

# Consultation on future development of distribution network planning security standard

Imperial College London

NERA Economic Consulting

DNV·GL

ENGINEERING RECOMMENDATION P2 REVIEW (PHASE 1)

# Consultation on future development of distribution network planning security standard

## Energy Networks Association

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Applicable contract(s) governing the provision of this Report:

Objective:

This document is the formal consulation document to gather responses from industry stakeholders and interested parties related to the potential reform of the ENA Engineering Recommendation P2/6 network security standard

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# 1 INTRODUCTION

Engineering Recommendation P2[1] has been in place since the 1950s and has played a major role in the development of secure and reliable distribution networks. Whilst a number of changes have been made over the years, notably the introduction of P2/5 in 1978, the document has served the industry and consumers well for over 30 years.

Engineering Recommendation is a subordinate document to the Distribution Code and also forms part of a Distribution Network Operator's (DNO) License conditions. Distribution Code[2], clause DPC4.2.1 Security states that "In accordance with the Condition 5 of the Distribution Licence, DNOs shall plan and develop their DNO's Distribution Systems to a standard not less than that set out in DGD Annex 1 Item 4, Engineering Recommendation P2/6 – "Security of Supply" or such other standard of planning as DNOs may, with the approval of the Authority, adopt from time to time."[3] The standard conditions of the Electricity Distribution Licence[4], condition 24.1 indicates a similar requirement.

The most fundamental issue regarding the future evolution of the P2/6 Engineering Recommendation is whether it continues to prescribe economically efficient investments, given the many changes affecting the energy markets and networks at present, including the (anticipated) prolific deployment of new and emerging technologies and the changing role of the customer, demand, generation and prosumer customers. This potentially gives rise to the need for a fundamental review of the baseline philosophy of distribution network planning to ensure that the UK Government's energy policy objectives can continue to be met in a cost effective and pragmatic way[5].

The review of ER P2 is formed of two distinct phases. The objective of Phase 1 is to identify and agree a range of options for a future UK security standard and agree the most appropriate approach that should be taken forward into Phase 2 which is the development and codification of the new standard.

The fundamental review of Engineering Recommendation P2/6[6] is being directed by the Distribution Code Review Panel P2 Working Group (DCRP P2 WG)[7] through the Energy Networks Association (ENA)[8].

In January 2014 the DCRP P2 WG, through the ENA[9], engaged a consortium consisting of DNV GL[10], Imperial College London (ICL)[11] and NERA[12] to carry out Phase 1 of the P2 review.

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1 Engineering Recommendation P2 is intended as a guide to system planning covering security of supply that defines the required capability of electrical networks to maintain supply to a defined level of demand under defined outage conditions. P2 is neither a design standard nor an operational standard.

2 "THE DISTRIBUTION CODE OF LICENSED DISTRIBUTION NETWORK OPERATORS OF GREAT BRITAIN", Issue 27 – 01 January 2016, available on the DCODE web site, http://www.dcode.org.uk/assets/files/dcode-pdfs/DCode%20v27%20121015v2%20DPC6.2%20and%20G12-4-1%20and%20guide%20stripped%20out%20161215.pdf

3 While DNOs can opt to invest in security above the minimum requirement prescribed by P2/6 where they can justify this, to propose design solutions below the minimum level the DNO is required to seek a derogation for this from the Regulator where they cannot self-derogate (a DNO can presently self-derogate for Class of Supply A, B and C listed in Table 1 of P2/6).

4 Gas and Electricity Markets Authority, ELECTRICITY ACT 1989, "Standard conditions of the Electricity Distribution Licence", 30 October 2015, available on the Ofgem web site, https://epr.ofgem.gov.uk//Content/Documents/Electricity%20Distribution%20Consolidated%20Standard%20Licence%20Conditions%20-%20Current%20Version.pdf

5 It is assumed by the DCRP P2 WG that within these policy objectives there is a need to maintain a security of supply that meets customers' expectations.

6 The present version of the Engineering Recommendation P2/6 document is available on the DCODE website for this review and can be accessed using the following link: http://www.dcode.org.uk/assets/files/Working%20Groups/P2/ENA_ER_P2_Issue_6_(2006).pdf

7 On behalf of the Distribution Code Review Panel (DCRP).

8 The Distribution Code Review Panel (DCRP) is the body responsible for overseeing the maintenance and development of the Distribution Code and its subordinate documents. Those subordinate documents include Engineering Recommendation P2/6. The ENA is the service provider to the DCRP for the physical maintenance of the Distribution Code and its subordinate documents.

9 Energy Networks Association is the industry body for UK energy transmission and distribution licence holders and is the voice and agent of the energy networks sector. ENA acts as a strategic focus and channel of communication for the industry and aims to promote the interests, growth, good standing and competitiveness of the industry. They also provide a forum for discussion among company members, and so facilitate communication and sharing of experience across the energy networks sector.

10 DNV GL is a Global certification and advisory business working in the maritime, oil and gas, business assurance and energy sectors.

The Consortium supported by DCRP P2 WG members has identified and assessed high level options for the reform of ER P2/6 through a range of quantitative and qualitative analysis. The high level options considered for reform included:

1. *Retaining the present deterministic[13] P2/6 standard without revision*.

