Next Gen Scada

Jan Vorrink

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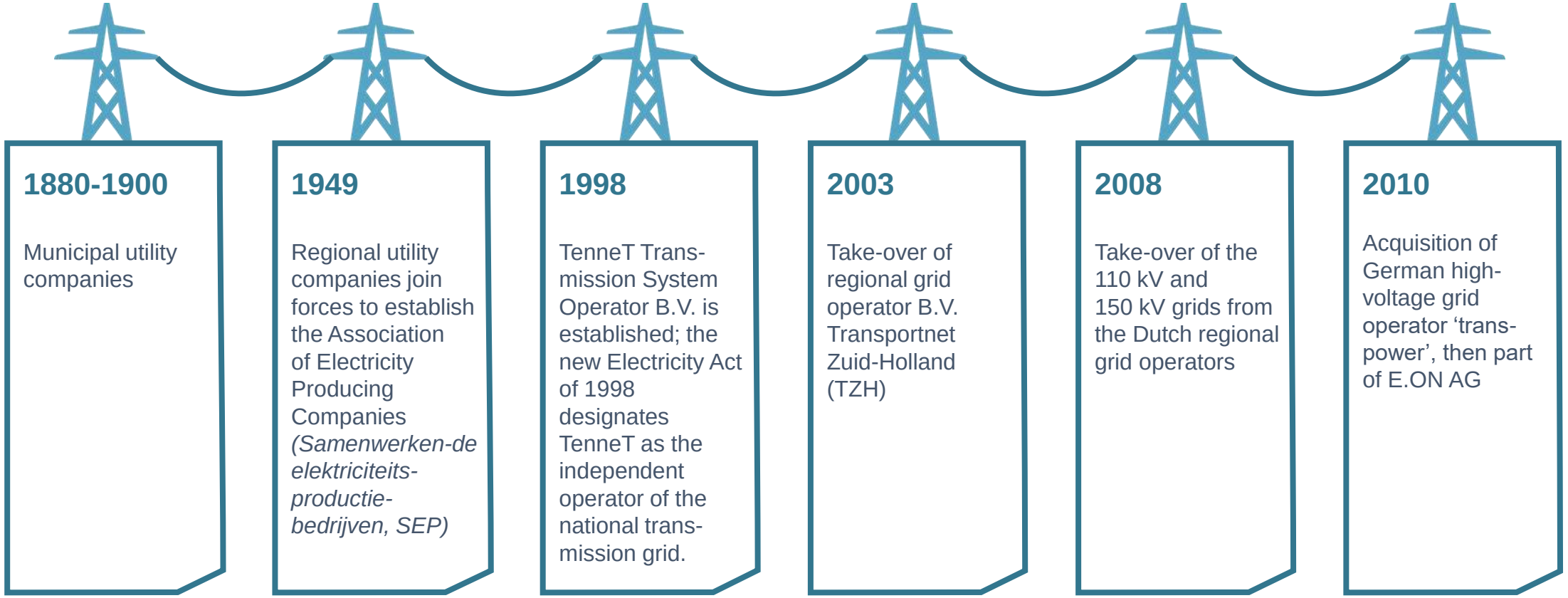
Next Gen Scada

Our origins



1880-1900

Municipal utility companies

1949

Regional utility companies join forces to establish the Association of Electricity Producing Companies *(Samenwerken-de elektriciteits-productie-bedrijven, SEP)*

1998

TenneT Trans-mission System Operator B.V. is established; the new Electricity Act of 1998 designates TenneT as the independent operator of the national trans-mission grid.

2003

Take-over of regional grid operator B.V. Transportnet Zuid-Holland (TZH)

2008

Take-over of the 110 kV and 150 kV grids from the Dutch regional grid operators

2010

Acquisition of German high-voltage grid operator ‘trans-power’, then part of E.ON AG

TenneT at a glance
2019

Workforce
4,913
Employees

EBIT
768
EUR million

Assets
21,8
EUR billion

Investments 2019-2029
35
EUR billion

Grid
99,99%
Availability

Grid length
23,555
Km

Dutch State
100%
Shareholder

Footprint
27.4%
Greened

March 17, 2021

TenneT at a glance
2020

Workforce
5,700
Employees

EBIT
796
EUR million

Assets
27
EUR billion

Investments >2025
5-6
EUR billion/year

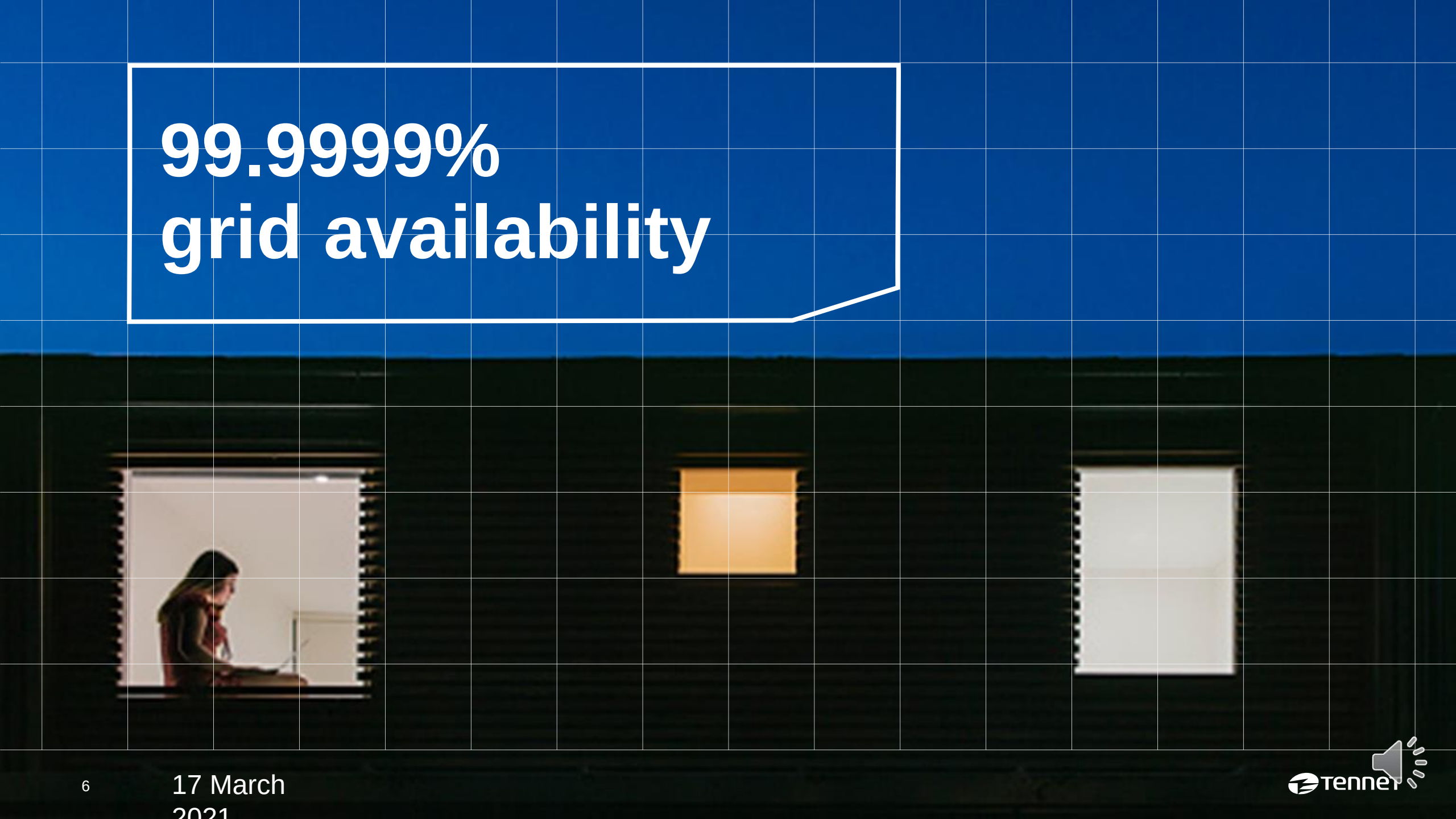
Grid
99,9999%
Availability

Grid length
23,900
Km

Dutch State
100%
Shareholder

Footprint
27.4%
Greened

99.9999%
grid availability



A grid operator’s tasks
Main tasks

Transmission services
Ensure a robust and efficient high-voltage grid

Market facilitation
Facilitate an efficient and stable electricity market

System services
Maintain the balance of electricity, 24/7

17 March 2021

The market is changing

Past

- Stable, predictable (price-driven) generation of energy, demand-driven
- Maintenance and (limited) replacement
- Focus on technology
- Local markets, separate price zones
- National focus and regulation

