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ITALY

Beyond Crisis Relief: The Value of Grid Enhancing Investments

Making Better Use of Existing Grids to Reduce Costs and Fossil-Fuel Dependence



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Fast deployment of proven grid solutions can complement immediate energy-price relief with structural benefits; reducing congestion, renewable curtailment and fossil-fuel use from the first year of deployment.

Energy security requires more than short-term relief

Italy is among Europe's electricity markets most exposed to volatile gas prices, with gas-fired generation influencing wholesale electricity prices in 89% of hours in early 2026.[1] This vulnerability has become particularly evident during the recent energy crisis, with Italy's average wholesale electricity price in August 2026 increasing by 48% compared to the same month in 2025.[2] The pressure extends beyond electricity markets: industry estimates suggest that Italy's energy import bill could reach nearly €60 billion in 2026, approximately €8–9 billion more than in 2025.[3]

In response, the Italian government has introduced several short-term measures to protect consumers and businesses, including cuts to petrol and diesel excise duties, which had cost approximately €2 billion by early July 2026.[4] The government has also announced plans to use additional fiscal flexibility equivalent to 0.6% of GDP over three years to support energy-related measures.[5] More recently, in October, Italy reached a preliminary agreement with the European Commission on a mechanism to limit the impact of high gas prices on wholesale electricity prices by introducing a gas price cap of approximately €60/MWh for electricity generation.[6] While these interventions aim to ease immediate cost pressures, they also highlight the scale of Italy's exposure to fossil-fuel price shocks.

At the same time, Italy's planned expansion of renewable generation faces growing network constraints. Renewable curtailment is projected to increase sixfold by 2030[7] partly because renewable resources are concentrated in areas far from major electricity demand centres.[8] Congestion-related curtailment and redispatch already impose substantial costs on the electricity system, estimated at around €500 million annually.[9] Without sufficient grid capacity, Italy risks losing part of the economic and energy-security benefits of its growing renewable generation. The need to reduce energy costs and strengthen long-term resilience is increasingly recognised in Italy's policy response.[10] Beyond immediate relief, making better use of domestic renewable electricity offers an opportunity to reduce reliance on imported fossil fuels and exposure to future price shocks.

The opportunity within Italy's existing grid

Expanding and reinforcing Italy's electricity network remains essential, but major infrastructure projects can take years to plan, permit and complete. In the meantime, grid-enhancing technologies offer a faster way to relieve existing bottlenecks, accommodate more renewable generation and reduce system costs, while longer-term network expansion progresses. CurrENT Europe and Arktos Analytics modelled the potential benefits of deploying grid-enhancing technologies, including **Advanced Thermal Coatings, Dynamic Congestion Management, and Advanced Conductors,** to address selected congestion bottlenecks in Italy's electricity transmission network (see Annex I for further details). These solutions were selected for their rapid deployment

[1] Rosslowe, C., & Petrovich, B. (2026, 13 March). Latest energy shock reminds Europe of its risky gas reliance. Ember. Link.
[2] Author's calculation based on EMBER's European monthly wholesale electricity prices, available at the following link.
[3] Reuters. (2026, 10 June). Italy energy imports to rise towards €60 billion in 2026, industry lobby says. Link.
[4] Fonte, G., & Jones, G. (2026, 27 July). Italy takes steps to cap fuel prices amid fiscal concerns. Reuters. Link.
[5] Fonte, G., & Jones, G. (2026, 5 August). Italy to make partial use of EU budget leeway for energy and defence. Reuters. Link.
[6] Johnston, I., Tamma, P., & Kazmin, A. (2026, 16 October). Italy secures EU deal to lower its electricity prices. Financial Times. Link.
[7] Aurora Energy Research. (2025, 24 October). Italy's renewables expansion faces grid challenges, Aurora says. Link.
[8] Terna. (n.d.). Market context and scenario. Terna. Link.
[9] Energy Solutions International. (2026, 26 August). Italy power grid: Congestion intelligence report 2026. ESI Grid Intelligence. Link.
[10] Sevinc, N. T. (2026, 13 October). Italy's Meloni urges EU to deliver long-term response to high energy prices. Anadolu Agency. Link.