2. *Retaining a deterministic planning standard, but with improvement.*

3. *Implementing a non-deterministic planning standard.*

4. *Implementing a high-level standard that obliges efficient investment, while retaining some deterministic elements,* represents a hybrid of options 2 and 3.

5. *Abolition of the planning standard*.

The options report[14] developed sets out the assessment of the high level options for reform of P2/6 drawing on evidence from various quantitative and qualitative tasks carried out together with inputs from a range of stakeholders including DCRP P2 WG members. It provides a set of potential recommendations for reform that will be further considered and amended following this industry consultation process. Once agreed as a DCRP P2 WG set of recommendations, they will be presented to the DCRP to be managed under their standard governance process. The latter part of this Phase 1 project will set out the high level plan for the Phase 2 standard development and codification works dependent on the outcome of the review by the DCRP and subsequent interactions with Ofgem[15].

Following the stakeholder event on 9th March 2016 covering the options report and publication of the report on 17 March 2016, as part of the extensive industry consultation process the DCRP P2 WG are now asking for feedback from industry stakeholders on the potential recommendations for reform of the security standard as part of the DCRP governance process.

When considering the consultation questions detailed in **Error! Reference source not found.**, respondents should provide their views and feedback based on the evidence and analysis provided in the supporting published reports as detailed in section 1.1 as well as their own knowledge and experience. The DCRP P2 WG also invites general observations on the requirements discussed.

## 1.1 Supporting documents

Please ensure that you have reviewed the evidence and analysis that has been presented by the Consortium and published on the ENA website[16] before addressing the consultation questions. This includes the following documents available on the Distribution Code Review Panel website:

1. Consortium Work Stream 2.0 report "Findings of the qualitative review associated with the future development of the P2/6 distribution network planning security standard", Nov 2015;

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11 Imperial College London is a university of world-class education and research in science, engineering and medicine, with particular regard to their application in industry, commerce and healthcare.

12 NERA Economic Consulting is a global firm of experts dedicated to applying economic, finance, and quantitative principles to complex business and legal challenges.

13 P2/6 is commonly referred to as deterministic in nature and throughout this report is also referred to as a deterministic standard in that the network security performance outputs from the standard are pre-determined based on group demand.

14 Consortium/ENA report "Options for future development of distribution network planning security standard", dated 17 March 2017.

15 Reform to P2/6 recommended by the DCRP would require agreement with Ofgem and an Ofgem consultation as P2/6 is referenced in the DNO license conditions.

16 http://www.dcode.org.uk/dcrp-er-p2-working-group.html

2. Consortium Work Stream 2.7 report "Engineering Recommendation P2 Review Workstream 2.7: Alignment of Security of Supply Standard in Distribution Networks with Other Codes and Schemes", prepared for the Distribution Code Review Panel, P2 Work Group, 20 November 2015;
3. Imperial College Work Stream 2.1 to 2.6 report "Review of Distribution Network Security Standards, Extended Summary Report", to the Energy Networks Association, March 2016;
4. Imperial College Work Stream 2.1 to 2.6 report "Review of Distribution Network Security Standards, Extended Report", to the Energy Networks Association, March 2016;
5. Imperial College Work Stream 2.1 to 2.6 report "Review of Distribution Network Security Standards, Extended Report Appendices", to the Energy Networks Association, March 2016, and
6. Consortium/ENA Work Stream 3 report "Engineering Recommendation P2 Review (Phase 1), Options for future development of distribution network planning security standard", March 2016.

Item 6 above is the main options report which items 1 to 5 support as the key evidence base.

## 1.2 Next steps

The Distribution Code Review Panel P2 Working Group (DCRP P2 WG) would like to hear the views of all industry parties and stakeholders relating to the questions outlined in this consultation document relating to potential options for reform.

Responses should be received by 12th June 2016 and should be sent to David Spillet at the ENA using the email address: dcode@energynetworks.org

Unless marked as confidential, all responses will be treated as non-confidential. All statements and remarks made in response to the consultation may be repeated in future related documents but will be non-attributable.

**Next steps:** In the interests of clarity and transparency, the DCRP P2 WG will review and consider all the responses to this consultation. Any questions on this document should be directed to:

David Spillet at the ENA using the email address: dcode@energynetworks.org

# 2 OVERVIEW

Phase 1 of the P2 review is essentially a comprehensive research, analysis and modelling engagement supported by a consultation process being carried out by the Consortium with direction and support provided by the DCRP P2 WG and the ENA. The objective of Phase 1 is to identify and agree a range of options for a future UK security standard and agree the most appropriate approach that should be taken into Phase 2 which is the preparation and codification of the new standard.

Phase 1 of the project commenced in February 2015 with the development of a Project Initiation Paper (PIP)[17]. The PIP highlighted the key objectives of Phase 1 of the Engineering Recommendation P2/6 Review project to industry stakeholders and the process adopted to achieve these objectives.