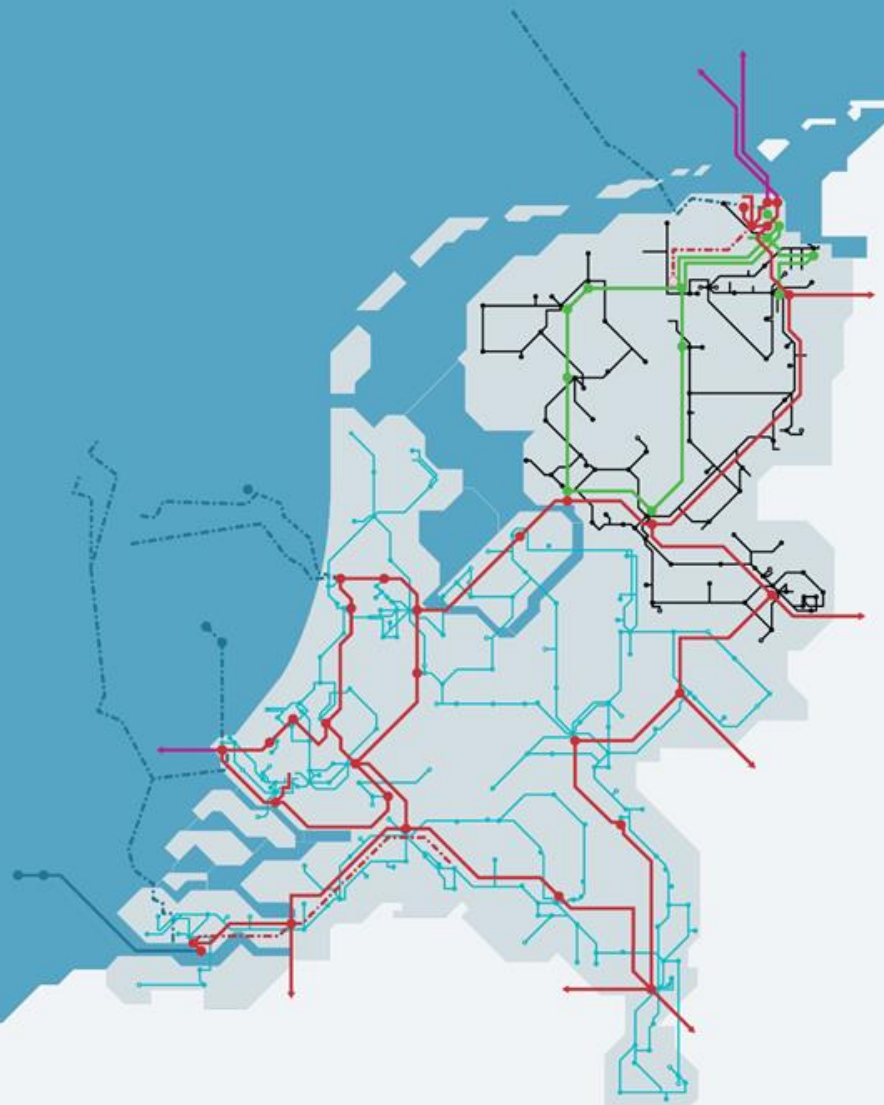
Present

- Fluctuating generation of energy (solar/wind), supply-driven
- Large-scale construction of new renewable generation and transmission capacity
- Focus on efficiency and acceptance
- North-West European market; market coupling
- Grid planning and regulation increasingly at the European leve

Onshore – Netherlands

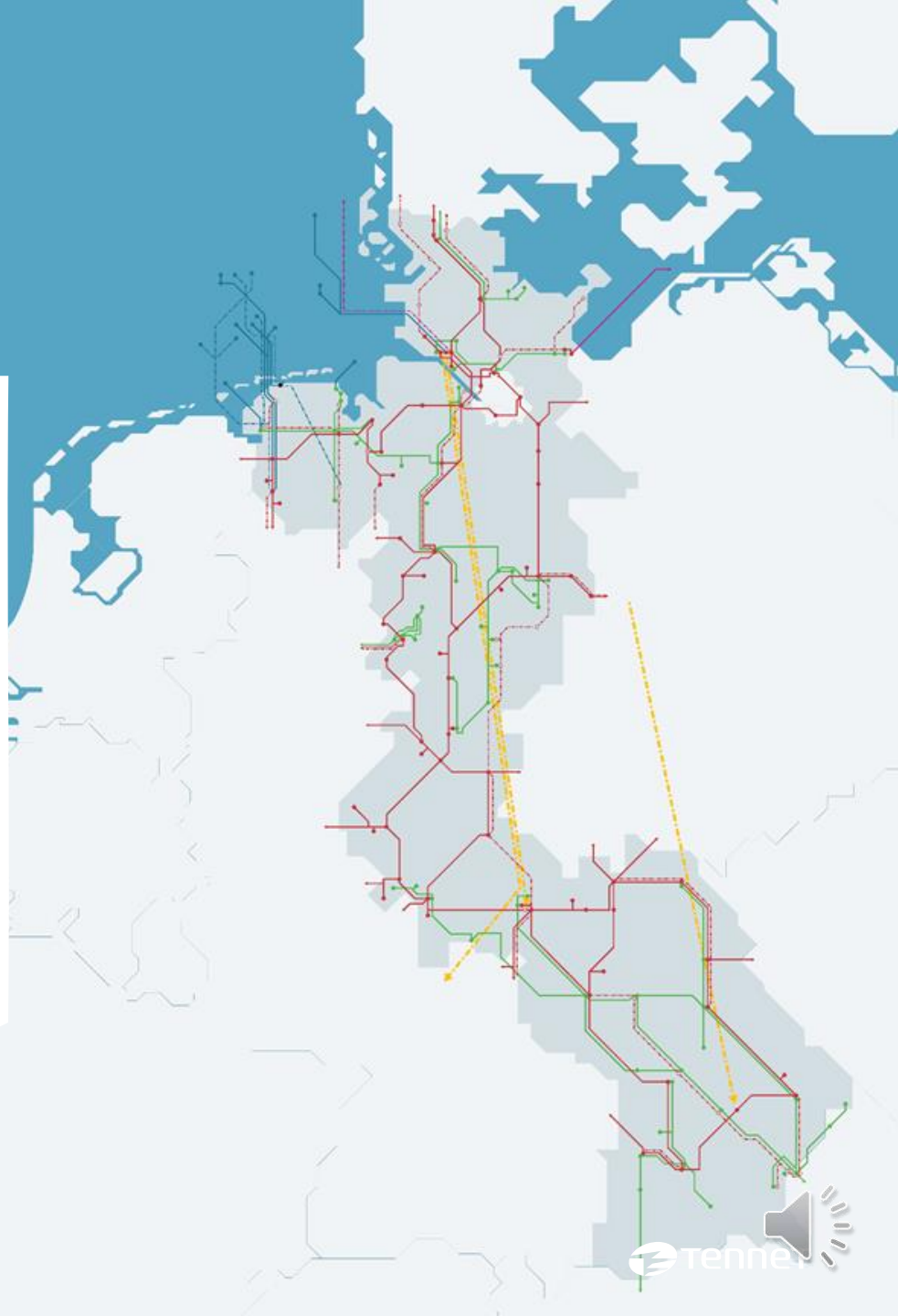
Largest projects:

- Zuid-West 380 kV West
- Zuid-West 380 kV Oost
- Noord-West 380 Eemshaven-Vierverlaten
- Increase capacity of national 380 kV ring.
- Offshore grid connections (9.6 GW by 2030)



