LCNF Competition

UK Power Networks KASM Project Interrogation Report

Document No. :	FNC 45646-41680R		
Issue No. :	003	**Compiled By :**	Doug Rattray
Date :	30 September 2014	**Verified By :**	Philip Williams
Client :	Ofgem	**Approved By :**	John Devlin
Client Ref. :		**Signed :**	Signed on original
Classification :	COMMERCIAL-IN-CONFIDENCE		

Distribution :

Copy	Recipient	Organisation
1	Andrew White	Ofgem
2	Project File	Frazer-Nash Consultanc

1. PROJECT SUMMARY

This UK Power Networks Low Carbon Network Fund (LCNF) submission outlines a project, which trials the integration of contingency analysis software within a Distribution Network Operator (DNO) control room, specifically within the South Eastern Power Networks licence area electrical network. The LCNF submission presents the high level goals of this project, which are summarised as:

1. To develop the business processes and the functional requirements to enable sharing of real-time operational data between the DNOs and Transmission Operators (TO);
2. To improve the DNO's in-house capability to conduct network power flow analysis within operational timeframes;
3. To improve the DNO's in-house capability to forecast network power flows.

The project aims to facilitate the development of a low carbon energy sector by providing the DNO with greater visibility of their network operating condition and a greater capability to forecast network operating conditions. It is proposed that a DNO with better visibility of the network is in a more capable position to improve network planning practices and as such is able to reduce the constraints placed upon low carbon technologies during new connection prospects and during outage planning.

The project seeks to generate implementation and operational learning that will be relevant to the wider low carbon community and of particular interest to UK distribution network owners, some of which may be considering similar schemes in the near future.

This is a three year project with a total project cost of £3,898,000. . The total project funding request is for £3,345,000, with UK Power Networks providing £378,000 as their compulsory contribution and an additional £72,000 as an extra contribution. UK Power Networks claim that this project will release £600,000 of benefits in the East Kent trial area and provide estimated £15,000,000 of benefits if rolled out across the UK by 2030.

2. ASSESSMENT AGAINST CRITERIA

2.1 SUMMARY OF ASSESSMENT CRITERIA

The criteria against which each submission will be assessed are outlined in the LCNF Governance Document.

2.1.1 LCNF

The criteria for the LCNF projects are

(a) Accelerates the development of the low carbon energy sector and has the potential to deliver net financial benefits to existing and/or future customers;

(b) Provides value for money to distribution customers;

(c) Generates knowledge that can be shared amongst all DNOs;

(d) Involvement of other partners and external funding;

(e) Relevance and timing;

(f) Demonstration of a robust methodology and that the project is ready to implement.

2.2 CRITERION (A): ACCELERATES THE DEVELOPMENT OF THE LOW CARBON ENERGY SECTOR AND HAS THE POTENTIAL TO DELIVER NET FINANCIAL BENEFITS TO EXISTING AND/OR FUTURE CUSTOMERS

2.2.1 Key Statements

Facilitate low carbon generation

The Kent Active System Management (KASM) method using a real-time contingency analysis platform will give deeper insight into the behaviour of the network and provide more flexibility in terms of how it is managed. Ultimately, this improved capability will be reflected in a greater range of options to expedite future renewable generation connections.

Building a stronger and smarter grid

Real-time analysis and modelling capabilities are critical to actively managing the increasingly unpredictable power flows inherent in networks with a high level of renewable connection integration.

The contingency analysis platform is a key enabler of smarter networks

Contingency analysis software will provide insight into alternative network configurations and allow the network to operate closer to its design parameters. This provides opportunities for new technologies to be developed and may speed up the adoption of smarter alternatives to traditional network investment.

Minimising cost and maximising economic benefit

This project maximises the volume of generation that can be connected to the network and minimises recourse to incremental investment until the investment signals are clear. In addition, by postponing traditional investment, and highlighting opportunities for alternatives, this project contributes towards reducing the cost of meeting the Carbon Plan.

Rollout to the GB network

Once proven successful, replication of this method across GB could conservatively provide savings of over £15m in present value (2014) terms by 2030, when compared to business as usual approaches.

2.2.2 Challenges and Potential Shortfalls

Criterion (A) – Accelerates the development of the low carbon energy sector and has the potential to deliver net financial benefits to existing and/or future customers;	
Sub-criterion (a.i) – Ability to facilitate the Carbon Plan through GB wide roll out.	**Challenge 1**: To enable analysis of the power flows in the network in an operational timeframe, the contingency software will require real-time data inputs from the distribution network and the National Grid. The requirement for data sharing between the DNO and the National Grid has been identified in the submission but the scope of this data has not been captured. To fully understand the solution's capability to increase the in-house visibility of operational network conditions, the scope of data capture and communication should be outlined in the submission. Can UK Power Networks outline the structure and metrics required for data capture and communication between the Distribution Network, the National Grid and the DNO Control Room?
	Answer 1: The proposed solution will integrate to the existing control room IT architecture in the distribution network control room and link directly to the transmission network control room. The data will be collected directly from National Grid's Energy Management System and there will be no new hardware deployment on the network. As a reminder, UK Power Networks' current in-house visibility of NG's network is limited to: • Annual updates to National Grid's publicly accessible Long-Term Statement • Outage schedules agreed for the coming year through the Week 28 process between NG and network operators • A static week-ahead DigSilent model containing expected generation / maximum demand figures lumped at National Grid's Grid Supply Points (GSPs) and 400kV substations • Week-ahead availability of generators at the transmission level, with no details around expected output level • Network running arrangement on a weekly basis, circuit and plant parameters as contained in the DigSilent model • Week-ahead prediction of the HVDC interconnectors operating mode (import/export), with no details around the level of power transmitted Currently UK Power Networks has no detailed information on the generating schedules of large transmission-connected generators (other than general availability) which can influence power flows in the area; exact running arrangement based on circuit breaker positions at a particular moment in time; SCADA measurements from National Grid's network; and real-time power flow levels from the HVDC interconnectors in the East Kent network. Given the interaction between the transmission network and the 132kV power flows in this area, these are critical elements for understanding how much margin is on the network at any given moment in time. The metrics to be collected by the proposed solution are real power, reactive power, and voltage at the 400kV substations of the East Kent network (Grain, Kemsley, Cleve Hill, Canterbury North, Sellindge, Dungeness, Ninfield), as well as through all the SGTs in the East Kent area. The solution will also collect the status of the circuit breakers at the substations. The sample rate at which data will be collected will be determined by the IT

