



Future of Security of Supply: Initial Research

NIA_084 Closedown Report

October 2025 – March 2026

**Electricity
Distribution**

nationalgrid

Version Control

Issue	Date
V0.1	1/03/2026
V0.2	18/03/2026
Final	17/04/2026

Publication Control

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1. Executive Summary

The Future of Security of Supply For Electricity Distribution (ED) project, funded by the Ofgem Network Innovation Allowance (NIA) and conducted between October 2025 and March 2026, aimed to evaluate whether the current ED security of supply standards in Great Britain (GB) remain fit for purpose in light of increasing electrification, decentralised generation, and digitalisation; and recommend options for future change if required. Sponsored by National Grid's Distribution System Operator (DSO) and delivered in partnership with the University of Bath, the project sought to identify practical options for modernising planning, operational, and output regimes. The total project budget was £85,517, with supplier costs of £70,000.

The project found that the main existing planning standard, Engineering Recommendation P2, is based on assumptions from the 1970s, reflecting a passive network with homogeneous customer needs and deterministic peak demand. These assumptions are increasingly misaligned with the evolving electricity system, which now includes widespread electrification of heat, transport, and industry, as well as the integration of distributed generation, energy storage, demand-side response, and digital dependencies. The current deterministic approach, including group-peak thresholds, limits the effective utilisation of flexibility and distributed resources. Additionally, the use of a single Value of Lost Load (VoLL) fails to capture the diversity of customer needs. The project also identified fragmentation between planning standards, operational practices, and output metrics, as well as insufficient alignment between distribution and transmission standards.

The project outlines several feasible pathways for modernisation. These include short-term targeted updates to the deterministic P2 standard, a transition towards probabilistic planning methods, the introduction of stronger output-based and customer-facing measures, and the development of operational standards to manage increasingly active networks.

The project's key recommendations and next steps are as follows.

- Undertake industry-wide study to develop a deeper understanding of customer needs.
- Consider short-term improvements to the deterministic P2 standard, including reassessing the dominance test, and considering demand group definitions based on customer numbers.
- Using outputs from the customer-needs study produce implementable proposals for probabilistic, output-based, and operational standards.
- Consider operational security of supply standards acknowledging that NG DSO have plans to start the trial for operational standard later in 2026.
- Develop greater alignment with transmission standards.

In summary, the project recommends a phased, evidence-led transition from the current deterministic regime to a more integrated approach combining targeted deterministic fixes, customer-informed output measures, operational standards, and potentially probabilistic planning. It is recommended that this transition is supported by customer research, trials, and coordinated code changes to balance risk, cost, and stakeholder expectations effectively.

2. Project Background

Security of supply standards for ED have been evolving since their original introduction and in most recent years have been updated to incorporate contribution from new generation technologies and to enable use of flexibility (demand side response). Future plans for decarbonisation of heat, transport and other processes, including industrial decarbonisation, has the potential to significantly increase both demand for and reliance upon electricity, thereby increasing the socioeconomic need for reliable electricity supplies. Existing standards and incentives may not fully meet this need.

Future of Security of Supply NIA project aimed to review the historic evolution of the existing documentation and provide realistic options for the modernisation of security of supply standards for electricity distribution.

3. Scope and Objectives

All project objectives have been met – further information is provided in Chapter 6.
The list of objectives is presented below:

Table 3-1: Status of project objectives

Objective	Status
Undertake a comprehensive review of the current state of electricity distribution security of supply standard and regulations, comparing with relevant examples from other utility networks nationally and internationally	✓
Evaluate increasing socio-economic reliance on electricity.	✓
Assess the current state of electricity distribution security of supply standards and make well justified recommendation as to whether any changes are needed (options for change proposed with rationale provided); or no changes are required.	✓

4. Success Criteria

All project success criteria have been met. Further detail is presented in Chapter 6.
All original success criteria are listed in the table below.

