

Network Planning in an uncertain world: lessons learned from GB's evolving process

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The landscape for electricity networks is changing rapidly to a more decentralised, decarbonised and digitised future. The role of the customer is becoming more active, demanding and important. This viewpoint explores network planning in such an uncertain and dynamic world through National Grid's network development process.

Overview of National Grid's network development process

In order to deal with ever increasing uncertainty around future generation and demand National Grid (NG) Electricity System Operator (ESO) has developed an annual network development process aiming to recognise uncertainty over future generation and demand on the National Electricity Transmission System (NETS). Figure 1 illustrates the three annually publishable documents that are at the core of the annual process the ESO follows. In summary:

- **Future Energy Scenarios (FES):** Provides a range of plausible and credible pathways for the future of energy to 2050.
- **Electricity Ten Year Statement (ETYS):** Translates FES into future electricity transmission requirements.
- **Network Options Assessment (NOA):** Evaluates and recommends options to meet reinforcement requirements.

Figure 1 NG's network development process



Future Energy Scenarios

The FES are the ESO's scenarios for energy outlook to 2050. For 2019 scenarios, four scenarios are defined varying by the level and speed of decarbonisation and from this, the type and location of future generation and demand. They are underpinned by an annual stakeholder engagement process across the industry. The use of a range of scenarios is intended to ensure that network planning is robust in the face of uncertainty. The annual process allows for frequent and regular updates of outlooks and accompanying planning decisions.

Electricity Ten Year Statement

The ETYS translates the demand and generation projections into requirements for the electricity transmission system. The existing system is broken down into zones with the boundaries between these representing major potential constraints. Potential transfer requirements across wider boundaries are then calculated based on approved Security and Quality of Supply Standards (SQSS) under two criteria:

- The **security criterion** calculates each boundary's required transfer in the absence of intermittent generation, such as renewables, and of imports from interconnectors. This ensures the system can deliver reliable supply at all times.
- The **economy criterion** calculates the required transfer with a high level of output from low carbon generation. This ensures that the system can deliver the least-cost and least-carbon generation mix.

There is increased need for this process to expand outside of its focus on winter peak demand.

Network Options Assessment

The NOA uses the required transfers calculated for each boundary to identify and evaluate network development options that will ensure these transfer requirements can be met in future years. Technical studies are conducted to identify feasible options to meeting requirements including commercial options such as intertrips or fast de-loading schemes.

The preferred option is then selected based on a 'least regrets' analysis, intended to minimise the risks of excessive costs. This looks to trade-off the 'regret' of not delivering an option (eg, increased constraint costs) against the regret of delivering an option which subsequently turns out not to be needed (stranded assets). The FES play a key role in this by specifying the potential future outcomes used in this analysis and, for example, showing whether an option is required under all or only some futures.

The NOA is updated annually, reflecting changing scenarios and current conditions. For example, it may choose to delay a network investment if it is driven by a generator connection that has been delayed.

For NOA 2018/19, 115 options were assessed of which four were commercial solutions. A total of 27 options have been selected with two being commercial options. Investments of £58.84 million for 2018/19 were identified, the incremental expenditure approved annually to allow review in the following year. Until commissioning, which can extend into future years, all suggested projects have a total estimated future investment requirement of £5.39 billion.

Moving forward

Thinking on future planning requirements continues to evolve. The Network Development Roadmap consultation¹ in 2018 identified a number of key areas for future improvement:

- Assess year-round transmission network needs rather than focusing on winter peaks.
- Increase the focus on regional voltage management that are becoming

¹ <https://www.nationalgrideso.com/insights/network-options-assessment-noa>

increasingly challenging with decentralisation of generation.

- Address the challenges of maintaining system stability with the reduction in synchronous generation.
- Accommodate a wider range of network and non-network options such as commercial and distribution-level solutions.

The future of network planning

Moving forward, network development will have to be more flexible and agile in its approach as can be seen from the evolution of NG's process. Critical areas for development by system operators will include:

- More and more it is not enough to plan a network based on peak demand limitations only. Probabilistic and scenario-based approaches to network planning across the year are better able to capture future uncertainties and changing network conditions.
- Expanding electricity transmission planning to include innovative non-network, distribution-level and commercial solutions can lower costs significantly, particularly when managing intermittency. A wide range of network and market participants should be engaged to deliver these options.
- Moving from a system historically driven by synchronous generation to a system reliant more and more on intermittent generation means that being able to articulate and quantify the technical requirements that will be required moving forward will be key to allow other technologies to provide them.
- Overall network development processes across network operators and market participants will need to be more transparent, accessible and agile in order to allow for the appropriate engagement amongst stakeholders for a whole system approach.