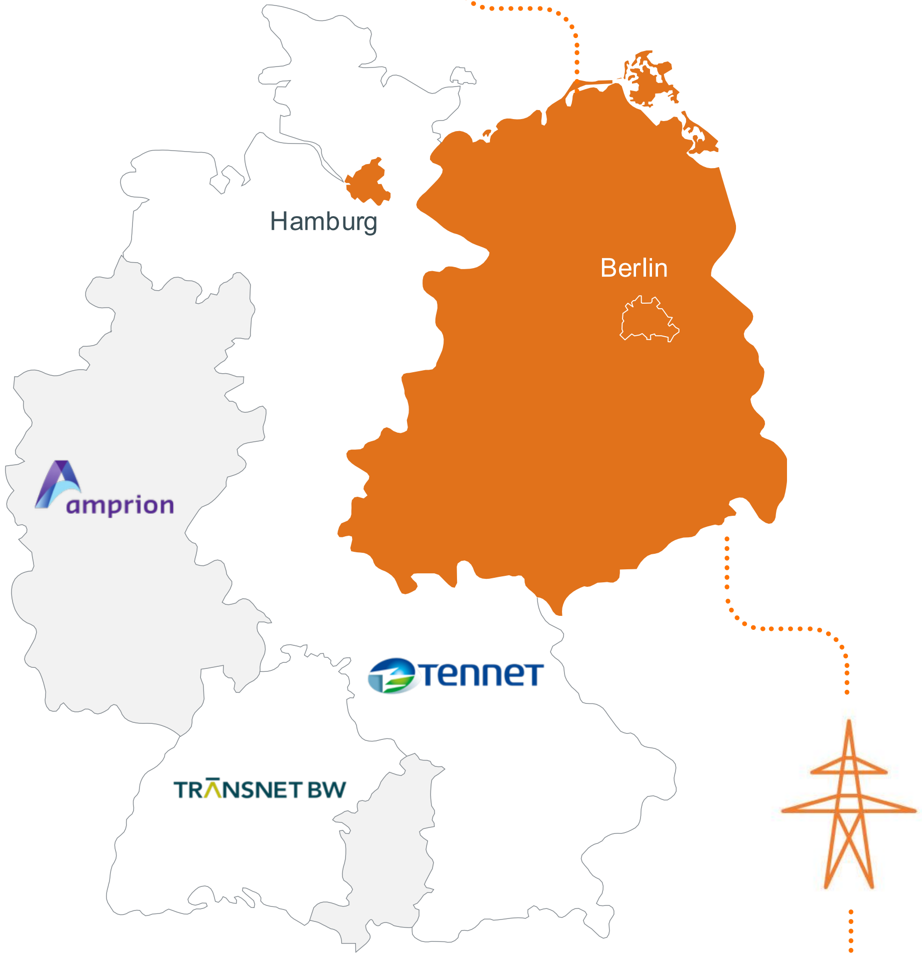
50hertz
| Elia Group

Increasing the resilience

Protection of critical infrastructure at a German TSO

October 2025

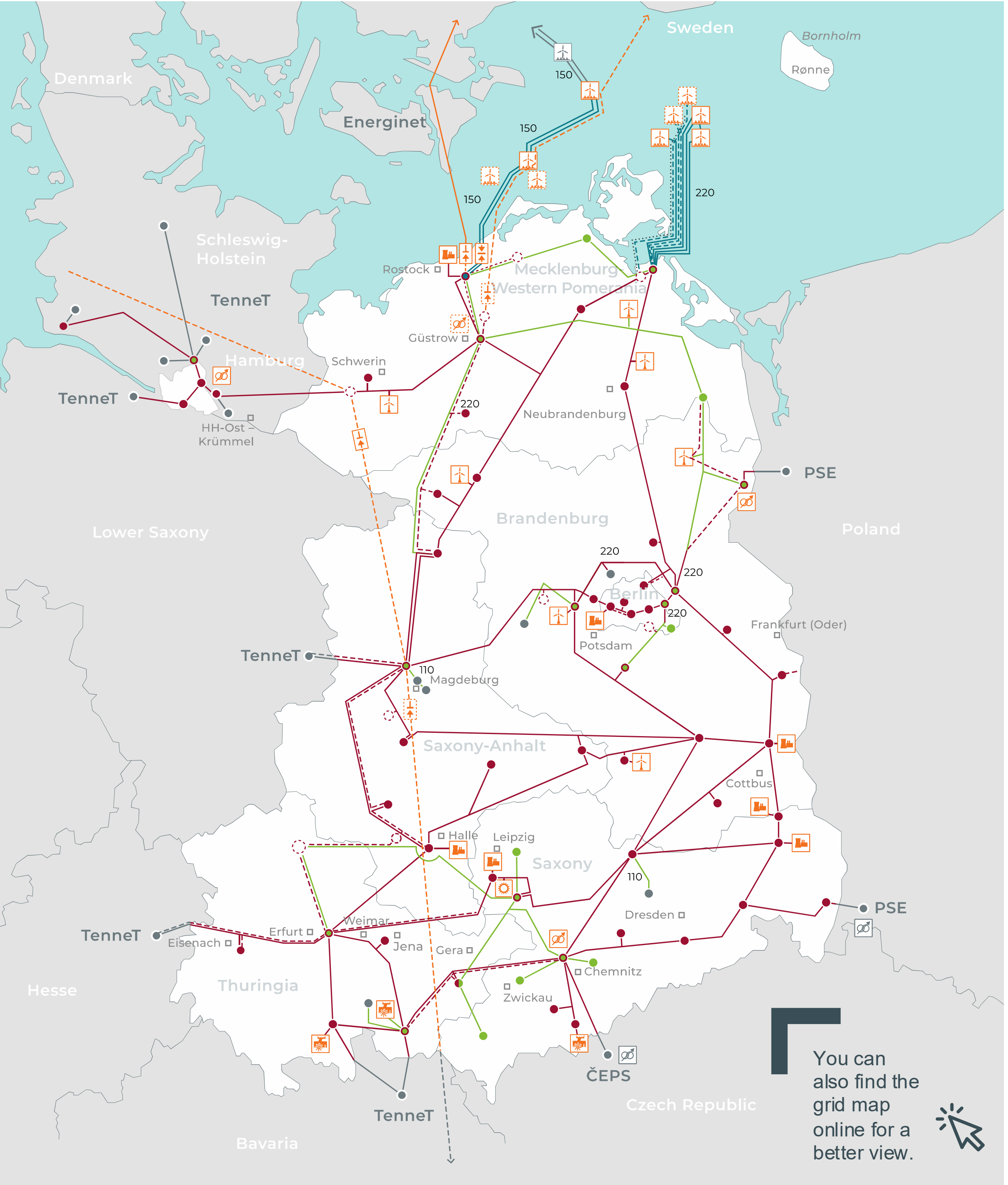
50Hertz – One of four German TSOs



50Hertz is one of the four German TSOs with control area responsibility.

We operate the electricity transmission system in the north and east of Germany with an electrical circuit length of more than 10,000 km – the distance between Berlin and Rio de Janeiro.

More than 2.100 employees ensure that 18 million people are supplied with electricity. 50Hertz is a forerunner in the field of secure integration of renewable energy. In our grid area, we want to integrate 100 percent renewable energies securely into the grid and system by 2032 - calculated over the year.



You can also find the grid map online for a better view.

50Hertz grid map

Switching stations (most with links to distribution system operators)

- ● 380 kV
- ● 220 kV
- ● Transformation 380/220 kV
- ● Transformation 380/150 kV
- ○ in planning/ construction
- ● Other companies