Table 4-1: Status of project objectives

Success Criteria	Status
Finalised comprehensive review of the current state of security of supply standard and regulations for electricity distribution. Comparison with gas and electricity transmission security of supply standards and regulations to be included where relevant in the context of decarbonisation and electrification of heat, transport and other processes focusing on increased socio-economic reliance on electricity	✓
Well-justified conclusion, either: Why and when electricity distribution security of supply needs to change, with credible options for change in security of supply proposed; or That no change in electricity distribution security of supply is needed and rationale for that recommendation provided.	✓

5. Details of the Work Carried Out

To achieve the defined project goals and objectives the following project delivery plan was implemented. All project activities have been delivered in four Work Packages (WP) as described below.

WP1: Review of the current state of security of supply obligation and incentives for DNOs

As part of WP1, the project team reviewed the current state of security of supply obligations and incentives for ED in GB. Specifically, the research covered the following aspects:

- A summary of the historical background to security of supply – how we arrived at the current arrangements – included a suggested timeline of key points from the first issue of P2 onwards.
- A comparison with the security of supply situation in electricity transmission, highlighting any inherent differences in distribution.
- A comparison with the security of supply situation in gas distribution (the current dominant energy source for heating) and liquid fuel distribution (the current dominant energy source for transport), highlighting any inherent differences in electricity.
- A comparison with relevant international security of supply examples, highlighting any inherent differences in GB.
- A commentary on the net effect of current security of supply obligations and incentives, including:
 - a. Obligations set in Engineering Recommendation P2.
 - b. Security of supply obligations set by the Electricity Safety, Quality & Continuity Regulations (ESQCR), and the Electricity at Work Regulations (EWR).
 - c. The effect of Interruption Incentive Scheme (IIS) on security of supply.
 - d. The effects of guaranteed standards set by the Electricity (Standards of Performance) Regulations on security of supply.
 - e. The effects of provisions for worst-served customers on security of supply.

WP2: Analysis of trigger points for changes in security of supply

WP2 explored the trigger points for changes needed in security of supply (i.e. why and when change would be needed). This analysis focused on:

- How the decarbonisation of heat, transport and other processes is increasing both:
 - a. Reliance upon electricity, so increasing the socioeconomic need for reliable electricity supplies.
- Consumption of electricity, both normally and in cold-load pickup. How the transition from passive to active electricity distribution networks is:
 - a. Creating a requirement for operating standards alongside planning standards.
 - b. Influencing customer behaviour, which in turn affects peak demand and assigned levels of security.
- Introducing new risks to security of supply alongside outages of circuits and busbar.
- A literature review of prior research and calls for change, including but not limited to:
 - a. The National Infrastructure Commission's report on ED
 - b. The government response to that report
 - c. The ENA's ongoing research into the Value of Lost Load (VoLL)
 - d. BEIS (now DESNZ) Electrical Engineering Standards Review, 2020
 - e. IEEE standards for smart grids

WP3: Recommendation and next steps for selection and implementation of future changes to standards and regulation

WP3 produced the main output of the project in a report format that sets out recommendations and next steps for how the sector can move forward in relation to security of supply. A workshop with key industry representatives (i.e. members of the ENA P9/2 working group, members of the

distribution code review group, etc) had been conducted before the report finalisation to verify recommendations and incorporate feedback.

The full report is available here: <https://commercial.nationalgrid.co.uk/downloads-view-reciteme/723314>

Work Package 4: Closedown report and dissemination

This Closedown report has been produced, and a dissemination webinar was held in February 2026 and is available here: https://youtu.be/XX_4LdnuJps

6. Performance Compared to Original Aims, Objectives and Success Criteria

Table 6-1 and 6-2 below summarise performance of the project against original objectives and success criteria.