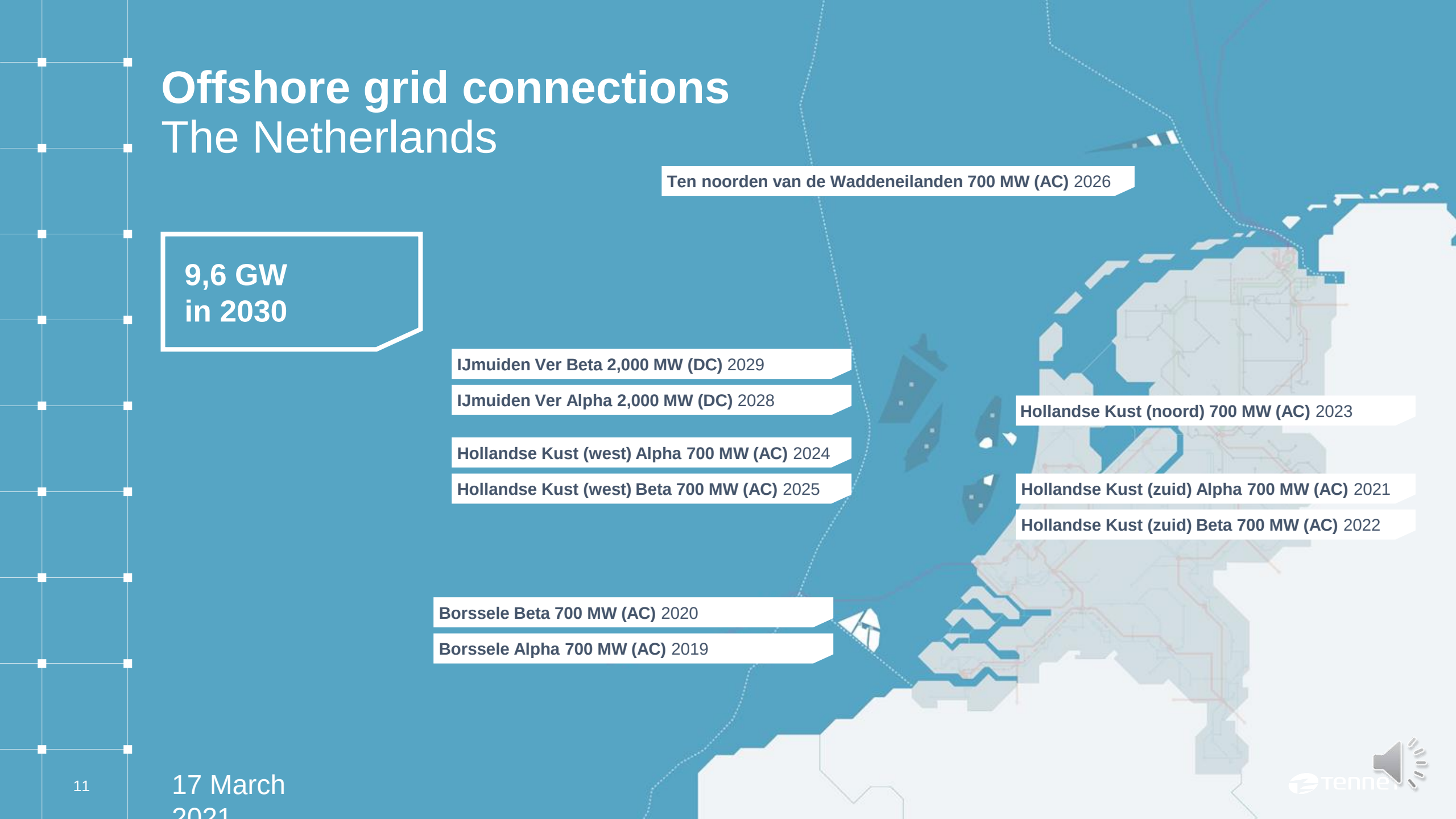
Onshore – Germany

- Some 2.000 km of new connections planned: 15 large-scale onshore projects and hundreds of smaller projects
- Wind energy to be transported from the north of Germany to the south
- SuedLink: With 800 km and 2 x 2 GW the largest DC connection in Germany (in cooperation with TransnetBW)
- SuedOstLink: 2 GW DC connection (in cooperation with 50Hertz)



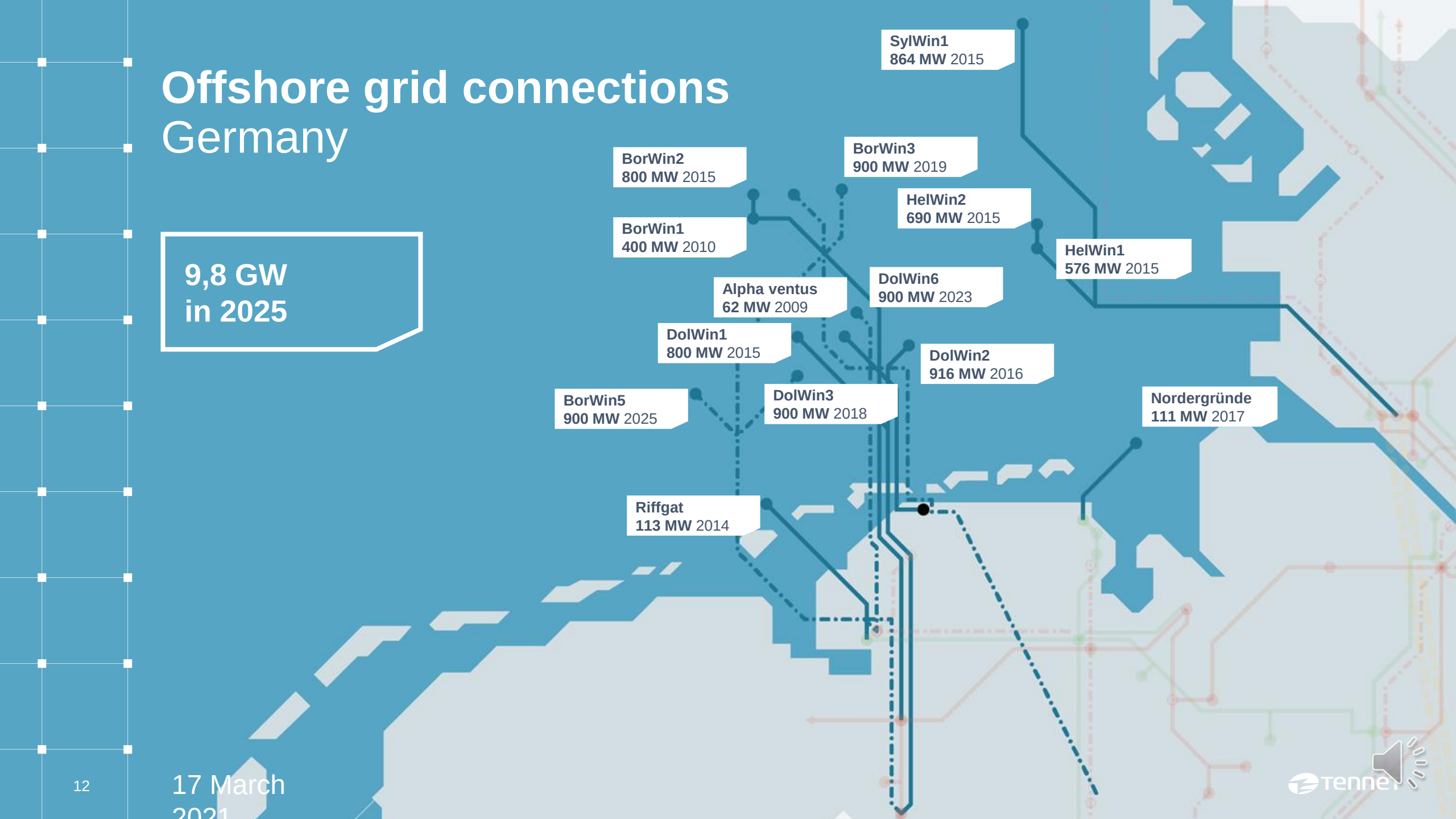
Offshore grid connections
The Netherlands

9,6 GW in 2030



Offshore grid connections
Germany

9,8 GW in 2025



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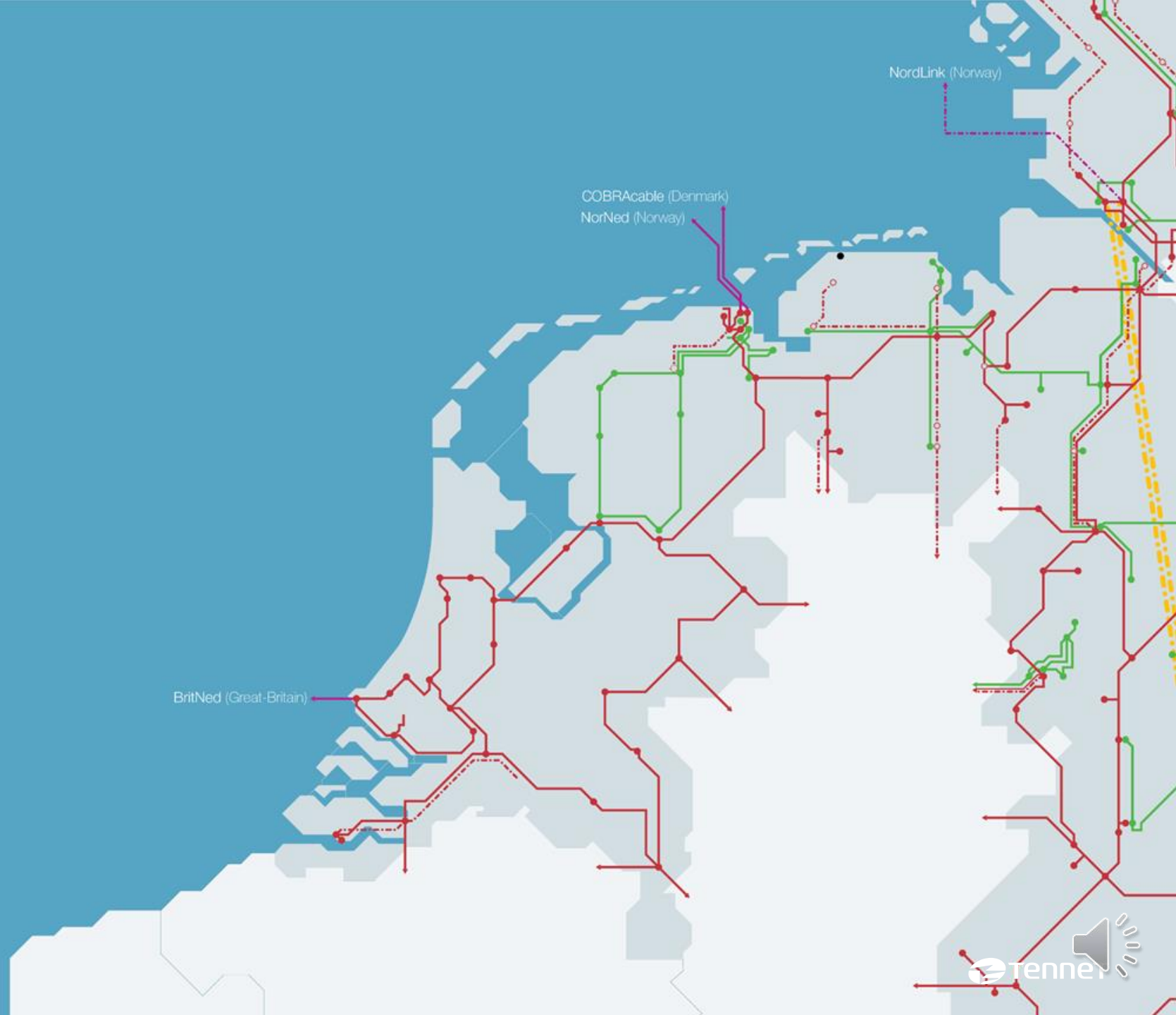
Subsea Interconnectors

