Terna Plants for Mediterranian HV network reinforcements

ROME – 23 FEBRUARY 2025

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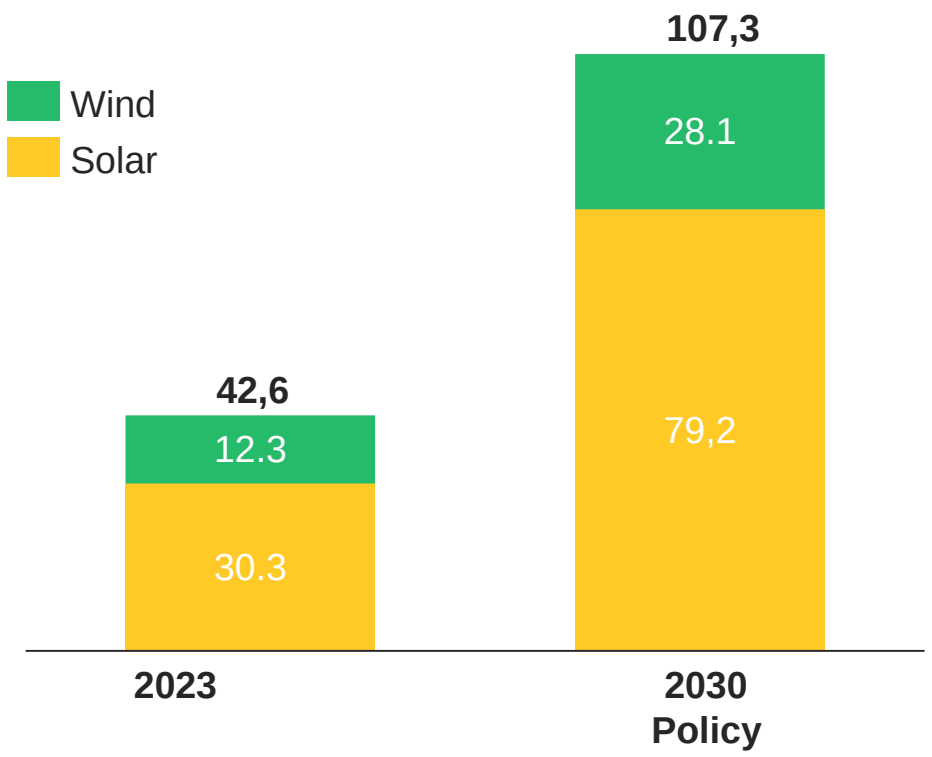
Agenda

- Challenges of Energy Transition
- Italian National Grid Development Plan
- The Role of Interconnections

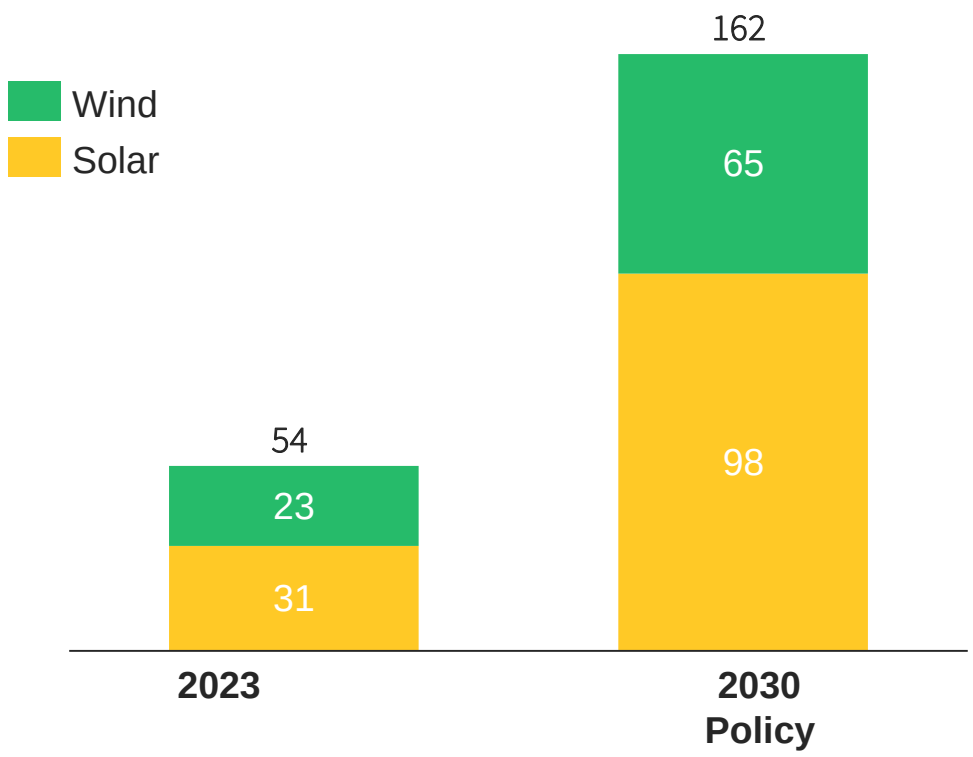
The importance of a balanced mix of renewable technologies

Installed capacity and production of wind and solar in 2030 scenarios

Installed RES capacity by 2030 [GW]



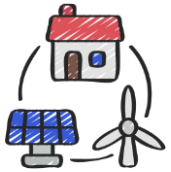
Energy produced by RES 2030 [TWh]



Achieving the EU and Italian decarbonization targets by 2030 requires tripling renewable capacities and addressing challenges like intermittency, congestion, and inertia loss. Coordinated investments in grid modernization, energy storage, and innovative solutions are essential to ensure a secure, resilient, and sustainable energy transition.

