**Grid Code Review Panel**

**Using National Grid Network Models for Long Term Planning**

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A Panel Paper by

UK Power Networks


**Summary**

East Kent is a particularly complex area of the GB system where the distribution network is heavily influenced by HVDC interconnector flows and other types of transmission connected generation. In parallel with this, due to the increasing amount of embedded generation connected to the system, GSPs are increasingly experiencing reverse power flows from the distribution network onto the transmission system. UK Power Networks has been awarded £3.4m funding from Ofgem under the Low Carbon Network Fund 2014 competition to progress an innovation project (Kent Active System Management - KASM) which it is running in conjunction with National Grid and which aims to allow more precise operation and planning of the 132kV network in East Kent (South Eastern Power Networks' (SPN) area). This is expected to demonstrate the following benefits:

- Operation of the network closer to its limits in a secure and reliable manner, enabling the connection of additional low carbon generation while improving the efficiency of future network reinforcement projects;
- Reduction in the impact of planned network outages on power export from existing generators;
- Improvements in operational processes and reduction in the overall risk on the transmission and distribution network.

In December 2015, the project established an ICCP link between National Grid and UK Power Networks control rooms, which will enable the two parties to share real time data including power flows and switch statuses.

To accurately model power flows, UK Power Networks needs access to an unreduced transmission system network model. UK Power Networks currently receives two sets of data on the transmission system as required by section OC2 of the Grid Code:

- As part of the annual week 42 process, a reduced network with simple static equivalents at Grid Supply Points to model the transmission network. This is used by UK Power Networks' Infrastructure Planning team.
- On a weekly basis at two weeks ahead of real time, an unreduced forecasted transmission network model in the form of National Electricity Transmission Study Network Data Files are extracted from the PowerFactory modelling tool. This includes the expected output of Central Volume Allocated generators. This data, which is used by the Operational Planning team, is also being used by the KASM project but is supplied in accordance with Grid Code OC2.4.1.3.3.(i).z.5 which states that:

  *'…the data from the National Electricity Transmission System Study Network Data Files received by each Network Operator* ***must only be used by that User in operating that Network Operator's User System*** *and must not be used for any other purpose or passed on to, or used by, any other business of that User or to, or by, any person within any other such business or elsewhere.'*

A solution to allow UK Power Networks use of data in the National Electricity Transmission Study Network Data Files for operational **and** planning purposes would help to realise the full benefits of the KASM project. This data could then also be utilised for: long term operability studies to accurately assess the network for future generation, new technology connections, maximising utilisation of existing assets; and finally, allowing the same network model to be used for all purposes which would achieve considerable efficiencies.

This paper has been written following presentation and discussion at the Grid Code Development Forum on 3 February 2016 which helped to consider the alternatives and develop these for presentation to GCRP.

## Users Impacted

***High***

Distribution Network Operators – as it allows better and more coordinated system planning

***Medium***

Transmission Owners, System Operators, Generators – better planning by DNOs will allow more efficient use of and investment in the system

***Low***

None

## Description & Background

As distributed generation penetration increases in the distribution network, so also do the complexity of studies that need to be carried out in both operational and planning timescales to operate the system as efficiently as possible and to plan appropriate future network investments.

Due to the interconnected nature of the distribution network in the South East, generation patterns and system flows, UK Power Networks are experiencing increasingly complex power flows on the distribution network. These can cause issues such as potential post-fault plant overloads and reverse power flows towards National Grid's transmission system in excess of equipment ratings. In light of the fact that under certain conditions UK Power Networks are now exporting to National Grid's network, and because the particular network configuration in the area means that the distribution system is heavily influenced by power flows in the transmission network, it is important to accurately model the whole network in longer-term planning timescales making it possible to ensure compliance with UK Power Networks' Bilateral Connection Agreements for their GSPs. Moving forward this will also be important when ensuring compliance with future applicable European Network Codes. Furthermore, the ability to model the full network including 400kV and 275kV running arrangements will ensure better protection of distribution and transmission assets, better utilisation of existing infrastructure, and more appropriate planning of future network investments. Furthermore, it will also mean that the results we produce align with those being produced by NG System Development team meaning a more co-ordinated approach and understanding of the issues.