The process to deliver the Phase 1 objectives outlined in the PIP consists of a number of work streams which can be broadly summarised as follows[18]:

- **Work Stream 1**; set out the Phase 1 objectives and process, and included an initial engagement with all key industry stakeholders.
- **Work Stream 2**; identified, researched and evaluated options for a future UK security standard.
- **Work Stream 3**; engaged with the DCRP P2 WG to examine the deliverables from WS 2 and derive and describe the range of options that will inform the processes in WS 5.
- **Work Stream 5**; included an industry wide workshop that focused on introducing and discussing the deliverables from WS 3 (both quantitative and qualitative exercises).
- **Work Stream 6**; will further support WS 5, through a formal industry wide consultation to seek and gather written feedback from all industry parties on some of the more pertinent issues and concerns associated with the proposed options for reform of the security standard.
- **Work Stream 7**; will develop a summarised and tabulated view of the WS 6 consultation question responses and identify and structure actions to be taken with regards to the final Phase 1 Report.
- **Work Stream 8**; will produce the final Phase 1 report that will lay out the arguments and all the supporting evidence for the development route for any new standard while critically highlighting the benefits of such a route.
- **Work Stream 9**; will scope the work needed to implement the final recommendations from Phase 1 that will be undertaken in Phase 2 including a work programme for Phase 2 with an associated project plan.

17 DNV GL, NERA and Imperial College document "Engineering Recommendation P2 Review (Phase 1), Project Initiation Paper", report number 16011094/110, rev 001, 13/04/2015. Available on the DCODE website for this review and can be accessed using the following link: http://www.dcode.org.uk/assets/files/Working%20Groups/P2/project%20initiation%20paper%2020150413%20V%20004.pdf

18 Work Stream 4 is an optional work stream for further, more in depth modelling and analysis presently not commissioned by the ENA for the Phase 1 works and hence is excluded in the list shown. If necessary a second iteration of the techno-economic modelling could be carried out under Work Stream 4 during Phase 2 to confirm one option to proceed within Phase 2 if a single option is not fully identified at Phase 1.

## 2.1 This consultation

This document forms part of the WS 6 formal consultation process and seeks the views and feedback from all interested industry parties on future reform of the UK security standard to succeed Engineering Recommendation P2/6.

Following this overview, section 3 provides questions relating to the options for reform and seeks the views of industry on outcomes to date.

# 3 CONSULTATION QUESTIONS

The key arguments and features of each of the high level options are documented in the Consortium report "Engineering Recommendation P2 Review (Phase 1), Options for future development of distribution network planning security standard", which is reference document 6 in section 1 of this document. The evidence supporting the options review in reference 6 is supported by reference documents 1 to 5 in section 1 of this report. To avoid introducing any bias towards any option within this consultation document the DCRP P2 WG has purposely not attempted to summarise the options from reference 6 here and would direct stakeholders to review the documents listed in section 1 prior to completing the questions set out in this section.

**Question 1**

Based on your experience and the working group reports do you believe that the current P2/6 standard should be revised or more radically reformed? Please state your views and provide any supporting evidence.

**Question 2**

Reducing the level of security in a reformed standard could defer the need for investment in UK distribution networks during the period to 2030, with an associated reduction in customer bills. What are your general views on the trade-off between the potential increases in outage duration and/or outage frequency compared to the potential reduction in customer bills?

**Question 3**

Should the present demand security standard be modified to include guidance on the contribution to system security from non-network technologies? Such non-network technologies could include Energy Storage, Demand Side Management (DSM), Demand Side Response (DSR) and other commercial arrangements? What are your views regarding the inclusion of these categories of users/providers.

**Question 4**

In a deterministic standard there should be a balance between the level of deterministic specification and the ability to depart from this using Cost Benefit Analysis (CBA) or derogation processes. Do you think this balance is correct in the current P2/6 standard? If not, how should this be addressed?

**Question 5**

What are your views on the merits of including Cost Benefit Analysis (CBA) or other economic assessment techniques in determining optimum networks versus the likely lower network planning costs associated with a prescriptive standard such as P2/6?

**Question 6**
What are the advantages or disadvantages in adopting any of the potential reform options outlined in the options report [6] to provide alignment with the NETS SQSS or other industry standards, codes or licence obligations?

**Question 7**
Should P2/6 which currently applies primarily to securing demand be extended to include securing generation? Please provide supporting evidence for your response.

**Question 8**
Regarding the options outlined in the options report [6], do you consider that the advantages and disadvantages for customers have been fully identified? If not, please identify, including additional benefit tests.

**Question 9**
Is it feasible to implement any reform to the security standard during the period of RIIO-ED1? If, not what would be the most appropriate timescale?

**Question 10**
What are your views on the use of deterministic rules ("look-up" tables) in a revised or reformed standard?
How could such tables be developed to include non-network technologies and/or relaxing of the present rules on network security?

**Question 11**
Recognising that there will be a trade-off between economic efficiency of any new deterministic rules, the variables that can be considered, the ease of use of developed rules, and the network planning scenarios that can be covered, there may be a need for flexibility to permit network planning outside of the deterministic rules where necessary. It would therefore also be appropriate to supplement such a revised standard with obligations on DNOs to conduct other economic analysis where new deterministic rules are not appropriate. Do you agree that network operators existing licence obligations adequately meet this requirement. Please explain your reasons.

**Question 12**
In order to provide consistency and transparency, in the planning process, would there be merit in providing guidance for DNOs on how to undertake economic assessments as outlined in any of the proposed reform options. Please explain your views and reasoning in your response.

**Question 13**
Do you believe the existing RIIO incentives are sufficient to support an entirely non-deterministic standard or removal of the security standard altogether? Please provide the reasons for your response.

