IIGCC

# Grids: Tool for engagement

Supporting investor dialogue with policymakers and grid operators

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Part of the Engage Series

# Contents





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# Background and context

## Background

Climate change can pose significant financial risks and opportunities for institutional investors. Consistent with their fiduciary duty to manage these risks and opportunities, many are working to align their investment portfolios with net zero. The most used framework to set individual net zero targets and develop strategies is the Net Zero Investment Framework (NZIF).[1] Stewardship through policy advocacy and corporate engagement is a key lever within NZIF to support real economy change. IIGCC has created the *"Engage Series"* - practical engagement resources focused on key themes and sectors - to support this dialogue.

### The sector context

Grids (electricity networks) are critical infrastructure for modern economies and play a central role in the energy transition. They are essential not only to support the decarbonisation of the power system but also to enable the electrification of other sectors (transport, buildings, and industry). More information on why grids are important for investors and the key European stakeholders that could be engaged, can be found in IIGCC's *Grids: Primer*.

Despite surging investment in renewable energy sources, spending on grids has only picked up modestly. They are becoming a major bottleneck to the transition, with hundreds of gigawatts of renewable energy projects stuck in connection queues, delaying not just the decarbonisation of the power sector but also other sectors that need access to clean electricity. Increasingly, accelerating progress on grids is seen as a priority by investors, policymakers, and utilities alike.

Fixing the problem requires more than just capital. Outdated regulation, supply chain issues and slow permitting are also issues. The transition imperative must also balance energy security and affordability objectives. Many of the solutions to "grid" problems require a system approach that integrates generation and demand considerations.

### About this engagement tool

*Grids: Tool for engagement* aims to support investor dialogue with policymakers and grid operators. Key policy asks and corporate engagement questions are organised by thematic topic, accompanied by a brief description of the issues and what investors might expect to see covered in a comprehensive response.

The topics have been developed by IIGCC based on feedback from members of the Grids Working Group, its own research as well as discussions with selected external stakeholders. Many of the topics are closely interrelated and their relevance will vary significantly by market and entity. As such the tool is designed to form the basis of productive discussions, it is expressly not intended to be either prescriptive or exhaustive. Investors make their own unilateral decisions regarding the ways and means with which they will engage with their investee companies based upon the context of their own strategies, agendas, starting points, fiduciary duties, client mandates, and regulatory considerations.



# Aims, structure and overview

The ultimate aim of this tool is to support investors who are seeking to accelerate the transition to net zero consistent with their fiduciary duty to manage risks. Beyond the emissions associated with their operation, grids play a pivotal systemic role in the transition, enabling both in decarbonising the power system and other end-use sectors. To deliver this, grids must both expand and modernise.

Decarbonisation is typically just one of the objectives that grid stakeholders must deliver on. Energy security (reliability) and affordability are also priorities. In many cases, there are synergies between delivering on these goals; however, that is not always the case. Resilience to physical climate risks and impacts on nature and biodiversity are also increasingly important. This tool focuses on the decarbonisation objective but recognises this must be balanced against other considerations.

Given their critical importance, grids are unsurprisingly heavily regulated. Many of the challenges investors want addressed require changes to policy and regulation as well as operator behaviour. Consequently, this tool supports dialogue with both policymakers and corporates.

The tool breaks down the central objective into six thematic topics (A-F), which aim to capture the most pressing challenges hindering grid expansion and modernisation today. Each includes both policy/regulator expectations and corporate engagement questions that investors can use in their dialogue.

### Figure 1: IIGCC Grids Investor Engagement Tool topics


Notably, there is significant overlap between topics. For example, regulatory reforms that incentivise flexibility can help ease grid congestion and increase capacity — but may also require safeguards to protect vulnerable households and maintain system reliability. While investors may choose to focus on specific topics relevant to their individual circumstances, they are encouraged to consider the framework holistically.

## Summary: Asks of policymakers and regulators

### A. Regulatory Framework Reform

1. Embed climate targets in the energy regulator's mandate.
2. Update grid operator remuneration models.
3. Adjust permitted rates of return.
4. Fairly allocate interconnector and offshore hybrid asset costs.

### B. Capacity and Planning

1. Minimise the curtailment of renewable generation.
2. Reform connection processes.
3. Align network development plan (NDP) with climate goals.
4. Enhance stakeholder coordination.