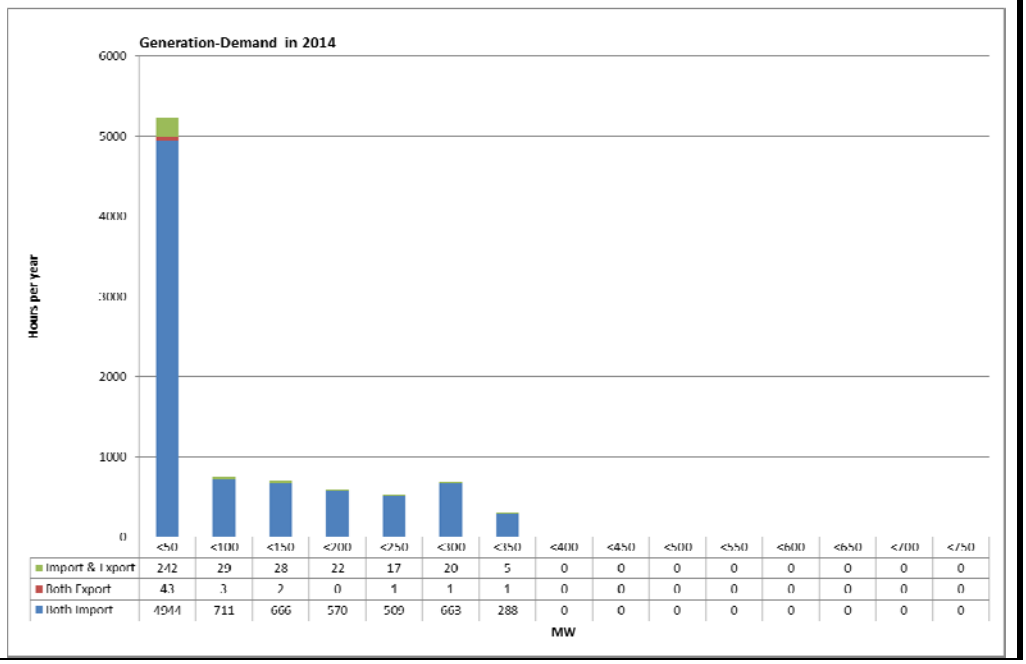
	architecture currently in use in National Grid's control room. The structure of the proposed link has not yet been defined in detail. However, it is expected that the connection will be implemented using an Inter-Control room Communication Protocol (ICCP) link between the National Grid control room and the UK Power Networks control room over VPN IPsec. In the early stages of the project, data shares of historic but frequent (e.g. half-hourly) data will be shared without the ICCP link in order to help specify and begin testing the contingency analysis software.
	Conclusion 1: Response is acceptable. No further comment.
	Challenge 2: To enable an improvement in network outage planning the submission has identified that a number of forecasting modules will be required. The scope of this requirement has not been captured in the submission. To fully understand the solution's ability to improve the in-house outage planning capability, the scope of forecasted data should be outlined. Can UK Power Networks outline the structure and metrics required for the forecasting modules?
	Answer 2: In the context of Work Stream 3, load and generation modules will be developed to accurately depict the nature of renewable resources on the network. A forecasting model architecture that incorporates the following attributes will be implemented: • Generator and load modules • Forecasting engine • Historical generation and load patterns • Historical weather patterns • Optimisation and normalisation modules The metrics that will be derived from the developed forecasting modules will be the output curves for distributed generation in the area based on forecasted weather, and the load curves based on historical data and forecasted weather. The overall structure of the forecasting modules has not yet been defined in detail, but our preferred solution is Bigwood Systems' Elite Multi Time-Scale Load and Generation Forecaster. UK Power Networks will work with the planning team and the software vendor to assist in designing the architecture. The design will include averaging or 'poll of polls' mechanisms to incorporate uncertainties of intermittent generation and load and achieve traditional type forecasts for the look-ahead horizon.
	Conclusion 2: Response is acceptable. No further comment.
Sub-criterion (a.ii) – Delivers the solutions more quickly than the most efficient	**Challenge 1**: Implementation of contingency analysis software at the DNO control room is deemed a time efficient method to stimulate increased levels of data sharing between the DNOs and TOs; improvements in capability to conduct network power flow analysis within operational timeframes and improvements in capability to forecast network power flows. No challenge required.
	Answer 1: N/A
	Conclusion 1: N/A

existing method	
Sub-criterion (a.iii) – The financial benefit of each method compared to most efficient existing method	**Challenge 1**: The financial benefit to UKPN is derived from the deferral of the installation of a new Super Grid Transformer in Richborough by two years. Appendix G states that "UK Power Networks estimates that the proposed method may defer the installation…" Can UK Power Networks provide further evidence to support this claim? Note that significant financial savings are estimated based on the deferral of SGT procurement costs. If these savings are to be considered, a full understanding of the mode of deferral and its likelihood is required.
	Answer 1: One of the potential benefits of the implementation of the proposed solution is the transition of network capacity management from a passive, fit-and-forget approach to a probabilistic approach based on network data. At the moment, capacity planning for most DNOs is based on the "worst-case scenario", and connection offers are oftentimes linked to expensive reinforcement works that might only be necessary for a few hours every year. UK Power Networks has conducted an analysis of the historical hourly demand and generation data in SPN's East Kent network to determine the frequency of occurrence for the worst-case scenario. The results of the analysis showed that the network is presenting the worst operating condition for only a few hours each year, and that managing the network using "smart" interventions during those hours can allow the deferral of the investment in conventional reinforcement. Specifically, the maximum generation in the distribution network will not always coincide with the minimum load, and there is also influence on the network power flows from the way the HVDC interconnectors in the area are operating (importing or exporting power). In the bar charts below, we have calculated based on historic hourly data the net generation (generation minus demand) in the East Kent network, under different interconnector operational states (import, export). Note that there are currently two interconnectors in the area, so both may be exporting ('Both Export'), both importing ('Both Import') or one importing and one exporting ('Import & Export'). The data are grouped into intervals of 50 MW. When comparing the number of hours the network is presenting maximum generation and minimum demand between 2014 (historical data) and 2016 (expected behaviour, based on accepted connections capacity of about 450 MW), we notice that there is only a small increase of only a few hours each year, which can be seen in the intervals marked "<400", "<450", "<500", onwards. Additionally, the increase in those intervals that is associated with unfavourable interconnector operation (one importing and one exporting, shown in green colour) is limited to a very small number of hours (fewer than 20). Based on traditional planning conventions, the network would have been reinforced to accommodate the operation during these few hours that constitute the "worst-case scenario" in order to ensure reliability, and at the same time, existing generators might have seen their capacity curtailed in situations where the network was not operated intact.

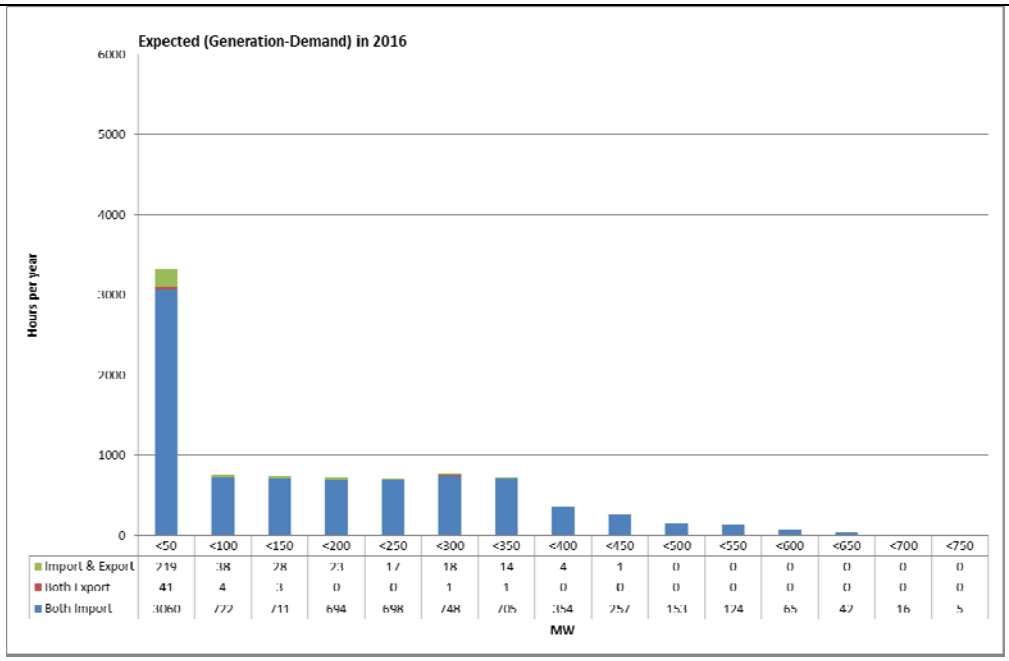
When using the proposed solution, capacity planners will be able to assess how many hours each year the network will present “worst-case” conditions, and will evaluate the usefulness of reinforcing the network.

Our analysis showed that there is capacity of about 300 MW that can be gained in the network, which will be subject to unfavourable conditions for less than 20 hours per year. We believe that conservatively, the solution will be able to make enough capacity available to maintain the existing annual rate of increase in distributed generation connections in the East Kent network area for two years (10% or approximately 100 MW per year), which is less than the predicted margin of 300 MW. Based on this, we believe that our estimate for a two year deferral in the installation of a third SGT in the network is realistic.