**Question 14**
Should the present planning standard be abolished completely? Please provide the reasons for your answer and cite any supporting evidence.

**Question 15**
From the five high level options outlined in the options report [6] regarding the future of P2, what is your preferred option? Please provide the reasons for your response.

## 3.1 Other considerations

**Question 16**
The phase 1 work to date has concluded that any reformed standard should provide guidance as to the methods for the treatment of construction outages separately from maintenance outages and unplanned outages due to their longer term nature; this would include longer term outages for new build, asset upgrade, replacement and refurbishment. Do you agree with this approach? Please state your views, indicating your reasons.

**Question 17**
The present P2/6 standard does not directly consider common mode failures (CMF) and high impact low probability (HILP) event mitigation in network designs. The DCRP P2 WG consensus was that the planning standard should not include extreme events; such events should be dealt with by alternative regulatory mechanisms due to their low probability and unpredictable nature. Do you agree with this conclusion? Please indicate the reasoning in your response.

**Question 18**

The DCRP P2 WG are keen to understand if there are other security standard reform options that should be considered or important issues that have not been considered by the Consortium and DCRP P2 WG so far. Please provide details if you believe there are other high level security standard reform options or materially important issues that should be considered during this phase of the P2 review process?

# Appendix 1 – Consultation response and questions

The Distribution Code Review Panel P2 Working Group (DCRP P2 WG) would like to hear the views of all industry parties and stakeholders relating to any of the issues set out in this document and specifically responses to the questions outlined in the main document. To assist responders and the DCRP P2 WG we would ask that all responses are provided using the questionnaire template provided in this appendix which collates all the questions in this consultation document.

Responses should be received by 12th June 2016 and should be sent to David Spillet using the email address: dcode@energynetworks.org

Unless marked as confidential, all responses will be treated as non-confidential. All statements and remarks made in response to the consultation may be repeated in future related documents but will be non-attributable.

**Next steps:** In the interests of clarity and transparency, the DCRP P2 WG will review and consider all the responses to this consultation and produce an anonymised results report that will support the ongoing P2 review process. Any questions on this document should be directed to:

David Spillet using the email address: dcode@energynetworks.org

| | |
|---|---|
| **Respondent:** | *Dr. Chris Dent and Prof. Keith Bell*<br>*chris.dent@durham.ac.uk*<br>*keith.bell@strath.ac.uk* |
| **Company Name:** | *Durham Energy Institute and School of Engineering and Computing Sciences, Durham University (CD)*<br>*Dept. of Electronic and Electrical Engineering*<br>*University of Strathclyde* |
| **Role or main business of your company/organisation** | *University* |
| **Do you wish your questionnaire responses to remain confidential?** | *No* |

**Throughout this response I provide comments on a number of issues in which I have specialist expertise. I thus do not provide comment on all questions.**

**Question 1**

Based on your experience and the working group reports do you believe that the current P2/6 standard should be revised or possibly more radically reformed? Please state your views and provide any supporting evidence**.**

**Response:**

We provide comments in this question on three broad issues, namely: justification for radical reform of P2; the current "F-factor" approach to including distributed resources; and the opportunity to provide greater clarity to distribution planners.

***CBA justification for benefits of radical reform***

The potential benefits of adopting a CBA approach to network planning are estimated at £2-7bn based on the modelling performed (Page 64 of the main analysis report). While this suggests that further investigation is worthwhile, this range seems to be based on a limited set of scenarios, on much simplified representation of the range of properties of different distribution network areas, and on point assumptions for various uncertain parameters. Key issues which are unclear in this section include the basis on which the savings are specified (is this total cash, NPV or something else?), the degree of headroom assumed in existing networks (many can take substantial load growth without reinforcement), and the way that the representative networks have been used to estimate total GB costs.

We recommend that future analysis within the P2 review provides a much more complete mathematical model specification and description of data used, plus a clear and concise summary of this aimed at the whole P2 community, so that parties outside the review may take an informed view of the robustness of the modelling results. We further recommend that a much broader and more systematic uncertainty analysis is carried out, rather than relying on central point estimates of inputs or a small number of discrete scenarios – given the amount of billpayers' money affected, we expect that this will be good value for money for customers and permit much more robust decision support based on the modelling studies.

***F-factor approach to including distributed resources***

The consultation documents provide results of numerical experiments comparing the capacity value assigned to distributed resources using the P2/6 "F-factor" approach with a risk-based assessment of Effective Load Carrying Capability (ELCC, a standard capacity value metric widely used in the literature – the ELCC of additional resource within a system is the additional load that may be connected without increasing the risk level when the new resource is added).

We believe, however, that the issues with the F-factor approach are much more fundamental. F-factors are calculated by comparing the reliability level of an isolated demand group fed by the distributed resource, with that of a system fed by a single circuit of capacity similar to the distributed resource. We further understand that the F-factors published in P2/6 and ETR130 were calculated with peak group demand rescaled to the distributed resource capacity. Hence the F-factors are not calculated with reference to a risk calculation in a realistic system. In addition, F-factor based capacity values for different technologies are simply added, which (even if the F-factors in an appropriate sense reflect the contribution of each technology individually) may not properly reflect their combined contribution. More details of these arguments may be found in the journal paper http://dx.doi.org/10.1109/TPWRS.2014.2363142 and the LCNF "Customer Led Network Revolution" project report at http://www.networkrevolution.co.uk/wp-content/uploads/2014/12/ACE49-Report-1.1.pdf.

