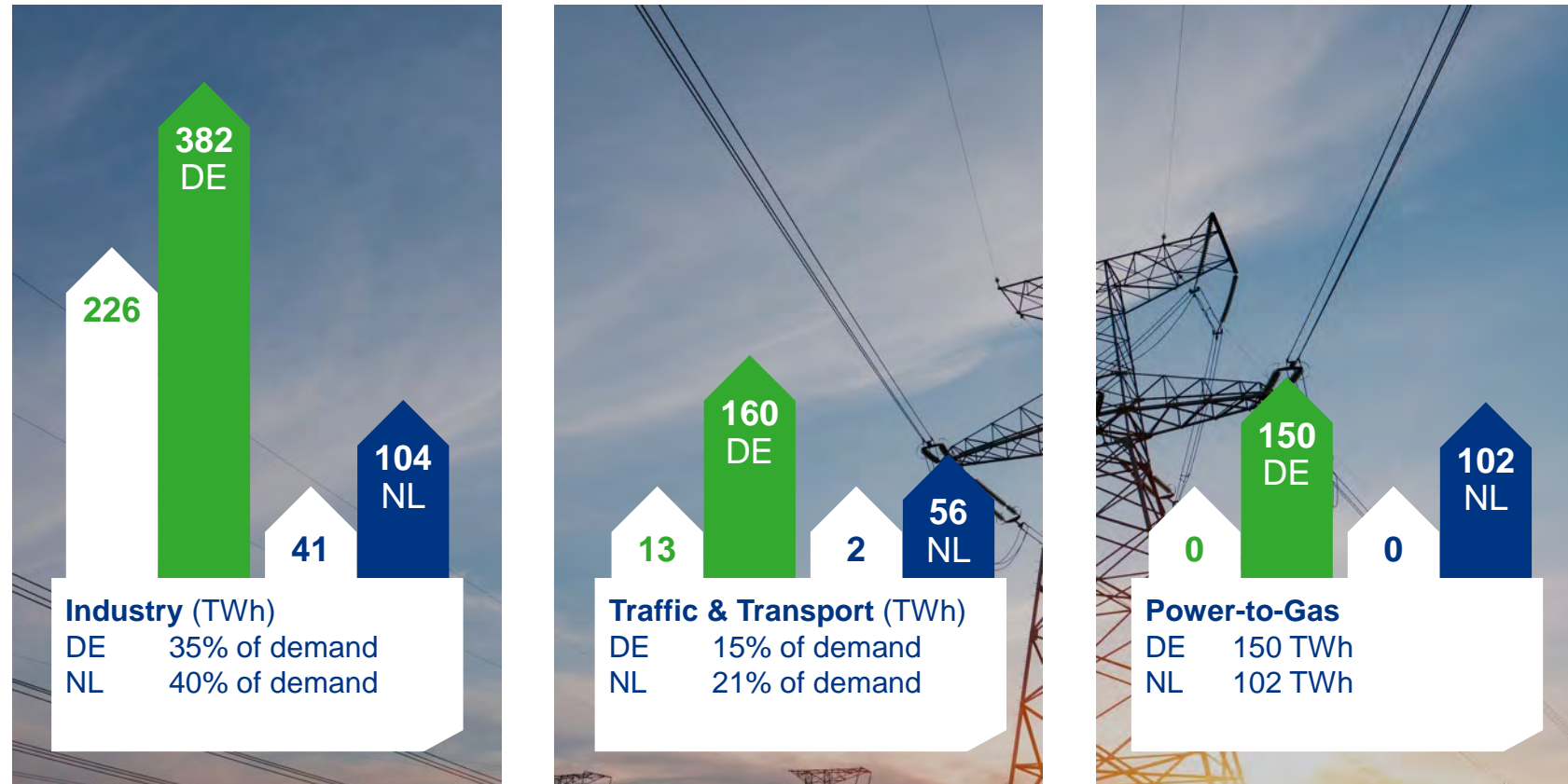
Prepare for more than a doubling of electricity consumption



Source: NL: Nationaal Plan Energiesysteem, DE: Szenariorahmen Netzentwicklungsplan (NEP) Strom 2037/2045 (2023)

