WESTERN POWER DISTRIBUTION

TELECOMS TEMPLATES

TELECOMMUNICATION SOLUTIONS FOR SMART GRIDS

WPD_NIC_001/V1

RIIO NIC NETWORK INNOVATION COMPETITION

1. Project Summary

1.1. Project Title	Telecoms Templates for a Low Carbon Future
1.2. Project Explanation	Telecoms Templates takes an innovative approach to define modern telecommunications which can support smarter electricity networks. The project builds on knowledge from global experience to test technology performance against smart grid criteria. It also delivers of a suite of design templates and a software tool to facilitate informed strategy decisions.
1.3. Funding licensee:	Western Power Distribution (WPD) South West, West Midlands, South Wales, East Midlands.
1.4. Project description:	1.4.1. The Problem(s) it is exploring The project aims to gain a clear understanding of why communications are not delivering satisfactory results in supporting Smart Grid applications in the distribution network environment. 1.4.2. The Method(s) that it will use to solve the Problem(s) Telecoms Templates will address the lack of strategic, top-down approach to the delivery of telecoms through three methods: (1) Global Appraisal; (2) Laboratory Testing; and (3) Field Testing 1.4.3. The Solution(s) it is looking to reach by applying the Method(s) The project will produce a selection system applicable to all DNO's 1.4.4. The Benefit(s) of the project This will deliver a financial saving of £413m. The associated carbon saving is expected to be up to 157 MTCO2

1.5. Funding			
1.5.1 NIC Funding Request (£k)	£12,614.94	1.5.2 Network Licensee Compulsory Contribution (£k)	£1,422.73
1.5.3 Network Licensee Extra Contribution (£k)	£0	1.5.4 External Funding – excluding from NICs (£k):	£0
1.5.5. Total Project Costs (£k)	£14,227.29		

1.6. List of Project Partners, External Funders and Project Supporters	Project Collaborators, service providers and equipment suppliers will be selected using a competitive tendering process. No External Funders have been identified. Project Supporters include; • Électricité de France (EdF); • Joint Radio Company (JRC); • National Grid (NG); • Newcastle University • Northern PowerGrid (NPg); • Scottish Power Energy Networks (SPEN); and • Siemens

1.7 Timescale			
1.7.1. Project Start Date	4th January 2016	1.7.2. Project End Date	31st January 2020

1.8. Project Manager Contact Details			
1.8.1. Contact Name & Job Title	Gary McElroy Infrastructure Manager (Midlands)	1.8.2. Email & Telephone Number	gmcelroy@westernpower.co.uk +44 (0)1332 827303 wpdinnovation@westernpower.co.uk +44(0)1332 827446
1.8.3. Contact Address	Western Power Distribution Pegasus Business Park, Herald Way Castle Donington, DE74 2TU		

1.9: Cross Sector Projects (only include this section if your project is a Cross Sector Project).	
1.9.1. Funding requested the from the [Gas/Electricity] NIC (£k, please state which other competition)	N/A
1.9.2. Please confirm whether or not this [Gas/Electricity] NIC Project could proceed in the absence of funding being awarded for the other Project.	N/A

Section 2: Project Description

2.1. Aims and objectives

The objective of the Telecoms Template project is to develop a robust methodology to enable fit-for-purpose communications approaches that will drive network planning decisions by DNOs. Its aims are to:

- Create a process and design methodology to help network operators choose the most appropriate communication technologies
- Develop a Solutions Finder tool than can be used by all network operators
- Deliver a framework and environment that will permit network companies and industry stakeholders to ensure that 'fit for purpose' communications are understood and available after completion of the Telecoms Templates Project

2.1.1 The Problem which needs to be resolved

The digital revolution and decarbonisation targets of the Carbon Plan present a challenge to DNOs to define appropriate performance levels for telecoms systems which meet the increasing range of telecoms reliant BAU functions and Smart Grid applications.

Previous innovation projects have largely focused on proving the viability of Smart Grid applications which deliver an alternative or interim measure, to conventional reinforcement; none to date have focused on the core enabler of telecoms. The problem Telecoms Templates is addressing is the lack of effective tools and processes available to DNOs in the selection of fit-for-purpose telecoms.

The ENA have recently publicised the 'Active Network Management' (ANM) 'Good Practice Guide'[1] – the detailed appraisal of systems and solutions. Within the findings the ENA and DNO's acknowledge the current concern of telecoms and the real risk which they pose if not addressed. This helps to identify that telecoms are not just a commodity but an underlying requirement to current and future electrical network operations;

"From a DNO Perspective, communications are commonly considered to be the single biggest challenge for ANM deployment at distribution level (and future networks as a whole)" (ENA, 2015)

Therefore, if a timely solution is not developed, networks can expect to experience real problems in the areas of:

- Security
- Quality
- Performance
- Scalability
- Cost

Conventional and new approaches are, and will remain, part of the DNOs' critical infrastructure, requiring specific and stringent telecoms requirements for successful implementation. There is the potential need to reach every power distribution asset throughout the UK, whilst achieving absolute reliability and secure operation in the power distribution environment. It is necessary to understand the capabilities of public and private networks, alongside communication technologies, to deliver the needs of the developing electricity network while providing value for money for customers.

[1] ENA (2015), 'Active Network Management: Good Practice Guide', *Energy Networks Association,* [ONLINE], available from http://www.energynetworks.org/modx/assets/files/news/publications/1500205_ENA_ANM_report_AW_online.pdf

Furthermore, the project offers the opportunity to inform UK and European communications policy on issues affecting critical national infrastructure.

Whilst the deployment of current communication technologies has proved adequate for conventional network applications, they are becoming increasingly outdated, which creates risk in the effective transition to a low-carbon UK.

The Telecoms Templates project follows a distinctly different approach to other LCNF/NIC projects in as much as it recognises the need to develop telecoms to support the needs of the power industry. Telecommunications is largely a self-serving industry delivering systems and processes that align with the primary customers, i.e. public operators.

Significant changes have occurred in the telecoms industry over the past 20 to 30 years as mobile networks have brought operators and vendors closer to the consumer environment. Advertisers have created a market of desire for handsets and services that, despite not existing previously, are now 'must haves'.

Many products have mean time between failure (MTBF) figures that align with the 5-10 year life expectancy that public operators will accept. Sometimes this has led to use of lower grade components rather than higher specification types that can deliver the 10-15 year minimum lifetime between refresh that DNO's will require through the transition of Smart Grid to BAU.

The Telecoms Templates project will address this problem by evaluating the design life expectancy and predicted ability to operate for longer (10 to 15 year minimum). Additionally, vendor engagement will be developed to allow an understanding of the power industry along with the future requirements of DNOs overall. As with any market, supply develops to meet demand and if the power industry is to have the correct tools at its disposal to meet future demand, it needs to have plans in place now with the right specifications defined and communicated to suppliers.

A wide range of communications systems and techniques have been identified for inclusion in the project please refer to the more exhaustive list included in Appendix 10 for further detail.

2.1.2 The Methods being trialled to solve the problem

Three methods have been developed to solve the problem as outlined above. These methods in combination will create an iterative, three-tiered approach to the evaluation of BAU and Smart Grid applications systems and allow triangulation of results.

(1) Global Appraisal;
(2) Laboratory Testing; and
(3) Field Testing

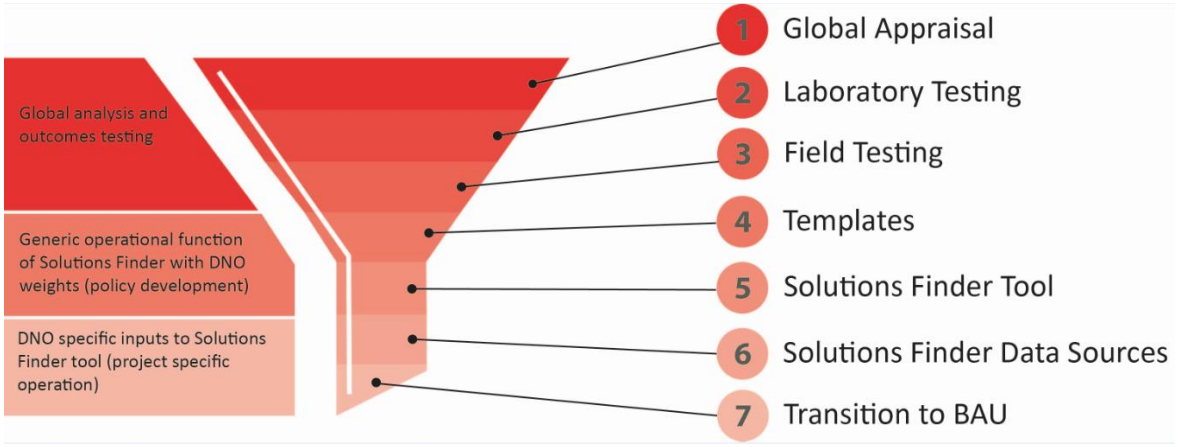


Figure 2.2 – Overview of the Telecoms Templates project lifecycle

Method 1 – Global Appraisal

At present telecoms selection for Smart Grid applications is generally a secondary consideration with a basic estimate of costs towards the project budget allocated for delivery and no real process in place for evaluation. This has led to poor performance in many cases.

The aim of Method 1, Global Appraisal, is to consolidate learning from previous global innovation projects, alongside current practice for traditional business, and analyse successes and failures with the key output of establishing a best-practice approach to telecoms design and delivery. It will follow the steps of:

Interviews and Workshops

Interviews and workshops will be conducted with stakeholders that have been involved with relevant projects, to collate the learning that is applicable to DNOs. Telecoms reliant projects will be examined to understand how success was achieved and any reports of weaknesses attributable to telecoms will be analysed. These sessions will facilitate the dissemination of any information which had not been detailed within public reports and will provide an opportunity to capture DNO specific concerns.