UK Power Networks understands that there is a lot of uncertainty around the potential behaviour of the network in the next few years due to the big changes that are expected to occur (approximately 450 MW of new distributed generation connections by 2016, new HVDC interconnector to Belgium by 2019). A significant aspect of the planned trials of the project use cases is to understand the capacity that can be released from the proposed solution. Nevertheless, we believe that our estimate for a two year deferral from the implementation of the solution is conservative, and there are potentially additional benefits for the business and the network participants.



	<50	<100	<150	<200	<250	<300	<350	<400	<450	<500	<550	<600	<650	<700	<750
Import & Export	242	29	28	22	17	20	5	0	0	0	0	0	0	0	0
Both Export	43	3	2	0	1	1	1	0	0	0	0	0	0	0	0
Both Import	4944	711	666	570	509	663	288	0	0	0	0	0	0	0	0



Conclusion 1: Response is acceptable. No further comment.

Challenge 2:

The project business case outlines the potential saving of £1.6m attributable to 'First of a Kind Costs'. The derivation of this cost is not provided in the submission. Can UK Power Networks provide additional evidence to support the validity of this claim?

Answer 2:

We believe that this challenge has been answered through the Q&A process, and specifically in the response for question 16, which is copied below.

First-of-a-kind costs include all LCNF-specific costs that will not be part of a business-as-usual commercial implementation of the solution.

Furthermore, first-of-a-kind costs include costs that are only required in the first implementation of the solution, as the publication of best practices and learnings from the KASM project will allow subsequent implementations to streamline several aspects of the implementation.

KASM cost	**£**
Project Management	842,310
National Grid consultation & link	755,345
CA software development	1,042,033
Forecasting Modules	308,326
Trials	344,975
Knowledge Dissemination	305,012
Contingency	300,000
Total	3,898,000

First-of-a-kind cost reduction	£
Project Management	-640,043
National Grid consultation & link	-188,836
CA software development	0
Forecasting Modules	0
Trials	-344,975
Knowledge Dissemination	-305,012
Contingency	-75,000
Total	-1,553,865
Method cost	**£**
Project Management	202,267
National Grid consultation & link	566,509
CA software development	1,042,033
Forecasting Modules	308,326
Trials	0
Knowledge Dissemination	0
Contingency	225,000
Total	2,344,135

Conclusion 2: Response is acceptable. No further comment.

Challenge 3:

Significant financial savings are calculated based on avoided lost revenue due to a reduction in outage constraints and a reduction in outage planning labour costs.

Can UK Power Networks provide further evidence to justify each of these claims?

Note that the savings from each of these benefits are summated when evaluating the 'Net System Cost' of the project therefore evidence is required to demonstrate that a reduction in outage constraints can be achieved whilst simultaneously reducing the labour cost of outage planning.

Answer 3:

As part of the current outage management procedures for the network in East Kent, distributed generators can be constrained to a specific capacity at times when the network is not operated "intact", either due to a fault or a planned maintenance. Due to the unpredictability in the network's behaviour that is introduced by the intermittent nature of renewable energy generators and the presence of HVDC interconnectors in the area, outage planners often impose restrictions on distributed generators based on "worst-case scenario" conditions, in order to make sure that the network reliability is not affected.

The method described above is without a doubt suboptimal, since distributed generation can be constrained for longer than it is actually required due to the reduced visibility of the network operation. As part of our analysis, we looked at historical hourly generation and demand data for the network in East Kent, and also extrapolated the analysis into the future based on the accepted connections that will become part of the network in the coming years. The analysis showed that the situations that are described at worst-case scenario are occurring for very few hours each year, and as a result, can be managed without the need for network

	reinforcement or high-duration capacity curtailment. To achieve this though, network planners require detailed data that would give them confidence in operating the network more closely to its realistic operating conditions. UK Power Networks has estimated based on historical curtailment data that the use of the proposed solution has the potential to reduce the curtailment of distributed generation by the equivalent of two days of production per year. Without the use of contingency analysis software and data forecasting, outage planners need to put significant effort in analysing different scenarios for the network. The network in East Kent contains just two Grid Supply Points out of the approximately 350 that exist in the GB network, and it requires 34 contingency scenarios just to analyse its behaviour under intact and N-1 conditions. UK Power Networks has estimated that in order to produce the analysis that will be generated automatically by the KASM software suite using the existing processes, it would require additional effort from outage engineers that would be equivalent to one person's full time each year.
	Conclusion 3: Response is acceptable. No further comment.
	Challenge 4: The relevance and timing section states that the East Kent operating area contains approx 510MW of largely intermittent wind and solar PV generation connected, including Thanet (315MW) and Kentish Flats (90MW). This allows for up to 105MW capacity remaining for solar PV and other (unnamed) wind generation sources. In Appendix G the report states that there is 385MW of solar PV installed. Can UK Power Network confirm the correct value? Note that a reduction of solar PV capacity from 385MW to 105MW reduces the proposed carbon savings of this project by approximately 25% (from 3,600 tonnes per annum to approximately 2,700 tonnes per annum).
	Answer 4: We believe that this challenge has been answered through the Q&A process, and specifically in the response for question 14, which is copied below. The East Kent operating area currently contains approximately 510 MW of largely intermittent wind and solar PV generation connected to the 132 kV, EHV and HV networks. Connection offers for a significant amount of additional generation, (approximately 450 MW), largely solar PV were accepted and as such these facilities are due to connect in the short term. The 385 MW of solar PV mentioned in Appendix G refer to distributed generation that has been accepted and is planned to be connected to the network in East Kent by 2016.
	Conclusion 4: Response is acceptable. No further comment.
Sub-criterion (a.iv) – The network capacity released and how	**Challenge 1**: The submission states that the implementation of contingency analysis software will allow the network to operate closer to its design parameters. However, there is insufficient evidence presented to quantify this claim. Can further evidence be provided that presents an estimation of spare capacity within the current network and predicted spare capacity post project implementation? This challenge is seeking to quantify the level of network capacity improvements that are expected,

quickly	and as such a full understanding of the benefit that can be elicited.
	Answer 1: As discussed in the response to challenge (a.iii.1), we believe that the proposed solution will provide network capacity planners the ability to employ a deterministic approach to capacity planning, rather than the existing passive approach of reinforcement, that is based on a fit-and-forget approach. Based on our analysis, we have calculated that there is capacity of 300 MW that can be gained in the network. We believe that conservatively, the solution will be able to make enough capacity available to maintain the existing annual rate of increase in distributed generation connections in the East Kent network area for two years (10% or approximately 100 MW per year), which is less than the predicted margin of 300 MW. Based on this, we believe that our estimate for a two year deferral in the installation of a third SGT in the network is realistic. UK Power Networks understands that there is a lot of uncertainty around the potential behaviour of the network in the next few years, due to the big changes that are expected to occur (approximately 450 MW of new distributed generation connections by 2016, new HVDC interconnector to Belgium by 2019). A significant aspect of the planned trials of the project use cases is to understand the capacity that can be released from the proposed solution. Nevertheless, we believe that our estimate for a two year deferral from the implementation of the solution is conservative, and there are additional benefits for the business and the network participants.
	Conclusion 1: Response is acceptable. No further comment.
Sub-criterion (a.v) – Potential for replication of the method across the GB	**Challenge 1**: The analysis undertaken to evaluate the perceivable benefits to GB rollout is considered to be optimistic. Grid Supply Points (GSPs) are evaluated based on the assumption of a worst case scenario for net import levels (derived from an absolute maximum demand and zero generation) and net export levels (derived from a minimum demand and full generation). GSPs are then considered ‘constrained’ when compared against strenuous network capacity conditions. (90% N-1 capacity for import levels and 66% capacity for export levels). As such, the analysis has found, what seems to be, an optimistically high number of ‘constrained’ GSPs. The likelihood of these network conditions should be reviewed and where applicable a reduction factor applied. A Cost/Benefit analysis is applied to these GSPs through an estimation of a potential deferral of infrastructure investment by application of contingency analysis and demand side management to reduce export constrained conditions. The estimation of this cost should take into account the cost of implementing contingency analysis and the cost of implementing significant demand side management infrastructure (enough to achieve a proposed change in minimum demand from 35% to 60%). The net cost of implementation should then be calculated based on the project cost offsetting the cost of traditional methods of improving network capacity. The estimation of benefit assumes that implementation of contingency analysis will result in future outage planning constraints being significantly reduced such that a distributed generator will be able to operate at double its currently constrained capacity (33% to 66%) and that the outage period will be reduced by 1 day (in