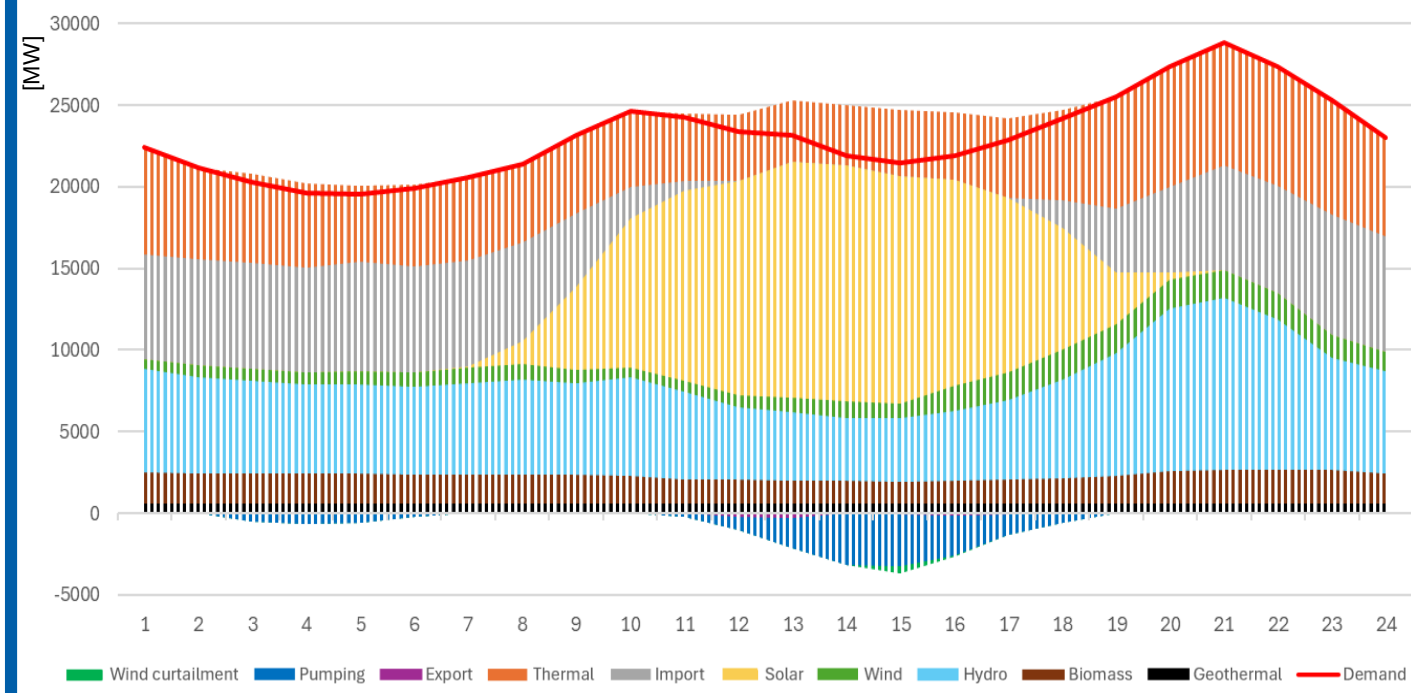
Overgeneration during «low consumption» days

Real case of «spring Sunday» - 7th of April 2024



Renewable production amounted to **74%**[1] of electricity daily demand. **Peak RES share** recorded at 1 PM reaching **97%**[1] of electricity demand (despite the modest contribution from wind)

ENERGY BALANCE



PV record input of 14.5 GWh[1] was recorded, a level never reached before, already net of self-consumption.

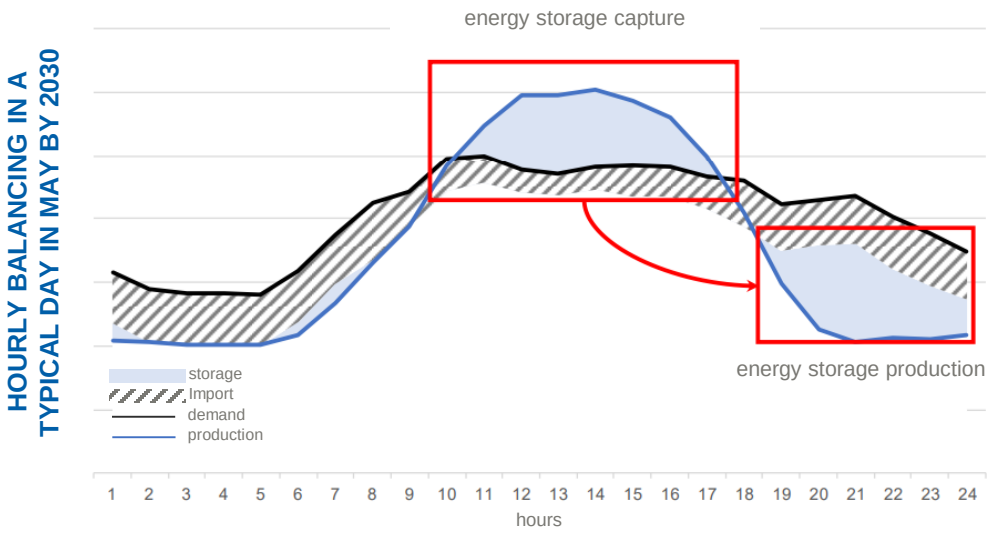
The usage of flexibility from **pumped storage plants** amounted to **13.6 GWh**[1].