Development of metrics

To achieve the aims of this project, a set of evaluation metrics will be defined and developed for the range of Smart Grid Applications *[SDRC-01/04].*

The metrics will offer sufficient breadth to capture standard telecoms measures, and will also include metrics attributable to DNO network applications. They will use recognised industry nomenclature for measurements to allow the language of the communications industry to become extensible into that of the power industry. The metrics will also include cost considerations and 'soft' considerations, such as, ease of installation.

Templates Baseline

The review of independent solutions and systems applied within GB, European and Global electrical networks will facilitate the initial iteration of Network Application templates. These generic templates *[SDRC-01]* will bring together the underlying knowledge-bases of the four often siloed areas; SCADA, Protection, Semi-Autonomous Control and Diagnostics.

Development of a telecoms encyclopaedia

The encyclopaedia *[SDRC-01]* will contain terminology from the different technology sectors that will combine to deliver the needs of the overall system. It will capture acronyms and technology specific terms and will develop a common language for planners and designers in the Smart Grid Services environment.

Why is the method innovative?

This method innovates in its qualitative approach to establishing key learning from previous projects and in its quantitative approach to the development of metrics specifically for the evaluation of electrical network needs. The development of the telecoms encyclopaedia will establish industry standard terminology to prevent miscommunication that might previously have been influential in sub-optimal project rollouts. The production of template baselines to guide telecoms deployment has never been attempted.

Method 2 – Laboratory Testing

The DNO application of telecoms is extremely specialised, placing emphasis on the integrity, reach and longevity of an identified fit-for-purpose solution. Method 2 provides a validation stage for the true capability and suitability of identified fit-for-purpose telecoms systems. Tests will judge these against rigorously defined capabilities in a laboratory model environment.

Traffic throughput and monitoring will be achieved through interfaces to real world telecoms and Smart Grid management and traffic emulation. Different loading models will also be simulated through this approach to understand how the selected system copes under stress.

Laboratory Trials/Testing will provide the opportunity to investigate the findings of Method 1 and deliver increased confidence in the refined outputs. There are two phases to Method 2:

Trial Project Selection

Method 1 will deliver clear guidance as to which network applications should be trialled to deliver maximum value to DNOs. These outputs will then be used to identify the telecoms enablers for each – both of which will be subject to conjoined laboratory testing to assess their suitability.

Smart Grid Emulation Platform Development

To avoid unnecessary risk and expense within the project, a suite of 'network application emulator platforms' will be created based on the typical requirements defined from the network application templates, an output of Method 1.

These platforms will be representative of the generic templates, conforming to a given interoperability profile from the component level of the Smart Grid Architecture Model (SGAM) – see appendix 10. This will ensure the transferability of the learning for other DNOs who wish to employ similar technologies within their networks. These emulation platforms will also be employed within the field trial delivery, to deterministically and reproducibly control the communications traffic, located within each trial area and communicate back to a centralised Telecoms Templates Management Centre (TTMC).

Laboratory Trials (including Vendor Assessment)

There will be 15 individual trials of a range of telecom technologies for each Smart Grid Service. By measuring each trialled telecoms system alongside its network application and project metrics, technical performance, security performance, installation practice fit and cost effectiveness will be determined *[SDRC-02].* The techniques will be chosen from those that represent best value (i.e. fit for purpose) from Method 1.

This process will also complete a 'technology assessment', testing like-for-like technologies all of which offer the same service (for example a GPRS router and a private radio network equivalent) and will form the 'best-practice guide' that will help a DNO gauge what level of expenditure is typically required to procure goods which conform with a given interoperability.

Why is the method innovative?

This method offers an opportunity to refine the templates developed within Method 1. Using an iterative approach to laboratory trial, learning outcomes from each stage will be subjected to further lab testing. This will further validate results whilst offering an increasingly robust test facility for post-project use by other DNOs. Method 2 forms stage two of the triangulation approach and will also ensure that only suitable network

applications and assigned telecoms approaches are taken into the field trials (Method 3) to avoid any unnecessary expense.

Method 3 – Field Testing

The Telecoms Templates project is conceived as using iterative approaches at every stage to develop refined and accurate templates and processes to deliver a high level of confidence to network planners and other end users in the ability to select fit-for-purpose telecoms for Smart Grid applications.

It is envisaged that post project only the Method 1 and Method 2 approaches will be required to achieve successful fit-for-purpose telecoms deployment in real world DNO applications.

However, in order to achieve the desired level of confidence in the application of Methods 1 and 2 in isolation the Telecoms Templates project will test several selected fit-for-purpose systems in real world environments both within WPD and external collaborators licence areas.

Method 3 represents the largest element of the project. It will replicate previous trials identified in Methods 1 and 2 and will demonstrate emerging solutions if justified. Outcomes from Methods 2 and 3 will be fed back into the Method 1 process iteratively to increase the percentage reliability and trust factor for deployment throughout ED1 and beyond.

There are three phases to Method 3:

Phase 1 - Trial Location Identification

Method 1 will determine which electrical network applications (BAU/Smart Grid applications) need to be trialled to deliver learning outcomes which add value to the GB transmission and distribution utilities. These outputs, which will be ratified against the laboratory trial results in Method 2 will direct the trial area identification within both WPDs license areas and those of the collaborators noted in section 4e *[SDRC-03].*

Phase 2 - Trial Project Establishment/ Build

WPD will work with collaborators to achieve the project's objectives. Specific trial areas will be developed within WPD's license area, alongside those of the project collaborators. All trials will meet the location and environmental requirements and will ensure that mechanisms for testing, measuring and validating the trial are in place.

Where a telecoms technology or service requires a management platform for deployment and/or operation, the platform will be configured to collect performance and operational data. All trial systems will be connected, either directly through the node elements, the service provider, or an intermediate management system, to a central data system, Telecoms Templates Management Centre (TTMC) for overall project data management purposes.

The TTMC will be established at a suitable centralised location appropriate for its role as data gathering point and overall trials management. There is potential for the TTMC to be used as a learning resource for other DNOs and external parties, which may influence its location. The TTMC will be a standalone resource allowing it to be used for widely distributed trials management and will have innovative security mechanisms that can be implemented without posing risk to current operational systems. The TTMC will comprise a high level network management platform capable of interfacing with the distributed trials telecoms management systems around GB, as well as the Smart Grid emulation platforms, in order to achieve high quality triangulated data on system performance. The TTMC will function in a real time operational mode.

The TTMC will also be capable of continuous evaluation of measured metrics values from the connected telecoms systems and these can be used in an 'offline' mode to provide iterative updates to the templates held and used within the Solutions Finder on an as required basis.

The 'local' (housed adjacent to trial areas) telecoms trials management systems will directly report critical trial data to the TTMC.

Such data will be captured using network management platforms from the telecoms industry to provide Fault, Configuration and Performance management (FCAPS) capability to the telecoms systems under its influence.

The Smart Grid emulator platforms will be PC based and established to generate traffic at the component layer, from SGAM, representative of the Smart Grid application under test. The emulators will also support the necessary interfaces to connect to the TTMC in order to permit triangulated data on whole system performance to the TTMC system.

Phase 3 - Field Trials

The field trials expose the communications solutions to real-world deployment, installation and integration issues and actual performance under the location specific degradation mechanisms will also be observed and evidenced. Robustness to the environmental conditions and data transfer requirements will be observed. This, the third stage of the robust triangulation approach, will validate the findings with the real-world application of telecoms technologies, *[SDRC-07/ 08].*

As per section 5 of this document, the results of each of the methods will be collated, analysed, and drawn up in the shape of various reports to deliver the learning to stakeholders, *[SDRC-09].*

Why is the method innovative?

The delivery of a wide-ranging conformance test, which considers BAU and Smart Grid applications network approaches alongside existing telecoms systems, has never been performed on such a scale – either within the Power or Communications industries. Therefore, the resulting learning will add value to all DNOs and ensure a strategic approach to the design and integration of network-wide systems.

2.1.3 The Development or Demonstration being undertaken

Telecoms Templates project has two clear and interlinked outcomes:

(1) Establish the requirements of fit-for-purpose communications policies and processes in the evolving world of Smart Grid and capture these as a suite of templates.

(2) Develop a Solutions Finder tool that can identify the optimal telecoms approach for any application and interoperate with other industry standard planning systems for use across any GB license area. Validated by robust trials in laboratory and real world trials.

2.1.4 The Solution(s) which will be enabled by solving the problem

As identified in Section 2.1.1 'The Problem that needs to be resolved', the lack of funding and effective tools and processes to address the overarching problem of an ageing telecoms infrastructure will lead to further problems in the areas of: security, quality, reliability, deployment, and cost.

Telecoms Templates will provide an effective approach for DNOs in their selection of communications, thereby providing solutions to:

Security: By applying a holistic approach to security across the entire project, consideration is given to all aspects of data accessibility, integrity and management.

Quality: The template approach will ensure that selected telecoms systems meet the quality requirements for the applications they are required to serve.

Performance: Effective telecoms will support the aims of low-carbon technologies to deliver a flexible, cost effective distribution grid. Fit-for-purpose design of these telecoms will be demonstrated by their transparency in delivery of the required application.

Scalability: The project will deliver a telecoms selection process capable of supporting Smart Grid applications on a BAU scale. This will include demonstration of their ability to support the scale of trialled applications under stressed traffic conditions. The nature of identifying fit-for-purpose telecoms for the electricity environment supports the likelihood of validity into the transmission and generation domains.

Cost: Additional project design costs incurred in the selection of telecoms will be avoided through the use of the Solutions Finder tool. Effective telecoms will contribute to the targets required to achieve a low carbon economy.

Development of the Solutions Finder tool

While the templates can be used as a stand-alone resource for evaluation of fit-for-purpose telecoms selection, they are also intended as feedstock for a Solutions Finder tool that will increase their application.

The Solutions Finder tool will fulfil two separate but complementary roles:

- Policy design - it can be used to define reference fit-for-purpose telecoms proposals with electrical network applications.
- Project specific - it will permit a full, geographically applicable, communications proposal.