	normally 14). Further evidence is required to justify this claim. Through this methodology the submission estimates the average savings per distribution licence area to be £0.8M. The repeatable implementation cost of this project is estimated in the business case to be £2.1M (Figure 6, page 15), which should be summed with the cost of implementing a significant level of demand side management. As such the extrapolation of this analysis to contingency analysis uptake of 3 sites per year for 10 years results in an estimated net benefit in excess of £15M by 2030 appears optimistic. UK Power Networks to provide further justification for this claim.
	Answer 1: The analysis that UK Power Networks has prepared for the potential benefits of the proposed solution at the project- and GB-scale is based on data from the Long Term Development Statements (LTDS) of the GB DNOs. However, there is some uncertainty around several aspects of the forward-looking extrapolation of the potential installations in the LTDS, and therefore some assumptions were made to facilitate the analysis. Specifically, the analysis examined the maximum generation and minimum demand at various GSPs to identify how many are considered "constrained". The reason for using these parameters is that network capacity planning for most DNOs today is based on "worst-case scenario" modelling to determine reinforcements. Furthermore, we considered limits of 90% for import capacity and 66% for export capacity based on estimates provided by National Grid to UK Power Networks network planners. The GSPs that have been identified as constrained from our analysis are setting the absolute ceiling for potential installations (technical potential) and we recognise that the installation of the proposed solution to all the GSPs is not realistic. In order to understand the potential number of sites that can benefit from the use of the proposed solution, we assumed that the capacity benefit from the use of the solution can be modelled by increasing the level of the minimum demand from 33% to 66% of the recorded maximum, and the reduced generation curtailment can be modelled by assuming a reduction in constraint from 66% of rated capacity to 33% for one day per year (out of the 14 that are assumed to be the base case). The above assumptions were based on the analysis we conducted at a project-level for the network in East Kent and we consider them to be conservative, since the analysis of the generation curtailment historical data justified a larger decrease in the curtailment. Based on the above analysis and assumptions, we came up with a number of five to eight sites benefited per year at the GB-scale. We considered this number high and we decided to reduce the number of installations to three per year over ten years for the GB network, and two sites per DNO (since our analysis was top-down, 30 sites divided between the 14 DNOs gives us 2.14 installations per DNO, which was rounded to the nearest integer). The table with the net benefits at the project-, licence area-, and GB network-level in page 64 of the Full Submission was calculated using the Ofgem CBA sheet, assuming a discount rate of 3.5% and capitalisation rate of 70%. For each individual project we assumed a net benefit of £600k, consistent with the project-level figures presented in figure 6, page 15 of the Full Submission. Overall, our analysis included a top-down approach (calculating the number of benefited sites at the GB-network scale) and bottom-up (calculating the benefits at the individual project-level). When faced with uncertainty, we always chose to move

	towards conservative assumptions and we exercised critical judgement to validate the results of our analysis. Lastly, we used benefits that are discounted over time based on Ofgem's CBA tool in order to capture the fact that not all the installations will happen at once.
	Conclusion 1: Response is acceptable. No further comment.

2.3 CRITERION (B): PROVIDES VALUE FOR MONEY TO APPLICABLE CUSTOMERS

2.3.1 Key Statements

Provides value for money to distribution customers

The project will deliver estimated net benefits of £0.6m at the scale of the East Kent Network alone. The project also provides value for money in the way it was originally identified and procured.

Project KASM is highly innovative

The conclusions and learning achieved from the project will be instrumental in helping other DNOs implement similar solutions, thus taking the first step in modernising the GB network.

A competitive procurement process was undertaken

UK Power Networks initiated a competitive procurement process to select the Contingency Analysis software supplier. This process enabled UK Power Networks to select the best contractor to deliver the solution, whilst ensuring value for money.

External funding has been agreed

Sources of funding, in addition to the LCNF have been agreed with relevant stakeholders.

2.3.2 Challenges and Potential Shortfalls

Criterion (B) – Provides value for money to applicable customers;	
Sub-criterion (b.i) – Benefits attributable or applicable to the relevant network vs. elsewhere.	**Challenge 1**: The direct benefits of this project apply to the distribution network owner in which contingency analysis is implemented through deferral of infrastructure upgrade requirements. Secondary benefits of this project apply to the distributed generation customers both through a potential reduction of constraints to new customers in the connections phase or existing customers during network outages. Tertiary benefits of this project apply externally to the relevant DNO, through dissemination of learning and the establishment of working practices with the TO. Each level of these benefits are challenged elsewhere in this report. No further challenge required.
	Answer 1: N/A
	Conclusion 1: N/A
Sub-criterion (b.ii) – Steps taken to undertaken open, competitive procurement process.	**Challenge 1**: The procurement process outlined in Section 4.1 (b), page 18 is deemed suitable to ensure that fair, open, competitive procurement process has been followed. No challenge required.
	Answer 1: N/A
	Conclusion 1: N/A

Sub-criterion (b.iii) – Other steps taken to ensure that funding request represents good value for money.	**Challenge 1**: The cost/benefit of the submission is challenged elsewhere in this report. No further challenge is required.
	Answer 1: N/A
	Conclusion 1: N/A

2.4 CRITERION (C) GENERATES KNOWLEDGE THAT CAN BE SHARED AMONGST ALL RELEVANT NETWORK LICENSEES

2.4.1 Key Statements

Generates knowledge that can be shared amongst all DNOs

Contingency analysis platforms are previously untested on GB distribution networks. The proposed trial is appropriately sized to provide meaningful results. The project expects to generate significant learning opportunities that will assist other DNOs implement similar solutions.

It will be the first time that a framework for communication and data exchange between distribution and transmission system operators will be put in place. This benefit has the potential to deliver operational gains in the wider GB network thought the enhanced cooperation with National Grid.

The project will comprehensively report on the implementation of the Contingency Analysis platform. Specifically:

- Procurement through to implementation
- Operation and Impact

The dissemination of learning from the project

All learning will be managed through a Knowledge Dissemination lead. The Knowledge Dissemination lead will use a Knowledge Dissemination roadmap to plan and guide activities to spread the learning from the project to stakeholders including the DNO community. This roadmap will be based on other LCN fund projects.

The knowledge products generated will include project website pages; press releases and articles; videos; training materials; newsletters and project brochures.

Various dissemination channels will be used to share project learning such as: UK Power Networks specific training and workshops; project stakeholder meetings; conferences, workshops and events; newsletters; reports, technical data and analysis; industry groups and forums; UK Power Networks' Innovation website; partner websites; press releases and articles; social media. The channels will be selected to best suit the type of knowledge and format.

The project's treatment of intellectual property

The project will conform to standard LCN Fund intellectual property rights requirements.

