Economic
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Network Bottlenecks and The Energy Transition

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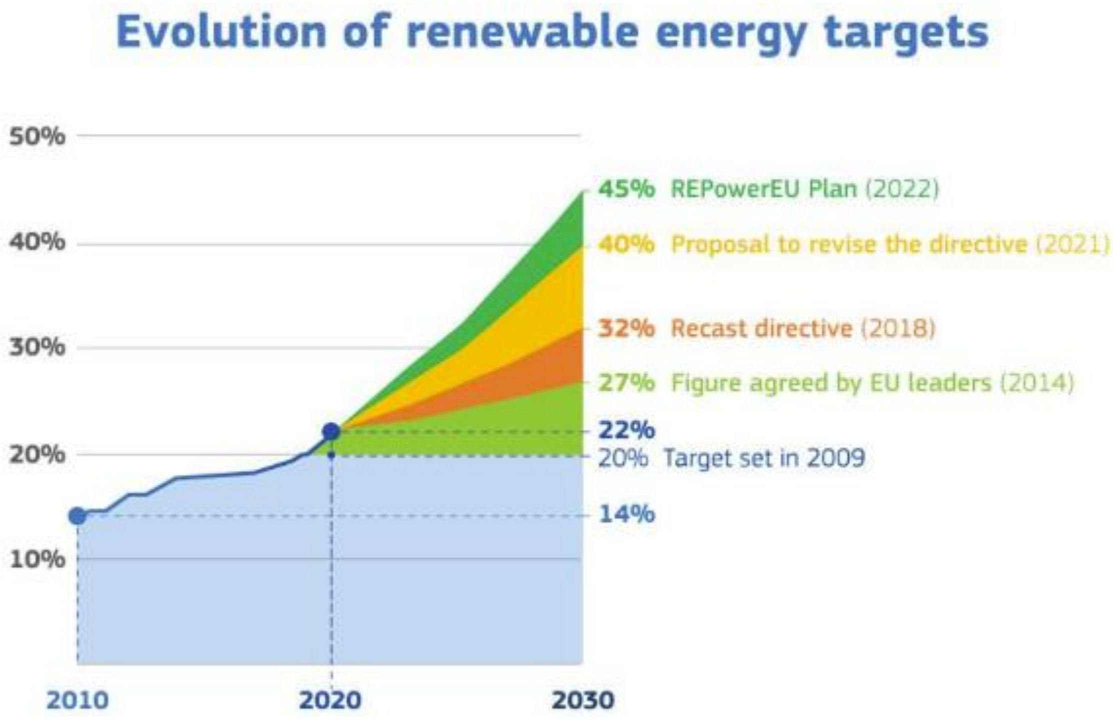
Decarbonisation policy commitments are growing…

- **REPowerEU projects:**

60+m Heat pumps | **65+m** EVs | **700+ GW** New RES capacity

70% of this new RES capacity is expected to be directly connected to distribution grids by 2030[1]

Can networks keep up?



European Commission [@EU_Commission]. 9 August 2022. *Renewable energy is our springboard towards net-zero CO2 emission and energy independence.* X. https://x.com/EU_Commission/status/1557003768419467267
45% is an 'aspirational' goal for gross final energy consumption, while the binding legal target is 42.5%

[1] Eurelectric, September 2023, Power System of the Future: Keys to delivering capacity on the distribution grid

Transmission network bottlenecks receive much attention, but distribution networks are a growing issue

Spain

Set a moratorium on new solar projects; new permitting and construction milestones, including deadlines for projects to be built or lose connection rights.[1]

Great Britain

20% of capacity in Tx queue have 10+ year connection wait; 40% offered connection dates beyond 2029[2]; filters to Dx connections queue: 90+ GW awaiting Tx reinforcements.[3] The Government and Ofgem trying to debottleneck with a 'first ready, first-connect' principle.[4]

Germany

Grid operators are (temporarily) allowed to throttle heat pumps and EV charging points to maintain grid stability in exchange for reduced network fees and not being allowed to refuse connections due to overloading risk.[5]

Australia

Rooftop solar PV 'switch-off mechanisms' introduced in multiple states as a tool of 'last resort'[6]; a blunt, if temporary, instrument?

Poland

Projected to be EU's clean energy laggard (latest 2030 target is 32-50% vs EU-wide target of 83%), with slow RES deployment attributed to restrictive permitting, inflexible connection procedures, and insufficient grid hosting capacity.[7] [8]

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[1] S&P Global, 19 September 2023, Spain's bulging solar queue spells risk of oversupply, price volatility

[2] DESNZ and Ofgem, November 2023, Connections Action Plan: Speeding up connections to the electricity network across Great Britain

[3] Energy Networks Association, 2023, Rising to Britain's Net Zero Challenge: Networks' fair and faster connections plan

[4] Ofgem, 2025, Decision on Connections Reform Package (TM04+)

[5] Clean Energy Wire, 28 November 2023, German grid operators allowed to throttle electricity in bid for faster expansion of heat pumps, EV chargers

[6] AEMO, 2022, Minimum operational demand

[7] P. Czyzak, 6 February 2023, PEP2020: Progress or disappointment?, Ember Insights.