The tool will produce an output report that will provide electrical network planners with a priority list of proposals for telecoms design. Each option identified will be assigned a 'Trust Factor' to establish its expected suitability, an assessment made by the tool based on the proposed BAU or Smart Grid application, the most suitable telecoms approach, and its current availability within the license area, [*SDRC-05/ 06]*.

Once the tool has been developed WPD and their collaborators will lead training sessions with DNOs to integrate the Telecoms Templates deliverables into their BAU practices*, [SDRC-10].* Furthermore, as part of the legacy of Telecoms Templates, it is envisaged that the laboratory environment and TTMC could be maintained to assist stakeholders with the development of new templates.

2.2. Technical description of Project

The Telecoms Templates project will be conducted in three separate Work Streams with multiple work-packages to deliver a full and holistic understanding of telecoms as an enabler for Smart Grids.

The Work-Streams are:

- Desktop Evaluations / Template Baseline
- Infrastructure Establishment
- Analysis & Dissemination

Activities within this project will be interlinked with other Smart Grid trials, however, their scope is beyond the remit of Telecoms Templates.

This project will deliver a clear focus on the design, delivery and performance of the telecoms systems under trial as an enabler for the specific application(s).

It is expected that Telecoms Templates will influence these broader trials by delivering clearer results and outcomes.

The data sources, inclusive of selected DNO specific agnostic services and developing templates, will facilitate the delivery of fit-for-purpose telecoms schemes, providing a service which is applicable to all DNOs.

In support of the above, the project has been constructed to deliver a series of subsequent aims. In the first instance Telecoms Templates will challenge conceptions around the ubiquity and applicability of public telecoms systems as they currently operate, and their suitability in supporting mission critical M2M communications within the electrical utility sector.

The use of language within different industry sectors will be an important consideration as previous communications issues in deployments for Smart Grid may have occurred through misinterpretation. An encyclopaedia will be developed within the project to define, explain and relate the various terms and acronyms.

The first stage in development of the Telecoms Templates is defining the metrics to be used in their construction. Many of the metrics will be readily apparent as they relate to the basic building blocks of any telecoms system design and will include such things as data rate, latency and availability. Other metrics will consider security and resilience concerns essential in ensuring fit-for-purpose capability, and a further set will cover specific issues relating to network applications, such as, ease of deployment and maintenance in the DNO environment. Finally there will be at least one metric related to cost in order to ensure that fit-for-purpose includes consideration of comparative deployment costs of alternative solutions. Additional metrics may be included following the results of Method 1 – Global Appraisal.

The metrics will determine a profile for every considered telecoms approach, or service, as a unique series of values. These will become the telecoms capability templates. Similarly each considered network application (BAU or Smart Grid applications) requirements will be developed into a profile through the same approach and will become the Application Templates. These two sets will create a suite of templates known as the Telecoms Templates, which will require ongoing development following the conclusion of the project. They will be made available to DNO community as part of the project.

Project Legacy

A number of processes will be developed through the project that will have ongoing benefit to DNO's in both policy decisions and practical business as usual application design. In addition the critical laboratory testing facility that is central to many aspects of the project including, metrics definition, templating, 'at scale' testing and technology assessment will be maintained in the first instance by WPD, however under the ENA Collaborative Energy Portfolio all DNO's will be offered the opportunity to participate and share the results. Together with the Solution Finder tool these elements will provide a valuable and constantly refreshed resource to deliver fit-for-purpose telecoms to meet future needs of the entire UK DNO community, bringing value for money to customers for decades to come.

2.3. Description of design of trials

The trials conducted under the Telecoms Templates project are intended to demonstrate the fit-for-purpose capability of telecoms systems to meet the needs of current and future electrical distribution networks. The three methods, as outlined in section 2.1.2

The Methods being trialled to solve the problem have been developed to provide a rigorous, three-tiered, approach to the evaluation of BAU and Smart Grid applications, alongside the applicable telecoms enablers which are central to their successful implementation.

The scope of the Telecoms Templates project within the trial stage is considered as:

The definition of fit-for-purpose operational criteria for generic network applications (both BAU and Smart Grid) in the form of 'Application Templates', supplemented with the laboratory and field trials of telecoms approaches to assess their performance classifications and thereafter suitability for use within given network applications. The generic network applications, in this case the Smart Grid Emulation Platform will be developed within the laboratory, offering a controllable platform for the delivery of laboratory and field testing.

This approach ensures transferability of learning throughout the whole industry and associated community, given the generic approach to trials and base-lining.

In order to deliver a robust trial process, five independent trial types have been determined. These will be employed iteratively within the three project methods noted. This approach, modelled on the triangulation concept, provides means to refine data and knowledge ensuring the provision of a sound data-set, itself used to create the 'Application' and 'Telecoms' Templates.

The five trial types are categorised as follows; (The combination of trial types will be determined during the project process).

- Desktop/Lab (Method 2)

  These trials will be conducted for both assessment of the generic network applications within the Smart Grid Emulation Platform(s) and the telecoms technologies. Such trials will be run for all 'in-scope' approaches, the works noted within Method 2, acting as an input to SDRC-2 *'Template Feasibility Testing – Proof of Concept for Screening of Build Options'.*

- Retrofit (Method 3)
  - Where a previous BAU or Smart Grid applications project, typically considered as LCNF for the purpose of this project, is retrofitted or overlaid with a new telecoms approach to assess its suitability for the network application. Note: such trials will not interface to existing infrastructure or control systems, but will simply use the same physical

and geographical considerations to add further rigour to the assessment and template approach.

- New (Method 3)
  In the circumstance where no existing infrastructure is available to test, be this either a network application or telecoms technology, the project will establish a new test facility within the electrical network. Again this will operate independently from the distribution network, though will be tested for suitability against the Smart Grid Emulator Platform.

- Future (Methods 1, 2 and 3)
  - This trial type influences the way Telecoms Templates project outputs will be used within a BAU application by electrical network planners. Where future Smart Grid Applications are being planned, the project will provide the learning to influence the design and implementation of fit-for-purpose telecoms.

- Solutions Finder Assessment
  - Within the later stages of the project, post beta-release of the innovative Solutions Finder tool, the project team will run a series of scenarios within the Solutions Finder to assess the policy and project level decision outcomes. This evaluation exercise will in-turn influence any procedural changes required to the templates delivery process which DNOs should use going forward.

2.4. Changes since Initial Screening Process (ISP)

The scope and direction of *Telecoms Templates* remains generally unchanged, bar those points noted below, from the original ISP submission although further focus has been given to those elements which will deliver the most significant long term industry, and therefore, customer savings through RIIO-ED1 and beyond.

Amendments;

Project timescale – The project had originally been envisaged to conclude within 42 months, starting 4th January 2016 and concluding on 28th June 2019. However, due to the unique nature of the Telecoms Templates project and the delivery requirements which are mapped within the delivery programme, extending the timescale to 49 months provides a feasible window to conclude the works.

Therefore, the project will now run from 4th January 2016 to 31st January 2020.

Method 1 – The title of Method 1, previously known as the 'Smart Grid Systems Desktop Review' has now been refined, providing the title of 'Global Appraisal'. WPD feel this title offers a fuller description of the activities and is more applicable to the project.

Method 2 – Within the ISP, Method 2 had been created to deliver all project trials. However, due to the revised delivery methodology developed and described below, Method 2 relates now to the 'Laboratory Testing' only.

Method 3 – As a direct result of the above, Method 3 is now 'Field Testing'. Refining the three methods has ensured the application of a robust process for trials delivery, which can be maintained and continued with DNO BAU activities post-delivery of the Telecoms Templates project.

Section 3: Project business case

Context

Telecoms Templates is a project which will leverage learning from the global innovation community with respect to existing and nascent telecommunications technologies. It will develop a solution that efficiently supports network and telecoms planning operations for the deployment of emerging smart grid applications and will optimally aid the transition of the energy distribution network to support a low-carbon economy.

The business case for *Telecoms Templates* is based on the timely requirement to deliver industry understanding and structured best-practice regarding the need for a strategically developed, top-down approach to the identification and selection of fit-for-purpose telecoms solutions within both BAU and Smart Grid application systems. The impact of sub-optimum telecoms within such projects can be extremely detrimental to their delivery, operation and eventual lifecycle costs of the project – see Appendix 11: An Initial Review of Telecoms and their Suitability within modern electrical networks (Excerpt) for supporting views.

From the Smart Grid forum workstream 3 'Transform Model' forecast costs for incremental investment in Smart grid communications were expected to be **£532m**. However when forecasting based on a top down model, as delivered through the Telecoms Template project, this figure drops to **£119m – a delta of £413m** in estimated cost benefit, this figure forms the base case benefit of this project. When collating both the purported carbon and financial savings from previous LCN fund sponsored projects which have a reliance on telecoms, this totals **£1.6bn** and **157.79MTCO2,** these are considered as associated benefits of this project.