Limited overall **wind curtailment,** approximately **0.5 GWh**[1]**.**

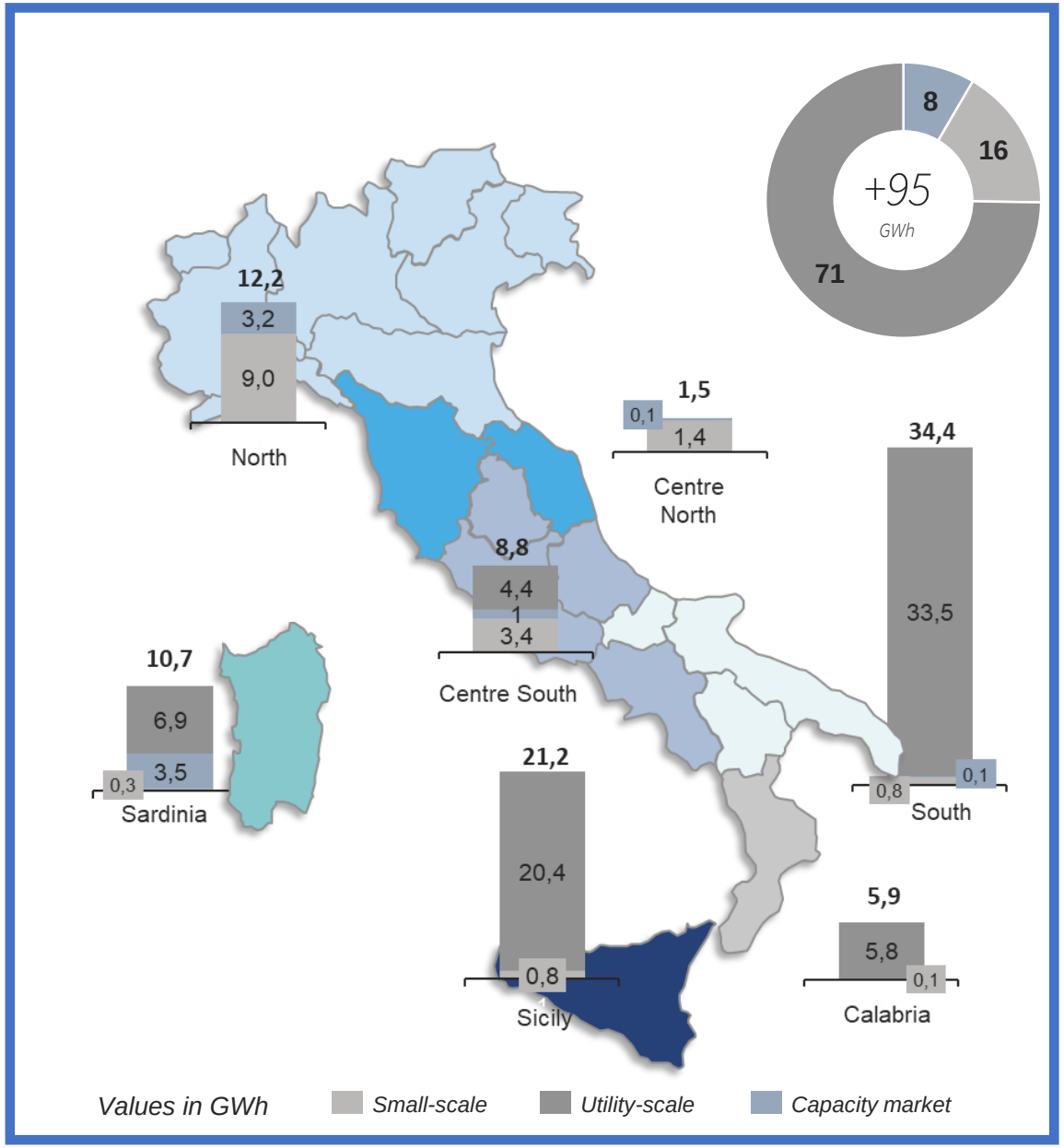
Energy Storage 2030 Scenario

Storage grid services

Storage capacity will significantly reduce RES overgeneration during surplus production hours. It enables energy shifting in time and space supports balancing demand, ensuring quality and security of supply.



Coordinated planning of grid, RES, and storage minimizes costs. Optimal storage location and sizing depend on RES growth and grid evolution, with higher RES integration driving storage demand and vice versa.



Drivers of the energy transition in the electricity sector

System requirements and forward mechanisms to enable the financing of investments

	Grid Developments	RES Development	New storage capacity	Markets for adequacy and EU integration

SYSTEM REQUIREMENTS	• ***Increased tranmission capacity***
	• *Enhanced **synergy** with the interventions outlined in **previous Development Plans***
	• *Innovative **solutions to increase transfer capacity***
		• *Targets for 2030:*
		  ○ ***+65 GW of renewable capacity***
		  ○ ***63% coverage of electricity needs***
		  ○ ***-55% CO2 emissions***
			• *Targets for 2030:*
			  ○ ***+72 GWh** of storage capacity*
			  ○ *Of which **50 GWh** new utility-scale storage capacity*
				• *Revision of capacity market **rules and execution of new auctions** (2025, 2026 and 2027)*
				• ***Full integration with European Balancing markets***

REGULATED, COMPETITIVE TOOLS	**REGULATION** *Evolution towards an **output-based regulation** to stimulate investments (ROSS[1])*	***CENTRALIZED CFD[2]*** *The Ministry reviewed the draft **FERX** decree for contracting 60+ GW of new RES, and the EC approved the MASE decree on transitional FERX for 2025*	***MACSE CENTRALIZED AUCTIONS*** *Defined fixed-term **contracting mechanism for storage capacity** (MACSE[3])*	***CAPACITY MARKET*** ***CM essential to ensure the resource adequacy***

1. ROSS: Remunerazione per Obiettivi di Spesa e di Servizio | CDF: Contract for Difference | 3. MACSE: Meccanismo di Accumulo per la Sicurezza del Sistema Elettrico