### C. Flexibility and Digitalisation

1. Develop clean flexibility strategies with quantitative targets.
2. Implement flexibility market frameworks.
3. Incorporate regional resources into network planning.
4. Ensure inclusive flexibility policies.
5. Set targets for smart meter rollout and maintain existing infrastructure.

### D. Permitting and Communities

1. Streamline permitting processes.
2. Involve communities in network planning.
3. Protect and restore nature when deploying grid infrastructure.

### E. Operations and Supply Chains

1. Support diverse and resilient supply chains.
2. Phase out $SF_6$ emissions.
3. Support innovative technologies.
4. Ensure skilled workforce availability.

### F. Reliability and Resilience

1. Maintain grid reliability and stability.
2. Enhance resilience to physical climate risks.



## Summary: Corporate engagement questions

### A. Regulatory Framework Reform

1. How are you engaging with policymakers (directly and indirectly) to support grid-related reforms aligned with decarbonisation goals?

### B. Capacity and Planning

1. How are you addressing renewable energy curtailment in the network?
2. How are you providing visibility into the network's capacity?
3. How are you managing connection queues for renewables and storage projects, and how are you considering readiness-based approaches?
4. How are you aligning the Network Development Plan (NDP) with national decarbonisation goals (including NDCs) and net-zero pathways?
5. Do you disclose the current and planned network investments, according to the NDP?

### C. Flexibility and Digitalisation

1. How are you advancing the rollout and maintenance of smart meters?
2. How are you deploying digital solutions to enhance the grid?
3. How are you enabling and integrating demand-side flexibility into the grid?
4. What is the penetration of customer EVs and heat pumps in your network?
5. How do you use interconnectors?

### D. Permitting and Communities

1. How are you engaging with communities to support the delivery of the NDP?
2. How are you disclosing and addressing the network's impacts on nature and biodiversity?

### E. Operations and Supply Chains

1. How are you managing grid-related supply chain challenges?
2. How are you managing $SF_6$ emissions from network equipment?
3. Do you disclose network losses, the associated emissions, and how you aim to reduce them?
4. How are you managing material grid-related Scope 3 emissions?
5. How are you deploying grid-enhancing technologies (GETs) to modernise the network?
6. How are you addressing any potential skilled workforce challenges?

### F. Reliability and Resilience

1. Do you disclose key network age and reliability indicators?
2. Do you disclose the current and planned number of grid-stabilising projects?
3. How do you conduct physical climate risk assessments for the network?

# A. Regulatory framework reform

## Why is this topic relevant?

Grid operators are natural monopolies and therefore subject to close oversight by National Regulatory Authorities (NRAs). Historically, NRAs have focused on ensuring energy security and affordability. However, to meet climate goals requires regulatory frameworks to evolve. Introducing a net-zero mandate for NRAs could accelerate reforms that align grid operator investment incentives with long-term decarbonisation — encouraging both new grid infrastructure and more efficient use of existing assets.

## Key issues

**Embedding decarbonisation within the NRA remit.** Most NRAs lack a clear mandate to support decarbonisation targets, focusing instead on short-term consumer interests. In 2023, the UK government amended the Energy Bill to give the Office of Gas and Electricity Markets (Ofgem) a statutory net-zero duty.[2] A net-zero mandate for NRAs could ensure alignment between high-level climate policies and energy regulation, enable anticipatory grid investments, which proactively oversize network capacity, allowing easier future renewables' integration. Eurelectric estimates that doubling grid capacity may only increase grid project costs by 10-20%.[3]

**Fit-for-purpose remuneration models.** NRAs define the rate-of-return (RoR) for grid operators, preventing excessive profits. Historically, cost-based regulation approaches like RoR focused on capital expenditure (capex) did not incentivise cost-efficiency. Incentive-based approaches, now applied in many countries including the UK and Italy, use financial awards and penalties to achieve efficient cost bases.[4] Considering total expenditure (TOTEX) instead of only capex allows grid operators to earn returns on both capital and operational spending, encouraging more cost- and time-effective solutions — whether through new infrastructure or smarter use of existing assets. This can accelerate the energy transition while helping maintain affordability.

To attract private capital, permitted returns must remain competitive with other risk-adjusted investment opportunities. Blended finance — e.g. concessional capital or guarantees from governments or multilateral development banks (MDBs) — can also help lower investment risk and attract institutional investors.