We suggest that any capacity credit assigned to distributed resources should either (a) reflect their contribution within an appropriate risk assessment relevant to the real system, or (b) should provide a natural extension to a deterministic N-x standard starting from a system with just incoming circuits and no distributed resource (e.g. the distributed resource might be assigned an appropriately defined credible minimum output in analogy to N-x for circuits).

If the existing N-x framework is retained, providing a systematic basis for assessing distributed resources' contribution (which we recommend) would require substantial background analysis, in analogy to the mid-2000s review in which P2/5 evolved into P2/6. At a minimum, analysis should be carried out to identify circumstances under which the present F-factor approach might severely overstate distributed resources' contribution – it is natural to suspect that such circumstances might exist given the logical problems in the current F-factor specification.

We further note that we understand the treatment of distributed generation in P2/6 to have been based on very limited data, much more limited and therefore much less robust than we expect most stakeholders would have suspected. We recommend that in the updated standard full use is made of the much larger datasets on DG performance which are now available.

***The opportunity to provide greater clarity to distribution planners***

It has been our experience when discussing P2.6 and its application with different Distribution Network Operator design engineers that there is significant variation in the way it is interpreted. This has the potential to lead to inefficient or unnecessary expenditure on network assets. Three particular issues are as follows:

1. some engineers interpret "circuit capacity" to mean the emergency or cyclic rating of a circuit while others take it to mean the continuous rating;
2. some engineers consider that, where P2/6 refers to N-2 conditions, planned outages should be accommodated and the group demand to be assumed then is the maximum that would be observed at a time when a planned outage might prudently be scheduled; others use simply two-thirds of peak demand for the group;
3. some engineers feel driven by what they understand to be the intention of 'load indices' while others depend on their own interpretation of what would be economic and efficient.

We discuss the last of these in more detail.

Given the licence obligation to comply with ER P2/6, P2/6 might be regarded as defining the minimum network capacity that should be provided in respect of meeting demand. The Interruptions Incentive

Scheme (IIS) might then be regarded as providing a basis for assessment of possible investment in additional network capacity or network control facilities to improve reliability of supply. These two provisions might ordinarily be expected to provide sufficient motivation for distribution network development for the meeting of demand. In practice, given the definitions of demand groups, ER P2/6 is significant in driving reinforcements only at the primary substation level (where 33 to 11kV transformers are located) and above. Action to date motivated by the IIS and CMLs and CIs has tended to be driven by the impacts of fault events at the 11kV level. However, Ofgem has felt the need to define a further measure: that of 'load indices' as part of the RIIO-ED1 settlement.

In its decision on load indices, Ofgem claimed that the IIS represents a "lagging indicator". This might be assumed to mean that investments driven by IIS are undertaken only after reliability has already been observed to be below the IIS target. This may or may not be true in respect of past DNO behaviour, but it need not be and, even then, perhaps should not be. This is because:

1. The events that affect CML and CI are stochastic and show significant natural variation; even for the same network capacity and configuration and the same demand, CML and CI may be expected to vary from one year to the next. In other words, high CML or CI values in one particular year are not necessarily indicative of a need for investment and low values in a year are not absolute indicators of sufficiency of investment.
2. It is possible to identify appropriate network interventions through an appropriate risk calculation, e.g. one that assesses the likely future range of CI and CML values

In respect of the latter observation, knowledge of a network's structure, capacity and the number of customers at each location along with suitable average fault rates for different classes of equipment and switching times can, given suitable software, allow useful analysis and comparison of different network configuration and development options.

Another issue with load indices is the apparent inconsistency with ER P2/6 in respect of definition of demand and network capacity. Although we have not been able to find out exactly how Ofgem's Reliability and Safety Working Group has defined 'maximum demand', circuit capacity, 'duration factors' and the contributions of generation, it is our understanding that they are not consistent many planners' interpretation of similar terms in ER P2/6 or what the author has argued above are appropriate in terms of economic and efficient network development. In particular, it seems that load transfer is not taken into account in calculation of load indices whereas ER P2/6 does permit load transfer, in particular under planned outage conditions or as a means of restoring demand. That is, the definitions relevant to load indices seemingly take no account of headroom represented by moving demand at critical times to exploit headroom available elsewhere within the network at those times (and, potentially, moving it back at other times). In light of the apparent use of load indices (difficult to ascertain given the paucity of easily accessible published information), shifting demand around potentially means a decrease in the load index for one group but might entail an increase for another one with no net benefit.

Given that ER P2/6 is a licence condition for DNOs, it is clearly anomalous that some different conventions – load indices – are in place that may drive different investments from those indicated by ER P2/6.

One possible outcome of the ER P2/6 review is that some new characterisations or analysis methods are developed that can guide planners in identifying the need for investment and which investments would be appropriate. However, it is also important to consider how new characterisations or methods will be used. That depends, to a very large extent, on the wording of a standard and any accompanying guidance. In this respect, a lead can be taken from the National Electricity Transmission Systems

Security and Quality of Supply Standard (NETS SQSS) and work led by the European Network of Transmission System Operators for Electricity (ENTSO-E) towards the harmonisation of standards across Europe and the development of new standards.