As explained in more detail in section 4a the cost of delays through unresolved telecoms issues is calculated **at £1,620m**

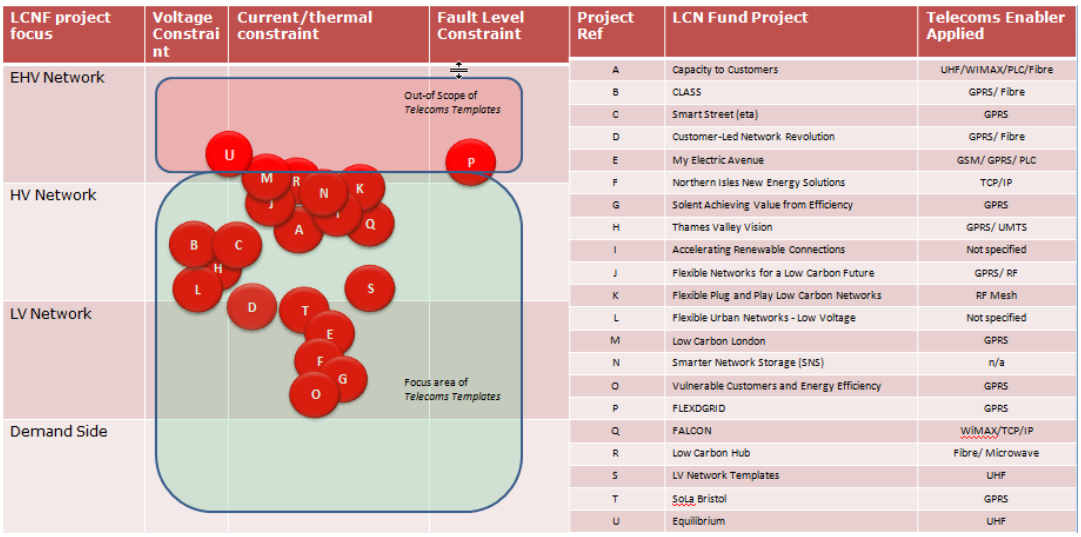
The role and importance of telecoms within electrical systems, for example protection, SCADA, and Smart Grid applications are ubiquitous, and can form a very real barrier to their effective application. It has been widely experienced that the current 'piece-meal' approaches to telecoms implementation in Smart or BAU projects will generally focus on leveraging existing and available telecoms services and/or the procurement of over-specified services in areas which are not currently served.

LCN Fund Tier-2 projects undertaken to date by the DNOs, shown in Figure 3.1, highlights the varied approaches applied to the development of Smart Grid applications. The technical deliverables of each project are cross-referenced against the area of application. Projects which are shown in a red circle represent those that are dependent upon telecoms for their acceptable use; those in green are not considered telecoms dependent. The relationship demonstrated throughout these largely independently devised innovative concepts shows that 90% of projects place a reliance upon telecoms to deliver the expected results. This represents the necessity to secure a managed delivery of telecoms to ensure the large scale deployment of such solutions is not at risk.

Business as usual approach and limitations

At present, BAU approaches within the DNO community generally apply independent or siloed approaches to the specification of telecoms for Smart Grid applications.

The selection of solutions will be specified from a subset of available technologies based on previous apparent success and with a defined cost level. It is widely acknowledged that this has led to less than optimum success levels within projects and has not delivered any positive learning around the communications themselves as an enabler for smart grid Operational Technology (OT) requirements. This, alongside the noted stress placed on existing/ legacy equipment due to increasing operational extremes and demand for electricity, impact the design and applicability of enabling technologies such as telecoms.



Project Ref	LCN Fund Project	Telecoms Enabler Applied
A	Capacity to Customers	UHF/WIMAX/PLC/Fibre
B	CLASS	GPRS/ Fibre
C	Smart Street (eta)	GPRS
D	Customer-Led Network Revolution	GPRS/ Fibre
E	My Electric Avenue	GSM/ GPRS/ PLC
F	Northern Isles New Energy Solutions	TCP/IP
G	Solent Achieving Value from Efficiency	GPRS
H	Thames Valley Vision	GPRS/ UMTS
I	Accelerating Renewable Connections	Not specified
J	Flexible Networks for a Low Carbon Future	GPRS/ RF
K	Flexible Plug and Play Low Carbon Networks	RF Mesh
L	Flexible Urban Networks - Low Voltage	Not specified
M	Low Carbon London	GPRS
N	Smarter Network Storage (SNS)	n/a
O	Vulnerable Customers and Energy Efficiency	GPRS
P	FLEXDGRID	GPRS
Q	FALCON	WiMAX/TCP/IP
R	Low Carbon Hub	Fibre/ Microwave
S	LV Network Templates	UHF
T	SoLa Bristol	GPRS
U	Equilibrium	UHF

Figure 3.1 – Comparison of LCNF projects and employed telecoms technique

Work undertaken by the ENA Smart Grid Forum through Work Stream 3 (WS3) has identified specific costs and issues attributed to taking the BAU approach of a needs basis or incremental approach to deployment of Smart Grid Solutions, including the enablers of monitoring devices, communications links and control systems. The 'Assessing the Impact of Low Carbon Technologies on GB's Power Distribution Networks' report[2] highlights the case for no-regrets investments in top-down strategies but understands that needs based deployment of some technologies may be required to go hand in hand for the period of ED1. The top-down approach to enabling technologies for long-term value for money however is clearly of benefit and presented through the report.

It is generally assumed by the British public, through messaging by the communications industry, that today's system can adequately meet demand. However through experience, when GPRS is deployed as an enabler for Smart Grid applications it will generally fail to deliver the quality of service promised by the service provider. This is where the innovative, quantitative, evaluation techniques of Telecoms Templates will reveal the true capabilities of wide ranging telecoms systems and provide templates for their wholesale use within the DNO environment. Essentially *Telecoms Templates* is an enabler for the no-regrets investment in a top down approach that ENA Smart Grid Forum Work Stream 3 recommends.

Business Case

The business case presented focuses on the potential benefits of a new and innovative top-down approach to developing a method that ensures telecoms systems deployed on a needs basis within future networks are optimised both commercially and technically, provide direct and indirect value and a long-term benefit for customers.

The learning and knowledge generated during the *Telecoms Templates* project will be dispersed to the licensed network community to further increase benefits for the GB customer base. The structured delivery of the project methods will ensure transferrable learning is captured and disseminated periodically from the outset.

[2]http://www.energynetworks.org/modx/assets/files/news/publications/Reports/Assessing%20the%20Impact%20of%20Low%20Carbon%20Technologies%20on%20Great%20Britain%E2%80%99s%20Power%20Distribution%20Networks_Full%20Report.pdf

The Global Appraisal method will ensure lessons learned from previous smart grid projects are incorporated into the projects outputs to develop a best-practice approach to telecoms application.

The remaining deliverables of the 'Capability' and 'Application' Templates plus Solutions Finder will provide value throughout the ED1 and ED2 regulatory periods with the establishment of universal best-practice and commonality in design to DNO and utility telecoms design and system integration.

The development of the Telecoms Templates and innovative Solutions Finder tool will benefit the GB energy industry by reducing the risk of wasted investment and subsequent management of 'unsuitable' telecoms infrastructure. They will ensure that high levels of service quality are realised through deployment of fit-for-purpose telecoms designs and platforms.
The value of the concept can be expressed within two specific areas;

- Facilitating the development and wide spread roll-out of Smart Grid applications and the expansion of existing BAU techniques within electricity networks
- Delivering a strategic, top-down, telecoms delivery methodology with support from holistic tools such as the 'Solutions Finder'

Financial Benefits

Between the years of 2020-2050, estimations have been raised as to the cost of an incremental approach to telecoms versus the strategic enablement of a 'Smart Top-Down investment strategy' – which is specifically highlighted within the Smartgrid Forum WS3 report.

The report uses the 'Transform Model' to forecast costs for enabling technologies such as communications throughout the period, and the financial consideration for the cumulative and incremental investment within the 'Comms & Control Platforms between variant solutions' is valued at circa **£532m**. However, when forecasting the top-down approach, this figure is reduced to **£119m** – **a delta of £413m** in estimated cost benefit, this forms the base case benefit of this project. Appendix 1 offers further analysis to the *risk* of not delivering the timely Telecoms Templates project. When collating both the purported carbon and financial savings from previous LCN fund sponsored projects which have a reliance on telecoms, this totals **£1.6bn** and **157.79MTCO2** respectively (refer appendix 1 para.2). With the understanding that the cost to the industry of unsuitable telecoms through current approaches is circa £413m from 2020–2050, this could be compounded by the risk placed on roll-out of unsuitable telecoms for Smart Grid applications and their related benefits.

A preliminary investigation into the methods of telecoms deployed across a selection of DNO areas focused on both BAU and Smart Grid applications projects has been undertaken to confirm the assumptions stated within this proposal. The interim results of this investigation can be found within Appendix 11: An Initial Review of Telecoms and their Suitability within modern electrical networks (Excerpt).

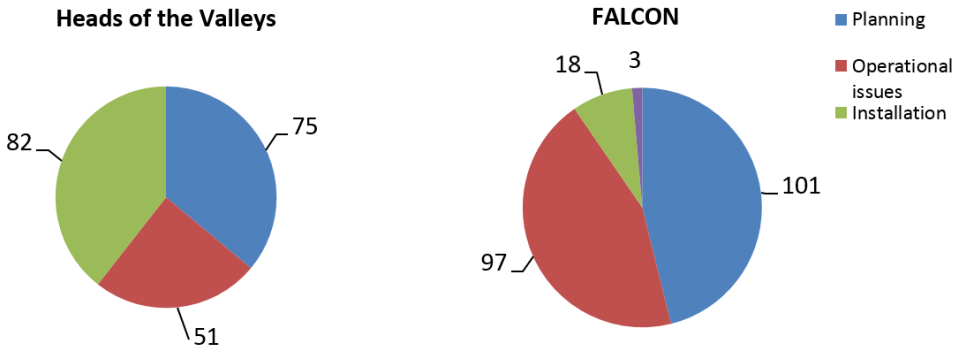


Figure 3.2 – WPD LCNF Project Analysis; Number of Sites impacted by Telecoms issues

A review of the successful LCN funded *FALCON* and *LV Templates* projects showed both were delivered with existing best-practice regarding telecoms design, establishment and on-going management, but noted some telecoms-based concerns. Figure 3.2 above suggests how these telecoms concerns were split, suggesting that telecoms technology itself is not the only contributor when acknowledging any limitations regarding the delivery of innovative systems. These findings suggest the costs attributable to the establishment of non fit-for-purpose telecoms were significant, as shown in figure 3.3.

Inadequate installation of telecoms equipment which could be down to spatial and/or expertise oversights, can seriously impair the roll-out and success of a project. Telecoms Templates will seek to create added value by providing guidance for considerations that should be taken into account during the delivery of a solution. This is to provide a level of risk mitigation which will drive potential project based financial benefits and long-term lifecycle management savings.