**Interconnectors and offshore hybrid assets.** Interconnectors enhance energy system integration, flexibility, and support climate goals by reducing reliance on fossil fuels. For example, establishing common practices for the financing of cross-border projects — such as the cross-border cost allocation (CBCA) for interconnectors in Europe[5] — ensures fair sharing of benefits between countries, catalysing progress. NRAs should develop equivalent frameworks for offshore hybrid assets — the next generation of interconnectors, connecting offshore wind farms to multiple countries.



## Asks of policymakers and regulators

1. **Embed climate targets in the energy regulator's mandate.**

   *What to look for: A legal mandate could enable forward-looking, anticipatory network investments by grid operators in strategic areas to support national climate targets*

2. **Update grid operator remuneration models.**

   *What to look for: TOTEX-based regulatory frameworks incentivise operational efficiency and reduce capital expenditure bias.*

3. **Adjust permitted rates of return.**

   *What to look for: Permitted rates of return need to be competitive with comparable risk-adjusted opportunities to attract private capital into grid infrastructure.*

4. **Fairly allocate interconnector and offshore hybrid asset costs.**

   *What to look for: Use of existing cost-sharing guidance for interconnectors such as the EU's Cross-Border Cost Allocation (CBCA), and development of equivalent frameworks for offshore hybrid assets to accelerate the deployment of critical infrastructure.*

## Corporate engagement questions

1. **How are you engaging with policymakers (directly and indirectly) to support grid-related reforms aligned with decarbonisation goals?**

   *What to look for: Evidence of direct lobbying and trade association positions that support the adoption of grid-related reforms that are aligned with decarbonisation goals and avoid advocating against these measures, and oversight of these lobbying activities.*

# B. Capacity and Planning

## Why is this topic relevant?

Limited grid capacity results in network congestion, leading to the curtailment of existing renewable generation and delaying the connection of new renewable capacity. Improved grid planning — grounded in the consideration of system-wide costs and benefits, enabled by greater stakeholder transparency and coordination, and supported by reformed connection processes — can accelerate the availability of renewable generation.

## Key issues

**Congestion and curtailment.** Congestion occurs when grid capacity is insufficient to transmit all available electricity, resulting in curtailment and compensation costs from grid operators to generators. This issue hinders the clean energy transition, industrial development, and energy security.[6] Approaches to congestion management include renewable energy zones (REZs), co-location of renewables and storage, shared connections, and alternative connection contracts.[7] Locational marginal pricing (LMP) could encourage generation and consumption where the grid can handle it by signalling a more reflective cost of electricity at specific locations. Yet, discussions for its adoption are still ongoing in Europe.

**Transparency on grid capacities.** Data disclosures from grid operators on available capacity are inconsistent. The EU Grids Action Plan (Action 6) calls for harmonised definitions and transparent, granular, regularly updated information on grid hosting capacities and connection request volumes.[8] Ember's ideal grid hosting capacity map includes substation-level granularity of installed and available capacity and queues.[9]

**Outdated connection process.** Speculative renewable projects in congested areas are stuck in connection queues due to the historic first-come, first-served approach. Reforms that mandate applicants meet specific milestones to progress in the queue, and shifting to a first-ready, first-served connection approach, can prioritise investment on realistic projects.

**Network development plans (NDPs) and coordination.** Grid operators forecast demand using integrated scenarios to identify energy resources needed to meet system needs. It is important that scenarios consider emissions mandates, span over appropriate time horizons and include the potential for demand-side flexibility in the transport, heating, and industrial sectors. Coordination between generation, transmission, and distribution, as well as local, national, and cross-border plans, can align perspectives. Transmission System Operators (TSOs) typically publish their results in NDPs every two years as mandated by EU Regulation 2019/943, but for Distribution System Operators (DSOs), NDPs are less standardised.



