

9th AIEE Energy Symposium, Rome 20-22 November 2025

Current and Future Challenges to energy Security

CESI

Inspired with innovation

Dual Plenary Session: Grid security and new technologies

The key role of Interconnections in integrating decarbonized electricity in the EU grids

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20 November 2025

A Global Player in Engineering, Testing and Power Systems Consulting



~2,000
Professionals



2,000+
Clients



70+
Countries Served

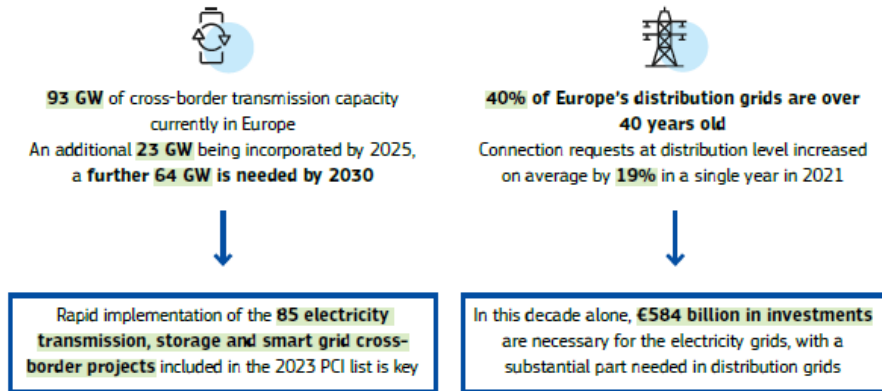


12
Global Sites



● Commercial Network ● CESI Global Office ● KEMA Labs Site

Grids and Interconnections are increasingly central in the EU ...



The system needs were further reviewed upwards (from 64 GW to 88 GW) in the ENTSO-E TYNDP 2024

Sources: EU Action Plan for Grids - 2023; EU Clean Industrial Deal – 2025; ENTSO-E TYNDP 2024

“...The Commission will put forward a **European Grid Package [expected in early 2026]** to, among others, **simplify Trans-European Networks for Energy**, ensure cross-border integrated planning and delivery of projects, especially on interconnectors, streamline permitting, enhance distribution grid planning, boost digitalisation and innovation as well as increase visibility and prioritisation of manufacturing supply needs, also building on actions from the **Grid Action Plan...**”

“...The EIB will also introduce a **'Grids manufacturing package'** for the European supply chain to provide counter-guarantees to manufacturers of grid components, with an indicative amount of at least EUR 1.5 billion...”



COP29
Baku
Azerbaijan

COP29 Global Energy Storage and Grids Pledge

“...Commit to a collective goal to **enhance grid capacity through a global grid deployment goal of adding or refurbishing 25 million kilometres of grids by 2030**, recognising analysis from the IEA on the need to add or refurbish an additional **65 million kilometres by 2040 to align with net-zero emissions by 2050**, and working to strengthen the electricity grid infrastructure...”

COP29 Green Energy Pledge: Green Energy Zones and Corridors

“...Recognising green energy corridors as a **tool to enable energy transitions and sustainable development through interconnection of electricity systems** and noting that many existing and planned interconnection projects aim at increasing the share of renewable and low-emission/clean energy in the electricity system...”

Note: COP29 is one example of recent global forum placing emphasis on grids and energy infrastructures.