The **Operational Planning team (Outage management)** at UK Power Networks is seeing first-hand the implications of certain post-fault scenarios during outage conditions in connection assets such as SGTs, as modelled using the full National Electricity Transmission Study Network Data Files supplied by National Grid under OC2. These files are delivered on a weekly basis in Power Factory (pfd) format and provide a static forecast of the transmission network two weeks ahead of real time. Included in these files is the expected output of Central Volume Allocated generators, which are connected to the transmission network. When UK Power Networks receives the files they are merged with the existing DNO network model in Power Factory by UK Power Networks' DigSilent Administrators. This model includes the characteristics of embedded generation so giving a complete and accurate model.

UK Power Networks' **Infrastructure Planning team (Network Capacity Management)** are not able to access the two week ahead data supplied under OC2 due to a restriction in the Grid Code allowing its use for operational purposes only. This is a longstanding issue, but is highlighted by the KASM project and increasing system complexity. Interactions between the distribution and transmission systems are not being completely portrayed by the model used in infrastructure planning since this employs a reduced network for the transmission system, modelled as static equivalents at each GSP, and as defined in the Planning Code forming part of the Grid Code, Appendix A part 3.

The **KASM project** which is running from Dec 2015 – Dec 2017 uses Contingency Analysis (CA) software for the purposes of real time network management, outage management and capacity management of the distribution network. It needs to use accurate network models for the distribution and transmission networks, and allows users to model multiple N-1 scenarios to

determine any potential future constraints on the network. UK Power Networks believes that for KASM to deliver the full benefits associated with operating the network closer to its limits, it is vital that planners in all timescales are able to make use of accurate network models.

If UK Power Networks were able to use the unreduced forecasted transmission network model in the form of the National Electricity Transmission Study Network Data Files for planning as well as operational purposes this would allow the unrestricted use of the improved modelling and contingency analysis in KASM. Furthermore, allowing the use of a common model for operational and planning purposes would also be more efficient in terms of software architecture.

## Proposed Solution

A number of options have been proposed to resolve this issue:

(i) Conclude that National Electricity Transmission Study Network Data Files can be used for planning purposes as well as operationally. Based on legal advice it is thought that this is not the case and that the Grid Code does restrict such use.
(ii) Seek a derogation from the Grid Code to allow sharing of data as required. This is unlikely to be successful as it raises questions of data ownership which makes a derogation inappropriate. Generally derogations are only granted on a time-limited basis where a solution is also identified but also it is not clear what derogation would be sought against.
(iii) Seek permission from the data owners to use data as required. In terms of the ownership of National Electricity Transmission Study Network Data Files the owners are National Grid, DNOs and generators.
(iv) Strip out any potentially confidential data from the study files. This could be an interim solution but unless automated becomes a repetitive and labour intensive task which addresses the symptom and not the cause.
(v) Make a change to the Grid Code to remove the restriction in OC2.4.1.3.3.(i).z.5 requiring the use of data supplied under this to be for operational purposes only.

UK Power Networks clarified as part of their presentation to GCDF that KASM will be undergoing operational testing starting in April. If the issue explored in this paper is not resolved by then it will either delay or limit these tests. On presentation at GCDF, the conclusions reached on each of the proposed actions were as follows:

(i) NGET and UK Power Networks have both checked with their legal teams and reiterate that the restriction in the Grid Code is binding (if unclear in intent)

(ii) A derogation could perhaps succeed if it could be clarified exactly what this would be against. In terms of the time to progress this it would though be unlikely to be resolved before April and would gain little or no time over a more enduring code change.

(iii) Genuinely confidential data is likely to be the generator performance or modelling parameters supplied in confidence to NGET by manufacturers. As the study file includes data for the whole system, gaining appropriate permissions even if possible would be time-consuming and difficult to prove complete.