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- **Italian National Grid Development Plan**
- The Role of Interconnections

Grid Planning: Italian Grid Development Plan

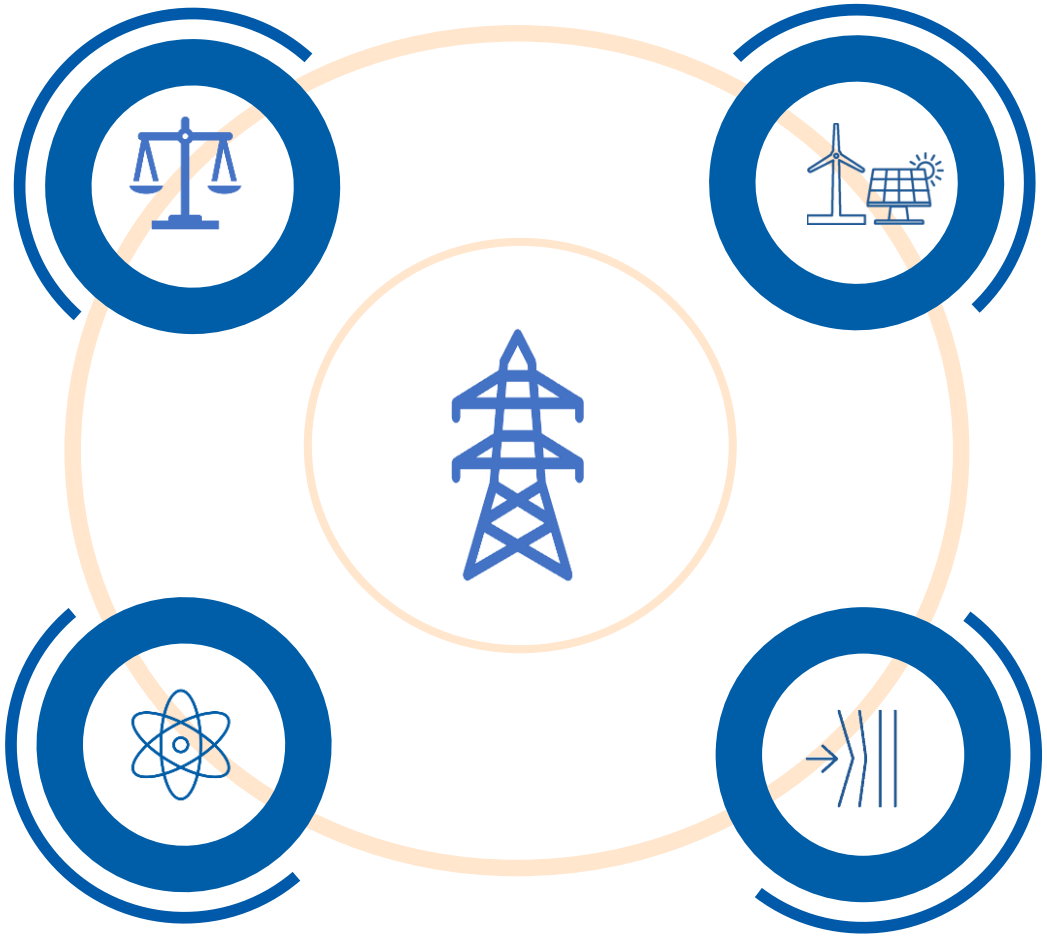
Guidelines

Increase exchange capacity between bidding zones

Enhancing transfer capacity between market sections to efficiently transmit renewable energy from Southern Italy to Northern load centers, supported by the development of innovative infrastructure solutions

Infrastructural synergies

Maximizing synergies with planned projects by using existing asset corridors and repurposing disused sites, while minimizing the environmental impact of infrastructure development



RES integration

Adding **65 GW of new renewable capacity by 2030** to achieve a minimum **63%** RES share in gross electricity consumption and a **55% reduction in CO2 emissions**