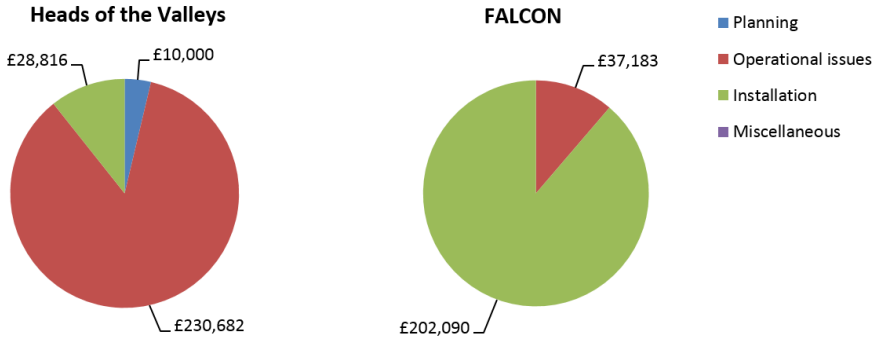


Figure 3.3 – WPD LCNF Project Analysis; Budget overspend due to Telecoms issues

Using a base case for cost analysis, the **Telecoms Templates** method and **Solutions Finder** tool are expected to deliver direct value, to the DNOs in terms of:

- Efficiency savings in design;
- Minimising telecoms CAPEX investment with a fit-for-purpose design and considered implementation; and
- Maintaining Smart Grid applications value with the realisation of telecoms systems which deliver the required level of service at an optimum cost

It should be noted that, while the base case costs can be allocated between the three methods described in Section 2 Project Description above, the same cannot be done as regards the benefits. This is because the methods are not parallel alternatives, but a sequential progression. All three methods are required in order to realise the benefits which have been calculated in Appendix 1.

Estimates and assumptions about the impact Telecoms Templates will have on GB plc can be derived by considering the provision of cost-effective means to the enablement of the roll-out of Smart Grid applications. Previous LCN Fund projects have made a number of assumptions to the financial benefits to GB plc and as such, some considerations can be made based on Figure 3.1 as to how Telecoms Templates will contribute to this.

The approach will leverage on industry-wide learning and also on knowledge of telecoms technology from whole-market engagement with vendors. This will form a part of Method 1 and will provide quantitative data around telecoms performance to date and recommendations for efficient fit-for-purpose solutions going forward.

Operational and Planning Benefits

Benefits associated with the roll-out of **Telecoms Templates** and the **Solutions Finder** tool to the DNO in support of operations and planning include:

- **Planning support for smart-grid and BAU deployment** – methods created will support power engineers in planning the requirements for telecoms associated with delivering nascent smart grid applications and traditional applications such as Protection, SCADA, etc.;
- **Risk mitigation** – reduced risk levels surrounding the specification, delivery and management of sub-standard telecoms;
- **Cost-effective methods of telecoms specification** – methods created to ensure the solution with optimal cost is specified for the specific application and location of deployment (rural, urban, etc.), including existing available services;
- **Improved service levels** – transparent and resilient telecoms services specified and deployed for applications, ensuring customer service expectations are met;
- **Minimise disruption and response requirements** – reduced levels of disruption to operations by eliminating the use of sub-standard telecoms and dispatch of field staff to rectify issues.
- **Right first time** - fit-for-purpose telecoms systems selection will ensure the smoothest possible transition to Smart Grid applications techniques and accelerate progress towards a low carbon future.

Customer Benefits

Customer benefits will be realised through investment costs reduction which will influence cheaper, quicker connections and help reduce response time for connection enquiries through use of the Solutions Finder. This will ultimately reduce DUoS charges, improve levels of service quality and customer satisfaction, whilst facilitating the roll-out of innovative LCT's and service offerings for the end consumer/prosumer.
Other key benefits from the acceleration of Smart grid application deployments resulting from streamlined communications design include support for general load growth and particularly ability to support heat pumps, EV's and socialised investment for domestic DG.

Carbon Benefits

Telecoms Templates takes an entirely new approach to developing Smart Grid applications, recognising that significant valuable effort has been expended on innovating in the component layer space (SGAM model). This innovation through LCNF and other funding mechanisms has delivered cost effective low carbon solutions and gone a long way to making the digital grid a reality in the BAU environment. The recognised carbon benefits of those LCNF projects alone considered in Appendix 1 show the value of this broad base of innovation as approximately 757mtCO_2.
The figure of 757 mtCO_2 can thereafter be reduced to 157 mtCO_2 with the removal of Low Carbon London's reported carbon savings. In numbers the project takes as its baseline the entire 157mtCO_2 carbon benefits savings claimed by the 11 LCNF projects, all of which have telecoms reliance and which are potentially at risk through non-availability of suitable communication layer capability. Assuming that Telecoms

Templates is successful and its outcomes are adopted by 50% of DNO's in their BAU rollout of Smart Grid applications then 78.50mtCO_2 is de-risked immediately. Additionally, since much of the design effort and inherent risk of the BAU rollout is eliminated through the legacy processes of the Telecoms Templates project, the achievement of this level of saving will be accelerated.

Costs and Assumptions

Telecoms Templates is seeking £12,780k funding from NIC for the delivery of the project (as given in Appendix 8). Including WPDs contribution this takes the total project value to £14,200k. The Base Case costs compiled for the delivery of typical telecoms solutions can be found in Appendix 1.

The funding request of £12,780k from the NIC fund, as shown in Appendix 8, is constructed of the following costs from the three Methods developed within *Telecoms Templates*;

- Global Appraisal: £[redacted]m
- Laboratory Testing: £[redacted]m
- Field Testing: £[redacted]m

The methods themselves are interlinked, requiring the inclusion of the three stages to deliver maximum benefit to the customers and the DNOs alike. Without this holistic approach the end result could be somewhat limited, for example if the Global Appraisal method were not undertaken then this industry baseline could not be factored into the best-practice documentation and thereafter the Templates and Solutions Finder. The main project costs are attributed to Methods 2 and 3 (Laboratory and Field trials respectively) and development of the Solutions Finder tool. These costs cover the purchase of equipment and the utilisation of resource to perform testing of templates against specific applications (lab and field based) and also the software development of the innovative Solutions Finder tool.

Risks

The main project risks to stated cost and benefits are detailed in Appendix 4: Project Risk Register. The major risks associated with the project have been reviewed and are understood. They can be tracked, controlled and mitigated to ensure the projects deliverables will be realised on time and to budget.

Western Power Distribution Direct Benefits and Contribution

Western Power Distribution own and operate a differing array of communications technologies and infrastructure which service the operational communications needs of the business, primarily supporting the remote monitoring and control of the electricity network. Other DNO's operate on a similar scale, although design, ownership and management may be dealt with by third party providers. In the main, these communications assets are renewed and replaced on a 10-15yr cycle. The production and development of the Telecoms Templates derived from this project, as well as the application of the innovative Solutions Finder will allow Western Power Distribution (as well as other DNO's) to approach wholesale technology refreshes from a different perspective than previously experienced. The templates will allow Telecoms Planners to look at the communications network totally differently, implement more effective designs and allow for the introductions of newer and more applicable technologies to be deployed.

When the traditional refresh methods are followed, significant investments have to be budgeted for and in the case of WPD, the ED1 period saw a budget funding request of circa £47M this is similar for other comparable DNO's over the period 2015-2023. With the application of Telecoms Templates and the Solutions Finder it is anticipated that the

technology refresh programmes can be implemented effectively and efficiently, thereby reducing Customer Interruptions (CI's) and Customer Minutes Lost (CML). A direct benefit to both company and customer alike.

The benefits for the use of Telecoms Templates and the Solutions Finder in respect of Smart Grid Applications are already thoroughly detailed in this document; however the benefits to the business in terms of supporting BAU deployment shouldn't be underestimated. During the twelve month period 2014-15, WPD deployed in excess of 300 radio links to Primary Substation RTU's (Remote Telemetry Units) and approx. 1100 radio links to Distribution Substation Automation Devices. Timely planning ensured that all installations worked first time, however, with the potential to require visibility and control of all 96,000 distribution substations at some stage, correct design and technology choices as well as deployment considerations will impact upon network management, security as well as operation and overall cost.

Section 4: Benefits, timeliness, and partners

(a) Accelerates the development of a low carbon energy sector and/or delivers environmental benefits whilst having the potential to deliver net financial benefits to future and/or existing Customers

The development of a low carbon energy sector depends on both the rate at which new initiatives can be devised, funded and implemented as projects and also on the rate at which successful projects can be expanded and rolled out across the entire network of both the project sponsor's and other DNOs. While the new technology each project seeks to develop is central, other supporting technologies may require parallel development and may be no less critical. Of these technologies, one of the most important is the supporting communications infrastructure.

Experience on a range of projects suggests that communications aspects are often not considered, or are assumed to be adequate, during project design and specification and in the early stages of the project. Only later does it become clear that innovative communications are required as a key component to a solution. By that stage, the identification and adoption of such solutions takes time and can delay project completion. In the worst cases, successful completion may be compromised by difficulties resulting from an inadequate communications infrastructure. *Telecoms Templates*, and in particular the development and wide availability of an effective Solutions Finder tool, would enable appropriate communications solutions to be identified and adopted at the beginning of a project.

Likewise, the extension of a project into wider areas of the network relies on an effective communications infrastructure. Often, what is sufficient in one particular location and on a small scale will not be more widely applicable, and will not be adequate to handle much larger quantities of data. For example, city centre locations with many secondary substations located in basements, inaccessible by radio, may require a fixed wire communications solution not needed in suburban or rural areas.