Scenario

Industry, transport and P2G dominate electricity use



Source: NL: Nationaal Plan Energiesysteem, DE: Szenariorahmen Netzentwicklungsplan (NEP) Strom 2037/2045 (2023)

Powerhouse

North Sea development

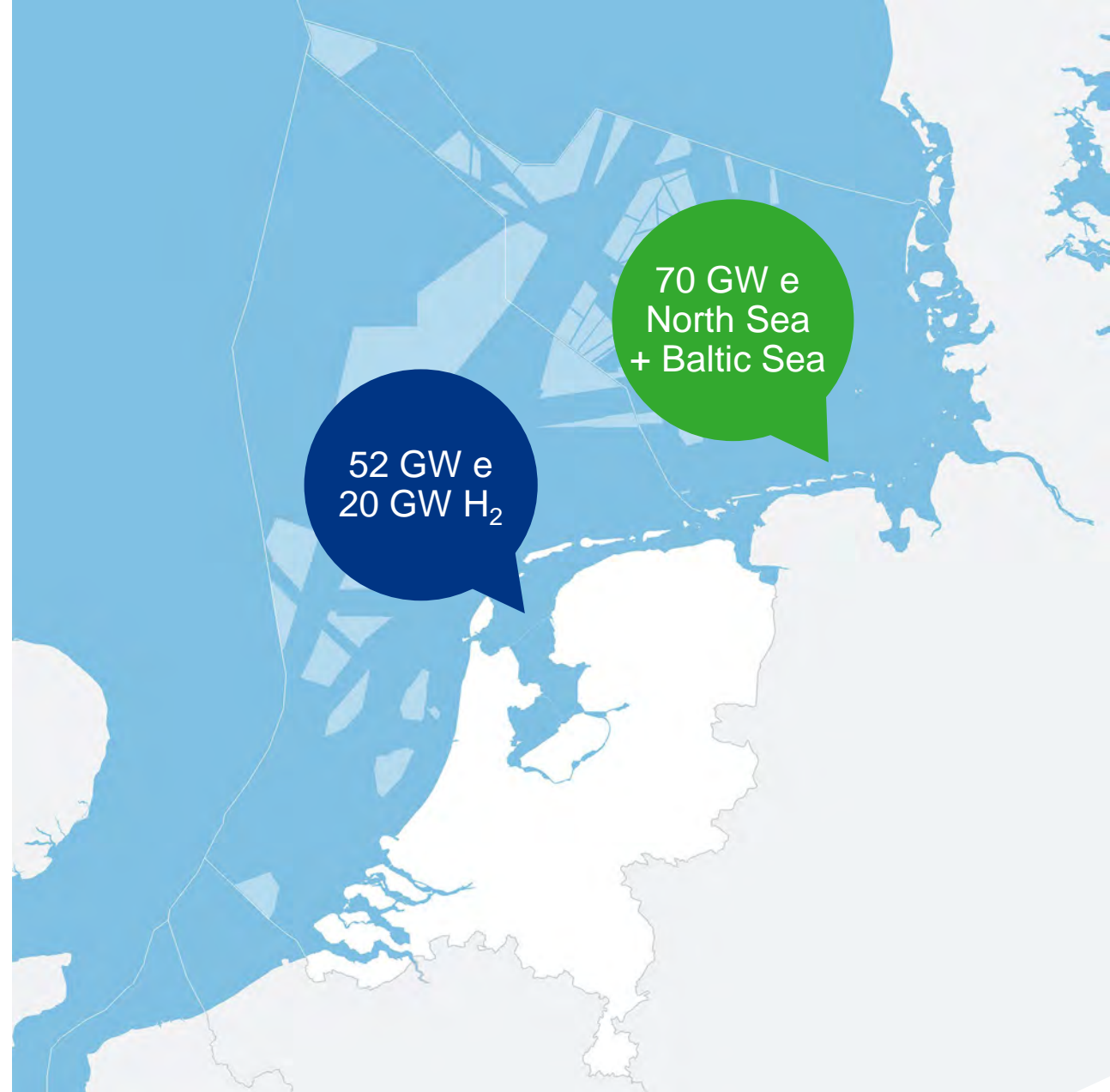
DE and NL plans each account for around 70 GW of offshore wind