Enhancement of system strenght and resilience

Increase of system strength through the implementation of planned projects

National Development Plan

Key feautures of NDP 2023

+70 GW

New renewable capacity

-4.100 kt/year

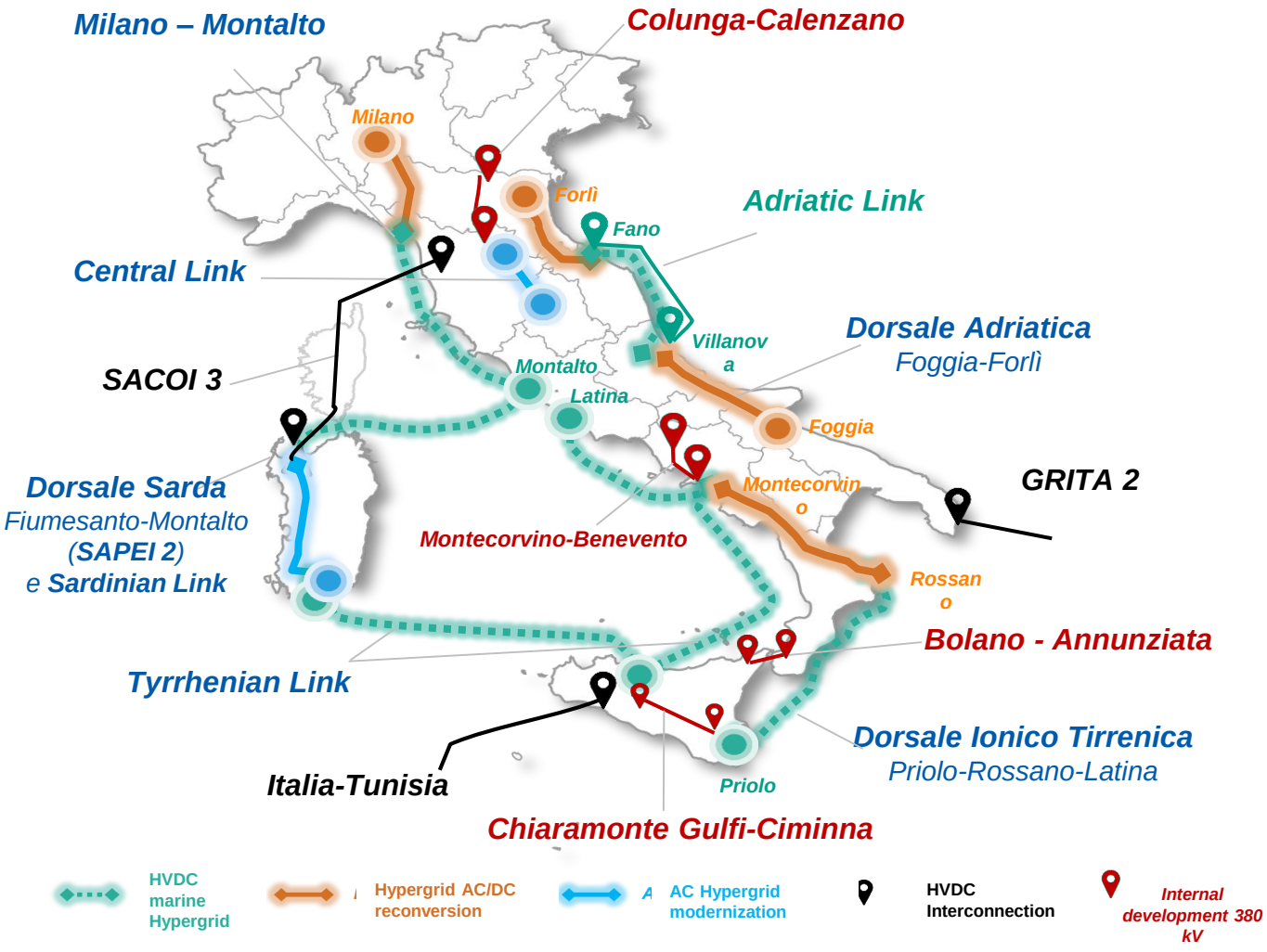
CO2 reduction[1]

+126 TWh

Production from renewable plants

-26,5 bcm

Savings of gas consumptions



Hypergrid is perfectly integrated with previously planned projects (i.e. Thyrrenian Link and SACOI3)

(*) Equivalent to the CO2 emissions of 4.5 million cars, with a projected reduction of 12,000 kt/year by 2040, based on an average consumption of 90 g/km for a vehicle traveling 10,000 km annually

National Development Plan 2023

Progress of key projects

National

Among the projects nearing completion are nationally significant initiatives, including:

- Submarine HVDC connection between Sicily, Campania, and Sardinia: the **Tyrrhenian Link**
- HVDC connection between Abruzzo and Marche: the **Adriatic Link**
- 380 kV power line **Colunga-Calenzano**
- 380 kV power line **Chiaramonte Gulfi-Ciminna**

Cross border

Additionally, these interconnections reinforce Italy's role as a key energy hub for Europe and the Mediterranean:

- **HVDC** connection between **Italy and Tunisia**, a strategic project to optimize energy resources between Europe and North Africa
- **HVDC** connection between **Italy and Greece**, which will double the current interconnection capacity between the two countries and enhance energy exchange

National Development Plan

Future grid architecture

Synergy Creation

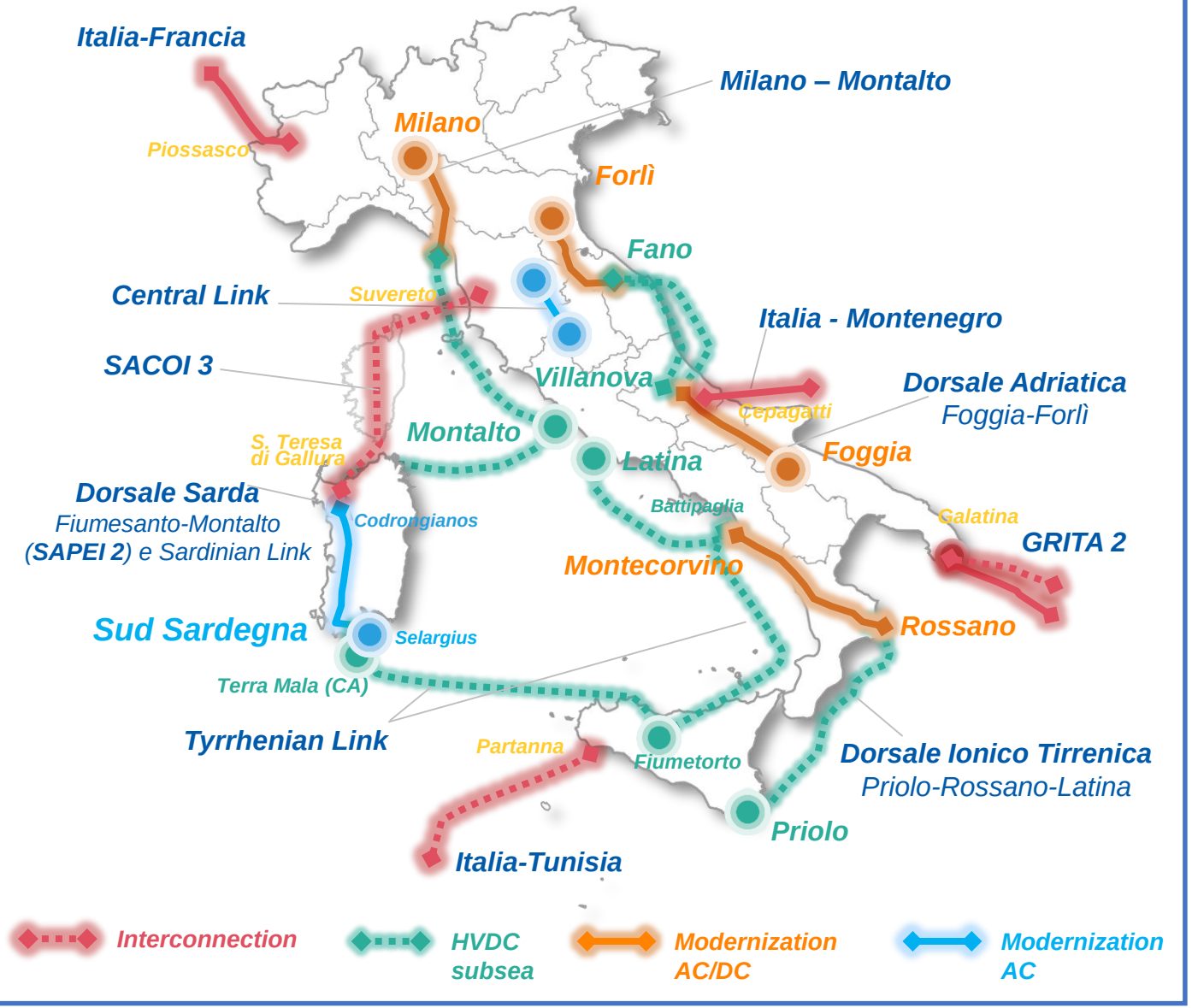
Hypergrid projects aim to synergize with planned developments and existing infrastructure, optimizing efficiency, utilizing assets, and maximizing NTC between market zones.