The proposed Birmingham smart grid application has been included within *Telecoms Templates* to address issues such as this which are specific to city centres. As another example, the high volume of data from around 1000 locations on the low voltage network in the Heads of the Valleys project was difficult to transmit and process, and would be impossible for a wider scale extension. Either more innovative communications solutions would be required, or else a way of diminishing the data flow (for example by processing most of it on local servers) would have to be adopted. The *Telecoms Templates* applications seek to address this potential problem, and to incorporate relevant findings into the Solutions Finder tool.

While real time trials on actual distribution networks are essential, they should be complemented by laboratory trials in specialised smart grid laboratories. This provides a number of additional benefits:

(1) Challenges can be addressed and resolved more quickly, and at less risk, than on an actual network.

(2) A wide range of intact and faulted network conditions can be simulated, which would not be possible on an actual network.

(3) Many more network types than those of the fifteen actual trial networks can be modelled and tested, ensuring that the Solutions Finder has a more universal applicability.

A detailed study of communications aspects of a wide range of smart grid projects, in the UK Network Licensee areas and elsewhere, is currently being undertaken in support of the present bid. An abstract of this study is included in Appendix 11: An Initial Review of Telecoms and their Suitability within modern electrical networks (Excerpt). It is intended

that the full report will be available in October 2015 ready for the commencement of this NIC project.

The financial implications of this acceleration are detailed in Appendix 8

Essentially; it is considered that unresolved telecoms issues could delay a smart grid project by a year or more, with an even greater impact on the eventual roll-out of that project into BAU. It is estimated that the median time of such a delay to roll-out would fall within the range 2-4 years. For the purposes of benefit calculation, a more conservative estimate of 2 years delay on average, affecting only 50% of projects, is assumed. However, applying this to the total project portfolio detailed in Appendix 8 with an assumed rate of return of 6%, the cost of such delay (and therefore the potential benefit of Telecoms Templates in avoiding such delay) is calculated at **£1,620m.**

(b) Provides value for money to gas/electricity distribution/transmission Customers

The communications network which supports the electricity distribution industry is a vital component of that industry, but it is all too often taken for granted, both in business as usual and also within innovation projects. Although communication aspects can account for up to 10% of the cost of an innovation project, they are often not considered in sufficient detail at the planning stage. This can lead to unnecessary expense at a later stage, and on occasion problems with communications can diminish the achievement or even jeopardize the success of the entire project.

Telecoms Templates addresses this problem by investigating and evaluating in depth a range of possible communications solutions and advising of the most suitable application within given network applications. The findings will then be used to develop a series of 'Application' and 'Telecoms' templates which act as feed-stock to the innovative Solutions Finder tool. This package can be used by any DNO, on any BAU or Smart Grid applications project or on the extension of previous projects across the distribution network to determine the most effective communications support structure. The effectiveness of the proposed solution will be measured against a weighted range of criteria including cost, reliability, quality and robustness.

The financial benefits of the *Telecoms Templates* project can be considered in a number of different ways. Smart Grid approaches to problems that would traditionally have been addressed by reinforcement are in many cases proving to have financial benefits. For example Real Time Thermal Rating (RTTR) schemes are demonstrating that they can postpone, perhaps indefinitely, the need for substantial network reinforcement in the form of additional overhead lines, which would cost many times as much as an RTTR solution. All these solutions require communications to function and therefore establishing a top down, efficient and trusted, system of fit-for-purpose communications in each case will have widespread benefit both practically and financially. We should also consider that as the distribution industry moves further into the dynamically managed world, with encouragement from RIIO, then the networks may prove not to require reinforcement due to the new balance mechanisms between local supply and demand.

In these cases where communications originally helped deferral of reinforcement, they are now in place, proven and trusted to be ready to support the new modes of operation. As will be seen from Appendix 1, where carbon reduction and financial savings from across previous LCNF projects are captured, even accepting a relatively conservative figure for the role of *Telecoms Templates* in driving efficiencies in communications deployment for smart grid applications, then the financial benefit over time of any projects of this kind can reach a total of £1,620m.

The second heading is that innovative power systems, even if they are not essentially about communications, still need innovative communications solutions to support them adequately. Often it is assumed that established communications methods will suffice for novel power systems, and sometimes they do. But on several occasions it has been

found, perhaps at a late stage of the project, that corresponding communications development is also required. At the very least, this adds to the cost and duration of the original project and, on occasion, it may even limit the success of the whole project against its original criteria. In such cases – and they are likely to become more frequent as power network innovations become more ambitious – the value of the original project may depend on finding an effective communications solution. The proposed Solutions Finder tool of *Telecoms Templates* could enable such a solution to be identified and implemented, thereby realising the original project benefit which would otherwise be at risk.

The third heading is the cost of the communications activity itself across the network. For example, the cost of telecommunications kit over the 8 year period 2015-2023 across Northern PowerGrid is estimated in their RIIO submission to be £45 M. A comparable figure (£47.0 M) is given by WPD as the Operational IT&T cost of communications for switching and monitoring over the same period. As Smart grid applications are developed and adopted across the distribution network up to 2050 and beyond, in the order of 100 times as much data will need to be handled as is presently the case.[3] One implication of this is that the distribution costs required by communications is likely to increase from the present c.£45 M, with efficiencies of scale, the associated cost increase may only be a factor of ten to perhaps c.£450 M. By systematically choosing cost effective communications solutions, it is anticipated that the long-term cost of communications can be reduced by 10%, or c.£17 M per year, across the GB Network Licensees' areas by 2030.

The fourth heading is perhaps the most important of all. If Smart Grid applications are to become widely adopted across the country, the volume of data transfer will need to increase by at least two orders of magnitude. The existing communications infrastructure will not be able to handle such increased volumes – already there are bottlenecks in certain types of data transfer such as UHF radio – which suggests that either a highly expensive investment in communications will be needed (such as dedicated fibre optic trunk routes), or else the anticipated extension of smart grid will have to be curtailed for want of the required supporting communications infrastructure. However, there is a third possibility, which is to squeeze more out of existing communications assets, just as smart grid itself seeks to do for power distribution assets.

There are various ways of doing this, from tighter concentration of data packets to processing more data locally rather than centrally, but determining the most effective way requires practical research and evaluation, which is what *Telecoms Templates* seeks to achieve.

Evaluating this fourth heading is not straightforward. Previous innovation projects have often been evaluated on the unspoken assumption that they would be able to be rolled out across the network, and that somehow the communications infrastructure would be capable of supporting them. This assumption may be over optimistic. The value of *Telecoms Templates* is that it would enable the benefits already claimed for the roll-out of other projects to be realised in practice.

In conclusion, it is calculated that the cost of *Telecoms Templates* - £14.2m, to allow for testing in a laboratory environment and across fifteen separate and diverse project sites, together with evaluation and the development of a Solutions Finder tool will lead to annual benefits in excess of that sum under four separate headings, as detailed in this section of the proposal.

[3] This figure is estimated conservatively based on the need to provide communications to most if not all secondary substations, with an average ratio of 100:1 compared with primary substations, for Smart grid requirements and aligns with the assumption that data growth will develop accordingly.

(d) Is innovative (ie not business as usual) and has an unproven business case where the innovation risk warrants a limited Development or Demonstration Project to demonstrate its effectiveness

The innovation within *Telecoms Templates* project is its focus on ensuring that an essential enabler of all Smart Grid applications, communications, is ready for wholesale deployment at a technology readiness level (TRL) and fit-for-purpose to support them as they become business as usual.

Identifying and addressing issues with current communications technologies and systems through a structured evaluation approach of the Global Review and analysis using the *Telecoms Templates* project as a single focal point eliminates the need for such activity on an individual case by case approach by other DNO's. Subsequently, any and all actions taken through *Telecoms Templates* project to ensure suitability of selected trial technologies and systems to deliver fit-for-purpose communications for verified Smart Grid applications, or combinations thereof, will be of immediate and lasting value to other DNO's and the Smart Grid future as a whole.

Fit-for-purpose means not only that the communications can deliver the requirements of particular Smart Grid applications, but also that they achieve this at the lowest cost point while meeting, or exceeding, the required quality and security metrics defined.

It should be stated here that all previous Smart Grid projects have delivered innovation to some extent in the selected communications approaches they have used.

Until relatively recently, telecoms applications within DNOs have been limited to SCADA and protection, with the exception of corporate IT services, and so the move towards widely dispersed Smart Grid automation has required new communications techniques to be trialled. Generally the selected communications technologies and services have been 'bought off the shelf' with little or no adaptation for the specific requirements of Smart Grid applications. Of course it should also be said that Smart Grid is still in its infancy and understanding of the specific needs that it will require as it moves towards BAU are not yet fully understood and hence undefined.

This is what *Telecoms Templates* project intends to address through developing a clearly defined set of requirements for each Smart Grid application.

(e) Involvement of other partners and external funding

e.1 - *Selection of Project Partners and External Funders*

The *Telecoms Template* project is something of a novel concept, especially within the NIC funding arena. With this in mind, WPD have taken existing best-practice methods of stakeholder engagement within the FSP stage, evolving the process in-lieu of the opportunity presented within *Telecoms Templates*.

Building on this individuality, early workshops with telecoms professionals representing the DNOs, non-electrical utilities and 3rd party expert groups (JRC[4] et al), led to some very positive feedback regarding the aims of the *Telecoms Template* project and its deliverables. The positivity received paved the way for following correspondence which enabled these stakeholders to advise on major concerns which they face within BAU and smart grid environments, recorded one-on-one interviews then supported these views.

Stakeholder letters of support can be found in Appendix 9. The feedback obtained formed a comprehensive input to the project scope selection, ensuring that the needs of the many will be addressed within the laboratory and field trials established throughout

[4] The Joint Radio Company Ltd. (JRC) is a joint venture company of National Grid plc (the UK electricity transmission and gas transmission and distribution operator) and the Energy Networks Association Ltd, representing UK gas and electricity transmission and distribution companies.

the delivery of the project. These initial findings will act as guidance within the Global Review Method.

WPD will follow a competitive process throughout, therefore no partners have been identified for the delivery of the project. However, given the interest declared from industry stakeholders a number of external collaborators have been identified, these are highlighted below.