2.4.2 Challenges and Potential Shortfalls

Criterion (C) – Generates knowledge that can be shared amongst all relevant Network Licensees;	
Sub-criterion (c.i) – The level of incremental knowledge to be provided by the project.	**Challenge 1**: Section 2.3 of the submission provides a description of the design of trials that will be used to generate knowledge that can be disseminated to interested parties. The trials are listed as: • Real-time reliability management; • Outage management; • Network capacity management. There is insufficient information regarding the form and function of each of these trials. There is a risk that if the input requirements, methodology and expected outputs of these trials are not fully specified then the trials may not generate as much useful learning as they have the potential to achieve. Can additional evidence be provided to demonstrate that the form and function of each of the trials listed above has been fully considered?

Answer 1:

UK Power Networks operational and planning priorities combine three main functions on three different timescales, each of which will be part of the KASM trials.

Timescale	Day ahead and reactive	Short term, 3 months ahead	Long term, 5 years ahead
Description	Issue permits to work on the network and respond to faults, ensuring the minimum number of customers are affected	Plan around construction and maintenance outages, including those of National Grid and neighbouring DNOs	Assist new connections and build the network to accommodate growth
Responsibility	Control room engineers	Outage planners	EHV planners

As part of the trials, KASM will assess three distinct use cases that will benefit the above functions.

- Reliability Management

The purpose of the Reliability Management trials will be to determine the operational framework and to assess the benefits of using the software suite in real-time in the network control room. Control room engineers will be trained to use the software suite and their feedback on its use will be used to customise the solution to their requirements.

We expect that the trial will involve the concurrent use of the solution with the existing operation framework for small periods of time throughout a year (to capture seasonal variances) in order to be able to compare ex-post the decisions made in each case (existing framework vs. framework based on software suite) and understand the difference in the results.

This benchmarking exercise will allow the generation of data that will in turn allow the project team to understand and quantify the benefit associated with the use of the solution in terms of reduced generation curtailment.

Furthermore, we will use at different times during the trial process questionnaires to capture the user experience from the use of the solution in order to tailor the software suite to the needs of the control room staff.

- Outage Management

Similar to the above, the Outage Management trials will involve the comparison of the use of the current methodology for forward planning (a few days ahead) with the proposed methodology that will involve the use of historical and forecasted data for generation, demand, HVDC interconnector operation, and power flows from the transmission network.

	The results of the benchmarking exercise between the existing and new outage planning methodology will generate data that will allow the project team to quantify the benefit of the use of the proposed solution in terms of reduced generation curtailment. All generators will continue to be given their outages based on current practice; but the Outage Planners during the trial will be able, at their discretion, to issue individual generators reduced outages or smaller curtailments, as their confidence in the software increases. • Network Capacity Management The data generated from the use of the software suite in Reliability Management and Outage Management will allow the development of a database that will in turn be used to develop a deterministic model for Network Capacity Management. Specifically, capacity planners will be asked as part of the KASM trial for Network Capacity Management to assess connection requests based on the existing framework. These connection requests will be re-assessed at a latter point using data around the coincidence of maximum generation and minimum load, transmission network power flows, and HVDC interconnector operation. We expect that the use of the data from the proposed solution will allow capacity planners and connection designers to issue more connection offers that are not linked to network reinforcement. Using the data from this benchmarking exercise, the project team will be in a position to assess the level of additional network capacity that can be released through the use of the proposed solution.
	Conclusion 1: Response is acceptable. Further comments: It is assumed that the primary goal of the trials is to provide data for analysis of a quantifiable improvement in performance (with regards to reliability or outage management) and that a secondary goal is to assess the usability of the software. Results from trials are derived from user feedback gathered in the form of questionnaires and benchmarking exercises. It is likely that the data collected from user feedback will be largely subjective and focussed on the software's user interface. This data will therefore be useful in satisfying the secondary goal of the trials but may not add to the primary goal of enabling an analysis of a quantifiable improvement. As such it is required that the benchmarking exercises be fully specified to ensure delivery of the primary goal. Thought should be given to how reliability/outage management performance is measured; what data needs to be captured to make these measurements, how much data needs to be captured to ensure that results are statistically relevant.
Sub-criterion (c.ii) – Applicability of new learning to other DNOs.	**Challenge 1**: As contingency analysis platforms are considered untested amongst GB DNOs the applicability of the new learning is deemed valid. No challenge required.

	Answer 1: N/A
	Conclusion 1: N/A
Sub-criterion (c.iii) – Plans to disseminate learning.	**Challenge 1**: UK Power Networks have stated that knowledge dissemination shall be achieved by following a knowledge dissemination roadmap and that various dissemination channels will be used to share learning. The dissemination channels listed in the key statements above are deemed appropriately wide ranging to satisfy the requirement for knowledge dissemination. UK Power Networks to clarify if a draft knowledge dissemination roadmap has been created or if any specific methods of knowledge dissemination have been planned at this stage.
	Answer 1: UK Power Networks will develop a knowledge dissemination roadmap at the beginning of the project, as part of Work stream 5: Knowledge Dissemination and Stakeholder Engagement. The roadmap will be based on successful practices employed in previous UK Power Networks LCNF projects and will incorporate various dissemination channels and activities that have proven to be successful in the past. We have a proven track record in successful knowledge dissemination event planning, as evidence by the fact that over 80% of delegates at our recent learning dissemination events rated their session as 'Good' or 'Excellent'. Some of the knowledge dissemination channels and activities for KASM will include: • Dedicated events at the completion of important project milestones (linked to the Successful Delivery Reward Criteria); • Training materials; • The LCNF annual conference; • The UK Power Networks' Innovation microsite (www.ukpowernetworks.co.uk/innovation); • Press releases and articles; • Project brochures and other printed material. We are attaching a copy of the knowledge dissemination roadmap for the "FUN-LV" LCNF project for your reference. Please note that is a live document that will continue to be monitored, updated, and added to throughout the lifecycle of the project.
	Conclusion 1: Response is acceptable. No further comment.
Sub-criterion (c.iv) – Robustness of the methodology to capture learning.	**Challenge 1**: Capturing learning is specified through the documentation and reporting of the project in terms of "Procurement through to Implementation" and "Operation and Impact". The method of capturing learning is deemed appropriate. No challenge required.
	Answer 1: N/A
	Conclusion 1: N/A
Sub-criterion (c.v) –	**Challenge 1**: The treatment of IPR will be in accordance with LCN property rights

Treatment of IPR.	requirements is deemed appropriate. UK Power Networks to confirm that LCNF IPR requirements have been reviewed and agreed with all project partners.
	Answer 1: The Low Carbon Networks Fund IPR arrangements have been discussed with all the project partners. With regard to the ownership of the source code for any interfaces between the contingency analysis software and other software within UK Power Networks, UK Power Networks will discuss the matter with the software supplier and will confirm the agreed arrangements. By its nature, interface software tends to be less transferrable to other installations which may be operating in a very different IT environment. With the exception of the above, the default IPR arrangements have been agreed with all project partners.
	Conclusion 1: Response is acceptable. No further comment.

2.5 CRITERION (D) INVOLVEMENT OF OTHER PARTNERS AND EXTERNAL FUNDING

2.5.1 Key Statements

Involvement of other partners and external funding

UK Power Networks engage with current and potential new partners and suppliers in a structured way via 'Critical Friends Panels', which represent academia, manufacturers and other stakeholders.

Relevant project partners and suppliers were leveraged via existing relationships, whilst new approaches were encouraged from third parties.

Partners have been engaged through the project selection phase

UK Power Networks developed a list of eleven project concepts, comprising of four brought forward from within the business and seven from external sources including SMEs. These were evaluated and three lead concepts developed further, before final selection of a preferred proposal.

This list of projects was consulted on with a wide range of stakeholders within UK Power Networks representing operational, IT, asset management and connections viewpoints.

When the final projects were selected UK Power Networks assessed each partner involved in the selection process relevant to the projects on their own merits of what knowledge, skills, experience and delivery capability they could contribute to the project.

Project KASM has developed key project partners

UK Power Networks has selected partners who have the experience and capability to successfully deliver this project.