(iv) NGET are progressing the option to strip out confidential data. A file has been supplied to UK Power Networks but study results using this are not the same as for the full network. Work on this option will continue but it is a complex and time-consuming task.

(v) GCDF were in agreement that a straightforward change to the Grid Code to allow use of OC2 data as detailed for planning as well as operational purposes would be the best solution. No new data is being supplied to UK Power Networks; this change would just allow them to make full use of data that they already hold and which is subject to existing OC2 confidentiality requirements. UK Power Networks have additionally signed a confidentiality agreement with NGET covering the work on KASM and data being used in this.

**Proposed Change to Legal Text**

It is recommended that the text of the Grid Code Operating Condition OC2.4.1.3.3.(i).z is changed to that given below. The text in red highlights the proposed new insertions and changes.

OC2.4.1.3.3.(i).z

(5) the data from the National Electricity Transmission System Study Network Data Files received by each Network Operator must only be used by that User in operating or planning that Network Operator's User System and must not be used for any other purpose or passed on to, or used by, any other business of that User or to, or by, any person within any other such business or elsewhere.

## Assessment against Grid Code Objectives

[Will the proposed changes to the Grid Code better facilitate any of the Grid Code Objectives:]

***(i) to permit the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity;***

A solution will facilitate more efficient and coordinated operation and planning of the UK Power Networks system with the potential for these benefits to be extended to other DNOs; this in turn leads to more coordinated and efficient operation and planning of the transmission system.

***(ii) to facilitate competition in the generation and supply of electricity (and without limiting the foregoing, to facilitate the national electricity transmission system being made available to persons authorised to supply or generate electricity on terms which neither prevent nor restrict competition in the supply or generation of electricity);***

Better DNO planning will help to facilitate connection of further embedded generation.

***(iii) subject to sub-paragraphs (i) and (ii), to promote the security and efficiency of the electricity generation, transmission and distribution systems in the national electricity transmission system operator area taken as a whole;*** and

In light of the fact that under certain conditions UK Power Networks are now exporting to National Grid's network it is important to accurately model the whole network to ensure better protection of assets and allow better utilisation of existing infrastructure.

***(iv) to efficiently discharge the obligations imposed upon the licensee by this license and to comply with the Electricity Regulation and any relevant legally binding decisions of the European Commission and/or the Agency.***

A solution will improve UK Power Networks' ability to comply with their GSP Bilateral Connection Agreements and future European Network Codes.

## Impact & Assessment

***Impact on the National Electricity Transmission System (NETS)***

Positive in terms of facilitating more coordinated planning.

***Impact on Greenhouse Gas Emissions***

Will help to facilitate connection of further embedded generation which will be predominantly renewables.

***Impact on core industry documents***

[Will any of the proposed changes have any impact on other core industry documents such as the BSC, CUSC, Grid Code or STC?]

Just Grid Code – OC2.

***Impact on other industry documents***

Unlikely.

## Supporting Documentation

Have you attached any supporting documentation [YES]

If Yes, please provide the title of the attachment:

- KASM Low Carbon Networks Project Submission

| Recommendation |
| --- |
| The Grid Code Review Panel is invited to:<br><br>[Progress this issue to Industry Consultation]<br><br>While this issue is raised by UK Power Networks, it is likely to be an increasing issue for all DNOs as system complexity increases.<br><br>As the proposed change to the Grid Code is very minor in nature and is essentially housekeeping, it is proposed that it should be taken straight to industry consultation to save time and allow completion as soon after the April 2016 start of KASM operational testing as possible.<br><br>NGET notes that if open governance had been implemented at the time that this proposal was taken forwards, this change could have been progressed under the auspices of self-governance which would have been quicker and more efficient. |

**Document Guidance**

This proforma is used to raise an issue at the Grid Code Review Panel, as well as providing an initial assessment. An issue can be anything that a party would like to raise and does not have to result in a modification to the Grid Code or creation of a Working Group.

Guidance has been provided in square brackets within the document but please contact National Grid, The Code Administrator, with any questions or queries about the proforma at grid.code@nationalgrid.com .