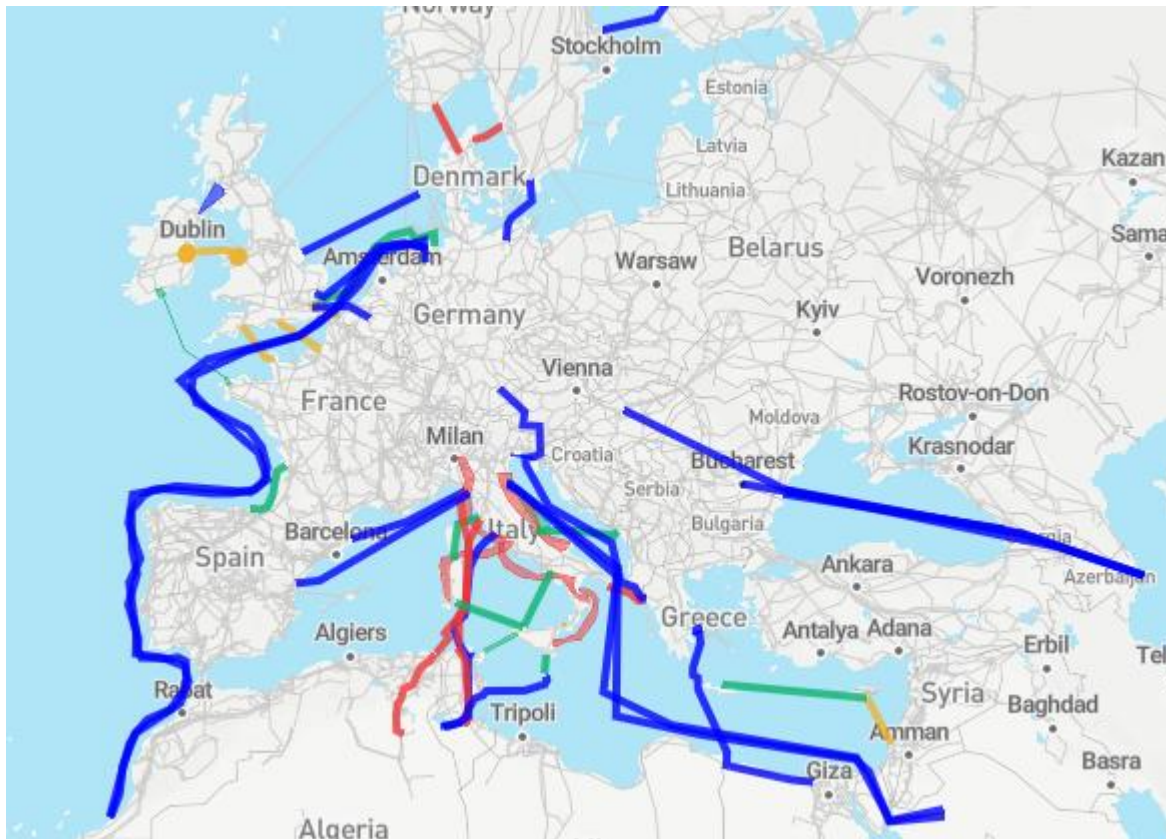
Sources: [COP29 Grids and Storage Pledge](#); [COP29 Green Energy Zones and Corridors](#);



COP30 Agenda and Negotiations (10-21 November 2025)

- Among the six dominant themes: **strengthening energy systems** to cut emissions and ensure security, with **investments in grids and storage**.
- Roadmap to **mobilize \$1.3 trillion/year in climate finance by 2035**, part of which will be allocated to **grid infrastructure and energy resilience**.

The growth of cross-border interconnections is also evident from the Ten Years Development Plans (TYNDs)



TYNDP2026 Projects:

- Under Construction
- Under Consideration
- In Permitting
- Planned but not yet Permitted

Sources: ENTSO-E TYNDP 2026 projects Map

Interconnections are a Multi-disciplinary Task involving opportunities and challenges

- Technical and industrial/supply chain aspects
- Regulatory / Markets Integration
- Financing
- Design, Operation and Maintenance
- Environmental
- Social Acceptance
- ...

Focus of the next slides

Technical and industrial/supply chain aspects (1/2)



Sound and detailed technical studies for:

- Confirmation of the technological feasibility for the Submarine cable at a certain water depth (Significant issues below 2,000 m);
- Selection of the technology and of the suitable system configuration;
- Link size in terms of power and voltage.

Testing of components (e.g. cables) is essential to ensure quality and optimize performance vs costs.



Identification of suitable routing satisfying environmental constraints.