National Grid will provide real-time information on power flows across 400kV SGTs; the configuration of the network, including switching; the output of generators connected to the transmission network; and the output of the HVDC interconnectors in the area. National Grid was approached due to key data they hold. UK Power Networks are engaged with National Grid and are developing the terms of a Memorandum of Understanding.

Bigwood Systems is the preferred supplier of the Contingency Analysis software solution. Their contribution will not be limited to software supply but also training opportunities and continued

software support. Bigwood Systems were engaged though UK Power Networks' established procurement process.

Navigant Consulting (Europe) Ltd will provide assistance on the development and integration of the contingency analysis software and will also support business processes. Navigant has considerable experience assisting international utilities to develop and implement smart grid projects.

Alternative funding arrangements

UK Power Networks is making a contribution of £72k in excess of the DNO compulsory contribution. The project will receive further contributions for its project partners Navigant Consulting (Europe) Ltd and National Grid (~£40k).

2.5.2 Challenges and Potential Shortfalls

Criterion (D) – Involvement of other partners and external funding;	
Sub-criterion (d.i) – Collaborators involved in the project	**Challenge 1**: Collaborators and project partners involved in the KASM project were selected in a structured manner. Suppliers have suitable experience in delivery of the solution in markets outside of the UK. Partners have suitable experience to assist the project. It is noted that Navigant Consulting (Europe) Ltd has been selected to provide assistance with development and integration of the contingency analysis software and will also support business processes. Navigant have been allocated 24 man days for this task, as shown in the tabulated breakdown of partner cost on page 19. Can UK Power Networks provide evidence to justify that adequate time has been allocated to this task and outline what contingency plans have been considered if the additional support from Navigant is required?
	Answer 1: Navigant Consulting (Europe) Ltd. has been engaged with UK Power Networks throughout the bid selection and development process. Leveraging its considerable experience in assisting international utilities to develop and implement smart grid projects, Navigant has been a valuable partner that has a firm understanding of the project requirements and the proposed solution. Navigant's involvement in the project implementation will be around providing assistance on the development and integration of the contingency analysis software and the support of the underlying business processes. We have budgeted 24 days of work over the first calendar year of the project's implementation, during which time the contingency analysis software and the forecasting modules will be developed and integrated to the control room IT architecture. UK Power Networks will appoint a workstream manager with experience of significant IT development projects in order to lead Workstream 2. This individual will in turn work with the software provider, the Design Authority Lead, and the Design Authority members representing the user community and UK Power Networks' IT architects in order to deliver the solution to the agreed requirements. We expect that Navigant will be part of the Design Authority, and more widely will have involvement in Work stream 2 and Work stream 3. We believe that due to the nature of the support Navigant will be providing to the project, our estimate for the effort of two days per month on average

	would be adequate. As with all other elements of the project, we expect that any requirement for additional support from Navigant will be covered through the project's contingency budget.
	Conclusion 1: Response is acceptable. No further comment.
Sub-criterion (d.ii) – Steps taken to indentify potential partners and ideas.	**Challenge 1**: No specific challenge. The selection of partners and ideas at UK Power Networks appears to have followed a fair and structured approach.
	Answer 1: N/A
	Conclusion 1: N/A
Sub-criterion (d.iii) – External funding for the project.	**Challenge 1**: No specific challenge. External financial support for the project has been identified via external funding from National Grid and UK Power Networks and via discounted day rates from project partners Navigant Consulting (Europe) Ltd.
	Answer 1: N/A
	Conclusion 1: N/A
Sub-criterion (d.iv) – How secure external funding is.	**Challenge 1**: No specific challenge. External (from LCNF) funding is sourced from National Grid (~£40k) and UK Power Networks (10% + £72k). UK Power Networks are in the process of agreeing the terms and conditions of the Memorandum of Understanding with NG. The security of these funds is deemed appropriate at this stage of project initiation.
	Answer 1: N/A
	Conclusion 1: N/A

2.6 CRITERION (E) RELEVANCE AND TIMING

2.6.1 Key Statements

Project KASM Addresses problems that exist today

UK Power Networks recognise that additional network visibility and control within operational timeframes is required in order to release additional generation capacity in the distribution network while avoiding or deferring conventional reinforcement schemes.

The East Kent operating area currently contains approximately 510MW of largely intermittent wind and solar photovoltaic (PV) generation connected to the 132kV, EHV and HV networks. Connection offers for a significant (~450MW) amount of additional generation, largely solar PV and wind, were accepted and as such these facilities are due to connect in the short term.

Project KASM addresses these areas of need and conducts trials in an exceptionally well-suited network that is due to see a significant increase in distributed generation.

If successful, the results from the project will form part of business as usual network management practices.

2.6.2 Challenges and Potential Shortfalls

Criterion (E) – Relevance and Timing;	
Sub-criterion (e.i) – The relevance of the solution to the move to a low carbon economy	**Challenge 1**: The direct carbon benefits for this project have been challenged elsewhere in this report. However, it should be noted that a move to automating the processes involved in network management is a key enabler for the introduction of LCTs and as such the solution is deemed relevant to facilitating the move to deliver a low carbon economy.
	Answer 1: N/A
	Conclusion 1: N/A
Sub-criterion (e.ii) – How the method will be used as part of future business planning.	**Challenge 1**: As noted in the key statements above, if successful, the results from the project will form part of the business as usual network management practices. UK Power Networks to clarify any perceived costs in the transition from trial to business as usual and how these shall be managed.
	Answer 1: As part of the trials for KASM, UK Power Networks will develop a roadmap for the transition of the learnings and outputs from KASM to business-as-usual. We expect that the parameters of this transition will be specified in practice and after the implementation of the project's solution. The transition will have to be structured in a way that doesn't introduce any disruption to the effectiveness of the control room operations and the reliability of the network. The transition of the learnings and outputs from KASM to business-as-usual will be funded by UK Power Networks.
	Conclusion 1: Response is acceptable. No further comment.
Sub-criterion (e.iii) – How the method will be used as part of future business planning if uptake of LCTs is less than expected	**Challenge 1**: The submission does not consider the applicability of the solution under varying uptake of LCTs in the UK market. UK Power Networks to clarify the perceived applicability of the project to business plans if uptake of LCTs is less than expected.
	Answer 1: The proposed solution has the ability to introduce enhanced visibility in distribution networks and to enable the use of smart interventions in a way that will facilitate the transition to "smarter" network management across different timescales. Looking at SPN's East Kent network, there are already significant constraints to the operation of the network that limit the available capacity for new distributed generation and create operation challenges for the network control room. Through the analysis we conducted as part of the KASM project, we have identified several other locations across the GB distribution network that are already facing similar challenges to the network in East Kent. The use of the proposed solution is expected to allow control room engineers and network planners to assess the real state of the network, based on real-time data, rather than worst-case scenario, fit-and-forget

	approaches. The enhanced visibility the control room will have as a result of the implementation of the proposed solution will create a significant benefit for DNOs, regardless of the potential uptake in Low Carbon Technologies (LCTs) since networks are already significantly constrained across the GB network. As such, we believe the risk of the project losing its applicability or relevance due to a lower uptake of LCTs to be small.
	Conclusion 1: Response is acceptable. No further comment.
Sub-criterion (e.iv) – The appropriateness of the timing of the project.	**Challenge 1**: No challenge required. A significant portfolio of low carbon technology connections to the East Kent distribution network is planned in the near future. Therefore the timing of this project is deemed appropriate as it has the capability to trial the technology under changing levels of LCT integration and quantify the effectiveness of application.
	Answer 1: N/A
	Conclusion 1: N/A

2.7 CRITERION (F) DEMONSTRATE A ROBUST METHODOLOGY AND THAT THE PROJECT IS READY TO IMPLEMENT

2.7.1 Key Statements

Detailed Project Plan

A detailed project plan is provided. The project plan lists all tasks to be completed, details milestones; SDRC and events such as conferences and knowledge dissemination workshops. The plan maps the timescales and duration of each of these activities so that the project manager can track the progress of each task and the status of the project throughout its lifecycle.