Germany

- Offshore generation mainly for electricity system
- No substantial role for offshore P2G

Netherlands

- 'Only' 38 GW is enough for annual electricity demand
- 52 GW is enough to cover national electricity demand plus exports
- With 72 GW of offshore wind, up to 20 GW of P2G offshore adopted



Source: NL: Nationaal Plan Energiesysteem,
DE: Szenariorahmen Netzentwicklungsplan (NEP) Strom 2037/2045 (2023)

Strategy

- Planning beyond political targets with Target Grid
- Design principle: Highest electrification scenario
- Target Grid Strategy: Long-term planning, early preparation, future-proof construction, standardisation
- Preparing for the highest electrification scenario



Target Grid

Our vision for the onshore and offshore electricity grid of the Netherlands and Germany

Target

We need to anticipate how the future energy infrastructure will look like and 'back cast' this into the actions we need to take today to realise this target picture.



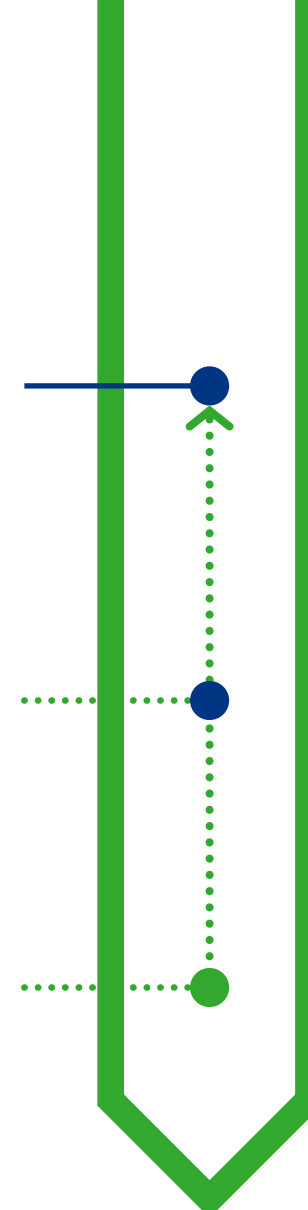
Target Grid is a preparation plan

We need to start preparations now for 2045

Today
Target Grid development started

2030
Target Grid prepared

2045
Target Grid realised



What we need to do:

Establish transmission corridors

Obtain permits

Strategic land acquisition

Grid

- International: HVDC 525 kV
- National: AC 220-380 kV
- Regional: AC 110-150 kV



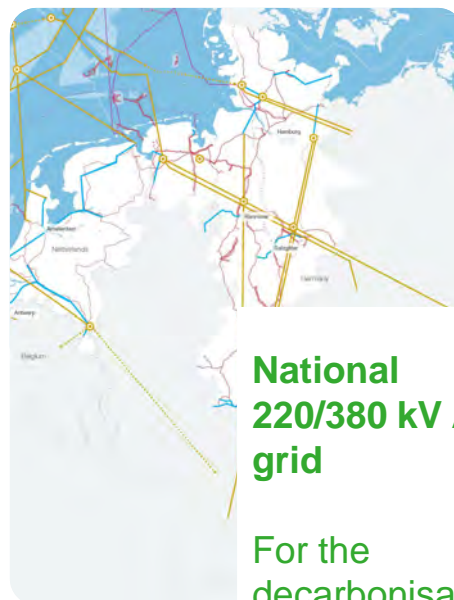
Target Grid Design

Different building blocks support different functions within the grid



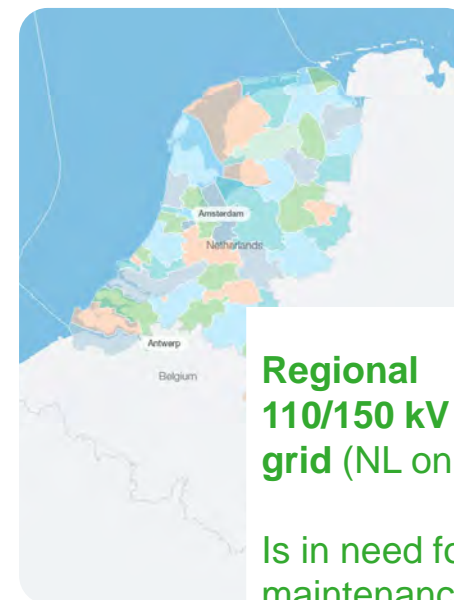
International 525 kV HVDC grid

To transport offshore-generated electricity via internationally connected superhighways