The NETS SQSS has emerged from a number of reviews post industry liberalisation, the first and most fundamental of which took place in the 1990s and resulted in the drawing together of a number of guidance documents covering different aspects of system planning and operation into one document covering both planning and operation. A major feature was the adoption of a harmonised set of terms and a significantly changed expression of security centred on clear and consistent definitions of 'secured events' and the possible impacts of events that action should be taken to avoid. For example, although the criteria for the design of connections of demand were based on those in ER P2/5 (the forerunner to P2/6), it was made clear that, in meeting demand, not only should there not be 'unacceptable overloading' (defined in such a way as to permit the use of short-term and real-time ratings), but voltages should be within acceptable limits. Clarity was also offered in respect of the demand to be met under conditions when planned outages would normally be taken. Draft accompanying guidance, developed in 2005 but not published, also sought to provide clarity on how consequences of events should be assessed, e.g. that both automatic and manual control responses should be modelled.

**Additional comments or points of view:**

**Question 2**

Reducing the level of security in a reformed standard could defer the need for investment in UK distribution networks during the period to 2030, with an associated reduction in customer bills. What are your general views on the trade-off between the potential increases in outage duration and/or outage frequency compared to the potential reduction in customer bills?

**Response:**

The headline estimated savings for customers of several billion pounds from switching to a cost benefit analysis approach sound impressive when expressed in this form. However we understand that this would equate to a few tens of pounds per customer per year – it is very doubtful whether customers would wish to save this relatively small amount of money in exchange for a possibly much reduced reliability of supply. (Quite how much reliability of supply would change would depend on the precise circumstances – rural or urban, long overhead line connection or short underground cable, etc.) The cost benefit analysis approach taken in the review documents further implicitly assumes that customers are indifferent as to whether they receive electricity supply, or they are cut off and paid compensation.

We propose that a cost benefit analysis approach of the kind presented in the consultation documents should be supplemented by this macro view of comparing the savings per customer (or percentage saving in bills) with the effect on reliability of supply – this could also incorporate consideration of the inevitable reduction in resilience to high impact, low probability events which would be a consequence of reducing network redundancy.

We understand that Ofgem has approved other developments in standards or regulatory mechanisms which give smaller savings, and that this might be used as an argument for making savings of several billion pounds by reducing network redundancy. We do not believe this is a directly relevant argument, as many other interventions (for instance reducing the cost to customers of offshore networks by holding

auctions for ownership) have no downside for customers – we emphasise again that customers might consider a significant reduction in reliability of supply, even with compensation for disconnections, as not worth the consequent savings on the network part of their bills.

**Additional comments or points of view:**

**Question 3**

Should the present demand security standard be modified to include guidance on the contribution to system security from non-network technologies? Such non-network technologies could include Energy Storage, Demand Side Management (DSM), Demand Side Response (DSR) and other commercial arrangements? What are your views regarding the inclusion of these categories of users/providers.

**Response:**

In principle, the measures mentioned should form part of a DNO's toolbox and should be considered as part of an economic and efficient solution. However, as yet the commercial mechanisms to deliver such services might be described as, at best, immature. Furthermore, a number of Low Carbon Networks Fund trials of flexible demand have suggested little or no appetite at present for it to be offered from small and medium enterprises or from the domestic sector.

A 'future proof' new standard or accompanying guidance would indicate the validity of storage, flexible demand or dispatchable generation for consideration in meeting the standard provided it is justified in economic terms and suitable commercial arrangements can be established for at least for a minimum period of time. The relevant minimum period would be the time in which any alternative, network asset based solution could be delivered should an extension of the commercial arrangements only be possible at such increased cost that network asset solutions are both more cost-effective and justified in themselves.

**Additional comments or points of view:**

**Question 4**

In a deterministic standard there should be a balance between the level of deterministic specification and the ability to depart from this using Cost Benefit Analysis (CBA) or derogation processes. Do you think this balance is correct in the current P2/6 standard? If not, how should this be addressed?

**Response:**

A 'balance' is not necessarily what is required. A 'deterministic' standard, albeit one based on probabilistic analyses, can set a prudent minimum requirement for which the risk of stranded assets is low. A CBA could be used to test whether any additional provision above the minimum is required. Two advantages of a 'deterministic' minimum, provided it is well-framed, are:

1. it can be clearly and consistently interpreted by both DNO staff and consultants appointed by

Ofgem to assess capital expenditure by DNOs;

2. it can provide a clear need case for any developments that require contentious planning consents.

The current standard does not make the above at all clear.

**Additional comments or points of view:**

**Question 5**

What are your views on the merits of including Cost Benefit Analysis (CBA) or other economic assessment techniques in determining optimum networks versus the likely lower network planning costs associated with a prescriptive standard such as P2/6?

**Response:**

Our response to this question is largely given under Question 2 – we believe that the standard cost benefit analysis methods used in the consultation documents may not properly reflect customers' preferences on a question of end-user security of supply (they may be more appropriate when considering day-in, day-out energy costs.)

We add that moving to any form of specific cost benefit analysis along the lines of the consultation report would require skills in probabilistic and statistical modelling which are currently not widespread in either energy systems research or the industry. In particular, the differences between demand groups might require subtlety in application of statistical methods, requiring highly specialised skills from disciplines other than engineering.