### Asks of policymakers and regulators

1. **Minimise the curtailment of renewable generation.**

   *What to look for: Policies that incentivise the deployment of renewable energy projects co-located with battery storage, pumped hydro, and the use of dynamic market-based pricing mechanisms.*

2. **Reform connection processes.**

   *What to look for: Measures designed to reduce speculative or non-priority projects, including a "first-ready, first-connected" approach, milestone-based queue management, flexible connection agreements, and project prioritisation based on system benefits, including decarbonisation.*

3. **Align network development plan (NDP) with climate goals.**

   *What to look for: Integration of national targets (including NECPs, NDCs) into all NDPs as a minimum, ensuring grid development supports climate commitments.*

4. **Enhance stakeholder coordination.**

   *What to look for: Measures that improve coordination may include a data exchange and structured engagement between TSOs, DSOs, market participants, regulators and policymakers.*

### Corporate engagement questions

1. **How are you addressing renewable energy curtailment in the network?**

   *What to look for: Curtailment volumes (MWh), associated costs, and measures to reduce curtailment, such as flexibility services, improved forecasting, or alternative connection contracts.*

2. **How are you providing visibility into the network's capacity?**

   *What to look for: Grid hosting capacity maps with location-specific and aggregated data on current and future available capacity.*

3. **How are you managing connection queues for renewables and storage projects, and how are you considering readiness-based approaches?**

   *What to look for: Number and capacity of late-stage projects awaiting connection, and whether a "first-ready, first-connected" approach is being considered.*

4. **How are you aligning the Network Development Plan (NDP) with national decarbonisation goals (including NDCs) and net-zero pathways?**

   *What to look for: How the ambition and assumptions in the NDP align with national energy and climate plans and/or net-zero pathways.*

5. **Do you disclose your current and planned network investments, according to the approved NDP?**

   *What to look for: Ratio between network and renewable generation investments for integrated utilities, breakdown by country, breakdown by network type (Transmission or Distribution) and breakdown by type (e.g. modernisation, expansion, digitalisation, resilience).*

# C. Flexibility and Digitalisation

## Why is this topic relevant?

Flexibility is the system's ability to respond to fluctuations in supply and demand. Higher flexibility can reduce the need for costly infrastructure expansions, improve system reliability, and enable the integration of higher shares of renewable energy. Digitalisation equips grid operators with real-time data and control capabilities, enabling them to monitor, forecast, and optimise electricity flows. This improved network insight, facilitated by digitalisation, is an enabler for a more flexible system operation.

## Key issues

**Enhanced system flexibility.** Greater flexibility allows the grid to respond to real-time changes in supply and demand without overbuilding expensive infrastructure. In the UK, NESO estimates that demand-side flexibility (DSF) could reach 10–12 GW by 2030 through smart EV charging, shifting household demand, and more responsive industrial use.[10] DSF is cost-effective and avoids the planning, permitting, and supply chain challenges associated with new grid infrastructure.

Supply-side flexibility is also significant, with technologies including battery storage, pumped hydro, and interconnectors. These support decarbonisation as they help accommodate a higher share of variable renewable generation, balance the system and reduce overall costs. The EU has set a target for member states to reach at least 15% interconnection capacity by 2030.

Regulators are beginning to support flexibility through market frameworks. In the UK, more than 100,000 distribution-level assets — including EVs and batteries — totalling 2GW of capacity are registered. Yet, despite progress, flexibility is not yet fully integrated into market design everywhere. National strategies with clear targets, robust procurement mechanisms and consideration of DSF access and impact on lower-income households can help scale clean flexibility as needed for net zero.

**Network digitalisation.** Smart grids use digital technologies to manage electricity flows in real time, helping operators balance supply and demand, detect faults quickly, and run the system more efficiently and reliably. The European Commission expects €170 billion in digitalisation investments will be needed by 2030. This includes smart meters and other digital technologies and is more than a quarter of the total outlined in the EU Grids Action Plan (€584 billion).

By the end of 2024, over 195 million smart meters had been deployed across the EU27+3, covering around 63% of electricity consumers.[11] However, many remain in 'dumb mode', limiting their ability to provide real-time data and insights. Digitalisation also faces structural barriers: poor interoperability between systems, fragmented data governance, and rising cybersecurity risks.[12] These challenges hamper grid operator forecasting, system optimisation, and consumer participation in flexibility schemes.