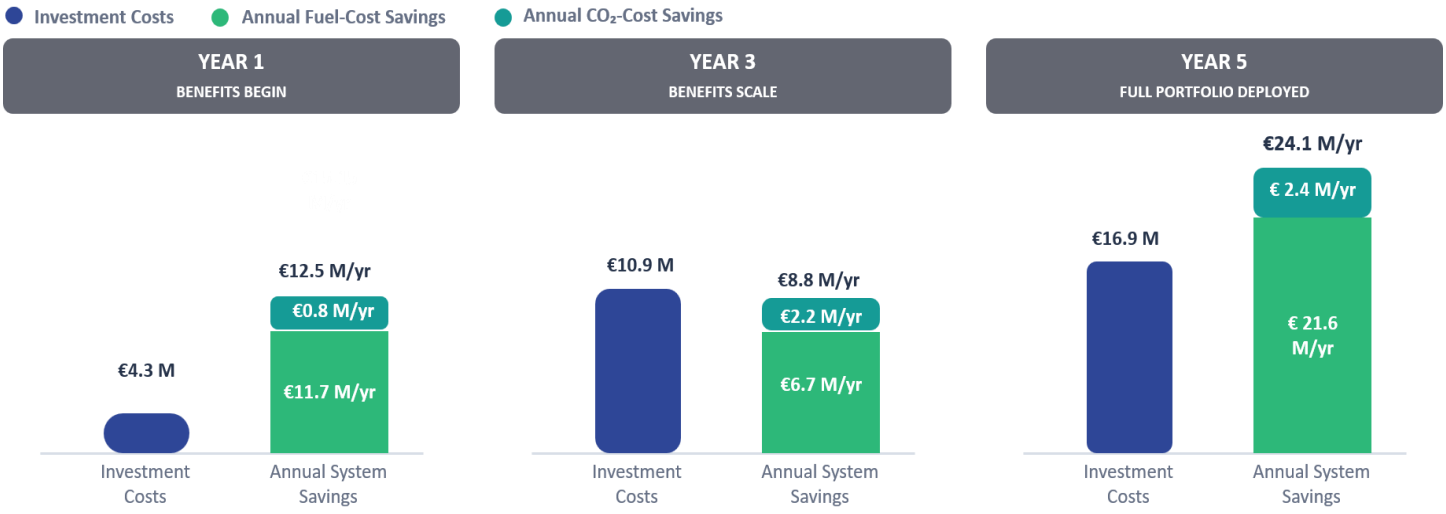
potential and ability to relieve grid congestion, reduce renewable curtailment and deliver benefits within a timeframe relevant to energy crisis response. Depending on the technology and planning and permitting requirements, deployment can range from a few days to five years. Used individually or in combination, they can increase the capacity and efficiency of existing infrastructure, providing a faster and potentially more cost-effective complement to conventional grid expansion.

Targeted grid enhancements can deliver immediate savings and growing long-term benefits, even with modest investments.

CUMULATIVE INVESTMENTS AND ANNUAL SAVINGS AT FULL DEPLOYMENT AFTER 5 YEARS

€32.2 M	€45.5 M/yr	€40.1 M/yr	€5.4 M/yr	-11.2%
total investment costs[11]	annual system savings[12]	annual fossil-fuel savings[13]	annual CO_2-cost savings[14]	renewable curtailment compared to 2024 levels[15]

INCREMENTAL INVESTMENT AND ANNUAL SAVINGS BY DEPLOYMENT STAGE



Note: Each chart shows the incremental investment and annual savings at each deployment stage. Investments are one-off, while savings recur every year, meaning that even when an additional investment exceeds the generated annual savings in a given year, the benefits outweigh the costs over a longer time horizon. Moreover, savings from earlier deployments continue to accrue, so total annual savings increase with each stage. For example, the €10.9 million invested in Year 3 generate €17.6 million in additional annual savings in just two years. See Annex II, Table 2 for details on the technologies deployed at each stage.

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[11] Investment is a cumulative one-off cost, while all other system benefits recur every year after deployment.
[12] System savings are defined as the annual reduction in electricity-system operating costs, comprising fuel-cost savings and CO_2-cost savings.
[13] Fossil-fuel cost savings are defined as direct economic savings from reduced thermal power plant dispatch (gas, coal) enabled by increased renewable energy integration and lowered grid congestion.
[14] CO2 costs are conservatively defined as the financial costs of EU Emission Trading Scheme (ETS) allowances avoided due to less fossil generation dispatched. These costs ignore the wider beneficial impact of reducing CO2 in the environment.
[15] This is relative to the 2024 modelled baseline of 186 GWh of renewable curtailment.

Key findings

- **Even small-scale deployment of grid-enhancing technologies can deliver substantial recurring benefits.** With a cumulative investment of €32.2 million over 5 years, Italy could generate €45.5 million in recurring annual system savings through the phased deployment of Dynamic Congestion Management, Advanced Conductors and Advanced Thermal Coatings across just 10 transmission circuits. Between Year 2, when the first deployments begin delivering benefits, and Year 6, when the full portfolio is operational, cumulative savings could reach approximately €113.1 million. Thereafter, the full portfolio could continue generating €45.5 million annually, providing lasting benefits beyond the initial investment.