110 Operating voltage in kV

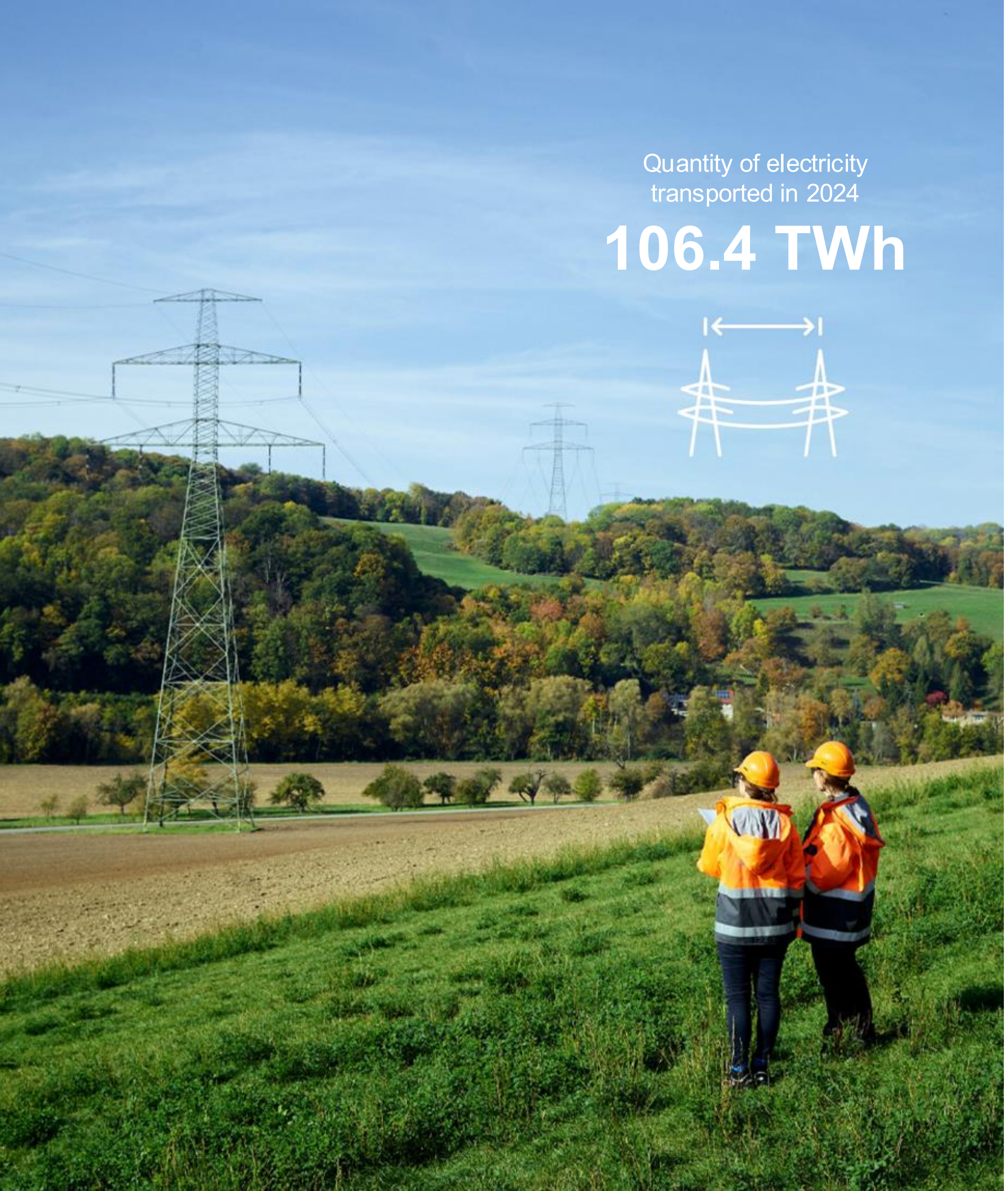
* New construction largely along existing route

Line	380 kV	—
Line in approval stage/ under construction*	380 kV	- - -
Line	220 kV	—
HVDC/direct-current connection	400 kV	—
HVDC/direct-current connection in approval stage/under construction	300/400/525 kV	- - -
Other companies	380/220 kV	—
HDVC/back-to-back converter	380/150 kV	⊳⊲
HVDC/converter	400 kV	⊳⊢
HVDC/converter in approval stage/under construction	300/525 kV	⊳⊢
Offshore grid connection	150/220 kV	—
Offshore grid connection in approval stage/under construction	150/220 kV	······

Grid users:

Our customers are regional distribution system operators and power stations, pumped storage plants, wind farms and large industrial facilities that are connected to the transmission system.

- Conventional power station
- Pumped storage plant
- Phase-shifting transformers
- Onshore wind farm/Offshore wind farm
- Photovoltaic (PV)
- Onshore wind farm in approval stage/ under construction
  Offshore wind farm in approval stage/ under construction
  PV farm in approval stage/ under construction



