

ERRA-RAP STUDY: NAVIGATING POWER GRID SCARCITY IN THE AGE OF RENEWABLE ENERGY

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PRESENTATION CONTENTS

- Background of the Study;
- Purpose and contents;
- RAP's Grid Scarcity Toolkit;
- ERRA Survey Results; and,
- Recommendations for policymakers and regulators.



BACKGROUND OF THE STUDY

- Preserving system stability with high penetration of RES is a major challenge to a successful decarbonization of the energy sector.
- Successful decarbonization is dependent on accelerating grid expansion/upgrades to enable a meshed system driven by DERs and capable of managing overall higher electricity demand.
- Some solutions to ease congestion and connection queues can be applied without adding capacities to the system.
- Regulators have an important role in facilitating both of these objectives.



PURPOSE OF THE PAPER

• Help regulators address grid scarcity by:

- Assessing the prevalence of grid scarcity among ERRA members
- Reviewing tools available to regulators to ease grid congestion
- Reviewing examples of international best practice
- Putting together recommendations for regulators and policymakers

RAP'S REGULATORY TOOLKIT



CATEGORIES:

- (Re)Allocation of Remaining Grid Capacities
- Utilizations of Existing Grid Capacities
- Creating New Grid Capacities

TIMEFRAMES: $\leq 2 \text{ years} | 2-3 \text{ years} | \geq 3 \text{ years}$

Full toolkit is available at: https://www.raponline.org/toolkit/rip-first-come-first-served/

RAP's Grid Scarcity Toolbox

(Re)allocation of remaining grid capacities	Better use of the existing grids	Creating new grids
Managing 'contractual congestion'	Shared connection / hybridization / colocation / pooling	Contestable built
Priority lanes	Setting up a congestion management platform	Anticipatory planning / RES zones
Cleaning the queue	Mobilizing participation in congestion management	Co-opting/buying-in of local communities
More transparency on the available capacities	Alternative connection contracts	Locational marginal pricing
Better governance	Rethinking grid assessment	
Competitive allocation of grid capacities	Grid enhancing technologies (GETs)	
	Incentives for network operators	
	Better scarcity signals for grid users (time and location)	≤2 years 2-3 years 23 years
	ISO	

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CASE STUDIES

INSIGHT ON THE APPLIED BEST PRACTICES ON GRID SCARCITY CHALLENGES

(RE)ALLOCATION OF EXISTING GRID CAPACITIES

> TRANSMISSION AND DISTRIBUTION

BELGIUM: TRANSPARENCY ON AVAILABLE CAPACITIES/ HOSTING CAPACITY MAPS AND DATA SHARING



BETTER UTILIZATION OF EXISTING GRIDS

POLAND: SHARED CONNECTION/ CABLE POOLING

DISTRIBUTION

TRANSMISSION

CREATING NEW GRID CAPACITIES U.S. (TEXAS): RENEWABLE ENERGY SOURCE ZONES





CASE STUDY FROM BELGIUM (RE)ALLOCATION OF EXISTING GRID CAPACITIES

BACKGROUND

- Federal policy focus on transmission and large-scale generation, regions responsible for distribution, retail, and renewables.
- Planned phase out nuclear power by 2025, transitioning to imports and gas short-term, relying on renewables and interconnectors from 2030 onwards.
- Electrification across sectors expected to double electricity consumption by 2034.
- Case: Development of transmission (Elia) & distribution maps (Fluvius) to have transparency on available capacities.



Source: Elia Group (2022). *Belgium transmission system*



CASE STUDY FROM BELGIUM (RE)ALLOCATION OF EXISTING GRID CAPACITIES

HOSTING CAPACITY MAPS

- Information about the available space on the power grid for new users at a certain location, at various voltage levels, incorporating planned future grid development.
- Reducing the time spent in grid connection queues, potentially speeding up investment decisions.
- Reducing the number of grid connection requests TSO/DSO need to process.
- Indicating where flexibility solutions such as storage and demand-side flexibility are in high demand.







150 225

CASE STUDY FROM POLAND BETTER UTILIZATION EXISTING GRID

BACKGROUND

- Ambitious renewable plans going forward
- Planned increase to 56% of renewables in the electricity generation by 2030 means doubling the share reached in 2023.
- Grid congestion strategy more focused towards towards Capex solutions.
- Lack of available grid capacities to host more renewables.



