EU experience on grid integration

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Where We Started – Fragmented National Systems

- Pre-1990s: Isolated electricity grids
- National monopolies controlled production and distribution
- Lack of cross-border energy exchange
- Energy supply crises exposed system fragility
- The need for an integrated, reliable energy system became increasingly evident



The Vision for an Integrated EU Energy Market

- European integration called for energy solidarity
- 1996: First Electricity Directive market liberalization begins
- 2003 & 2009 packages pushed interconnection and unbundling
- Key institutions like ACER (Agency for The Cooperation of Energy Regulators) and ENTSO-E (European Network of Transmission System Operators for Electricity) were established to regulate and support the market



Development of Interconnections (1990s–2020s)

- The 1990s saw the start of cross-border interconnection development
- 2025: ~430 interconnectors across EU
- The EU developed policy frameworks such as TEN-E (Trans-European Networks for Energy) and PCIs (Projects of Common Interest) to streamline planning and investment
- Enhanced regional cooperation allowed for more coordinated infrastructure projects
- These efforts laid the groundwork for a pan-European energy market



The European transmission grid



Interconnected and stable electricity grids as backbone of a wellfunctioning energy market.



Source: ENTSO-E, https://www.entsoe.eu/data/map/

European Commission's Role in EU Electricity Market and Grid Integration

- The European Commission leads energy policy design and coordination across the EU
- It sets legislative frameworks that support market liberalization and decarbonization
- Through ACER (Agency for the Cooperation of Energy Regulators), it ensures regulatory compliance and transparency
- Funding tools like the CEF (Connecting Europe Facility) support Projects of Common Interest
- The Commission promotes innovation and the deployment of new technologies



Cross-border infrastructure planning

- ENTSO-E (European Network of Transmission System Operators for Electricity) coordinates grid development
- Ten-Year Network Development Plan (TYNDP) guides investments
- TYNDP 2024: ~€584 billion needed by 2030
- European Commission and regional groups drive the selection of trans-European projects





Electricity value chain before and after liberalisation



Source: Next Kraftweke



How the EU Electricity Market Works

- Day-ahead, intraday, balancing markets
- Market coupling harmonizes trading
- Price convergence and more efficient dispatch
- ACER monitors market integration and fairness







Why integrating markets and grids?

ECONOMIC EFFICIENCY

- Reduce electricity prices by increasing competition
- Reducing the need for back-up generation
- More liquid markets reduce risk
- More efficient use of grids capacity & more flexibility



- Increasing security of supply, resource adequacy and system resilience
- Increasing independence from imports of fossil fuels

SUSTAINABILITY

- Exchange of RES electricity surpluses across time & space
- Allow RES development in the best suited locations
- Less generation from CO2 emitting generation







Benefits of Integration

Economic benefits

- €9 billion/year in generation savings by 2040 (ENTSO-E)
- More efficient use of infrastructure & resources
- €100 billion boost to EU GDP; €45 billion in tax revenues
- 1.6 million jobs supported by grid projects
- Increased market liquidity and investor confidence

Security of Supply benefits

- Shared resources and redundancy reduce blackouts
- Greater flexibility during crises (e.g., winter shortages)
- 2x improvement in supply security expected by 2030
- RES integration smooths variable production



Regulatory and Financial Frameworks

- - TEN-E Regulation revised for decarbonization
- - Projects of Common Interest (PCIs) get funding, permitting support
- - Blending Connecting Europe Facility, other EU funds and national funds
- EU Grid Action Plan



EU offer in support to APG

- EU is shaping up a Team Europe offer to scale up support to the APG through Global Gateway, together with EU MS and European financial institutions
- EU can share lessons learnt from energy market integration in Europe: in terms of regulatory convergence, innovation and technology e.g. on subsea cables
- as well as **financial support**, which can include support to pre-feasibility studies, bankable project preparation and investment for project implementation.





Lessons Learned and Ongoing Challenges

• Need for a

- shared vision and mutual trust,
- functioning governance and cooperation platforms,
- robust regulatory mechanisms to jointly assess cost & benefits,
- cooperation on developing plans, implementing solutions, monitoring progress
- Increasing grid interconnectivity & market integration significantly improves efficiency, security, flexibility and resilience of the power system for the benefit of all consumers
- Need for faster permitting, digitalization