Quantity of electricity transported in 2024

106.4 TWh

Our transmission system

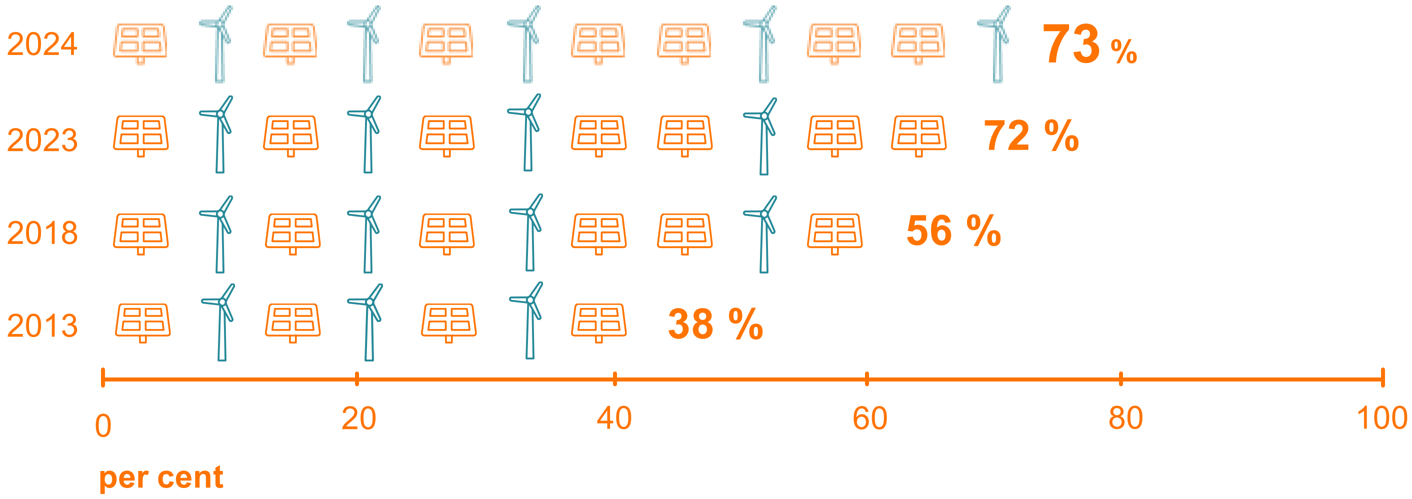
50Hertz offshore circuit lengths in 2024 (total values):

220 kV AC sea cables	560 km
150 kV AC sea cables	290 km

circuit lengths in 2024 (total values):

380 kV AC overhead lines	7,840 km
220 kV AC overhead lines	2,075 km
380 kV AC cables	55 km
400 kV DC cables (HVDC)	15 km
220 kV AC cables	3 km

50Hertz increases investments for a climate-neutral society



RE generation 2024

69 TWh

Electricity consumption 2024

94 TWh

Infrastructure operators and the state

Transmission system operators
in Germany are private-law companies

State as „risk owner“ sets the frame
close cooperation with the operators

Relation has to be balanced
clear cut responsibilities and cost recovery.