## Asks of policymakers and regulators

1. **Develop clean flexibility strategies with quantitative targets.**

   *What to look for: National strategies with measurable targets for low-carbon flexibility sources such as battery storage, demand-side response, and virtual power plants.*

2. **Implement flexibility market frameworks.**

   *What to look for: Market mechanisms—such as capacity markets, constraint management, and ancillary services—that explicitly support low-carbon flexibility (e.g. by including carbon caps in capacity mechanisms).*

3. **Incorporate regional resources into network planning.**

   *What to look for: Network development plans that include cross-border interconnection targets, referencing appropriate policies—such as the EU target of at least 15% interconnection capacity by 2030—where applicable.*

4. **Ensure inclusive flexibility policies.**

   *What to look for: Policy measures that ensure access to demand-side flexibility for all consumers and include protections for vulnerable households.*

5. **Set targets for smart meter rollout and maintain existing infrastructure.**

   *What to look for: Clear national targets for smart meter deployment, alongside measures to ensure the continued functionality of the existing meter base.*

## Corporate engagement questions

1. **How are you advancing the rollout and maintenance of smart meters?**

   *What to look for: Current and planned percentage of customers with smart meters, and details on the functionality and interoperability of the meters.*

2. **How are you deploying digital solutions to enhance the grid?**

   *What to look for: Approach to smart grids, automation, digital substations, and data-driven grid management tools.*

3. **How are you enabling and integrating demand-side flexibility into the grid?**

   *What to look for: Engagement with industrial, commercial, and residential consumers or aggregators, and the volume and type of flexibility services tendered and contracted.*

4. **What is the penetration of customer EVs and heat pumps in your network?**

   *What to look for: Number of electric vehicles, chargers and heat pumps, and how these trends are incorporated into network planning and flexibility strategies.*

5. **How do you use interconnectors?**

   *What to look for: Current interconnection capacity and utilisation rates, and how future interconnector projects will support system balancing and decarbonisation.*

# D. Permitting and Communities

## Why is this topic relevant?

The construction of new grid capacity is often delayed at the permitting stage due to public opposition and lengthy administrative procedures involving multiple stakeholders — particularly in relation to large transmission lines. Streamlining permitting procedures for critical projects, while ensuring adequate community involvement, and maintaining nature-inclusive practices are essential to sustainably accelerating grid deployment.

## Key issues

**Permitting challenges.** Inefficiencies or inconsistencies in government review procedures, subjective or incomplete interpretation of regulations, and complicated land use change requirements often make the permitting stage the lengthiest. Power grid infrastructure projects often involve multiple authorities and jurisdictions, resulting in delays. In Europe, the average duration of the permitting stage ranges between five to six years, with total project duration often exceeding 10 years. Over a quarter of electricity projects of common interest (PCIs) are subject to delay due to permit granting.[13] The UK's Clean Power 2030 Action Plan is overhauling planning rules to accelerate permitting for Nationally Significant Infrastructure Projects (NSIPs).[14]

**Community engagement.** Opposition from local stakeholders, reflecting concerns about visual, noise, and biodiversity impacts can delay buildout of grid projects. While the energy transition has long-term society-wide benefits, the short-term and local impact on communities due to construction and landscape changes can be acute.

Early community engagement and potential compensation can improve acceptance. In Europe, grid operators should implement the 'pact for engagement' launched alongside the EU Grid Action Plan, which calls for cooperation between authorities and alignment of permitting and stakeholder engagement processes. In Australia, the Energy Grid Alliance[15] aims to improve community engagement and advocate best planning processes in new transmission projects. Local communities can benefit from price discounts for electricity consumption and local business involvement in the project's lifecycle. The UK's Electricity Bill Discount Scheme recommends community funds and direct benefits in the form of bill discounts.[16]

**Nature protection.** Grid deployment should seek to minimise nature and biodiversity impacts. In Eurelectric's guidebook for grid operators, biodiversity integration is based on the mitigation hierarchy, a sequential approach to avoid, minimise, restore, and offset negative biodiversity impacts, aiming for a net gain in biodiversity.[17] Grid operators are recognising the importance of protecting nature whilst building out the grid and are taking measures such as identification of high-risk bird spots, implementation of bird-friendly barrier measures to avoid collisions and vegetation management such as flower lines.