National 220/380 kV AC grid

For the decarbonisation of large industries and for future expansion of offshore wind energy

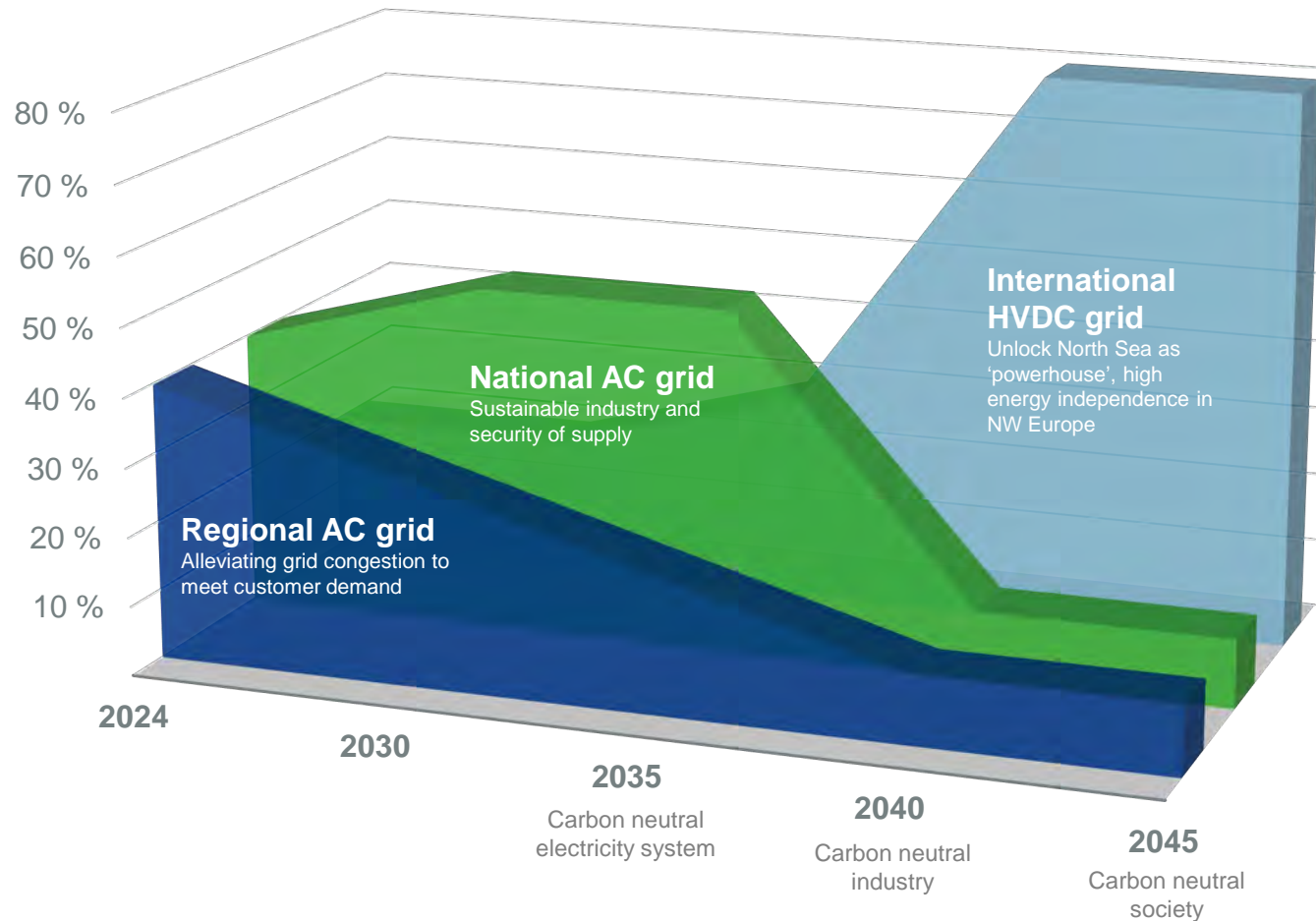


Regional 110/150 kV AC grid (NL only)