NorNed (2008)
700 MW
650 million

BritNed (2011)
1,000 MW
600 million

COBRAcable (2019)
700 MW
620 million

NordLink (2020)
1,400 MW
1.5 to 1.0 billion



17 March
2021

Next Gen Scada

March 24 2021

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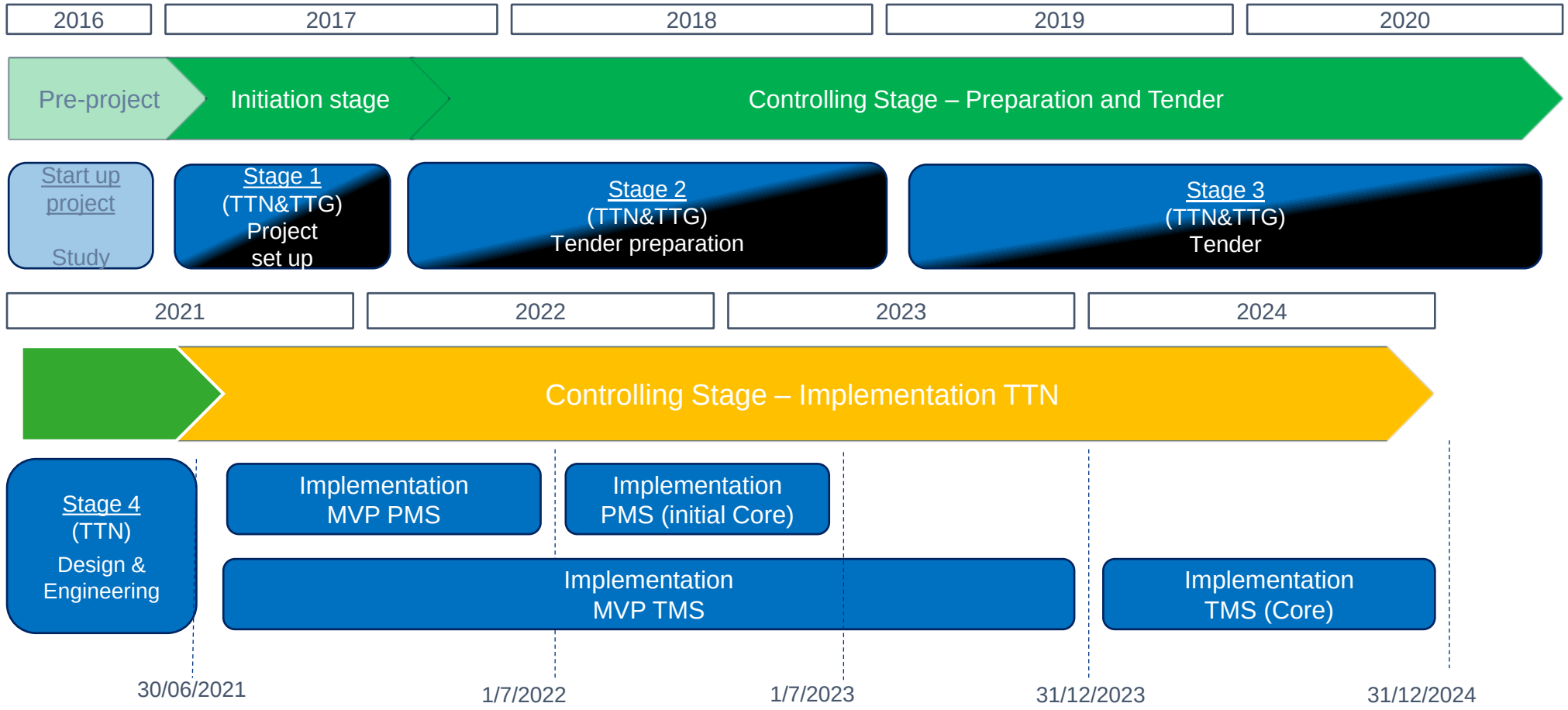
Tender proces Next Gen EMS/SCADA TenneT

Job de Visser / Jan Vorrink

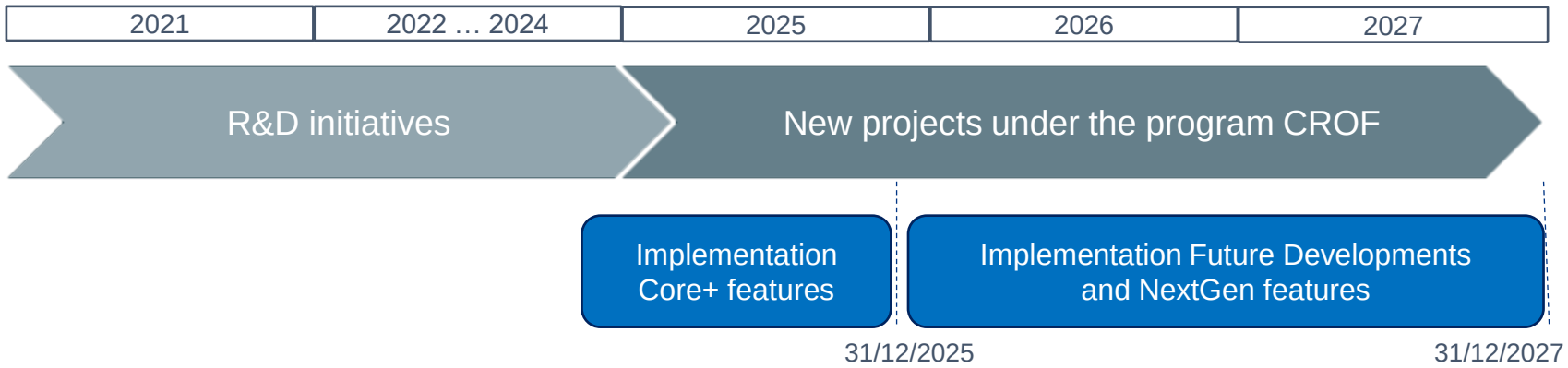
Timeline Replacement and upgrade EMS/SCADA

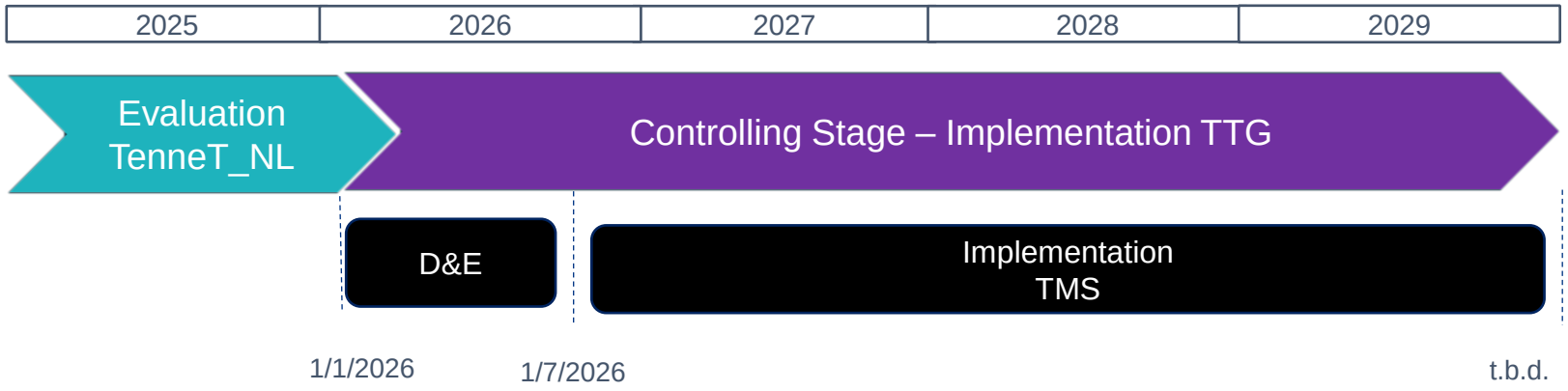


Legenda:

- Joined Stage TTN and TTG
- Stage TTN only

Timeline Replacement and upgrade EMS/SCADA





Legenda:

Stage TTN only

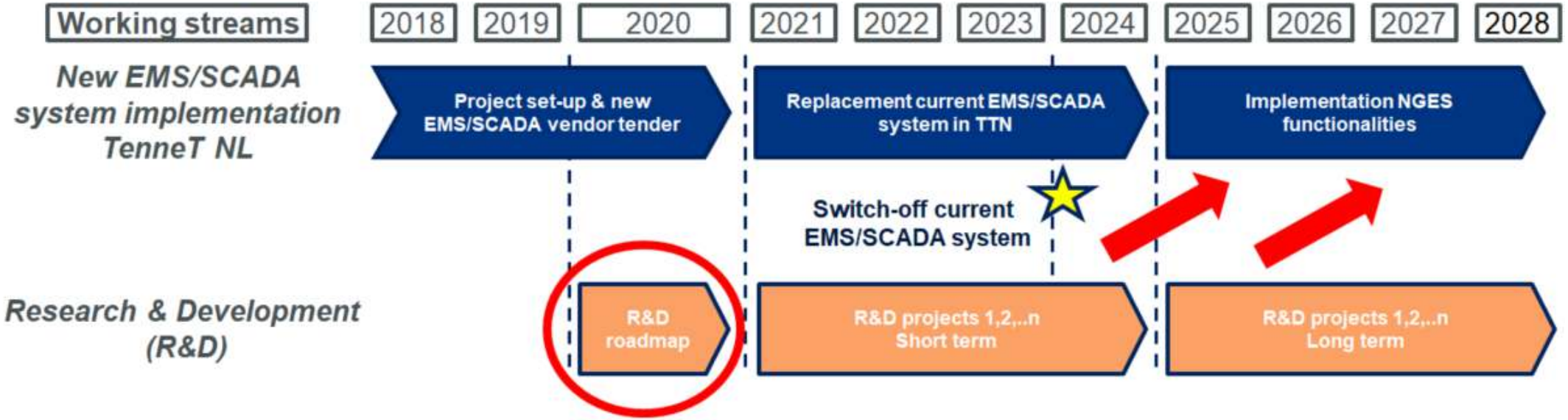
Stage TTG only

CRoF R&D roadmap

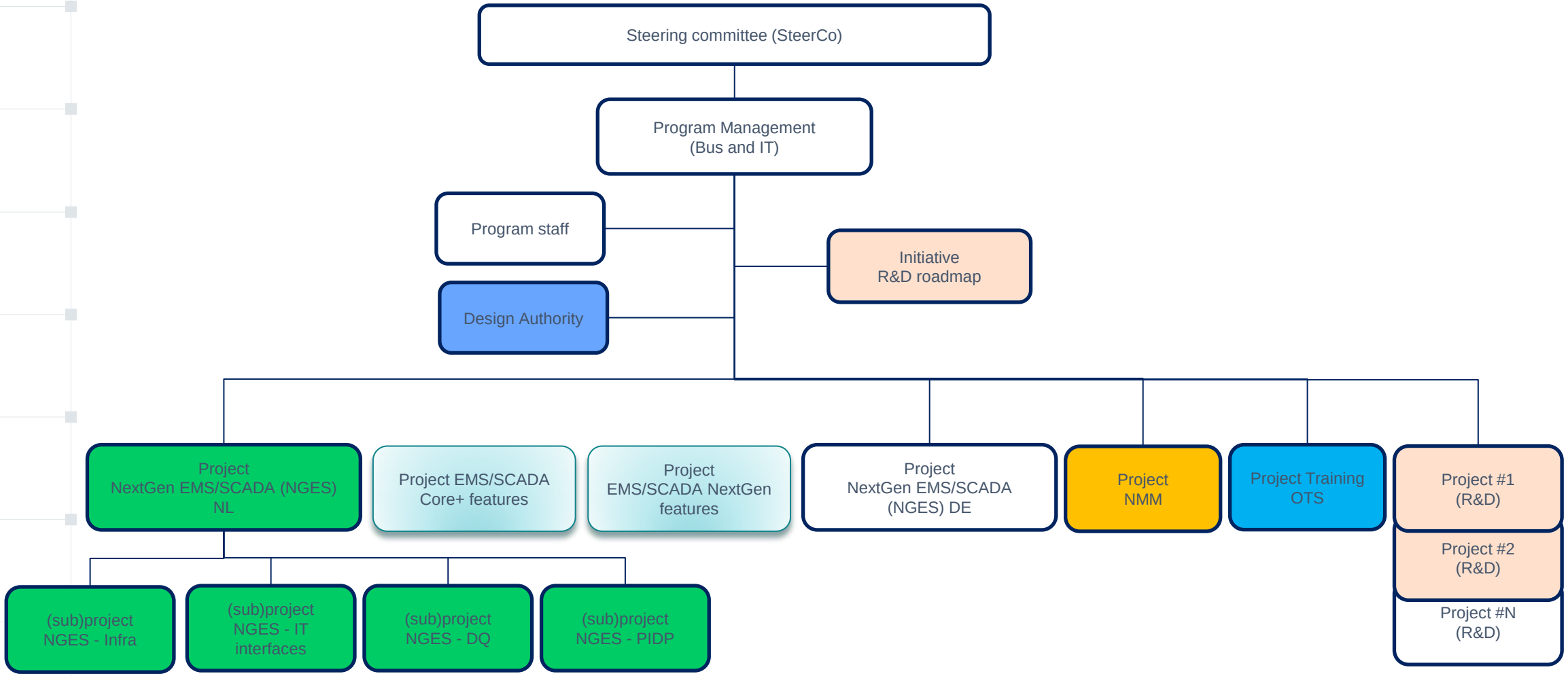
Aim:

- Provide **additional functionality of the EMS/SCADA** to support the power system operators
- **Modernization** the **EMS/SCADA related processes and supporting systems** for more efficient, reliable, and cyber-resilient management of the future power system

Timeline:



Organization Chart Control Room of the Future



Fundamentals of the Tender 1

A solution based, to the maximum extent possible, on the supplier's off-the-shelf product with flexibilities such that:

- specials and other functionalities are realised on a non-intrusive, modular manner
- industry standards are followed

- the supplier's road map can be followed easily, and
- (new) functionalities can be easily and stepwise introduced, and
- growth-path towards meeting the full requirement set.

Fundamentals of the Tender 2

A trusted partnership between supplier and TenneT:

- benefitting both, technically and commercially, during the implementation and the services period;
- collaborating in future developments;
- where both parties are technically and commercially transparent;

A solution that:

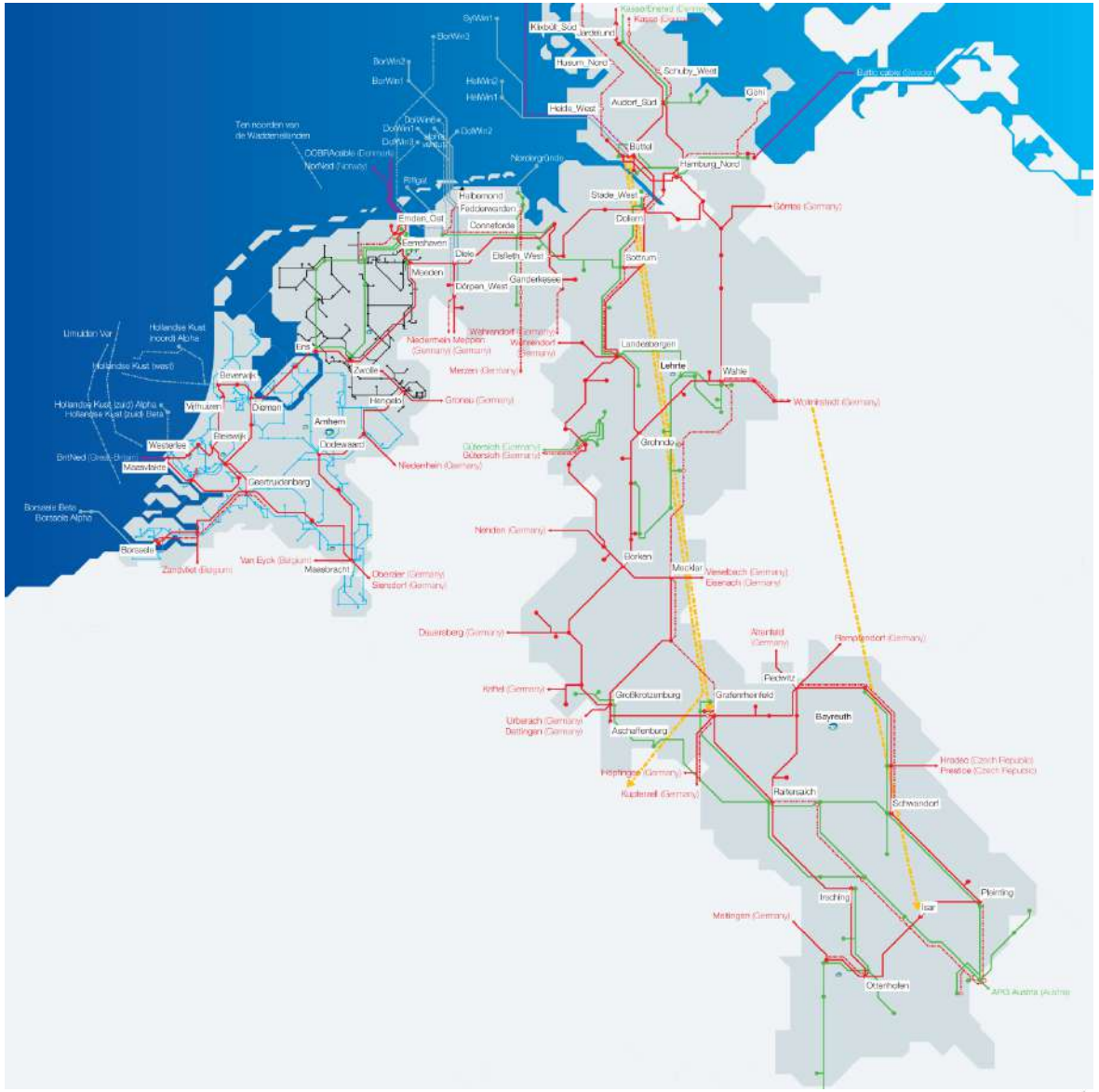
- is highly reliable, available and (cyber) secure according the latest standards, and
- supports TenneT towards operating a reliable, efficient and secure transmission network, and
- Enables TenneT and its people to drive the energy transition.

