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Unlocking Grid Capacity for Rapid Renewable Energy Deployment

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Position Paper

Renewables Energy Source (RES) curtailment is the solution to connect more renewables faster

Across the world, renewable energy sources (RES) such as wind and solar are abundant, cost-competitive, and can be deployed quickly. They are among the fastest and most affordable ways to increase electricity supply and reduce dependence on conventional generation. Yet, one challenge often limits their growth: the transmission grid. Building new high-voltage lines and substations takes many years often a decade or more due to planning, permitting, and construction. In the meantime, valuable renewable projects remain stuck waiting for grid capacity.

A proven operational solution can unlock this bottleneck almost immediately: RES curtailment. By allowing a small, managed reduction in output during rare periods of local congestion, far more renewable capacity can be connected to the grid today, rather than waiting years for expansion projects to finish.

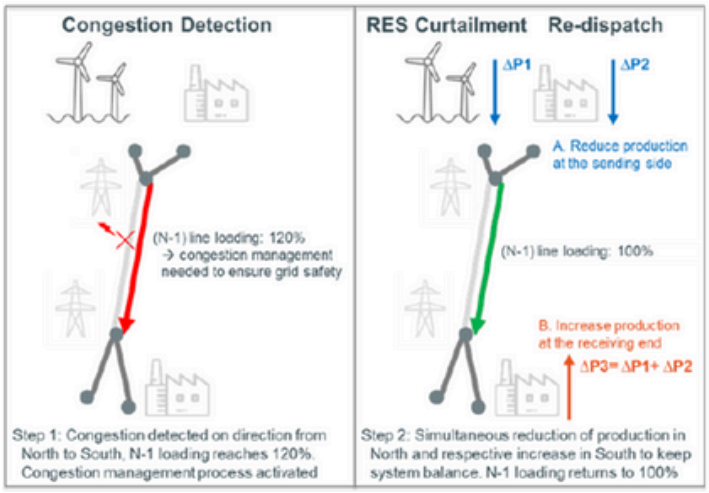
Curtailment is the active control of renewable generation output in response to temporary grid constraints or system security needs. It does not mean routinely wasting clean energy, rather maximizing the use of the existing network while managing rare peak events.

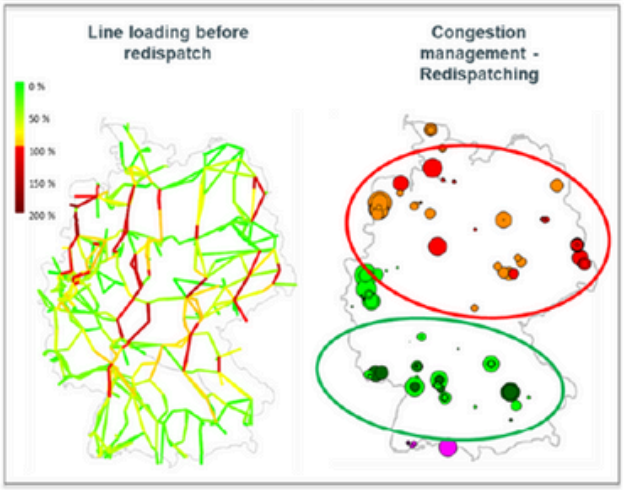
When planned and implemented well, curtailment can:

- Increase the RES hosting capacity in constrained areas by 50–100 percent or more.
- Maintain safe and reliable grid operation.
- Integrate 90 percent or more of the potential renewable output from newly connected plants

Global Best Practice in Action

In many advanced power systems, curtailment is a standard operational tool. For example, North-eastern German TSO 50Hertz (grid region with 18 million people, 100 TWh annual load) is one of the European frontrunners for the integration of variable RES in Germany where renewables can exceed 60 percent of annual supply, have been applying curtailment for over a decade. The approach is embedded in congestion management frameworks, ensuring optimal system use while keeping costs low.





Making It Happen: RES Curtailment Framework

Implementing a curtailment framework involves three main areas:

- System Operations: Establish clear operational rules and processes for identifying congestion and issuing curtailment instructions. Begin with existing control capabilities and scale up to automated, optimized congestion management tools as renewable penetration grows.
- Market and Regulatory Framework: Integrate curtailment provisions into contracts and grid codes. Adopt take-or-pay mechanisms and socialize congestion management costs to maintain investor confidence and equitable treatment.
- Grid Planning Philosophy: Move from a “zero curtailment” planning mindset to an optimal curtailment approach, where grid hosting capacity is assessed using cost-benefit principles. This allows more renewable capacity to connect sooner, while prioritizing the most impactful grid reinforcements.

Addressing Perceptions: Taking the Fear Away

Some stakeholders view curtailed energy as waste. In reality, curtailment is an efficiency measure — a way to unlock more clean energy faster and use existing infrastructure to its fullest. Effective communication is key:

- Curtailment means more renewables overall, not less.
- It is a temporary and targeted tool, applied only when needed.
- It enables innovation by creating incentives for storage, flexible demand, and new uses for surplus energy.

A Catalyst for Innovation

Experience shows that curtailment does more than just solve short-term bottlenecks:

- It can accelerate grid investment by highlighting where constraints occur most often.
- It encourages technical excellence in operations to minimize unnecessary curtailment.
- It inspires business models that make productive use of surplus energy, such as battery storage, hydrogen production, or local heat networks.

The Time to Act is Now

RES congestion curtailment is not a stopgap; rather, it is a strategic enabler of faster, cheaper renewable integration. By embracing this proven approach, power systems can:

- Connect more clean energy without waiting for full grid build-out.
- Maintain reliability and fairness for all market participants.
- Reduce dependence on expensive or polluting generation.

The essential message is simple: a little curtailment unlocks a lot of clean energy.

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ABOUT ELIA GRID INTERNATIONAL

The earlier we join your project, the greater the impact. From concept to boardroom and policy discussions, our multidisciplinary experts help you navigate complex power system challenges, anticipate risks, and turn uncertainties into confident decisions.

With successful projects in 20+ countries and 7 offices worldwide, EGI combines hands-on experience with innovative thinking. As part of Elia Group, a European leader in transmission and renewable energy integration, we bring proven expertise to de-risk your project from the start.

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