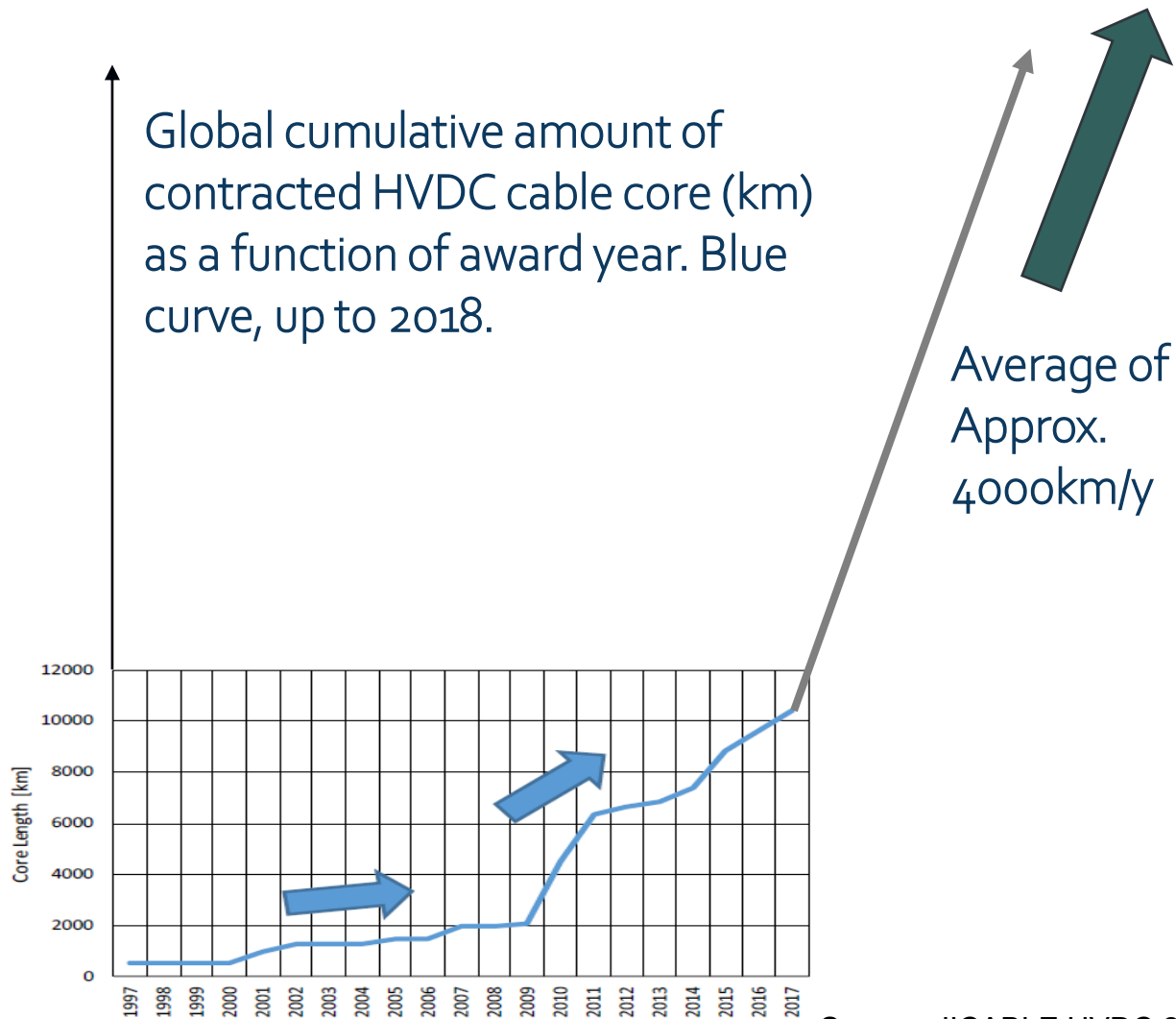


Definition, in accordance with Financing Institutions, of the Scope of Work, Technical Specifications and Prequalification documents for the Project including, for submarine interconnections, Seabed Investigations.



Costs-Benefits Analys (CBA) need to reflect evolving parameters and criteria

Technical and industrial/supply chain aspects (2/2)



EUROPACABLE estimates that in total, Europe will need some 45,154 cable km of HV land and submarine cables in the period to 2019-2029

This figure should be updated with more recent projects



Congestion in the cable market, due to high demand of HVDC and HVAC cable for both interconnections and RESs

Manufacturers are investing in new manufacturing plants; nevertheless, the supply chain of HV cable will need to be stepped up.