### Asks of policymakers and regulators

1. **Streamline permitting processes.**

   *What to look for: Standardised approval processes and the designation of transmission corridors for priority infrastructure can accelerate deployment and reduce costs.*

2. **Involve communities in network planning.**

   *What to look for: Policies that promote early and transparent community engagement with benefit-sharing mechanisms.*

3. **Protect and restore nature when deploying grid infrastructure.**

   *What to look for: Policy and/or regulatory frameworks that encourage grid developers to follow a nature mitigation hierarchy (avoid, mitigate, compensate).*

### Corporate engagement questions

1. **How are you engaging with communities to support the delivery of the Network Development Plan (NDP)?**

   *What to look for: Information on consultation practices, use of standardised engagement frameworks, and any community investments related to network development.*

2. **How are you disclosing and addressing the network's impacts on nature and biodiversity?**

   *What to look for: Lines in protected areas. Actions taken in line with a nature mitigation hierarchy to achieve nature-positive outcomes. These may include biodiversity corridors, undergrounding, bird protection measures, or habitat restoration.*

# E. Operations and Supply Chains

## Why is this topic relevant?

Grid operators face several operational challenges. These include managing their own emissions, ensuring access to skilled human capital, and accelerating the deployment of grid-enhancing technologies (GETs) to increase capacity, reduce losses, and improve resilience. At the same time, supply chain constraints—particularly in cables and transformers — are delaying critical grid infrastructure projects.

## Key issues

Greenhouse gas (GHG) emissions. Grid operator emissions span three key areas:

- **Scope 1 – $SF_6$ emissions:** Sulphur hexafluoride ($SF_6$), an insulating gas used in substation equipment, is 24,300 times more potent than $CO_2$. Though it contributes ~1% of global warming, it can make up 90% of a grid operator's Scope 1 emissions.
- **Scope 2 – Transmission losses:** These are indirect emissions from electricity lost during transmission. For many operators, they are the most material source of emissions—for example, Italian TSO Terna's losses are 23 times larger than $SF_6$ emissions, and account for over 95% of its combined Scope 1 and 2 footprints.[18]
- **Scope 3 – Embedded emissions:** Delivering new grid infrastructure involves a short-term trade-off: a potential increase in Scope 3 emissions linked to the procurement of capital goods such as steel and concrete.

**Skilled workforce.** In the IEA's NZE scenario, employment needs to exceed 11 million by 2030, indicating a gap of around 3 million jobs from 2023 levels.[19] Skilled labour is essential to meet the demands of infrastructure projects, installations and support the expansion of manufacturing capabilities. By fostering a skilled workforce, governments can support manufacturing and grid operators' operational capacities effectively.

**Grid-Enhancing Technologies (GETs).** GETs are hardware and software tools that improve grid capacity and resilience. Enabling a more efficient network use reduces the need for costlier and lengthier expansions. Key GETs include dynamic voltage control, dynamic line rating, automatic network reconfiguration and high-temperature low-sag conductors.[20]

**Supply chain bottlenecks.** Shortages of grid components pose roadblocks for the energy transition. A shortage of transformers has persisted since 2021 amid supply chain disruption and rising demand, resulting in project delays and high prices. Between 2020 and 2023, distribution transformer prices rose by 68 and procurement times for cables and transformers has almost doubled to up to four years.[21, 22] Avoiding supply chain bottlenecks for grid components requires coordinated efforts, providing firm and transparent grid project pipelines, and standardising grid equipment procurement.



## Asks of policymakers and regulators

1. **Support diverse and resilient supply chains.**

   *What to look for: Coordinated, standardised, and forward-looking grid equipment procurement strategies that provide visibility and certainty to manufacturers, helping reduce bottlenecks.*

2. **Phase out $SF_6$ emissions.**

   *What to look for: Policies that set clear timelines for phasing out $SF_6$ in grid infrastructure, enabling operators to plan for alternatives and reduce emissions.*

3. **Support innovative technologies.**

   *What to look for: Regulatory models—such as TOTEX approaches—that treat CAPEX and OPEX equally, or other support mechanisms for the adoption of innovative grid-enhancing technologies (e.g. dynamic line rating, advanced conductors).*

4. **Ensure skilled workforce availability.**

   *What to look for: National strategies or funding mechanisms that support education, vocational training, and workforce development to address skills gaps in the electricity sector.*

## Corporate engagement questions

1. **How are you managing grid-related supply chain challenges?**

   *What to look for: Identification of material supply chain risks, mitigation strategies such as advance purchasing or diversification, and partnerships to strengthen supply chain resilience.*