Table 6-1: Performance compared to project objectives

Objective	Status	Performance
Undertake a comprehensive review of the current state of electricity distribution security of supply standard and regulations, comparing with relevant examples from other utility networks nationally and internationally	Complete	The projects final report (https://commercial.nationalgrid.co.uk/downloads-view-reciteme/723314) provides a detailed overview of the history of security of supply regulatory landscape in GB with a specific focus on evolution of P2 (Engineering Recommendation that defines minimum level of security and restoration capability for a network; P2 ensures design adequacy). Review of other standards, legislation and regulations that directly address operational reliability, customer service and real-time resilience are also included for completeness. The list include Electricity Safety, Quality and Continuity Regulations (ESQCRs), Obligations in the Guaranteed Standards of Performance (GSOP), Obligations in the Electricity at Work Regulations (EAWR), Obligations in the Interruptions Incentive Scheme (IIS), Provisions for Worst-Served Customers (WSC) and Priority Services Register (PSR). Chapter 2 of the report also provides a brief comparison between security of supply in electricity distribution and the security of supply in transmission system and other sources of energy (i.e. gas and oil). International perspective is added to provide a wider view of the potential options for change.
Evaluate increasing socio-economic reliance on electricity.	Complete	Chapter 3 of the projects final report (https://commercial.nationalgrid.co.uk/downloads-view-reciteme/723314) describes the growing complexities of the electricity distribution systems in the UK associated with the rising electricity demand and growing renewable generation whilst containing network costs and improving customer services. Specific drives for the increasing realiance on electricity are as follows: - Electrification of transport - Electrification of heat (and cooling)

Objective	Status	Performance
		- Electrification of industry - Digital dependency - Distributed generation. Chapter 3 of the report also goes into detail about how the current security requirements in P2 are driven by group demand; however energy efficiency improvements are increasing the number of customers within a demand group and there is growing difficulty in observing true group peak demand as flexibility, storage, and DG reshape load patterns. The point is also made about current Value of Lost Load (VoLL) calculations and the fact that a “one-VoLL-fits-all” no longer reflect the increasing diversity in customer technologies, usage patterns and flexibility. More detail for each of the identified drivers are provided in Chapter 3 of the final report.
Assess the current state of electricity distribution security of supply standards and make well justified recommendation as to whether any changes are needed (options for change proposed with rationale provided); or no changes are required.	Complete	Chapter 3 and Chapter 4 of the final report (https://commercial.nationalgrid.co.uk/downloads-view-reciteme/723314) goes into the detail of the proposed changes that can be summarised as following: - Continue with a deterministic standard such as P2 with changes to address some of the issues outlined with the current approach. - Change to a probabilistic standard. - Rely on an output-based standard such as IIS. With further options to recognise the changes being driven by technology and the drive to net zero: - Incorporation of an operating standard - Consideration of voltage, reactive power and harmonics - Need for greater consistency between distribution and transmission network standards. The report outlined benefits and limitations of each proposed option in Chapter 4.

Table 6-2: Status of project success criteria

Success Criteria	Achieved	Performance
Finalised comprehensive review of the current state of security of supply standard and regulations for electricity distribution. Comparison with gas and electricity transmission security of supply standards and regulations to be included where relevant in the context of decarbonisation and electrification of heat, transport and other processes focusing on increased socio-economic reliance on electricity	Achieved	As stated in the Table 6-1 above, a comprehensive review of the key standards and regulations for security of supply for DNOs in GB was completed and documented in the final report. Similarly, a comparison with gas and transmission requirements for security of supply requirements were conducted and also documented in detail in the final report.
Well-justified conclusion, either: - Why and when electricity distribution security of supply needs to change, with credible options for change in security of supply proposed; or - That no change in electricity distribution security of supply is needed and rationale for that recommendation provided.	Achieved	The results of the review concluded that the change in security of supply for ED is needed with some varying views as to how quick that change can realistically be implemented. To verify project's recommendations for change, project team organised and delivered a workshop in December 2025 with industry technical experts on the topic of security of supply to ensure the final report is validated by the expert community. Feedback from the workshop was incorporated in the final report. The list of recommendations is provided in Chapter 4 of the final report (summary is also available in the Table 6-1 above) with recommended next steps included in Chapter 5, which can be summarised as following: - Short term improvements to deterministic planning standard – reassessment of dominance test, explicit requirement that network capacity under intact conditions is sufficient and expressing demand groups in terms of customer numbers. - Customer needs – understand the changing needs of current and future customers. - Options development – develop options into practical and implementable proposals to allow assessment of whether they meet customer needs. - Operating standard – develop safe and efficient network operating envelopes. - Alignment with transmission standards – convergence of system behaviours requires alignment between distribution and transmission standards.

7. Required Modifications to the Planned Approach during the Course of the Project

There were no modifications to the original approach.