HVDC is a winning technology for long-distance links with a strong EU leadership. Boosting HVDC is great industrial opportunity for Europe.

Source: JICABLE HVDC 2019 Paper D8-3 and Europacable

Financing aspects

➤ How finance the interconnection projects?

Finding appropriate financing schemes is key to move from CBA to the implementation stage

Classical business models to ensure project bankability may not always work...

...additional mechanisms shall be investigated considering also the gaps in the legislation and regulatory frameworks in non-EU countries vs EU

REGULATED
ASSET BASED

MERCHANT
LINE

HYBRID RAB +
MERCHANT SCHEME

AVAILABILITY
BASED LONG-
TERM SCHEME

MERCHANT LINE
WITH CAP & FLOOR
REVENUE

ASSET BUILD AND
LEASE

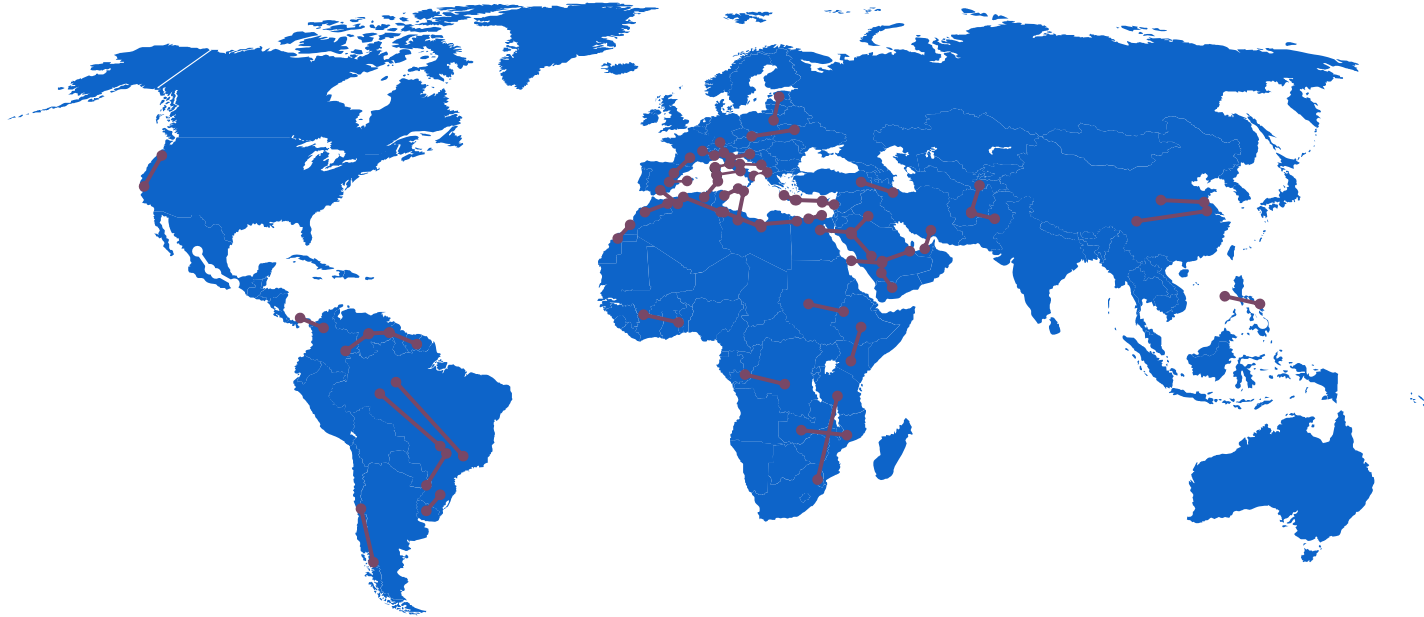
COMPETITIVE APPOINTED
TRANSMISSION OWNER

Further opportunities and challenges arises when the interconnection project is closely coupled with the deployment of RES power plants in non-EU countries.