Grid Strengthening

Investments focus on strengthening the grid, boosting South-North backbones, improving island-mainland links, and enhancing resilience, efficiency, and renewable integration

Cross-Border Interconnections

Upgraded cross-border interconnections will expand exchange capacity and support renewable energy integration



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Existing and Future Interconnections

Overview

30* *Existing interconnections in operation*

3 *Under construction or permitted*

4 *Projects in permitting, consultation, or planning stages*

Opportunities from Interconnection Development:

- Maximize benefits for consumers and investors
- Drive price convergence and market integration
- Support RES growth and integration
- Enhance system flexibility and security
- Strengthen mid- and long-term supply security

1. *Double links/poles are considered twice*
2. *Include main projects included in the National Development Plan*
3. *Project in HVDC technology*
4. *Second HVDC module full permitted and realization/commissioning is subject to the development of trans-Balkan corridor and electricity markets in the Balkans*

Italy's strategic geographical position establishes it as a natural energy hub for the Mediterranean region.

** Including Brennero-Steinach, where works have been completed, and the system is now entering definitive operation.*

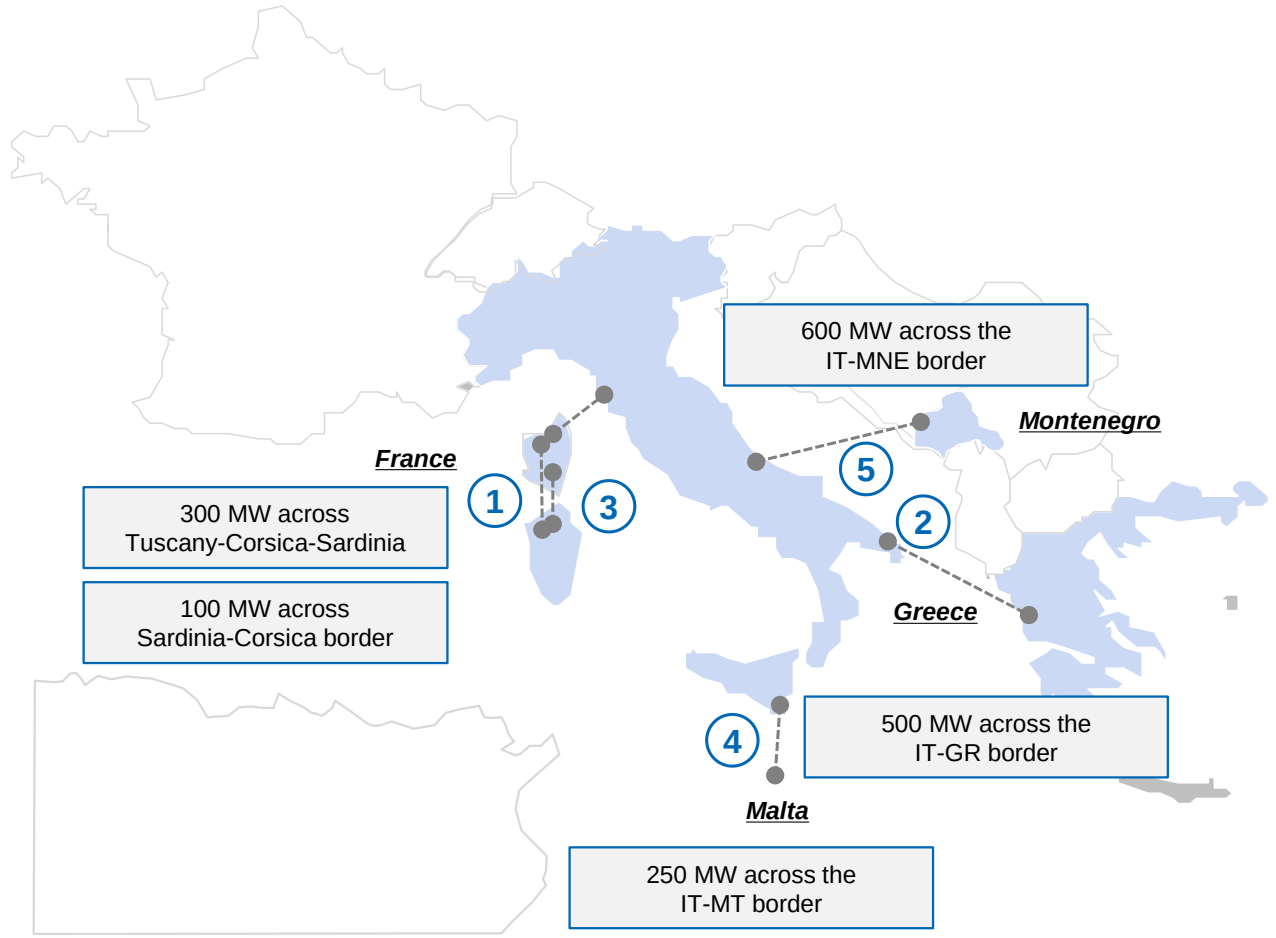
Existing Interconnections in the Mediterranean