8. Project Costs

Table below provides a summary of the financial delivery of the project.

Table 8-1: Overall Project Spend

Activity	Budget	Actual	Variance (%)
NGED Internal Cost	£16,944	15,517	-8%
University of Bath Services	£70,000	£70,000	0
Contingency	£8,694	£0	-100%
Totals	£95,638	£85,517	-10.5%

There were no unforeseen circumstances on the project therefore contingency was not released.

9. Lessons Learnt for Future Projects and outcomes

The key learning points are summarised below:

Project Management and Dissemination

- The project was a research study with recommendations (if implemented) that could significantly change how electricity distribution operators plan and operate the network. Because of this, a wider industry perspective was needed to review and verify findings and proposed implementation options.
- To ensure thorough review, the project plan included an additional workshop with members of the ENA P2 working group and the D-Code Review group. This workshop helped verify assumptions and gather extra information, which was incorporated into the final report for completeness.
- The project had strong internal sponsorship, ensuring engagement of all subject matter experts from the start. The project team was kept informed about ongoing work and proposed changes related to security of supply standards and legislation industry-wide. This helped ensure the proposed options were suitable for implementation and adaptable to any changes during review or consultation stages.

Limitations of current security of supply standards for ED:

- Legacy assumptions: the core planning standard, Engineering Recommendation P2, largely reflects assumptions from the 1970s, such as passive networks, homogeneous customer needs, and predictable peak demand. These assumptions no longer hold due to electrification and digitalization.
- Deterministic planning: P2 uses fixed, deterministic thresholds based on group peak demand, which is increasingly unreliable in a system with DG, energy storage ES, and DSR.
- Limited role of flexibility: DG, storage, and flexibility are treated conservatively and non-firmly, restricting their contribution to security despite their growing importance.
- Fragmented standards: planning standards (P2, EREP 130) and output measures (IIS, WSC) operate independently rather than as an integrated whole-system framework.
- Voltage and reactive power: current standards inadequately address modern voltage and reactive power requirements, limiting the network's ability to leverage flexible customer responses.
- Divergence from transmission standards: despite increasing convergence in system characteristics, distribution and transmission security standards remain misaligned, causing inefficiencies and coordination challenges.

Potential Future of Supply Options:

- Output Standards (customer-facing): enhance IIS and customer service metrics to reflect diverse customer needs, including differentiated VoLL by customer segment, technology, and contract type.
- Planning Standards (network-facing): modernize P2 by updating group classifications, reassessing the dominance test limiting DG/ES/DSR contributions, and moving towards probabilistic standards that better capture risk and uncertainty.
- Operating Standards (network-facing): introduce real-time operating standards defining flexibility use, operational security margins, and coordination with the System Operator. Develop standards for DG, storage, and demand-side services including firmness and interoperability.
- Whole-System Alignment: align distribution and transmission standards, integrate planning, operating, and output standards, and clarify limits of network capabilities to guide customer responses to extreme events.

Broader Lessons Learnt:

- Transitioning from deterministic to probabilistic standards requires extensive data, transparency, and phased implementation.
- Enhanced output standards need high-quality, granular data and risk raising customer expectations beyond what the network can economically provide.
- Coordination between distribution and transmission operators is complex but essential to manage increasing system interdependencies.
- Security of supply standards must evolve from static, one-size-fits-all rules to dynamic, customer-centric, and data-driven frameworks.
- Flexibility and digitalization are key enablers for a resilient, cost-effective, and net-zero compatible electricity distribution system.
- Clear accountability, open and agile review processes, and whole-system thinking are critical for future standards development.

10. The Outcomes of the Project

NG DSO sponsored the project and issued a position statement in response to the proposed recommendations/next steps. The position statement is available here:

<https://commercial.nationalgrid.co.uk/downloads-view-reciteme/723619>

In summary, NG DSO support all recommendations made by the report with some further context provided around ongoing activities with SQSS modifications and further information about the operation standard trial (more information in Chapter 13).