Following discussion at the P2 review public meeting in March 2016, we also note explicitly the difference between a standard engineering cost benefit analysis (which is part of any professional engineer's skillset), and the kind of probabilistic CBA and consequent decision analysis relevant to risk-based network planning.

**Additional comments or points of view:**

**Question 6**

What are the advantages or disadvantages in adopting any of the potential reform options outlined in the options report [6] to provide alignment with the NETS SQSS or other industry standards, codes or licence obligations?

**Response:**

The interactions between transmission and distribution have always been important but, in light of the increasing penetration of distributed generation and the reliance anticipated by many researchers, not least those involved in the consortium engaged by the ENA to review P2/6, on flexible demand, it is becoming much more so. Fitness for purpose in the modern context and consistency between standards

and codes is essential to ensure that the power system as a whole meets society's requirements of it.

**Additional comments or points of view:**

**Question 7**

Should P2/6 which currently applies primarily to securing demand be extended to include securing generation? Please provide supporting evidence for your response.

**Response:**

The purpose of any planning or design standard is to give guidance leading to the facilitation of operation of the system. The latter should be done in accordance with relevant operating standards which, in turn, should be defined to provide an appropriate balance between cost of infrastructure, cost of operating the system and the impact of unreliability. A key part of operating the system is the extent to which energy users' access to the cheapest sources of power can be enabled. (If carbon emissions or the consequences of failing to utilise low carbon generation are priced correctly, 'cheapest' would also lead to a lowest carbon generation dispatch of available generation). However, that does not mean that all generators' access to the market or energy users' ability to make use of it should always be constraint-free. Again, there should be a balance between the cost of network infrastructure and the cost of curtailment and replacement of generation that is constrained by lack of network capacity.

At present, there is no clear and consistent guidance to DNO planners on how to identify the most economic solutions when facilitating generator access. The largely ad hoc arrangements that seem to have been put in place to date in respect of 'actively managed' connections place almost all risk on the generator.

**Additional comments or points of view:**

**Question 8**

Regarding the options outlined in the options report [6], do you consider that the advantages and disadvantages for customers have been fully identified? If not, please identify, including additional benefit tests.

**Response:**

Our views on this question are contained in the discussion above of appropriateness of classical cost-benefit analysis methods.

**Additional comments or points of view:**

**Question 9**

Is it feasible to implement any reform to the security standard during the period of RIIO-ED1? If, not what would be the most appropriate timescale?

**Response:**

**Additional comments or points of view:**

**Question 10**

What are your views on the use of deterministic rules ("look-up" tables) in a revised or reformed standard?

How could such tables be developed to include non-network technologies and/or relaxing of the present rules on network security?

**Response:**

We acknowledge the benefits of such deterministic rules for incorporating distributed resources within a standard such as P2, in terms of ease/speed/cost of decision making, and in terms of the range of engineers who will be able to apply the standard as written. We reiterate however that such a look-up table approach should have a systematic basis either in the resources' contribution in a risk calculation which is relevant to the real system under study, or as a natural extension of how the standard would look without the presence of distributed resources. We further emphasise the need for any approach to incorporating distributed resources to recognise the diversity of performance of different units of the same technology and, in contrast to what we understand to have been the case when P2/5 was changed to P/6, to be based on a sufficiently large set of observations of generator performance. Using a single generic set of parameters for all units of a given technology might in some areas result in significantly degraded security of supply.

**Additional comments or points of view:**

**Question 11**

Recognising that there will be a trade-off between economic efficiency of any new deterministic rules, the variables that can be considered, the ease of use of developed rules, and the network planning scenarios that can be covered, there may be a need for flexibility to permit network planning outside of the deterministic rules where necessary. It would therefore also be appropriate to supplement such a revised standard with obligations on DNOs to conduct other economic analysis where new deterministic rules are not appropriate. Do you agree that network operators existing licence obligations adequately meet this requirement. Please explain your reasons.

**Response:**

It might be argued that the 'totex' basis of the RIIO-ED1 price control settlements provide an adequate

incentive to DNOs to properly evaluate operational measures ('active management', etc.) as a means of meeting network users' requirements in comparison with network asset based measures. However, the revenue adjustment factors will, at best, be approximate. Considerable experience will need to be accrued before there can be confidence in them. As we discussed in the answer to another question, our feeling is that both network users' and DNOs' interests would best be served by minimum 'deterministic'; standard and, at the very least, clear guidance on the conduct of economic appraisals of potential network interventions that can be used by DNOs in identifying those that should be taken and by Ofgem's consultants in providing advice to Ofgem on reasonable expenditure and the sensitivity of allowed revenues to changing circumstances.

**Additional comments or points of view:**

**Question 12**

In order to provide consistency and transparency, in the planning process, would there be merit in providing guidance for DNOs on how to undertake economic assessments as outlined in any of the proposed reform options. Please explain your views and reasoning in your response.

**Response:**

Yes. See the discussion provided above on consistency of interpretation, the skills required and the need for stakeholders to have confidence in the terms of regulatory settlements.

**Additional comments or points of view:**

**Question 13**

Do you believe the existing RIIO incentives are sufficient to support an entirely non-deterministic standard or removal of the security standard altogether? Please provide the reasons for your response.