2. **How are you managing $SF_6$ emissions from the network's equipment?**

   *What to look for: Current leakage rates, historical trends, and future targets or initiatives to reduce $SF_6$ use and transition to alternatives.*

3. **Do you disclose network losses, the associated emissions, and how you aim to reduce them?**

   *What to look for: Historical and current loss rates, GHG emissions from losses, and targets or initiatives to reduce them.*

4. **How are you managing material grid-related Scope 3 emissions?**

   *What to look for: Procurement of low-carbon and recycled materials (e.g. steel, aluminium, concrete), design optimisation to reduce material intensity, circularity or refurbishment initiatives for grid assets.*

5. **How are you deploying grid-enhancing technologies (GETs) to modernise the network?**

   *What to look for: Role of technologies such as advanced conductors or dynamic line rating, and any plans, pilots, or targets for their adoption.*

6. **How are you addressing any potential skilled workforce challenges?**

   *What to look for: Workforce gaps, training and recruitment initiatives, partnerships with educational institutions, and long-term workforce planning.*

# F. Reliability and Resilience

## Why is this topic relevant?

Reliability and resilience are critical aspects of electricity grids. These concepts are becoming increasingly complex to manage due to ageing infrastructure, the growing share of variable renewables driven by the energy transition, and worsening climate conditions. Reliability refers to the grid's ability to deliver electricity consistently, while resilience is its capacity to withstand and recover from unexpected events such as extreme weather or cyber-attacks. Following the blackout in Spain and Portugal in April 2025, these considerations are likely to receive increased attention.

## Key issues

**Grid Reliability.** Ageing infrastructure poses a growing challenge, with many grid components in developed countries over 25 years old, increasing the risk of failures. Grid operators often report reliability using metrics that measure the System Average Interruption Frequency and Duration (SAIFI, SAIDI), which are frequently tied to their compensation.

**Grid Stability.** Inertia refers to the energy stored in large fossil rotating generators, which gives them the tendency to remain rotating. This stored energy is valuable when a power plant fails, as it can temporarily make up for the power lost. As renewables grow, grid operators are turning to technologies such as synchronous condensers (SCs) and grid-forming inverters to maintain inertia and stability, without relying on fossil generators. BloombergNEF research states that a record number of SCs is expected in Europe in 2025, with the UK and Italy leading the deployment.[23]

**Adaptation and Resilience.** Climate change is increasing the frequency and severity of extreme weather events, such as wildfires, floods and hurricanes. New and existing grid infrastructure must be resilient to these events.

In 2024, the U.S. Department of Energy announced nearly $2 billion in funding for grid resilience projects, though future funding may depend on evolving political priorities.[24] Utilities are already enhancing the climate resilience of their grids. Enel has identified storms, hurricanes and fires as direct risks, while heat waves can lead to spikes in demand, risking of grid overload. It has dedicated 12% (more than €3 billion) of its grid investments to resilience, focusing on proactive adaptation and damage reduction solutions for rapid recovery and service continuity.[25] Similarly, Iberdrola is burying overhead networks in vulnerable areas and designs substations that can maintain service during floods and fires, among others.[26]

IIGCC's PCRAM 2.0[27] offers a practical guide for understanding and managing the physical climate risks that climate change poses to real assets, appraising the adaptation options and linking it back to asset values.

### Asks of policymakers and regulators

1. **Maintain grid reliability and stability.**

   *What to look for: Regulatory frameworks that enable sufficient investment in modernisation and technologies that support system reliability and stability, such as synchronous condensers and grid-forming inverters.*

2. **Enhance resilience to physical climate risks.**

   *What to look for: Requirements for grid operators to conduct physical climate risk assessments and integration of adaptation and resilience plans, into network planning processes for regulatory oversight.*

### Corporate engagement questions

1. **Do you disclose key network age and reliability indicators?**

   *What to look for: Age profile of network assets, modernisation initiatives, and reliability metrics such as SAIDI, SAIFI, or equivalent.*

2. **Do you disclose the current and planned number of grid-stabilising projects?**

   *What to look for: Number and type of projects (e.g. synchronous condensers, grid-forming inverters), location, timeline, and anticipated impact on system reliability.*

3. **How do you conduct physical climate risk assessments for the network?**

   *What to look for: Scenario analysis across its network, and how the results are used to inform investments across its asset base*

## References


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