[8] H. Kryszk, et al, 2023, Barriers and Prospects for the Development of Renewable Energy Sources in Poland during the Energy Crisis, Energies, 16, 1724.

De-bottlenecking is a multi-dimensional problem – what's the diagnosis?

Forecast error

- Distributed energy resources are inherently harder to forecast and plan for compared to transmission connected projects

Low quality connection queues (speculative / dead projects)

- Refine connection queue standards and requirements
- Potential 'easy win': Aggressively boot moribund projects and / or waive penalties for leaving the queue

Planning and permitting is an overarching risk

- Lengthy timescales, legal / local opposition, uncertain land availability, environmental impact assessments, etc.
- Outside of utility regulators' typical scope but solutions may include:
  - Developing firm, national infrastructure plans
  - Tightening the scope for legal challenge
  - Designing incentives / funds for local communities

Regulators can focus on where network utilities themselves are the bottleneck

- Are networks being too passive?
- Are network capex plans too rigid?
- What are the incentives provided by the form and duration of the regulatory framework?
- What connection charging regime is in place?

Trade-off: stranded assets vs network bottlenecks
Goal: Networks that enable the energy transition at reasonable cost

Network bottlenecks are not easily recognised

- ✓ Bottlenecks may be linked to accelerated uptake of distributed energy resources
- ✓ Such risks cannot be identified by 'traditional' transmission-level dispatch modelling
- ✓ Heat and transport electrification increase forecasting uncertainty
- ✓ Network operator grid data and management practices can be opaque
  - o Distribution-level data management and transparency is an increasingly important issue[1]

Trade-off for policymakers and regulators

- ✓ **Overbuild capacity**
  - o Stranded asset risk
  - o Excess costs for consumers or unrecovered costs for networks
- ✓ **Networks becoming a bottleneck**
  - o Failure to meet decarbonisation policy targets

[1] Kufeoglu, S., M. Pollitt, K. Anaya, 2018, 'Electric Power Distribution in the World: Today and Tomorrow', Cambridge Working Paper in Economics 1846

Ensuring networks can meet the challenge of the transition

Proactive network capex planning

- **Networks need clear direction** as to what Energy Transition they are tasked with delivering
- Match investment uncertainty with **delivery flexibility**
- Regulators need to **sense check** if network plans are commensurate with policy targets
- What **incentives** are provided by the form and duration of the regulatory framework?
- Is there a case for ‘anticipatory’ investments?

Responsive connection procedures

- Can design connection incentives but **benchmarking needs to be applied with care**
- **Get creative** in sharing connection cost risks
  - Craft ‘shallow’, ‘deep’, or ‘shallow-ish’ (capped) charging regimes

Flexibility and deliverability within price controls

- Prevent capex plan rigidity from becoming a bottleneck
- Multiple options for **uncertainty mechanisms**: ‘logging up’, reopeners, volume drivers, partial pass-through
- Can increase scrutiny of capex delivery (eg, KPIs, project delivery indices) but **need to balance regulatory burden**
- **Focus on outputs**, not inputs

New roles and responsibilities for network operators

Supporting innovation

- The Energy Transition requires **innovation and creativity**
- Does the regulatory framework support this? **Does orthodox regulation lead to a 'regulatory straightjacket'?**
- Regulatory options: innovation funding, 'regulatory sandboxes', WACC premiums, investment tests
- Need **DSO-TSO cooperation** to enable a shift to decentralised networks[1] and for relieving transmission-distribution bottlenecks[2]

Network operators as platform providers

- Electrification and decentralisation bring new challenges: EVs, heat pumps, rooftop PV, active consumers / prosumers
- Network **passivity is a potential bottleneck**
- Transition from Distribution Network Operators (DNOs) to **Distribution Service Providers (DSPs)**
- Provision of **flexibility services**, aided by remote management, flexible tariffs, and flexibility markets

Network-owned assets vs markets: reassessing natural monopolies

- What services does a network provide itself vs contracting with third-parties?
- Can BESS be both generation and network-owned within an unbundled electricity sector?
- **GB**: Ofgem allowed DNOs to offer Customer Load Active System Services (CLASS) during RIIO-ED2 despite neutrality risks[3]
- **Ireland**: ESBN temporarily allowed to build and own EV infrastructure vis ESB eCars, with costs recovered through distribution charges, despite also owning and operating the distribution network.[4] These distribution charges have ceased but ESB still owns ESB eCars.

[1] IRENA, 2020, Co-Operation Between Transmission and Distribution System Operators, Innovation Landscape Brief

[2] Energy Networks Association, Improving and Accelerating Customer Connections: Our immediate action plan

[3] Ofgem, 13 December 2022, Decision on the Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control

[4] CER, 14 October 2016, ESBN Electric Vehicle Pilot & Associated Assets

Scott Edmonds

scott.edmonds@eca-uk.com

41 Lonsdale Road
London NW6 6RA
United Kingdom

+44 20 7604 4546

info@eca-uk.com

www.eca-uk.com