Resources

A project organogram is provided. The organogram shows the project sponsor, senior responsible officer and project manager. It lays out the structure and roles of the project management office; identifies the Work Stream leads for all five Work Streams and lays out the structure of the design authority.

The KASM project partners are Bigwood Systems (software supplier), National Grid (System Operator and data provider) and Navigant Consulting (Europe) Ltd (technical consultants). The project will also utilise contractors for software integration with the OSI Soft PI platform and for additional network modelling.

Demonstrate timely implementation

By initiating and completing a number of key activities during the preparation of the full submission, the project is ready to commence at the beginning of January 2015:

- The project has progressed through UK Power Networks' business as usual internal business change and IT/IS architecture governance processes, the Project Governance and Control (PG&C) and Design Authority Board, respectively.
- In-depth analysis of the project objectives and requirements has been undertaken, resulting in the development of a well-defined scope and description for each work stream.

- In order to demonstrate value for money and optimum preparation for a timely project start, we have worked closely with IT specialists and the IT procurement team to specify our IT requirements and complete a procurement process with contingency analysis software and integration services suppliers in accordance with UK Power Networks' IT procurement approach. By the start of the project, we will have will have finalised the specifications and negotiated a full implementation contract, meaning that the project delivery team will make an impact from day one on a typically long lead-time element of the project.
- Continual engagement with the project directors and project managers of UK Power Networks' existing portfolio of LCN Fund projects ensures a detailed understanding of lessons learnt on these projects can be applied to this project.
- Significantly, the project governance and management processes developed and implemented on the Flexible Plug and Play project, and subsequently on the Smarter Network Storage and Future Urban Networks projects, will be used as the basis for the project handbook that will define governance and management arrangements from project kick-off.
- A detailed project plan identifying the key activities, milestones and dependencies has been produced.

Customer impact

UK Power Networks do not envisage any negative direct customer impacts resulting from the deployment of the Contingency Analysis software.

Traditional load customers will be unaffected by the project.

Existing Distributed Generation customers are expected to experience positive impacts as results of the trial. Benefits may include fewer constraints on power outages and improved congestion management.

Cost and Benefit

To ensure robust and realistic costs, they have been calculated with a bottom-up approach across each of the project Work Streams. The Method costs have been carefully prepared with detailed procurement costs identified during the submission preparation phase, including using costs determined from the competitive tendering process for the contingency analysis software and integration support.

Benefits have been determined for the project method described, along with customer benefits and the benefits of wider rollout to GB. More detail is provided in Appendix G – Cost Benefit Analysis.

Successful Delivery Reward Criteria (SDRC)

Six SDRC have been defined for this project:

1. Development of the strategy for inter-control room communication protocol for the purposes of KASM
2. Completion of the system integration of Contingency Analysis (CA) software into UK Power Networks systems, excluding a real-time link to National Grid
3. Completion of installation of forecasting modules that will link the DNO control room with other data sources
4. Demonstration of use of real-time contingency analysis in the control room
5. Completion of trials and implementation of reliability management, outage management and network capacity management

6. Development of business design to incorporate contingency analysis as business-as-usual

Risk Register

A risk register including mitigation actions has been developed for this project. The risk register will be reviewed regularly as part of project management process procedures.

2.7.2 Challenges and Potential Shortfalls

Criterion (F) – Demonstrate a robust methodology and that the project is ready to implement;	
Sub-criterion (f.i) – Their project plan, risk management, mitigation and contingency plans, risk register and resources to deliver the project	**Challenge 1**: Risk0006/Risk0007: The long term risk of a software partner going out of business should be considered higher than the short term risk. In addition the long term implications of risk0007 occurring should take into account the lack of software training and maintenance capability from within UK Power Networks and as such, mitigating actions should seek to solve these issues. UK Power Networks to review the probability and mitigating actions of Risk0007. Risk0008: It is noted that the probability of this risk occurring is particularly low. As noted elsewhere in this report there is insufficient evidence provided that the output of the trials has been adequately specified. It is suggested that details should be specified for the trial inputs, methodology and expected outputs and that this risk be reviewed against those. General Risk: Project overspend has not been listed as a likely risk. It is assumed that detailed project planning and cost reporting would be listed as risk mitigating actions. However, contingency sources of funding should also be identified or considered as part of this risk. The project requiring additional time and resource after its planned lifecycle should be considered a risk for this project. Mitigating actions should identify or consider the need for contingency plans with UK Power Networks staff and project partners.
	Answer 1: <u>Risk0006/Risk0007:</u> We consider that the probability of the software supplier going out of business both on the long term and the short term is low. UK Power Networks has conducted full financial due diligence as part of the procurement process, and the selected software supplier has a proven track record with utilities in North America. Additionally, through the arrangement of software escrow, we believe that even if the supplier were to go out of business, we will be able to ensure continuity in the support of the software suite. <u>Risk0008:</u> Details around the trials process have been provided under challenge (c.i.1). Additionally, UK Power Networks believes that the risk of the trials not delivering the expected results is very low. We have documented the problems in the East Kent network area thoroughly and we have discussed the usefulness of the proposed solution with control room engineers and planners, who will be benefited from its use. Furthermore, through our analysis of historical data for generation and demand, we have identified that there is a substantial potential to reduce

	generation curtailment and increase available connection capacity just by increasing the visibility of the network that the control room engineers have. Lastly, we believe that the fact the trials will not begin before the second year of the project will allow the project team and the project partners to develop a detailed trial plan that will ensure the delivery of the expected results under minimum risk. <u>General Risk:</u> We agree that project overspend, and the underestimation of the required resources are potential risks that should have been included in the risk register. We believe that we have accounted for these risks in the project contingency budget. Based on our significant experience with delivery of LCNF projects, we don't expect that there will be any spending requirement beyond that covered by the project budget and the contingency. We will include these two risks in our bid resubmission.
	Conclusion 1: Response is acceptable. No further comment.
Sub-criterion (f.ii) – The customer impact of the project	**Challenge 1**: No Specific Challenge. There are no realistic negative direct customer impacts that will result from the deployment of the Contingency Analysis software. Traditional load customers will be unaffected by the project. The positive impacts affecting existing distributed generation customers and new connections are challenged elsewhere in this report.
	Answer 1: N/A
	Conclusion 1: N/A
Sub-criterion (f.iii) – Uncertainties in costs and benefits	**Challenge 1**: No Specific Challenge. The cost / benefits delivered by this project are challenged elsewhere in this report, including the perceived benefit to the customer.
	Answer 1: N/A
	Conclusion 1: N/A
Sub-criterion (f.iv) – Project methodology	**Challenge 1**: No Specific Challenge. A number of workstreams have been identified to deliver the key goals of the project. Assuming that these key goals are fully specified and that project personnel are mobilised the project methodology is suitable to achieve project delivery.
	Answer 1: N/A
	Conclusion 1: N/A
Sub-criterion (f.v) – Successful Delivery Reward Criteria	**Challenge 1**: Section 9 of the submission outlines the evidence that shall be produced to demonstrate compliance with the Successful Delivery Reward Criteria. A lack of clarity in some of the SDRC reduces the potential value of the claim. Criteria 9.3 details the installation of forecasting modules that will link the DNO control room with other data sources. A minimum magnitude of data sources or extent of data collection should be specified to ensure that this