Ensuring knowledge is developed which addresses the needs of the wider industry is critical to any LCNF/NIC bid, however Telecoms Templates, needs to overcome any geographical boundaries. With the varied support from the collaborators noted it is expected that the robust methodology developed can deliver outcomes representative of the needs of all UK DNOs.

Project Collaborators/Supporters

EdF - Électricité de France
ENA – Energy Networks Association
ESB Telecoms – Electricity Supply Board
JRC – Joint Radio Company
NG – National Grid
NPg - Northern Powergrid
SPEN – Scottish Power Energy Networks
UoS – Surrey University

WPD have developed this bid with the support of Siemens and Newcastle University. WPD has identified the scope of services needed to deliver the Project, which will be selected via a competitive tender after the award of NIC funds. This aspect is further defined in Section 6.1.

e.2 - *Reasonable Endeavour to attract External Funding*

Post ISP acceptance and prior to the delivery of the Full Submission Proposal to Ofgem, WPD distributed a Request for Information (RfI) to a range of telecoms service providers, vendors and stakeholders. The response to this RfI, alongside engagement workshops, has led the team to conclude that a competitive procurement process would be the most suited for this project. WPD will tender for all solutions, selecting the most economically advantageous response, suppliers will be given the opportunity to contribute to the project, financially, time or equipment, representing the best value to customers. WPD will select appropriate telecoms solutions as a result of the tendering process. Notices will be placed on Achilles, also in telecoms procurement journals to ensure all parties are aware of the opportunities.

e.3 - *Systems and Processes for identifying potential Project partners*

How the DNO has made interested parties aware of the LCN Fund?

Our project website www.westernpowerinnovation.co.uk sets out the work being delivered through the NIC and provides contact details. Further to the information submitted in the ISP, WPD has distributed separate "Requests for Information" (RfIs) for stakeholder feedback, to capture interest in the delivery of telecoms technology and also consultancy support throughout delivery. Each RfI was posted on the Achilles vendor database. The RfI responses, 70 in total, have been received and used to shape the *Telecoms Templates* Full Submission Pro-forma. Project suppliers will be selected through a competitive process, in line with WPD purchasing procedures (approved by Ofgem as part of the Equilibrium and FlexDGrid projects) and EU regulations.

How the DNO has actively sought ideas for projects and what process did WPD go through to decide which ideas it takes though to NIC?

WPD followed the now-established process for selecting ideas for ISP. This year, two potential projects were identified as worthy of consideration and evaluation. Our evaluation process tests:

- The quality of the idea;
- How well developed the idea is;
- The quality of the documentation/research;
- The value the solution may deliver;
- The appropriateness for NIC (particularly the scale of the project);
- How likely it is that the solution would become a normal business solution (for example, ease of implementation and need for legal or regulatory changes);
- Project risk; and
- Timelines

In 2015, one potential project was developed from a concept identified by WPD and one idea was received from a third party organisation. Both were evaluated in detail under the NIC process as described above, where one was discounted at initial evaluation. *Telecoms Templates* was selected after careful evaluation and challenge by WPD senior management.

(f) Relevance and timing

The *Telecoms Templates* project has direct relevance to all DNOs as it addresses a key enabler to all smart grid applications requiring communications connectivity beyond the primary substation. Currently where DNOs operate their own communications systems these are of an extremely high quality of build and management, but they extend at best, as far as the primary substation.

The growth of smart grid applications requiring connectivity to a vastly increasing number of elements often far beyond the primary substation, the last mile as it is sometimes referred, means that new approaches to delivering fit-for-purpose communications are urgently required.

By developing an accurate understanding of the relationship between communications requirements of current and foreseen smart grid applications and the critical aspects of their individual needs it will be possible to design fit-for-purpose communications solutions to these in combination. This is a considerable exercise, but one that is essential and best performed in advance of large scale rollout.

The term fit-for-purpose is used widely in this submission relating to communications that meet the needs and any special requirements of the electricity distribution industry in the development of the evolving Smart Grid.

The implication of the term is twofold, naturally the communications themselves have to be fit-for-purpose and this is where the metrics and objective evaluation process is applicable. However additionally the processes involved in deployment also have to be fit-for-purpose and considerable data exists from previous projects that demonstrate this not to be the case at present, at least in certain cases.

Two examples of these second case types include the requirement for specialist knowledge transfer from the communications industry to the power distribution industry to ensure that established communications practices can be followed by engineers trained in the specialist environment of high voltage distribution.

Additionally for communications to be fit-for-purpose in the power distribution industry they must be capable of operating in the harsh environments that will be encountered. This may mean higher than usual temperatures, or temperature range, humidity range and other challenging conditions. Primarily though, consideration has to be given to the

presence of strong electromagnetic fields that are an inherent feature of power distribution systems, these may affect wired, through induced currents, or wireless, for example GPS timing signals, systems and this will undoubtedly need to be included in the developed metrics of the Telecoms Templates project.

All of the above are extremely relevant to developing effective fit-for-purpose communications infrastructure for Smart Grid in the DNO area, but they are also timely as we now have the evidence and experience to learn from, while still being at an early enough stage in deployment to extract maximum benefit from their resolution.

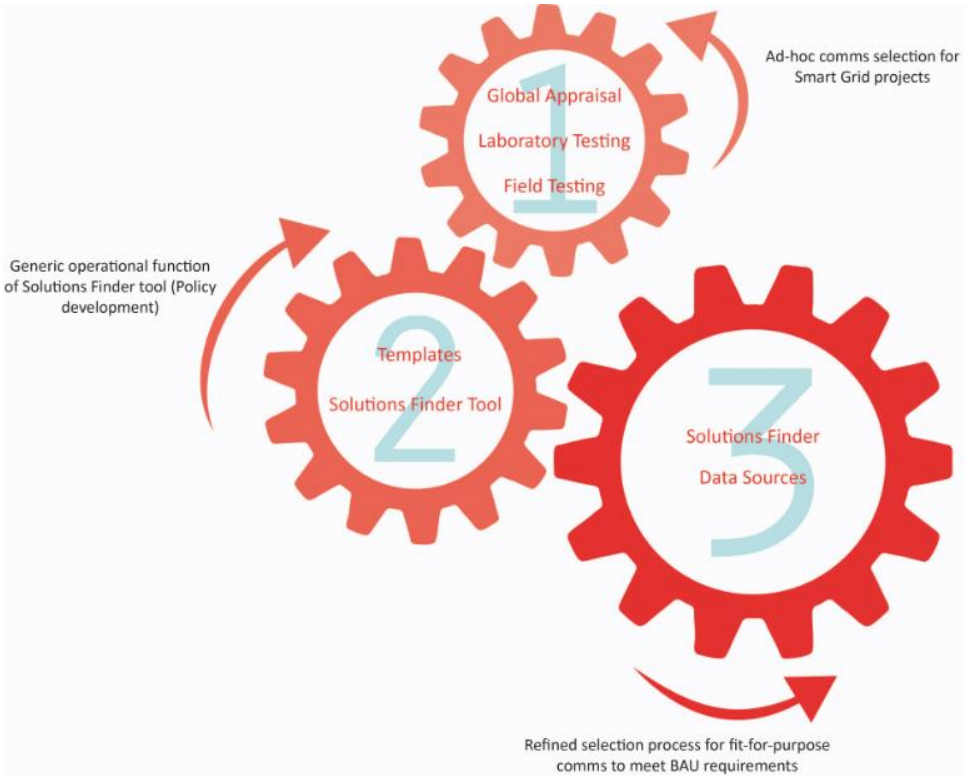


Figure 4.1: The three stages of Telecoms Templates

Section 5: Knowledge dissemination

5.1. Learning generated

Distribution network operators use telecoms for many purposes and have substantial knowledge and experience in using them for a well-defined range of purposes from obtaining half-hourly average measurements to complex generator inter-tripping schemes. As described elsewhere in this document in recent years many innovation projects have created a need for communication capabilities that are above and beyond those which are currently in the range of the DNOs' experience. There have been varying degrees of success in the implementation of communications infrastructure to meet the performance requirements for a variety of smart grid applications. In cases where the performance of the communications solution served the smart grid application, it is not necessarily clear whether the selected communications solution was the most appropriate in terms of cost, future-proofing and integration within the wider communications strategy of the DNOs. In cases where the communication issues caused significant deficiencies to the delivery of the project the knowledge that *Telecoms Templates* will deliver would have provided a well-defined process for selecting the appropriate communications solution. As the scope and quantity of smart grid applications increases, the current piecemeal development of communication solutions will become increasingly inefficient and cumbersome – potentially locking out more coherent and efficient strategies; the knowledge needed to avoid this eventuality will be generated.

The review of the communication solutions used in previous innovation projects will identify where the performance has fallen short of, or unnecessarily exceeded, the requirements of the smart grid application. In itself this adds to the knowledge base of the DNOs through a review that focuses only on the communications limitations, abstracted from the final application's reported performance. When similar applications are planned in the future, an extensively researched knowledge base will be available to refer to. This benefit is extended by carrying out laboratory and field trials.

Laboratory trials will benchmark the performance of a suite of communications solutions and interfaces that are subsequently tested in field trials. By using a controlled laboratory environment, their capabilities will be determined under close to ideal conditions and the effect of degradation of specific components of the system investigated. This provides knowledge on the upper limits of the performance of the tested communication technologies.

Field trials will yield operational experience and data that measures the actual performance of each communications system in comparison to idealised and degraded performance from the laboratory tests. The metrics that define each technology's suitability for use against smart grid applications' performance criteria will be available to DNOs for them to apply in the specification of future projects that will rely on communications.

The knowledge generated from the testing and trials will be incorporated into the Solutions Finder tool. By assimilating the knowledge generated by the project into a directly useable form, the DNOs will have an output from *Telecoms Templates* that will immediately bring tangible benefits to the planning of communications solutions for advanced network monitoring, control and protection applications.