11. Data Access Details

Project material is available on the NGED Innovation webpage under 'Documents and Links' section:

<https://commercial.nationalgrid.co.uk/innovation/projects/future-of-security-of-supply-for-electricity-distribution-initial-research-future-sos>

If you've got a specific request regarding this project please get in touch via a dedicated email address: nged.innovation@nationalgrid.co.uk

12. Foreground IPR

All the material produced as part of this project is published on the project webpage:
<https://commercial.nationalgrid.co.uk/innovation/projects/future-of-security-of-supply-for-electricity-distribution-initial-research-future-sos>

13. Planned Implementation

NG DSO position statement (available here: <https://commercial.nationalgrid.co.uk/downloads-view-recite/723619>) specifies the immediate actions following the review of the recommendations and next steps outlined in the main project report.

Table 13-1: Project recommendations and NG DSO response for implementation

Recommendation	NG DSO response
Short-term Improvements to Deterministic Planning Standards Making Short-term Improvements to Deterministic Planning Standards by reassessing the dominance test that restricts the contribution from DG, energy storage and DSR; requiring that network capacity under intact conditions is sufficient; and expressing demand groups in terms of customer numbers rather than peak demand.	Support this recommendation and believe that work can start on this recommendation once current P2 modification under review is approved and implemented. Distribution Code modifications should be raised to: - Reassess the dominance test to make best use of contributions from DG and flexibility services; and - Introduce a requirement to secure supplies when the network is intact, taking into account existing customer expectations and the developing framework for NESO access to distributed energy resources. While NG DSO recognise the potential benefits of expressing demand groups in terms of customer numbers rather than peak demand, different methods of weighting customer classes could significantly skew security of supply. NG DSO believe that choosing a method requires Deeper Understanding of Customer Needs, so should be deferred until after that work.
Deeper Understanding of Customer Needs Gaining a Deeper Understanding of Customer Needs by analysis of the stakeholder engagement that network companies already undertake. This may need additional stakeholder engagement to cover any missing stakeholder segments.	Support this recommendation and are keen to collaborate with industry partners to implement it. This project could lead to major changes to security of supply, which shouldn't be made before understanding what customers want and need.
Option Development and Engagement Carrying out Option Development and Engagement using the customer needs to build on the options identified in this report.	Support this recommendation and keen to collaborate with industry partners to implement it. It depends on the outputs of Deeper Understanding of Customer Needs, so should wait until after that work. Implementing the options developed in this recommendation would require further code modifications.
Introducing Operating Standards	Wholeheartedly support this recommendation. NG DSO have already started a project with NGED DNO to co-develop an operational security of

Introducing Operating Standards to deliver safe and efficient network operating envelopes under yearround conditions	supply standard for NGED; a trial is scheduled to start later in 2026. NG DSO propose that an industry-wide operational security of supply standard for electricity distribution is developed under code governance. This should build on learning from NGED internal trial and the outputs of Deeper Understanding of Customer Needs.
Greater Alignment with Transmission Standards Developing Greater Alignment with Transmission Standards at distribution in planning, operating and performance standards. This should simplify the treatment of flexibility.	NG DSO propose this recommendation should wait until Deeper Understanding of Customer Needs is complete. It is also acknowledge that similar works has already started as follows: - There is an ongoing SQSS modification GSR029 to align SQSS section 3 to Engineering Recommendation P2. - As part of Ofgem's ongoing Code Reform programme , the Distribution Code (to which Engineering Recommendation P2 is annexed) and SQSS are due to be consolidated into an electricity technical code along with the Grid Code and STC.

14. Contact

Further details on this project can be made available from the following points of contact:

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15. Glossary

Abbreviation	Term
DESNZ	Department of Energy Security and Net Zero
DG	Distributed Generation
DSO	Distribution System Operator
DSR	Demand Side Response
EAWR	Electricity at Work Regulations
ED	Electricity Distribution
ES	Energy Storage
ESQCR	Electricity Safety, Quality & Continuity Regulations
GB	Great Britain
GSOP	Guaranteed Standards of Performance
IIS	Interruption Incentive Scheme
NESO	National Energy System Operator
NGED	National Grid Electricity Distribution
NIA	Network Innovation Allowance
PSR	Priority Service Register
UK	United Kingdom
VoLL	Value of Lost Load
WP	Work Package
WSR	Worst Served Customer