01 SACOI

In 1987, the plant became the world's first tri-terminal system, known as SACOI-1 (Sardinia-Corsica-Italy), with the addition of the conversion station in Lucciana, Corsica.

05 MONITA

A 445 km project, the longest ever undertaken by Terna, connecting the Cepagatti substation in Pescara, Italy, to the Lastva substation in the municipality of Kotor, Montenegro.



SACOI — HVDC LCC — 116 km — 1 — 1965 (tri-terminal in 1987)

GRITA — HVDC LCC — 161 km — 2 — 2002

SARCO — HVAC — 15 km — 3 — 2006

ITALY-MALTA — HVAC — 120 km — 4 — 2015

MONITA 1 — HVDC LCC — 445 km — 5 — 2019

Planned Interconnections in the Mediterranean

01 SACOI3

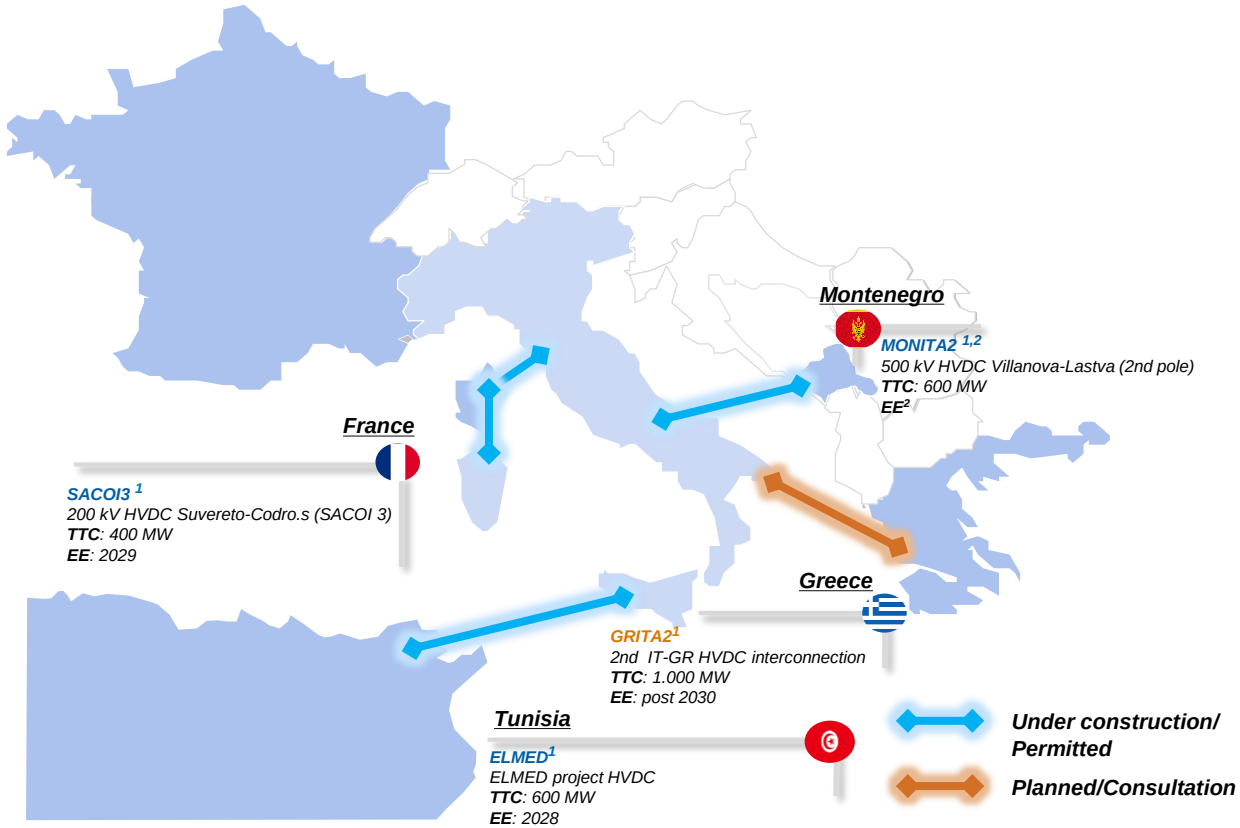
SACOI 3, by EDF and Terna, upgrades the 200 kV, 400 MW Sardinia-Corsica-Italy HVDC link with 120 km submarine and 20 km underground cables, plus new converter stations in Codrongianus (Sardinia), Lucciana (Corsica), and Suvereto (Tuscany).

02 MONITA2

A ±500 kV HVDC link (423 km, 600 MW), connects Italy and Montenegro. The first pole has been operational since 2019. It enhances energy security, integrates renewables, and supports Balkans market connectivity.