Is in need for maintenance, strengthening and modernisation to address increasing congestion

Target Grid Development

On three levels in the next 20 years



International (HVDC)

Efficient use of the grid and efficient investments

- Bidding zone configurations
- Cost sharing mechanisms

Technological changes and adjustments by grid users

- New ancillary services based on new technologies
- Adaptation of system integrity approach, grid design requirements and technical connection requirements

National (220/380 kV AC)

Efficient use of the grid and efficient investments

- Offshore bidding zones for hybrid interconnectors and hubs

Investment security for market participants

- Strengthening future market
- Capacity charging mechanisms (only if necessary)

Technological changes and adjustments by grid users

- New ancillary services based on new technologies
- Adjusting system integrity approach, grid design requirements and technical connection requirements

Regional (110/150 kV AC)

Efficient use of the grid and efficient investment

- New products to relieve congestive and better use the grid
- Unlocking demand response, storage and industrial flexibility
- Alternative transmission agreements
- Adjustments to the grid tariff system
- Developing forecasts and analysis (data)

Target Grid Full picture



-  Energy hub
-  Target grid HVDC
-  Target grid HVDC to be discussed
-  Target grid AC
-  220 kV - 380 kV in service
-  220 kV - 380 kV projected
-  Offshore windparcs
-  TenneT Service Area