Fundamentals of the Tender 3

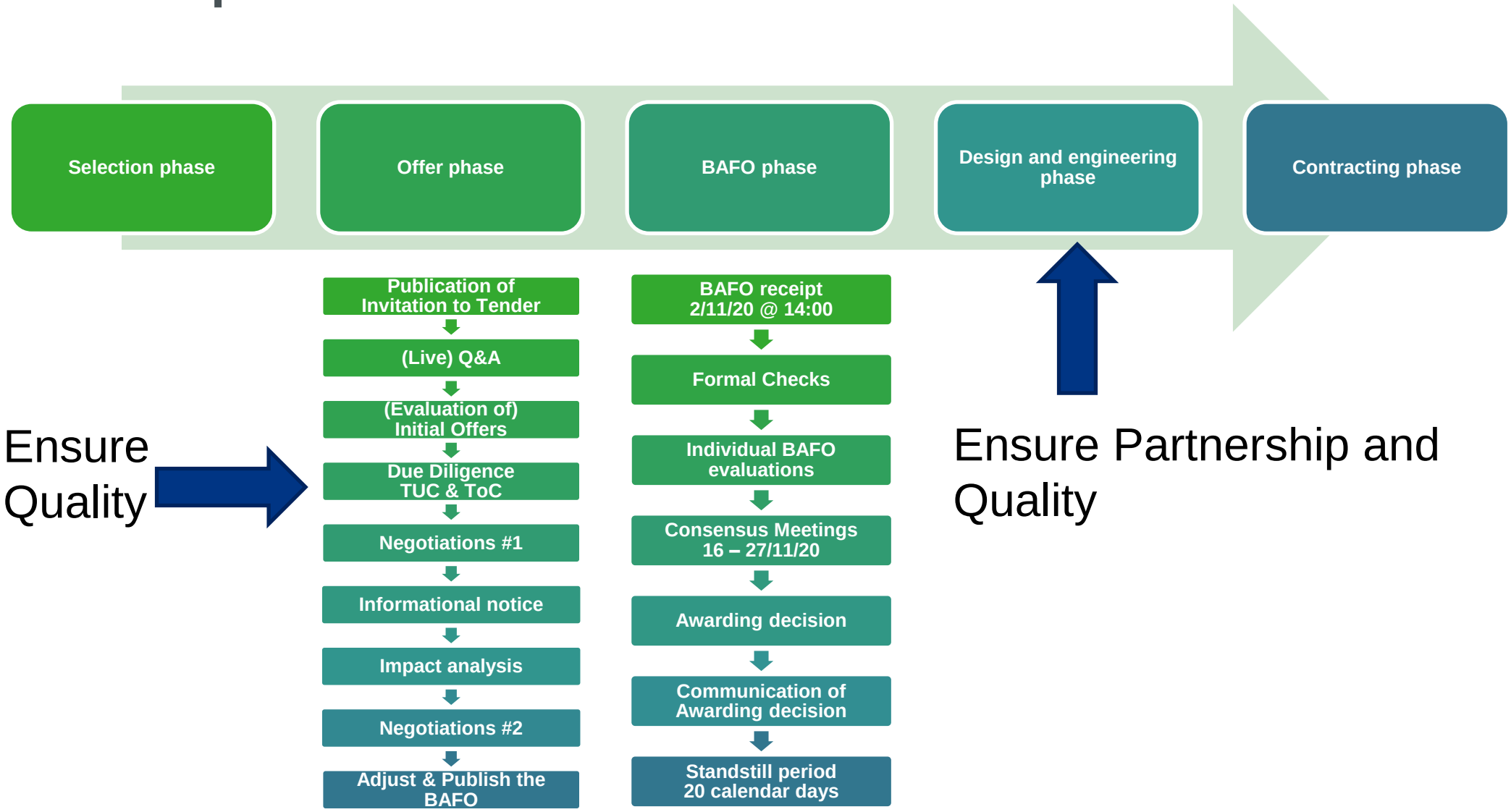
Harmonisation and system integration between TenneT Netherlands and TenneT Germany

Time path Power Management Module

and Transmission Management Module



Tender process



Control Room of the Future

March 24 2021

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Control Room of the Future R&D roadmap

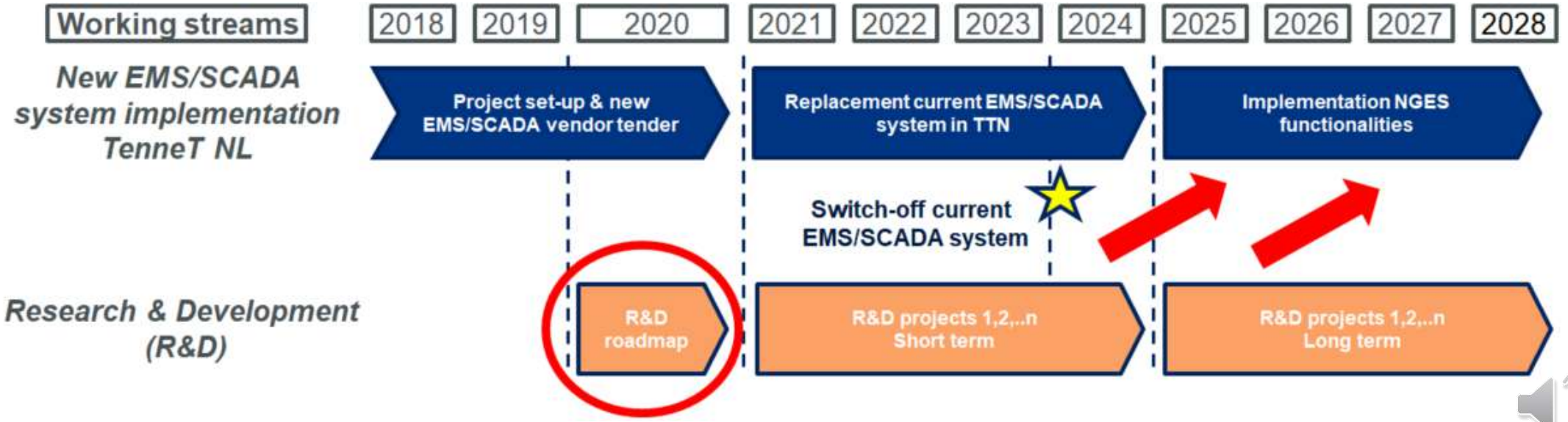
Jan Vorrink

CRoF R&D roadmap
R&D aim and timeline

Aim:

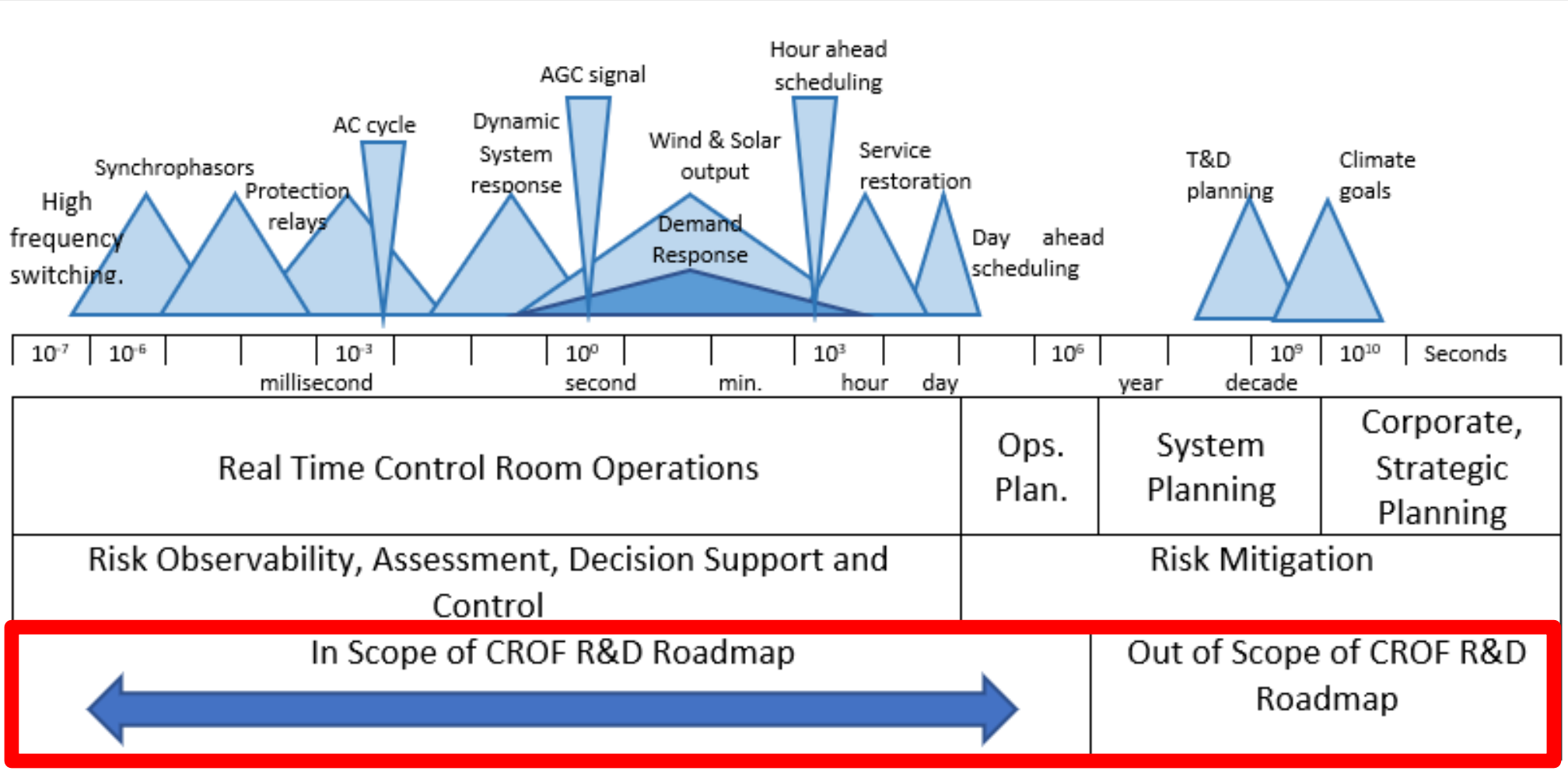
- Provide **additional functionality of the EMS/SCADA** to support the power system operators
- **Modernization** the **EMS/SCADA related processes and supporting systems** for more efficient, reliable, and cyber-resilient management of the future power system

Timeline:



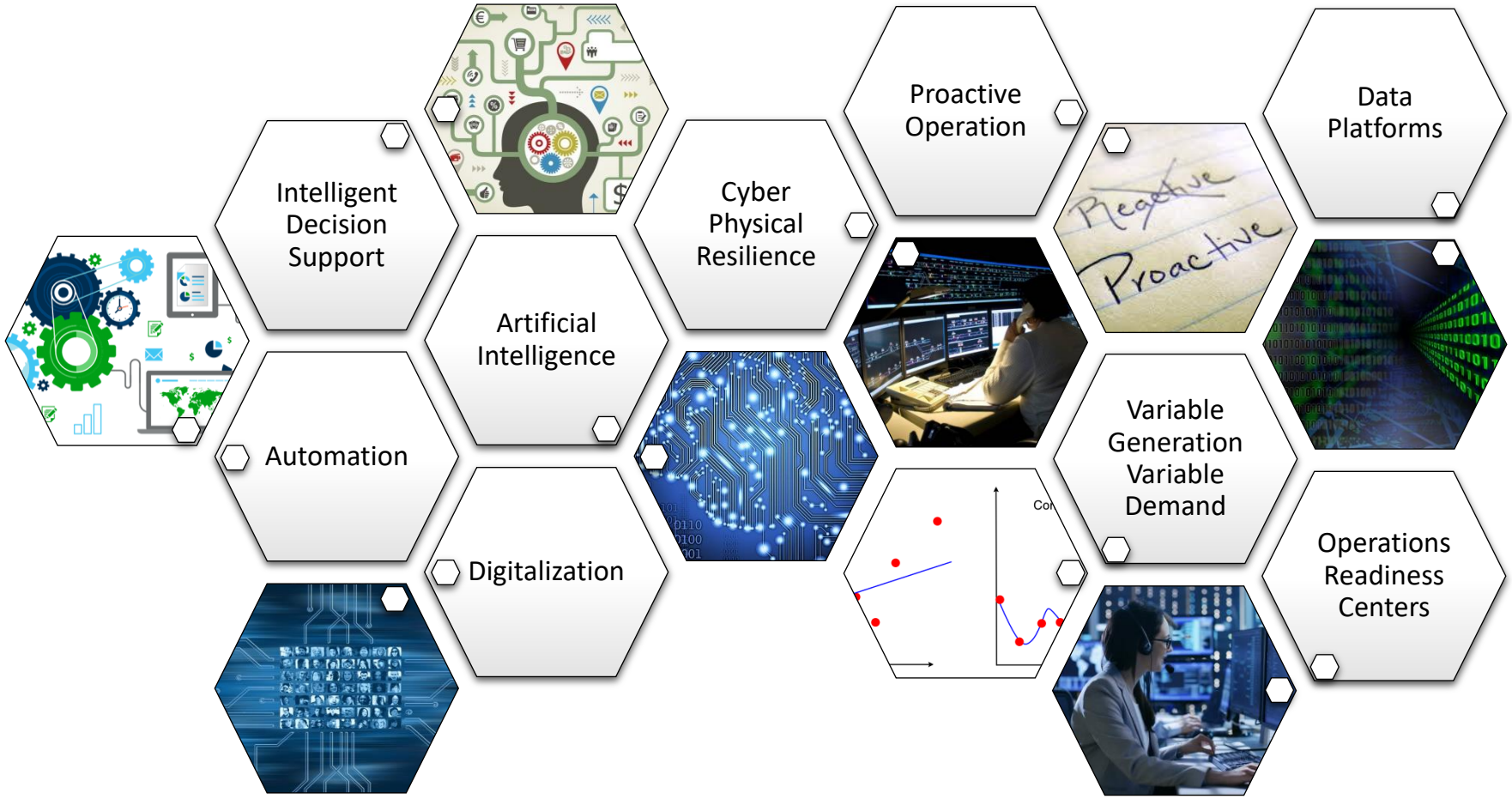
Roadmap Scope and Future Trends

A Discussion of the Scope of the CROF Roadmap

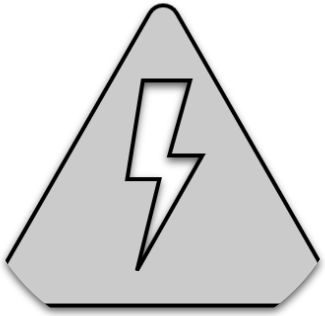


CROF Facilitates Operators to Monitor and Assess System Risks. Assets to Mitigate Risks are not in Scope