CASE STUDY FROM POLAND BETTER UTILIZATION EXISTING GRID

CABLE POOLING FOR RES GENERATORS

- In Polish climate conditions PV and wind are often complementary throughout the year and could work interchangeably on a single connection to the grid.
- The aim of the measure is better utilization of connection capacities, flattening of the generation profile at a given connection point and better use of land.
- Problems still remain exclusions from cable pooling:
 - storage (shared connection can only be granted to two or more generation installations), and
 - installations from the CfD support scheme (only one of the connected installations sharing the same connection point is allowed to participate in the scheme).



Source: ERRA-RAP Report. *Monthly wind and solar generation profile in Poland*



Source: ERRA-RAP Report. *Cable pooling/shared connection illustration*

CASE STUDY FROM THE U.S. (TEXAS) CREATING NEW GRID CAPACITIES

BACKGROUND:

- Leading U.S. State in bringing new RE generation online; energy-only market under the independent system operator (Electric Reliability Council of Texas -ERCOT), which plans for transmission projects.
- 'Connect and manage' approach for new transmission grid connections – only focuses on needed local upgrades to the grid; doesn't examine broader network upgrades.
- Any grid bottlenecks caused by a new generator managed through market redispatch and curtailment.
- Curtailment is not capped (unlike in Europe) therefore network operators will have to foresee the risk of curtailment in their business plans



Source: US Energy Information Administration (EIA). *Combined wind and solar capacity (MW) per ISO as of 2023*



CASE STUDY FROM THE U.S. (TEXAS) CREATING NEW GRID CAPACITIES

RENEWABLE ENERGY ZONES:

- Spatial planning for renewable energy an important factor in power grid investment planning as new RES resources are located far from load centres.
- Competitive Renewable Energy Zone (CREZ) initiative since 2005 to support large-scale wind projects and ensure enough transmission capacity for them. 5 zones 83,000 sq. km.
- After the implementation of CREZ, curtailment of wind fell from 17% to 1.2%, and wholesale prices fell to a historic low + prices converged and were less volatile across the state.
- Similar initiative in Türkiye (YEKA) or Renewable Energy Acceleration Areas (REAA) as defined in the European renewable energy directive



ERRA SURVEY ON GRID SCARCITY Surveyed Countries: 11





ERRA SURVEY ON GRID SCARCITY POWER GRID CAPACITY SCARCITY IN ERRA



ERRA SURVEY ON GRID SCARCITY POWER GRID CAPACITY SCARCITY: PRIME REASON



- Because of more RES (AL, GR, HU, LT, PL)
- N/A to my Country (AZ, OM)
- Other (FR, GE, TR, TH)

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1. Utilizations of Existing Grid Capacities

≤ 2 years 2-3 years



2. (Re)Allocation of Remaining Grid Capacities

≤ 2 years 2-3 years More transparency on the available capacities Better governance Cleaning the queue Priority Lanes Quencies 2 Managing 'contractual congestion' 1

Competitive allocation of grid capacities

1	

3. Creating New Grid Capacities

≤ 2 years $\leq 2-3$ years $\leq 2 \leq 3$ years (Locational Marginal Pricing)

Anticipatory planning / RES zones	6
Contestable built	3
Co-opting / buying-in of local communities	3
Locational Marginal Pricing	0

RECOMMENDATIONS FOR POLICYMAKERS



Define goals for renewable energy in combination with new grid infrastructure.

2 Give the national regulator a net zero mandate.

Perform a thorough assessment of the grid congestion
problems and identify those that could be remedied with the minimum effort and short lead time.



Acknowledge implicit benefits/explicit costs of renewables projects to all connected to the power pool.

RECOMMENDATIONS FOR REGULATORS (1/2)



Define a 'net zero' or 'target' grid together with grid operators.

Minimise uncertainty for the investors and maximise speed of 2 connections by consulting planned grid scarcity tools with all stakeholders with minimum discretion remaining during application.

Consider grid transparency as a no-regret option. 3

RECOMMENDATIONS FOR REGULATORS (2/2)





Base selection of geographically desirable locations for renewables and transmission development on thorough economic 5 assessment of ideal renewable locations and alternative transmission line options.



Use a comprehensive planning process to reduce or eliminate the administrative process for subsequent individual new power lines.



Navigating Power Grid Scarcity in the Age of Renewable Energy

Policy and Regulatory Context and Tools



THANK YOU FOR YOUR ATTENTION!

DOWNLOAD THE FULL REPORT AT:

HTTPS://ERRANET.ORG/

OR WITH THE QR CODE ⇒