	piece of work delivers an appropriate level of value. Criteria 9.4 details the use of real time data for contingency analysis. Sign off of forecasting modules is repeated as evidence here. UK Power Networks to confirm if this is in error. A minimum use of real-time data sources should be identified to ensure that effective contingency analysis can be proven. Criteria 9.5 details the data transfer between DNO control room and National Grid. The minimum extent of data variables and the minimum rate of data transfer should be specified to ensure that the communication channel is capable of effective data sharing. UK Power Networks to provide additional evidence showing that each of these issues has been considered.
	Answer 1: The development of a software suite that will integrate data from various sources (TNO control room, DNO control room, forecasting modules, etc.) requires special attention to data quality and compatibility. A significant part of the up-front work in Work stream 1, Work stream 2 and Work stream 3 is about developing the right framework of communication between all the data sources, some of which are not under the control of UK Power Networks. As a result of the above, UK Power Networks has deferred the determination of detailed targets for data collection magnitude and rate for each data link for the project implementation phase, since this will require input from all project partners. Some indicative details on the implementation of the data links are provided below. <u>Criterion 9.3</u> • Interconnector Load forecast Two interconnectors, the Anglo French interconnector at Sellindge and the BritNed interconnector on the Isle of Grain are both within the East Kent network area. The interconnector operators are obliged under the terms of their licence to publish a load forecast at various points within the day and at the day ahead phase. This data can be used to forecast the interconnector loads. • Load forecast The load forecast module will combine historical demand data from the East Kent network with weather forecasts to derive a load forecast. • Distributed Generation This module will combine weather data with generation profiles the various distributed generation technologies within the East Kent network. There will also be a discussion with National Grid around the forecast for larger generators in the area, for which National Grid might have its own forecasting models. • Traditional Generation Use existing UK electricity market data feeds to get generation estimates from power stations within the KASM area.

	Criterion 9.4 Sign off for forecasting modules is an error and will be removed in the final bid re-submission, we apologise for its inclusion. The proposed solution will integrate to the existing control room IT architecture and collect data on real power, reactive power and voltage, at transformers, feeders, and lines using the existing SCADA infrastructure via the control room's Distribution Management System (DMS). The data on UK Power Networks' 132kV network is collected by Remote Terminal Units (RTUs) which are configured to transmit instantaneous measurements periodically. Separately, the RTUs use a 'deadband' to avoid re-transmitting values that have not changed since last transmitted. The solution will integrate to the existing control room IT architecture and collect data using existing SCADA hardware on the network via the Distribution Management System (DMS). The communication with the SCADA systems is achieved through SCADA using either the DNP3 protocol running over an Internet Protocol (IP) network, or the eWISP+ protocol running over an IP network. The solution will operate on the instantaneous data. It will collect data directly from the control room Distribution Management System (DMS). We expect to collect data at least every 15 minutes and potentially will experiment with higher sampling rates, bearing in mind the increase in data volumes. This will be achieved by adjusting, if necessary, deadband settings and periodic update settings on the RTUs in the trial area. The same approach has been used on our Flexible Plug and Play (FPP) Low Carbon Network Fund Tier 2 project. The solution will collect data from all 132 kV substations and lines in the East Kent network (see figure B5). In the East Kent area there are eight 132 kV substations (Canterbury North, Canterbury South, Herne Bay, Richborough, Betteshanger, Morehall, Folkestone, Sellindge). Criterion 9.5 Please see our response to challenge a.i.1. The proposed solution will integrate to the existing control room IT architecture in the distribution network control room and link directly to the transmission network control room. The data will be collected directly from National Grid's Energy Management System and there will be no new hardware deployment on the network. The solution will collect data on real power, reactive power, and voltage at the 400kV substations of the East Kent network (Grain, Kemsley, Cleve Hill, Canterbury North, Sellindge, Dungeness, Ninfield), as well as through all the SGTs in the East Kent area. The solution will also collect the status of the circuit breakers at the substations. The sample rate at which data will be collected will be determined by the IT architecture currently in use in National Grid's control room. At the moment, it is expected that the connection will be implemented using an Inter-Control room Communication Protocol (ICCP) link between the National Grid control room and the UK Power Networks control room over VPN IPsec.
	Conclusion 1: Response is acceptable.

	Further Comments: UK Power Networks have noted that the up-front work, to specify the communication framework for data sources, is required to feed into the detailed targets for the project. This approach is deemed reasonable and acceptable on the assumption that the detailed targets are adequately reviewed and agreed with OFGEM following development.

3. INITIAL FINDINGS

This UK Power Networks LCNF submission outlines a project, which trials the integration of contingency analysis software within a DNO control room, specifically within the South Eastern electrical network. The LCNF submission presents the high level goals of this project, which are summarised as:

1. To develop the business processes and the functional requirements to enable sharing of real-time operational data between the DNOs and TOs;
2. To improve the DNO's in-house capability to conduct network power flow analysis within operational timeframes;
3. To improve the DNO's in-house capability to forecast network power flows.

The project aims to facilitate the development of a low carbon energy sector by providing the DNO with greater visibility of their network operating condition and a greater capability to forecast network operating conditions. It is proposed by UKPN that a DNO with better visibility of the network is in a more capable position to improve network planning practices and as such is able to reduce the constraints placed upon low carbon technologies during new connection prospects and during outage planning.

Frazer-Nash Consultancy Conclusions

1. Frazer-Nash Consultancy have challenged the quantified carbon benefit claims presented within the submission, however it should be noted that it is recognised that the transition to automating network management processes is a key enabler for the introduction of systems such as active network management and demand side management, which in turn facilitate the move to deliver a low carbon economy.
2. The value for money of the project to the DNO is largely derived from the deferral of traditional means of network capacity upgrade costs. It is recognised that the project has the capability to achieve this goal if sufficient additional evidence is presented to support the quantified claims of this cost saving. Additionally, the value for money of this project to the customer is largely derived from a reduction of constraints placed on the customer during planned outages. Once again it is recognised that the project has the capability to achieve this goal if sufficient additional evidence is presented to support the quantified claims of this cost saving.
3. The learning generated from within this project has been deemed appropriately timed and relevant to the wider low carbon community with particular bearing to UK distribution network owners, some of which may be considering similar schemes in the near future. It is recommended that additional specific requirements and outputs for the project trials be identified in this project submission to ensure that the correct level of useful knowledge can be generated from within the project. The means of knowledge dissemination appears to follow a structured and proven methodology based on previous LCNF projects. This is judged acceptable for the level of knowledge dissemination required from within the project and the predicted interested parties.
4. The project partners are judged relevant and appropriately selected to support this project in their specified role, generating only a minor challenge regarding planned time allocation.
5. To ensure that useful learning can be elicited from the project it is required that further clarity is provided to the key inputs such as quantity and quality of data to be collected and the extent of forecasting capability to be tested. It is recommended that the successful delivery reward criteria be reviewed to specify a minimum functional criteria for each these aspects of the project.

4. UPDATED FINDINGS FOLLOWING DNO RESPONSES

From the review of the responses provided by UK Power Networks, it is judged that all of the challenges raised by Frazer-Nash Consultancy have been satisfactorily addressed. Of the 16 challenges initially raised, 14 have been addressed via the provision of additional information to support the initial claim or via the outlining of an acceptable and logical method of deriving results. The response to 2 challenges indicated that futher work would be required and it is accepted that this work will be undertaken within the normal lifecycle of the project. The two challenges requiring further work are discussed below:

1. It was raised in (c.i) that insufficient information regarding the form and function of trials could restrict their potential to generate useful learning.

   Further information has been provided by UK Power Networks, demonstrating that a significant level of thought has already been put into the role of the trials within the project. On review of this information, it was concluded that the specificity of the trials is adequate for this stage of the project but that further work is required to specify measurable data to allow an analysis of quantifiable performance improvements.

   Given that the trials are not scheduled until year two of project delivery and that the project plan accommodates a level of up-front work in development of the trials, it is accepted that this requirement will be satisfied within the normal lifecycle of the project;

2. It was raised in (f.v) that a lack of clarity in successful delivery reward criteria could result in a reduction in the potential value of a target.

   UK Power Networks have noted that the up-front work, to specify the communication framework for data sources, is required to feed into the detailed targets for the project.

   This approach is deemed reasonable and acceptable on the assumption that the detailed targets are adequately reviewed and agreed upon with OFGEM following development.