It is key to promote investments for interconnections by strengthening and simplifying access to cross-border financing schemes

CESI Expertise globally

Energy - Transmission Planning & Engineering



> 30 HVDC projects realized



> 100.000 Km OHTL and power Cables



> 50 different power systems analyzed

Services for the entire Project life-cycle

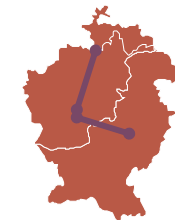
- Feasibility and Power System studies, Master Plans, CBA, Market studies
- Technical specification and Procurement support, Design Review and QA
- Construction and Commissioning supervision

Crossing the Mediterranean



Since the 80's walkable ways to cross the Mediterranean with submarine cables.

The CASA-1000 Project



Full owner's engineering for the 500kV HVDC transmission line in Afghanistan.

Linking the Arab World



CESI is entrusted in fostering regional interconnections to enhance power export.

Concluding remarks

- **The importance of Grids and Interconnections is increasingly central in the EU and Globally.**
- **Italy is a natural energy bridge between the EU and Africa / Middle-East.**
- **Interconnections is Multi-disciplinary, holding opportunities and challenges (Technical, Industrial/Supply Chain, Regulatory, Market Integration, Financing, ...).**

Boosting interconnections across Countries and Regions through HVDC links is a no-regret option for decarbonization and a great opportunity to further strengthen the industrial EU leadership in this field

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Milan (IT) · Arnhem (NL) · Berlin (DE) · Mannheim (DE) · Prague (CZ) · Chalfont (US) · Knoxville (US) · Dubai (AE) · Santiago de Chile (CL) · Rio De Janeiro (BR) · Shanghai (CN)

Energy Transmission: Expertise for Reliability and Safety



Testing Inspection Certification



Expertise		Switchgears
		<ul style="list-style-type: none"> • AC Circuit Breakers & Switchgears AIS/GIS (up to 1100kV) • HVDC Switchgears and Breakers (up to 1200kV) • HVDC Valves • HV Disconnectors and Earthing Switches • Generator Circuit-breakers
		Cables
		<ul style="list-style-type: none"> • AC Cable and Cable Systems • Submarine Cables • HVDC Cable and Cable Systems
		Other Products
		<ul style="list-style-type: none"> • Bushings, String and Post Insulators • Surge Arresters • Power Transformers, Tap-changers • Instrument Transformers • Line Trap and Air Core Reactors

ACER: Electricity infrastructure development to support a competitive and sustainable energy system

ACER 2024 – Monitoring Report

Local, national and cross-border electricity grids face major challenges in accommodating more renewables and consumption. ACER finds the costs of managing electricity grids congestion in the EU continues to rise (costing EUR 4.2 billion in 2023), and several Member States are already experiencing grid-connection delays for renewables generation due to limited grid capacities.

To build a decarbonised EU energy system, investment of an unprecedented magnitude will be needed in the electricity transmission and distribution grids reaching net zero, doubling and even tripling annual investment rates of the past decades.

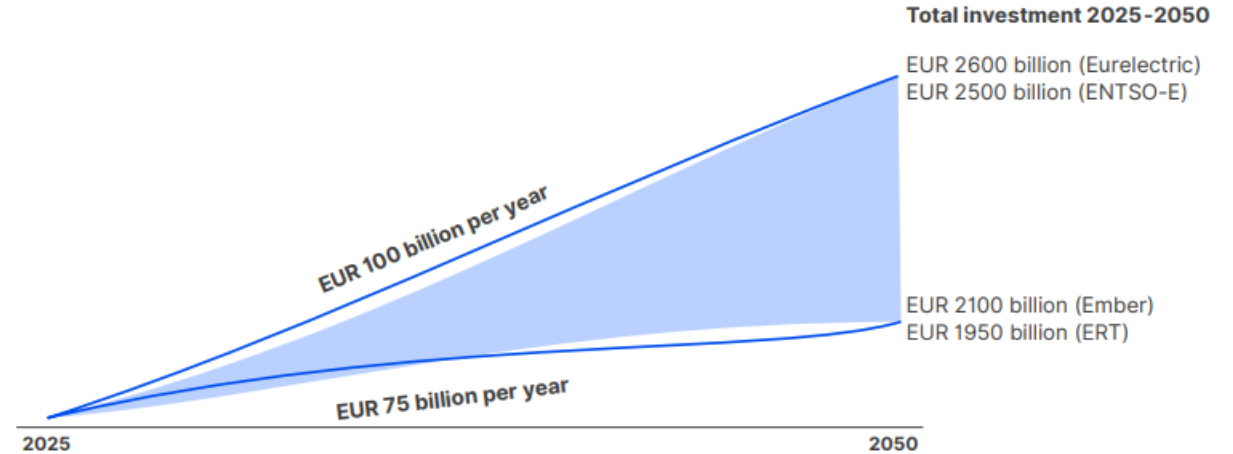
In these projections, it is assumed that the transmission level accounts for a smaller portion (about one third) compared to the distribution level (about two thirds)