03 TUNITA

A 600 MW, ±500 kV HVDC link spanning 220 km, with submarine cables (800 m depth) and terrestrial sections from Castelvetrano (Italy) to Mlaabi (Tunisia). The €850M project, (€307M EU-funded), boosts EU-North Africa ties, renewables, and energy security.



1. *Project in HVDC technology*
2. *Second HVDC module full permitted and realization/commissioning is subject to the development of trans-Balkan corridor and electricity markets in the Balkans*

Decarbonization ***System security*** ***Market efficiency*** ***Sustainability***

Under study projects and private Merchant Lines (ML)

Merchant Lines

Project	Promoter	MW
TuNur Italy	TuNur Ltd	2000
Med-Link 1	Medlinks B.V. (Zhero)	2000
Med-Link 2		2000
Cesana Briançon	Enel produzione SpA	150
Mese Castasegna	Repower, MERA SRL	200
Greenconnector	Worldenergy SA	1000
MEMC	MEMC/Tinetz	100
Somplago-Wurmlach	Alpe Adria Energia Srl (Enel)	300
Dekani-Zaule	Adria Link Srl (Enel)	125
Vrtojba-Redipuglia	Adria Link Srl (Enel)	125
Malta-Italy Cable 2	Interconnector Malta	225
Apollo Link	OMNIA	2000

Thank you

Terna
Driving Energy

ITALIAN POWER SYSTEM

Overview

Under review in view of New National Development Plan 2025

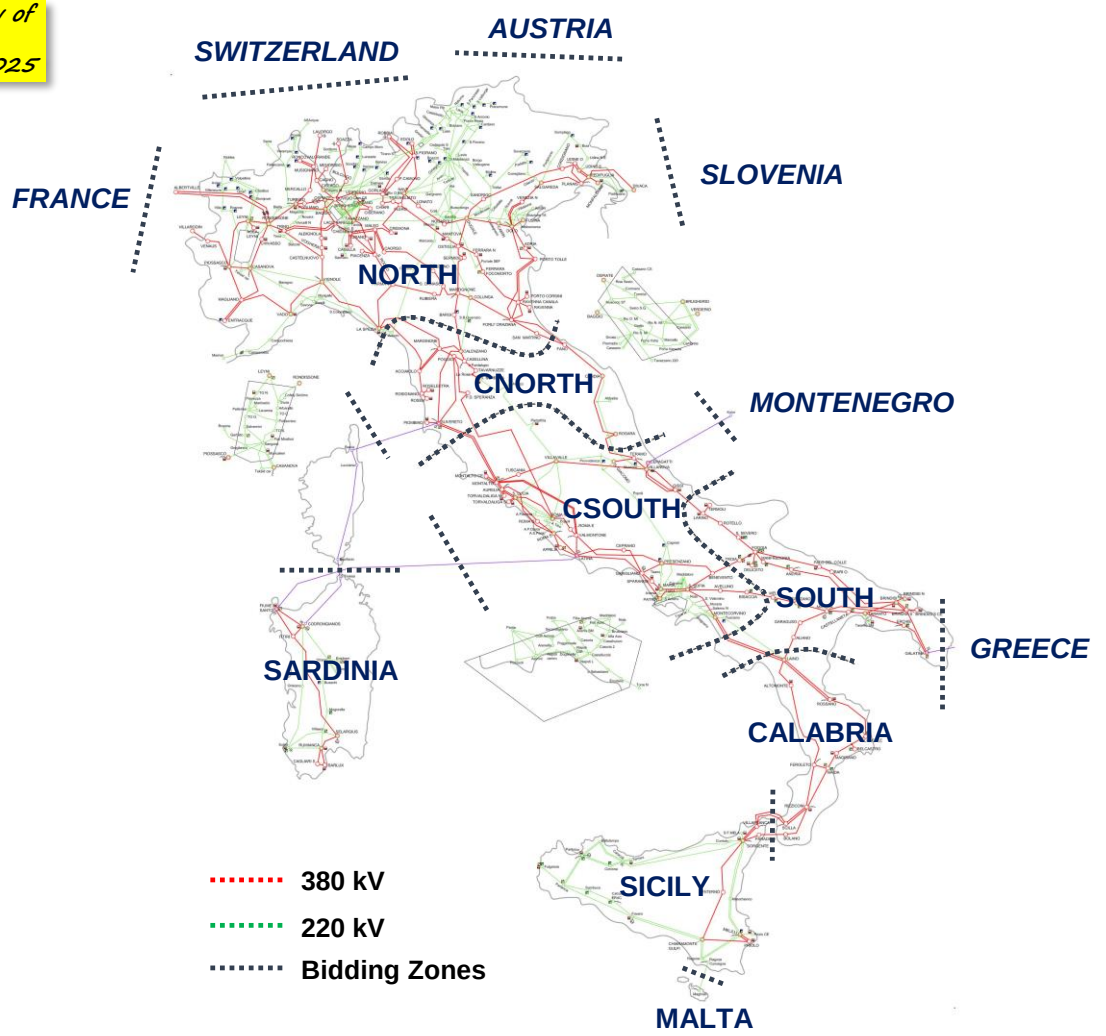
*Italian power system is splitted in **seven bidding zones**: North, Centre-North, Centre-South, South, Calabria, Sardinia and Sicily*

*30 **interconnections with 7 countries** (France, Switzerland, Austria, Slovenia, Malta, Montenegro, Greece)*

***HVDC submarine connections with Corsica, Sardinia, Greece and Montenegro**, and one HVDC underground cable with France*

***>21 Mld€** investment planned in the 2023 Network Development Plan*

***+17%** as compared to the previous 2021 Network Development Plan*



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