Challenges

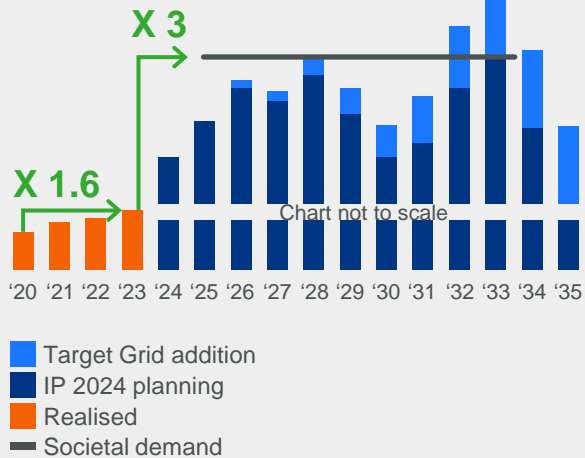
- Manage growth
- Advise politics



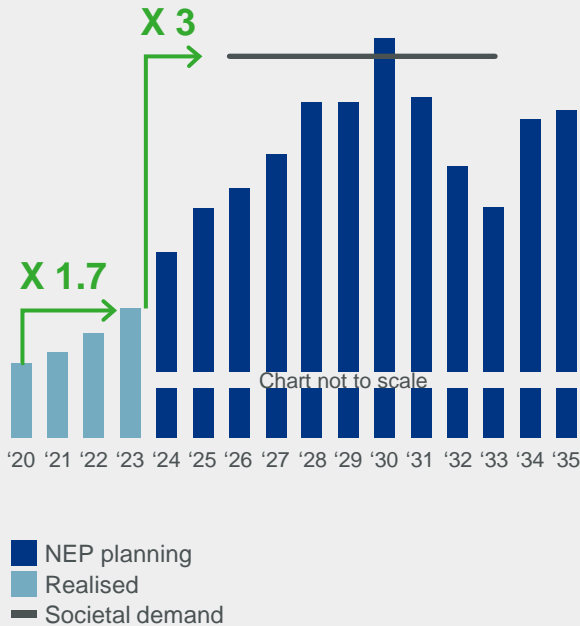
Manage growth

Ballooning project portfolio leads to high investments

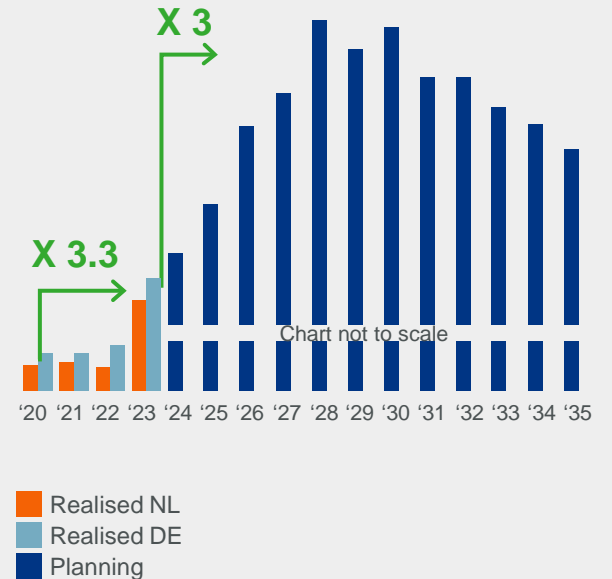
Investment growth
Onshore Netherlands



Investment growth
Onshore Germany



Investment growth
Offshore NL and DE



Source: Internal Calculations
based on IP/NEP

Manage growth internally

The organisation needs to grow to realise the target grid

Set up sophisticated portfolio management

Prioritisation and optimisation of the project portfolio to deliver maximum value for TenneT

Onboard new employees & plan for the future

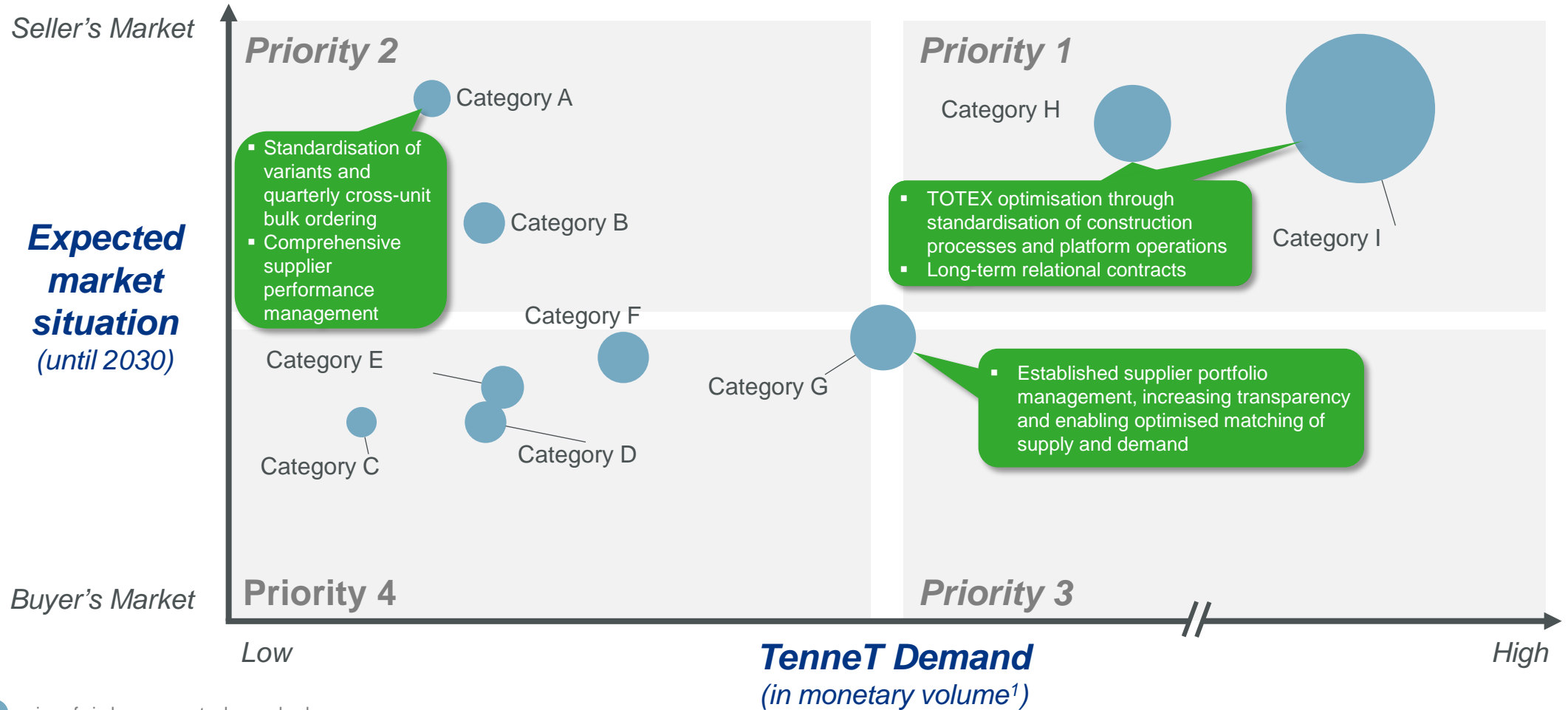
- Management of acceptable, healthy growth
- Development of onboarding journey to enable a smooth start
- Plan future roles of employees when the Target Grid has been realised