As grid costs become a main driver of electricity costs, containing their rise is key for competitiveness.

Estimations referred to net-zero emissions by 2050

Transmission and Distribution

Transmission and distribution investment needs projections for 2025–2050



- ✓ Total investments on grids in the period: 2025-2050: € 1950 bn (ERT) ÷ € 2600 bn (eurelectric) → € 75 ÷ 100 bn/yr
- ✓ Investment on the transmission grid accounts for about one third compared to the distribution grid (about two thirds)

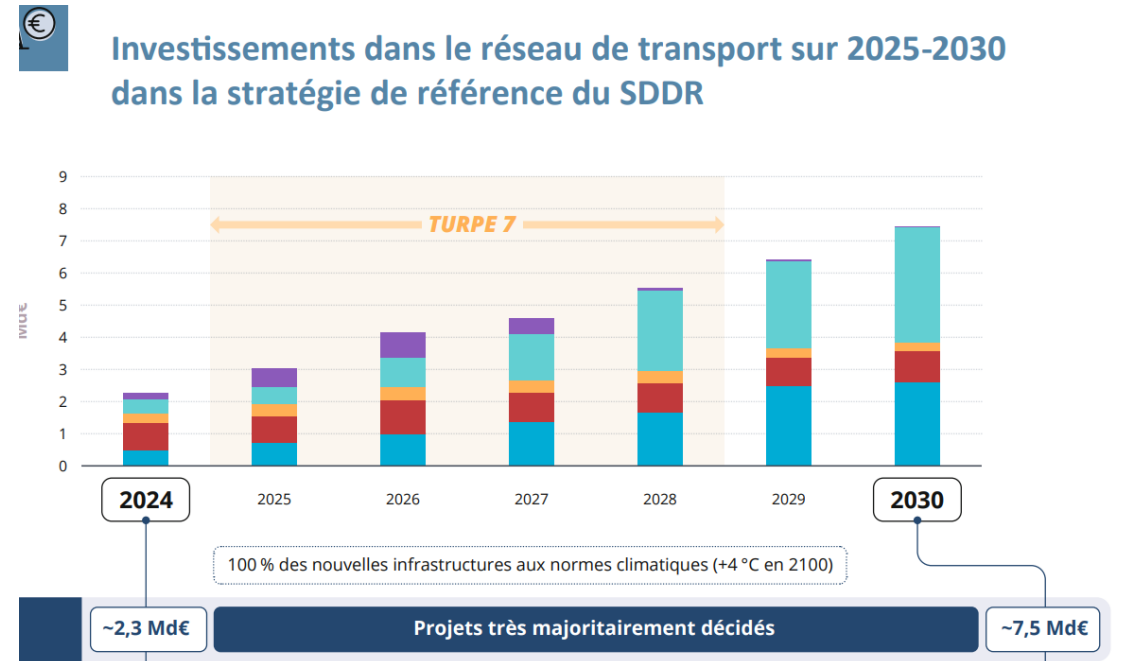
The grid: need for accelerated investments

ITALY



In Italy the forecast on the Transmission Grid Investment has increased from 4 billion € in the decade 2009-2018 to **23 billion € in the decade 2026-2035** (source Terna)

FRANCE



In France, RTE announced to invest **100 billion by 2040** on the transmission grid.

GERMANY

Investment on transmission grid: **about € 300 billion in the next 20 years** (source: Bundesnetzagentur)