Control Room of the Future Trends



CROF Roadmap Development - High Level Project Overview



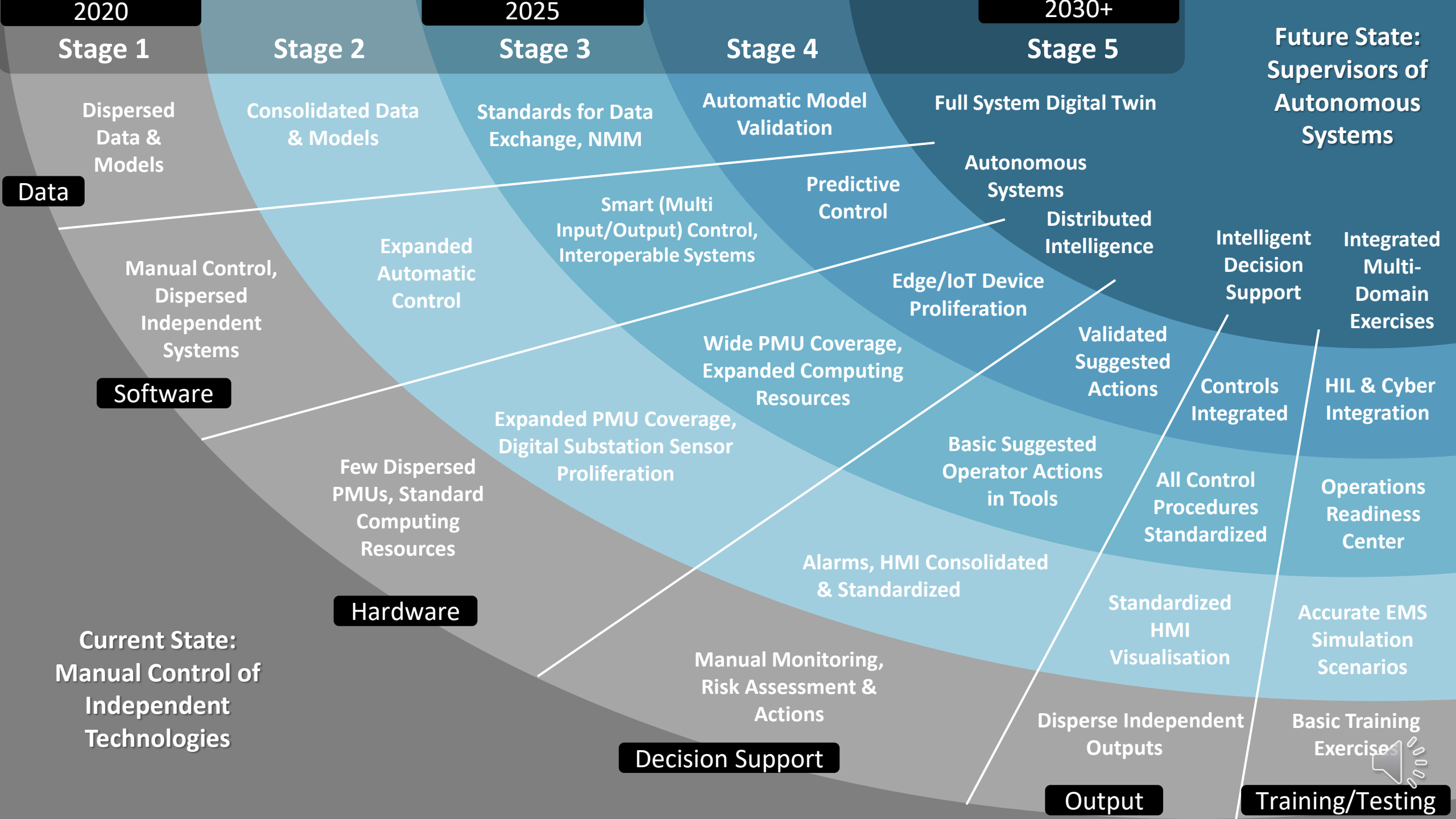
1. System Risk Assessment and Solution Identification

2. Technology and Methodology Assessment

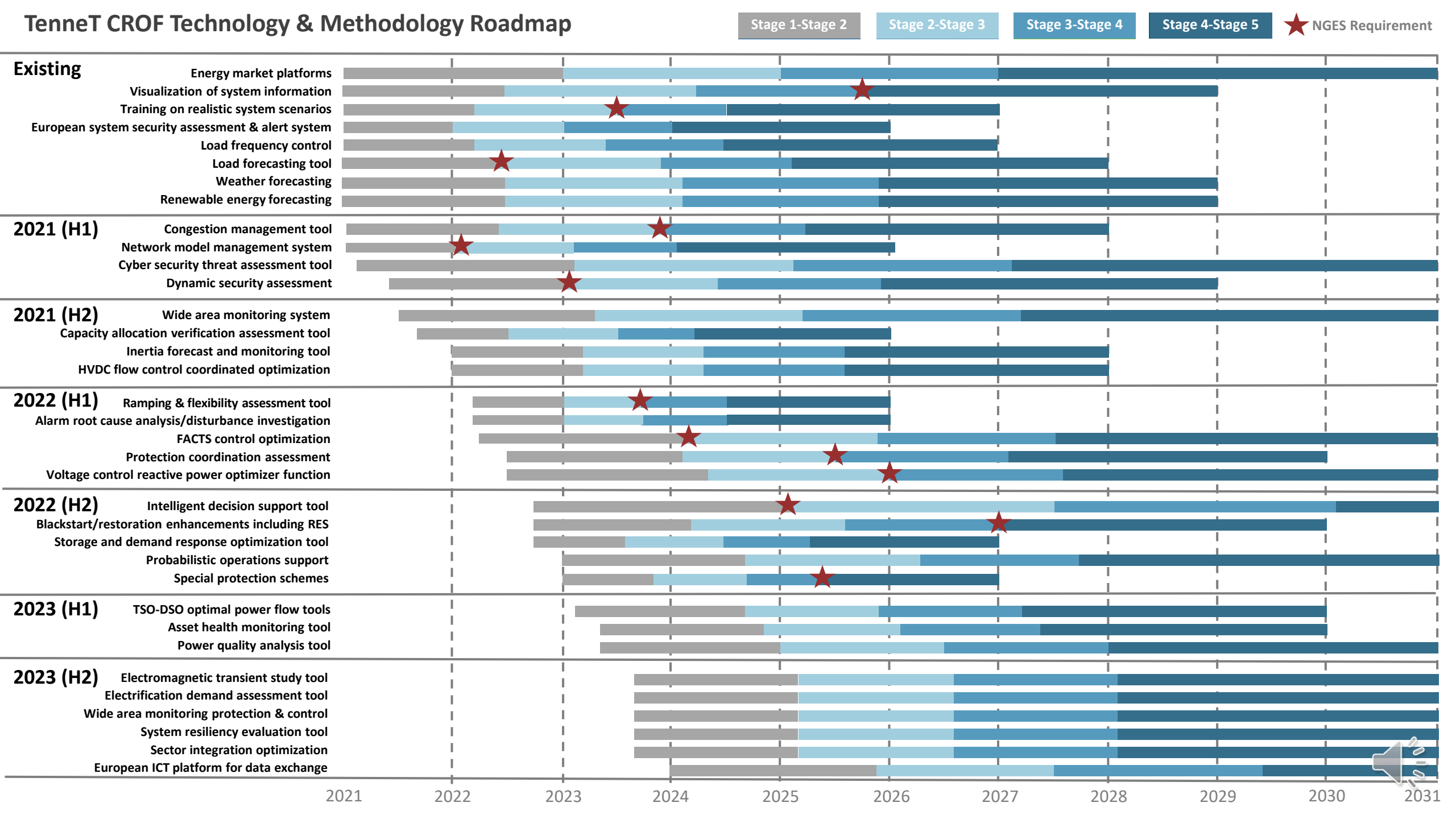
3. TenneT Status, Roadmap and Implementation Plan

Risks Applicable for Netherlands and Germany

Top 17 System Risks for Netherlands and Germany	
Increase in Transmission System Congestion in Known Areas	Reduction of Transient Stability Margins
Increase in Transmission System Congestion in Unpredictable or Unknown Areas	Inaccurate Load Model Data/Information
Increased ROCOF & Reduced Nadirs	Reduced Dynamic Reactive Power Reserves
Faster Ramping	Reactive Power Fluctuations
Increased Frequency Volatility	More Frequent Heatwaves
Larger Propagation of Low Voltages During Disturbances	Increased Flexibility Deficits
Larger Voltage Dips	Reduced Static Reactive Power Reserves
Inadequate Observability of RES	Fossil Fuel Shortage
Lack of Operator Situational Awareness for New Issues	


2020
2025
2030+
Stage 1
Stage 2
Stage 3
Stage 4
Stage 5
Future State: Supervisors of Autonomous Systems
Dispersed Data & Models
Consolidated Data & Models
Standards for Data Exchange, NMM
Automatic Model Validation
Full System Digital Twin
Data
Autonomous Systems
Predictive Control
Smart (Multi Input/Output) Control, Interoperable Systems
Distributed Intelligence
Intelligent Decision Support
Integrated Multi-Domain Exercises
Manual Control, Dispersed Independent Systems
Expanded Automatic Control
Edge/IoT Device Proliferation
Validated Suggested Actions
Controls Integrated
HIL & Cyber Integration
Software
Wide PMU Coverage, Expanded Computing Resources
Expanded PMU Coverage, Digital Substation Sensor Proliferation
Basic Suggested Operator Actions in Tools
All Control Procedures Standardized
Operations Readiness Center
Few Dispersed PMUs, Standard Computing Resources
Hardware
Alarms, HMI Consolidated & Standardized
Standardized HMI Visualisation
Accurate EMS Simulation Scenarios
Current State: Manual Control of Independent Technologies
Manual Monitoring, Risk Assessment & Actions
Disperse Independent Outputs
Basic Training Exercises
Decision Support
Output
Training/Testing

TenneT CROF Technology & Methodology Roadmap



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TenneT is a leading European grid operator (Transmission System Operator, TSO). We design, build, maintain and operate the high-voltage electricity grid in the Netherlands and large parts of Germany and facilitate the European energy market. We are committed to providing a secure and reliable supply of electricity, today and in the future, 24 hours a day, 365 days a year and to playing our role in driving the energy transition. We transport electricity over a network of approximately 23,500 kilometres of high-voltage connections, from wherever and however it's generated, to over 42 million end-users while keeping electricity supply and demand balanced at all times. With close to 5,000 employees, we achieve a turnover of 4.1 billion euros and a total asset value of EUR 23 billion. TenneT is one of the largest investors in national and international onshore and offshore electricity grids. TenneT makes every effort to meet the needs of society. This will require us all to take ownership, show courage and connect with each other.

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