- **Benefits can begin within just one year, with a high return on investment.** An initial investment of €4.3 million across four transmission circuits could generate approximately €12.5 million in recurring annual system savings. While conventional grid expansion can take years and require substantial capital, grid-enhancing technologies offer a faster, cost-effective way to relieve congestion and improve network performance while longer-term infrastructure projects are planned and developed.

- **Most of the benefits come from reduced dependence on fossil fuels.** Around €40.1 million of the €45.5 million in annual system savings at full deployment would come from lower fossil-fuel generation costs. By relieving congestion, these technologies enable more renewable electricity to reach consumers, reducing the need for fossil-fuel generation and Italy's exposure to volatile imported gas prices.

- **Grid enhancements can help address Italy's growing renewable curtailment problem.** The modelled deployment could reduce renewable curtailment by 11.2% compared to the 2024 baseline, equivalent to approximately 20.8 GWh of additional renewable electricity being used annually. This helps ensure that more electricity generated from solar and wind reaches consumers instead of being curtailed due to network constraints.

- **Lower system costs and emissions go hand in hand.** At full deployment, the modelled portfolio could avoid approximately 79.3 kt of CO_2 emissions annually, equivalent to around €5.4 million in annual savings from reduced purchases of emission allowances under the EU Emissions Trading System (EU ETS). This demonstrates how better use of existing electricity networks can advance Italy's decarbonisation objectives while delivering direct economic benefits.

From crisis to action

The above findings point to an immediate opportunity for action. While major grid expansion remains essential, it takes time. Grid enhancing technologies offer a complementary solution that can be deployed today to relieve critical bottlenecks, unlock substantial system benefits and reduce dependence on volatile fossil fuels. In the face of current energy pressures, targeted investment in these solutions should be considered an integral part of the crisis-response toolkit, not only to ease pressures today, but to strengthen Italy’s resilience to future energy shocks.

Annex I – Grid Enhancing Technologies Overview

Table 1. Overview of the grid enhancing technologies included in the study and their characteristics

Technology	What it does	How it was modelled	Deployment time
Advanced Thermal Coatings	By applying specialised coatings to existing conductors, it improves heat dissipation and allows them to safely carry more power.	Increased available line capacity by 15% on average	From days to 1 year
Dynamic Congestion Management	Monitors grid conditions and coordinates controllable assets in real time to optimise power flows, reduce congestion and make better use of available grid capacity.	N-1 criterion is relaxed so that the line capacity increases to its thermal limit.	1 year
Advanced Conductors	Replaces conductors on existing overhead lines with advanced-material designs that carry more power with less sag, increasing capacity on existing corridors.	Available line capacity increased to 2 × baseline (+100%)	1.5 - 3 years

Note: These technologies can be deployed in combination on the same circuits, creating additional synergies and capacity gains.

Annex II – Methodological Note

The results are indicative estimates based on a simulation of Italy's electricity network using publicly available 2024 network, generation and price data. A combination of technologies was selected through a trial-and-error process, targeting transmission lines where additional capacity could deliver the greatest benefits. The selected technology portfolio was then phased in over five years according to the corresponding deployment timelines per solution (see Table 2). This represents one indicative deployment pathway, designed to illustrate the scale of benefits that targeted grid-enhancing technologies could deliver. It does not provide an optimised investment plan.

The results for each deployment stage (i.e., in year 1, 3 and 5) are relative to the same 2024 baseline model. Demand, generation capacity and other underlying system conditions are held constant throughout, meaning that the progressive deployment of grid-enhancing technologies is the only change between the two scenarios.

Lastly, as the analysis relies on 2024 data, it does not capture the significant increase in fossil-fuel prices due to the current energy crises. Under higher fuel-price conditions, the value of reducing reliance on fossil-fuel generation would be greater. The modelled benefits can therefore be considered a conservative indication of the potential value of grid-enhancing technologies.

Table 2. Number of circuits equipped with each technology by deployment stage

Technology	Year 1	Year 3	Year 5
Advanced Thermal Coatings	3 lines	3 lines	3 lines
Advanced Conductors[16]	-	3 lines	6 lines
Dynamic Congestion Management	1 circuit	1 circuit	1 circuit
Total circuits with grid enhancements	**4**	**7**	**10**

Note: Each cell shows the cumulative number of circuits equipped with the technology by the corresponding year. For example, three lines have been reconductored with advanced conductors by year 3, with three additional lines completed by year 5, bringing the total to six.

[16] A "line" in the case of Advanced Conductors equates to minimum two circuits.