Improve internal processes to realise the project pipeline more efficiently

- Streamline internal improvement initiatives
- Reduce bureaucracy and optimise governance processes

Manage growth with suppliers

Tight seller's market in most key categories needs to be managed



1) Based on Ten Year Investment Forecast


Ensure affordability

Steer politics to favour more affordable solutions



VS.




Invest
 Low cost, lower impact on grid fees; planning, licensing and realisation faster


Maintenance
 Mature technology, easy access and low repair time, higher reliability


Public reception
 In the past: massive public protests against overhead lines based on misconception


Invest
 High cost (~4x-8x of overhead line cost), high impact on grid fees; planning, licensing and realisation slower


Maintenance
 New technology, fault location challenging, repair requires civil works and easements, thus high repair time


Public reception
 Higher acceptance, but also resistance due to large environmental impact during construction

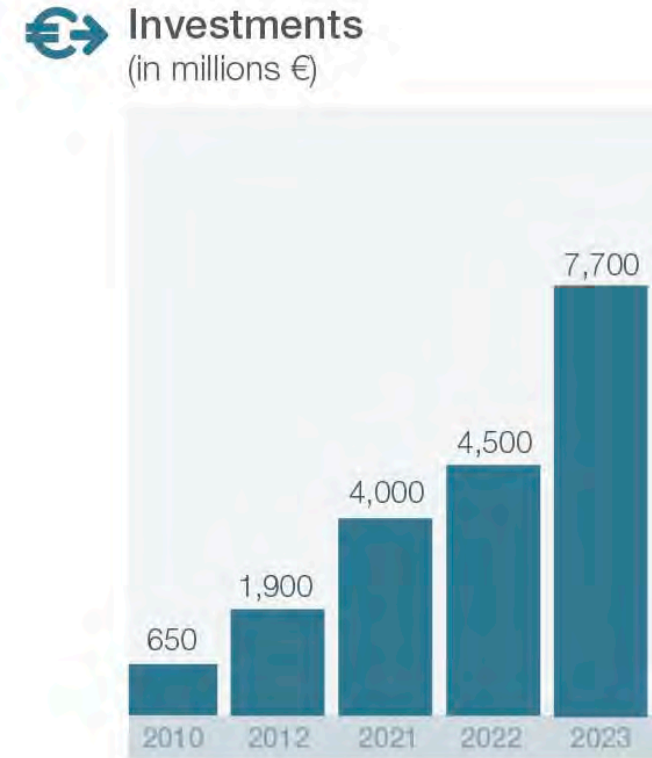
Ensure financeability

Energy transition – financial interests of our stakeholders

TenneT needs capital to make the electricity grid fit for the future

Financial strategy:

- Maintaining a credit rating in the 'A' category or higher
- Generating an acceptable return on investment in line with our risk profile



Target Grid Program

Key Elements

System Stability

Power quality, voltage control, and congestion management

New Technologies

Enable new technologies in grid design and in grid observability

Market Design

Efficient use, cost allocation, and resource adequacy

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