Legal framework for critical infrastructure in Germany

This is an optional indication of source

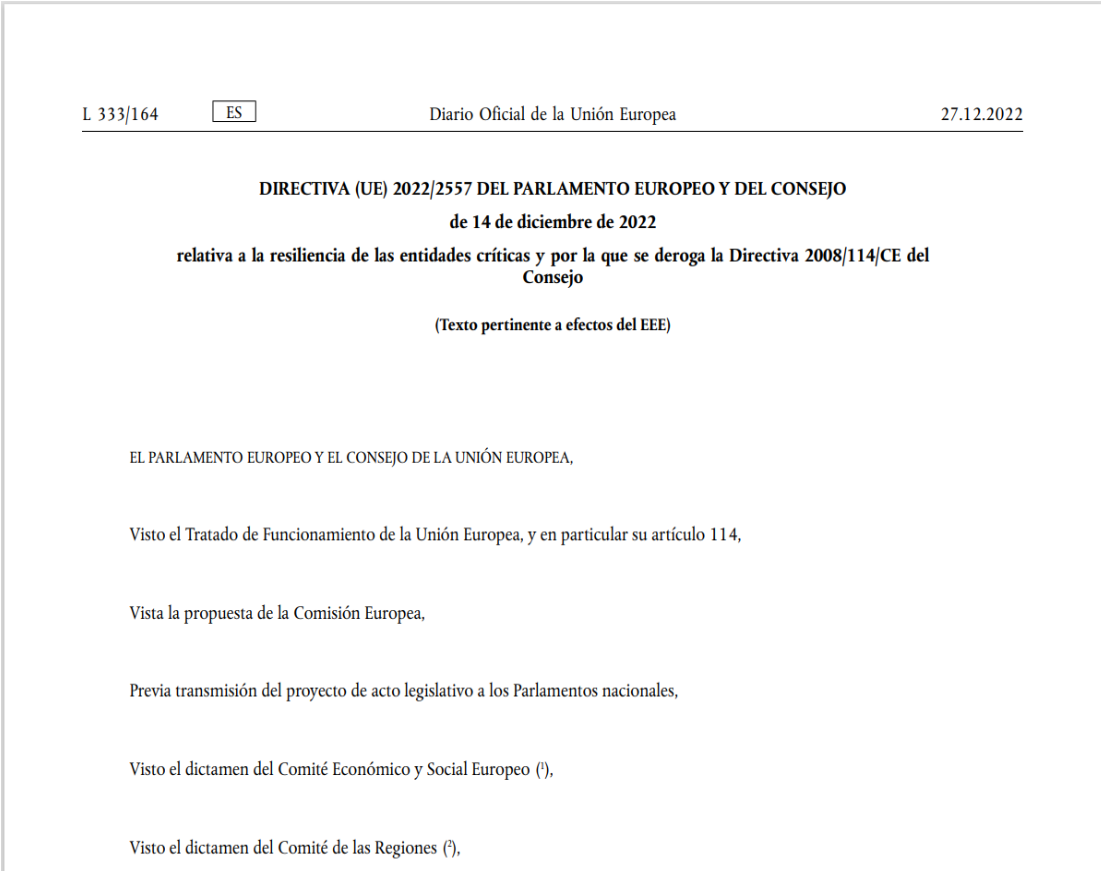
Brief look back

- German legal framework on critical infrastructure as well as cybersecurity predominantly driven by EU law.
- EU has opted for setting the framework by issuing Directives – have to be transposed into national law.
- First EU Directive in 2008 “on the identification and designation of European critical infrastructures and the assessment of the need to improve their protection”
- Basic principle:
  - Member state assesses the risks and sets forth scenarios
  - Operators of infrastructure identify the impact by applying the scenarios to their assets
  - When the loss of the asset exceeds certain threshold of impact the asset is considered “European critical infrastructure”
- EU Commission evaluated the Directive and attested low efficiency

Similar approach for national critical infrastructure

- Although no national legislation exists in Germany for the identification of national critical infrastructure, the federal ministry of economics and energy applied a similar procedure to identify national critical infrastructure
- The thresholds were set lower, but the principles (scenarios, assessments) remained unchanged.
- German TSOs identified a list of assets crucial for the security of supply with electricity on a national level.
- Protection concepts were developed by TSOs and approved by federal authorities
- Currently still in the course of being implemented.

Identification of critical infrastructure – new approach



L 333/164 ES Diario Oficial de la Unión Europea 27.12.2022

DIRECTIVA (UE) 2022/2557 DEL PARLAMENTO EUROPEO Y DEL CONSEJO

de 14 de diciembre de 2022

relativa a la resiliencia de las entidades críticas y por la que se deroga la Directiva 2008/114/CE del Consejo

(Texto pertinente a efectos del EEE)

EL PARLAMENTO EUROPEO Y EL CONSEJO DE LA UNIÓN EUROPEA,

Visto el Tratado de Funcionamiento de la Unión Europea, y en particular su artículo 114,

Vista la propuesta de la Comisión Europea,

Previa transmisión del proyecto de acto legislativo a los Parlamentos nacionales,

Visto el dictamen del Comité Económico y Social Europeo (1),

Visto el dictamen del Comité de las Regiones (2),

- EU Commission issued a successor Directive in 2022 “on the resilience of critical entities”
- Introduces a system change: get away from asset based approach to service based approach
  - EU defined list of “essential services”
  - Member states remain responsible for defining risk analyses
  - Operators of infrastructure identify components needed for the essential services
  - When loss of these components exceeds threshold, the asset is considered critical infrastructure
- New Directive embraces all-hazard approach

Legal framework for cybersecurity advanced

- EU issued the first Directive on “Network and Information Security“ in 2016.
- It was recently amended by NIS-2 Directive in 2022. Key elements:
  - Scope: applies to a wider range of companies and sectors, including critical infrastructures (energy, transport, health, etc.) as well as important and particularly important entities.
  - Risk management: Affected companies must take appropriate technical and organizational measures to manage risks and ensure the security of their systems.
  - Reporting obligations: to report significant security incidents to competent authorities.
  - Cooperation: Directive promotes cooperation and information exchange between member states through national CSIRTs (Computer Security Incident Response Teams) and a single point of contact (SPOC).