**Response:**

See our answer to the previous question.

**Additional comments or points of view:**

**Question 14**

Should the present planning standard be abolished completely? Please provide the reasons for your answer and cite any supporting evidence.

**Response:**

For the reasons outlined in our answer to Question 12, we do not believe that a planning standard should

be abandoned completely.

**Additional comments or points of view:**

**Question 15**

From the five high level options outlined in the options report [6] regarding the future of P2, what is your preferred option? Please provide the reasons for your response.

**Response:**

One basic question is this: is what we seek a distribution network design standard, or a distribution security of supply standard? If the former, it should be broadly about what 'economic and efficient' means in terms of investment in new facilities and, as such, should include the economics of generation connections from a generator's point of view. (We deliberately refer to 'new facilities'. They might be new primary (meaning operating at power voltages, not just 11kV) assets, or new network controls, i.e. secondary assets, or services bought from other providers, e.g. flexible generation or demand or storage.)

A key for any standard is that is addresses that what of something but not the how.

- The 'what' means the fundamental objective or requirements.
    - Because it should be 'standard' it should not be expected to change very often. Equally, because it is a standard, any change would need to be extensively consulted on.
- By not presupposing the 'how', scope is left open for innovation .
    - Help might be offered with respect to the 'how' by offering guidance (that does not need to be very extensively consulted on and can be updated relatively easily).

In the relatively short run we advocate continuation of the present broad framework, with (a) improved framing of the standard that leads to more consistent interpretation and application; (b) greater clarity on the place of cost-benefit analysis relative to a 'deterministic' minimum standard; and (c) a more systematically justified approach to accommodating distributed generation (with acknowledgment that substantial resource will be required to develop this better justified approach).

In the longer run we recommend funding of broad research and development on how risk modelling may be used in distribution network planning, in a way which maintains an appropriate level of security of supply in light of continued development and use of 'distributed resources' (not only generation but also flexible demand and storage), and which can be applied robustly by network licensee staff without the need for unrealistically specialised skills.

**Additional comments or points of view:**

**Question 16**

The phase 1 work to date has concluded that any reformed standard should provide guidance as to the

methods for the treatment of construction outages separately from maintenance outages and unplanned outages due to their longer term nature; this would include longer term outages for new build, asset upgrade, replacement and refurbishment. Do you agree with this approach? Please state your views, indicating your reasons.

**Response:**

The key to "N-1" or any design standard is not necessarily, or not only, an ability to survive unplanned outages (and deliver some expected level of service to network users) but to accommodate/facilitate planned outages for maintenance or construction in such a way that the impact on network users of the planned outages while they are being taken is acceptable. The difference between unplanned and planned outages is that the timing of the latter can be controlled. A reformed standard and/or accompanying guidance should address this and promote DNO engineers' understanding of the key considerations and the differences between planned and unplanned outages and the different measures that might be used to mitigate their impacts.

**Additional comments or points of view:**

**Question 17**

The present P2/6 standard does not directly consider common mode failures (CMF) and high impact low probability (HILP) event mitigation in network designs. The DCRP P2 WG consensus was that the planning standard should not include extreme events; such events should be dealt with by alternative regulatory mechanisms due to their low probability and unpredictable nature. Do you agree with this conclusion? Please indicate the reasoning in your response.

**Response:**

We agree that the nature of HILP events is by definition distinct from that of events which are included in standard quantitative risk analyses. Depending on the nature of the possible disturbance and the context, resilience against HILP events (such as extreme wind or rainfall/flooding) may require additional network capacity. However, the most cost-effective interventions by a DNO might make use of temporary defences to limit the impact of disturbances or might be concerned with accelerating safe recovery from a disturbance, for example better identification of the nature and location of damage to equipment and management of the logistics of access to site and repair. Hence, whether or not they are considered in a document called the planning standard, consideration of HILP events should continue to be a part of system planning and of what a well-run network utility does. To the extent that additional network capacity might be 'the right answer' to a HILP event risk, it may be considered logical that they be incorporated in the P2 standard, as otherwise it would not be the planning standard which directly drives decisions on capacity requirements in some areas.

**Additional comments or points of view:**

**Question 18**

The DCRP P2 WG are keen to understand if there are other security standard reform options that should be considered or important issues that have not been considered by the Consortium and DCRP P2 WG so far. Please provide details if you believe there are other high level security standard reform options or materially important issues that should be considered during this phase of the P2 review process?

**Response:**

**Additional comments or points of view:**

# Appendix 2 – Feedback questionnaire

The DCRP P2 WG considers that consultation is key to the future development of the security design standard and an important part of the due process for any future reform of the standard. The DCRP P2 WG is keen to consider any comments or issues concerning the manner in which this consultation has been conducted. To improve future work in this area, the DCRP P2 WG would be keen to get your answers to the following questions:

1. Do you have any comments about the overall process, leading up to or associated with this consultation?
2. Do you have any comments about the content or approaches detailed in the supporting set of the reports and background information?
3. Although technically detailed, were the reports easy to read and understand?
4. Did the description of the potential options provide a clear and balanced view?
5. Did the suite of reports set out the relevant information and support the set of potential recommendations in a clear and transparent manner?
6. Please add any further comments?

Please send your comments to:

David Spillet using the email address: dcode@energynetworks.org

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