Transposition into national law – state of play in Germany

- Although the Resilience Directive should have been transposed into German law by October 2024, the operators of infrastructure are still awaiting new laws and in particular ordinances that further determine the new legal framework
- The new “umbrella law” for critical infrastructure is to be expected in second quarter of 2026.
- NIS Directive is implemented, however for NIS-2 Directive Germany missed the deadline, and the process for the NIS-2 Implementation and Cybersecurity Strengthening Act (NIS-2UmsuCG) is still ongoing.

Implementation at 50Hertz

Corporate security – core of the resilience

- Central body for all security related issues
  - Setting the framework
  - Contact for competent authorities as well as the management
  - Organizing crisis team and exercises
  - Protection of classified documents
  - Development of BCM concept
  - Employment screening
  - Contribution to expert discussion of legislative projects
- The team grew by double in the past years also mirroring the increased risks in Central Europe.
- Cybersecurity still a separate unit within the IT department.

Co-operation between the TSOs in Germany and Europe

- The 4 German TSOs co-operate closely on all matters that are of national relevance
- Organized in several steering and working groups and staffed with specialists of the companies.
- All matters of the critical infrastructures are dealt with in the steering group consisting of 8 members.
  - Interdisciplinary
  - Including representatives of corporate security, legal, asset, operation, IT and communication
  - Point of contact for authorities on related matters.
  - Joint reports on European critical infrastructure.
- Regular meetings with Federal ministry of Economics and Energy.
- The European Network of TSOs for Electricity (ENTSO-E) in Brussels serves as representation of interest on the EU level.
- Also contains group dealing with critical infrastructure and cybersecurity.

Further development

- Steering group critical infrastructure between the 4 German TSOs to be further developed for covering resilience concepts as foreseen in the EU Resilience Directive.
- Mirrors the new legal framework from asset based to functional approach.
- Scope will be broadened
  - BCM
  - Cybersecurity
  - Critical functions and services
  - Reporting obligations

Conflicting interests

Legitimate public interests in terms of transparency

- TSO have to obey a complex set of legal requirements
- As natural monopoly, there are transparency obligations regarding the infrastructure, market and operational data due to regulatory oversight and public information.
- As private-law companies, there are corporate law requirements.
- As being obliged to extend the network in order to accommodate the needs, public participation is inevitable for approval procedures.
- Report and publication obligations in a wide variety of matters, including disturbances, outages, attacks.
- Exemptions foreseen for critical infrastructure, but these are interpretated narrowly.
- Reporting to authorities can be restricted to confidentiality, but public has rights to access to information towards authorities.

Conflicting security interests of the TSOs

- Precise knowledge on our infrastructure, the operational and system status are crucial.
- Balance has to be found between interests of transparency and security.
- New developments due to the war in Ukraine and hybrid attacks increase the importance of minimizing the transparency obligations to the volumes strictly necessary.
- Problem: Infrastructure is not invisible and hardly to be protected across the countryside
- Also, lots of data bases publish very specific infrastructure data for free in high definition.
- New development: drone footage. Filming and photographing of our infrastructure from above or from a distance so far not illegal.

Procurement

- Due to its shareholder structure, 50Hertz has to purchase equipment and material via tenders following (European) public procurement law.
- This implies publishing of the demand by specifying the layout/technical requirements.
- The awarding of the bids has to follow predefined criteria – and the exclusion of certain countries of origin or manufacturers is not per se allowed.
- For IT components, a formal approval of the component before its first application is implemented. This might indirectly lead to the exclusion of assets of certain manufacturers.
- However, procedure is bureaucratic, since no white or black list approach was chosen.
- For other assets of the TSO this procedure is not yet foreseen.

Employment

- In order to tackle the challenges ahead of us, we increase the staff massively.
- Of course, the data protection rights and the personal rights of the applicants have to be respected.
- Still, a pre-employment screening is deemed very useful and advisable.
- The new EU Resilience Directive mentions the pre-employment screening in two places; including the screening of service providers and their personnel.
- However, this has to be further developed and needs a legally sound basis.

Who will be footing the bill?

- Level of security is a matter of costs.
- TSOs refinance via grid fees, but as regulated entities the fees are under stringent control by the NRA.
- Conflict arises on question of responsibility: Who orders, pays.
  - But who orders security?
- Baseline: operational safety is part of TSO's business and to be organized and accounted for by the TSO itself.
- Security in the dimension of terror and national security remains the responsibility of the state.
  - Estimating the risks and the evaluation of the corresponding protection measures are the responsibility of the state.
  - TSOs as owner of the critical infrastructure have to be compensated for the extra efforts.

50hertz
| Elia Group

Thank you.