It is recognised that WPD manage their communications infrastructure in a different manner to some other DNOs, managing the majority of their requirements in-house over purpose designed infrastructure rather than external 3rd party delivered and managed services. This brings a big advantage in being able to control the delivery of this project in a way that would be more difficult for others. While it is recognised that the commercial environment may result in solutions appropriate in one license area being

inappropriate in another, the knowledge generated by *Telecoms Templates* will be applicable for all DNOs.

5.2. Learning dissemination

Knowledge capture is a fundamental component of the Project and as such *Telecoms Templates* has been designed to offer the maximum opportunity to capture and deliver learning to all DNOs and the wider electricity network community. Therefore, to capture such learning the project requires a robust methodology and plan for its delivery. To deliver these outcomes and provide benefit to stakeholders, the project will utilise the approach proven throughout the delivery of previous WPD LCNF/NIC projects. The knowledge capture and dissemination approach is a combination of two processes, which are highlighted below.

5.2.1 Knowledge capture methodology

The dissemination programme will be an early output of the project delivery, identifying the format of the applicable sessions, and the respective dates, for wider engagement. The methodologies below identify the components of the learning and dissemination processes, though each stage will occur throughout project delivery, i.e. be iterative in nature.

There will be learning potential at all stages of the *Telecoms Templates* project, from the initial desktop studies right through to project completion and dissemination. Therefore capture of this learning will be a high priority and high value outcome of the project.

Regular reports will be produced in line with OFGEM/NIC requirements, but additionally workshops and communications events will be held to cover specific elements of project process, eg.: Global analysis, laboratory testing and field testing.

At present eight workshops have been identified which could offer value to the wider industry – though the specific nature of each will be reviewed during the preparation of the dissemination programme, the project hopes to deliver most of the following:

Workshop 1 - Knowledge Capture, Telecoms Limitations within Electrical Networks

Workshop 2 - Laboratory Trials, Defining a Suitable Approach to the Assessment of Telecoms in a Clean Environment

Workshop 3 - Trial Area Identification, Dissemination of Agreed Trials/ Methodology

Workshop 4 - Design of the Solutions Finder, Dissemination of Proposed Tool Functionality

Workshop 5 - Implementing Telecoms Network Infrastructure for 'Live' Trials

Workshop 6 - The Solutions Finder Tool, an Introduction to its Functionality

Workshop 7 - How to Deliver Fit-For-Purpose Telecoms within Electrical Networks

Workshop 8 - How to Integrate Templates and the Solutions Finder into BAU Activities

Information disseminated under the *Telecoms Templates* project will be modelled on the Smart Grid Architecture Model (SGAM) system and language, as adopted by CENELEC and others. This approach will ensure that standard terminology and imagery will be used which in turn will permit the clear and concise description of the techniques employed and the results of each. Applying an industry standard approach will eliminate any confusion in language and terminology through the coming together of power distribution and telecoms industries in the project.

The international recognition of SGAM as a platform for communicating activities and processes around the Smart Grid evolution will ensure the widest transferability of knowledge gained through the *Telecoms Templates* project.

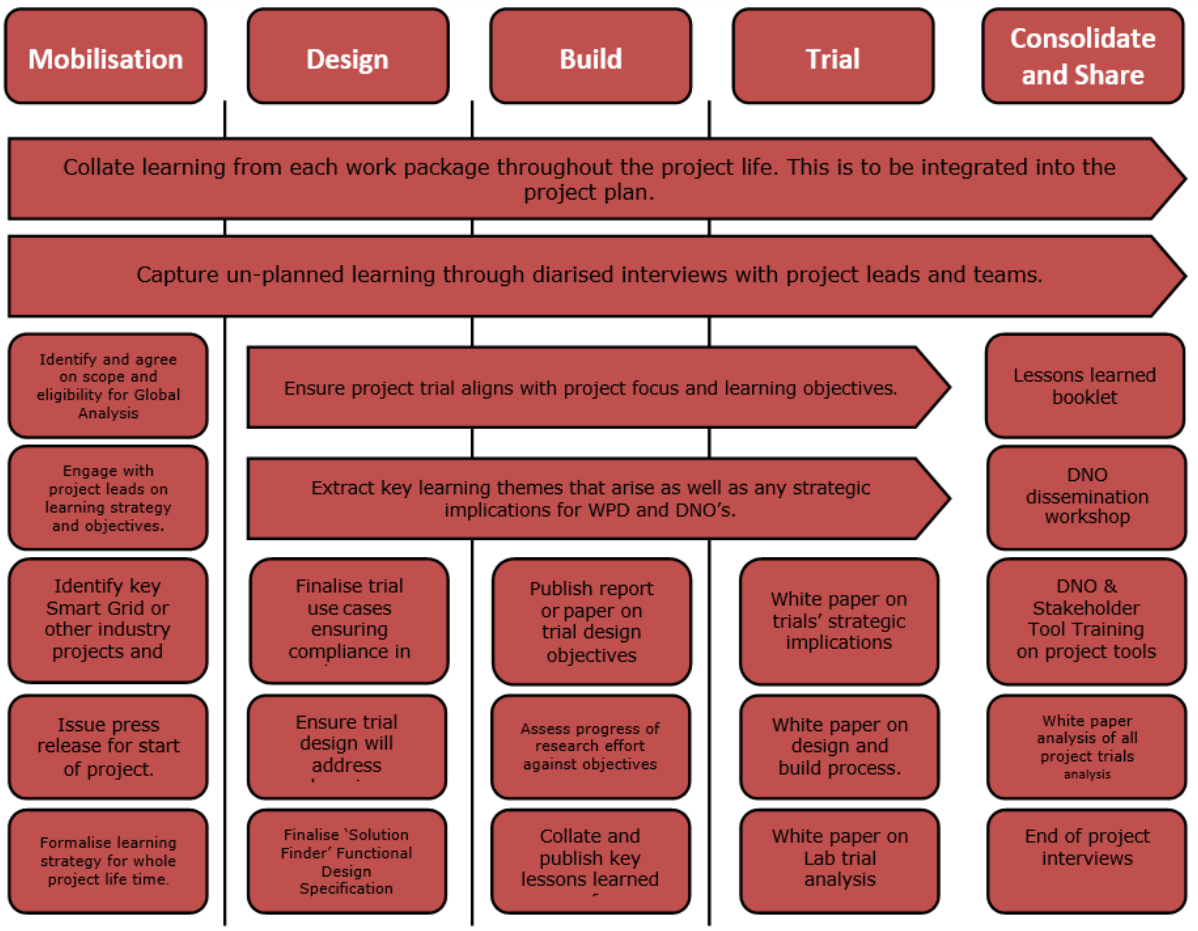


Figure 5.1 – Overview of learning activities of *Telecoms Templates*

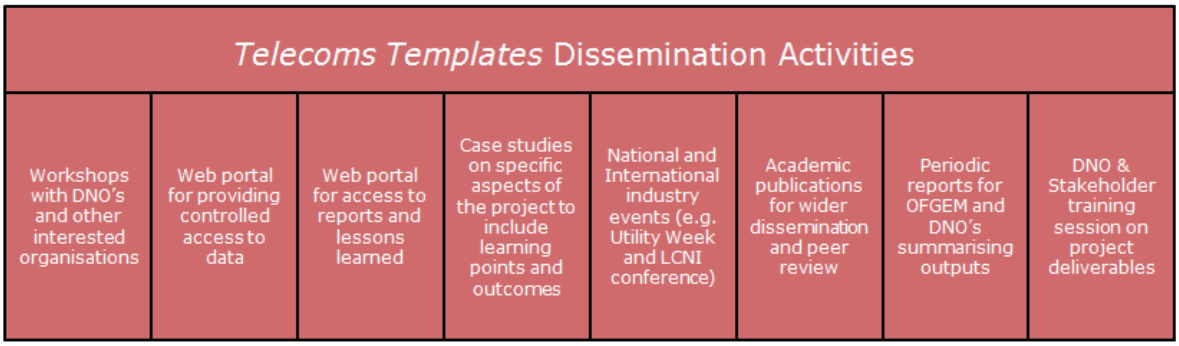


Figure 5.2 – Overview of *Telecoms Templates* Dissemination Activities

5.2.2 Plans for learning dissemination to Key Audiences

5.2.2.1 Distribution Network Operators

DNOs will be engaged throughout the project to ensure valuable industry learning is disseminated within a timely manner. Support for the project has already been received from NG, SPEN & NPg whom have issued a letter of support. Utilisation of frequent engagement sessions, both in the form of webinars and press-releases, and supplemented within formal events such as NIC conferences and WPD driven events will be delivered to provide maximum transparency regarding project findings to the DNOs.

Several DNOs have requested to engage with the project as collaborators and so will benefit from learning as it is generated as well as participating in knowledge development.

5.2.2.2 Industry Groups

Groups such as the Joint Radio Company (JRC), ENA, and wider utilities, will be engaged throughout the project, the prime interest of these bodies will be the learning outcomes from the Global Analysis Method, alongside the telecoms network planning tool, or Solutions Finder, to establish best-practice for the delivery of Smart Grid Systems and their supporting telecommunication infrastructure.

5.2.2.3 Telecoms Vendors

Engagement with telecoms system and product vendors is a core requirement of the project to ensure the solution providers are aware of the developments made within the project. The projects dissemination efforts will provide a valuable opportunity for the telecoms industry to integrate findings into future product development and ascertain operational feedback for any products and systems tested within the trial.

5.2.2.4 Academic Institutions

Universities and Higher Education establishments will share interests in the project learning generated. The Global Analysis and trial outputs will form the basis of best practice documentation and data which can be analysed by academic stakeholders with directive feedback provided regarding the project outcomes. As previously noted, Newcastle University have aided the development of this FSP using the knowledge from Customer Led Network Revolution (CLNR) and other LCNF projects. They already have an established Smart Grid lab which is being used for innovation projects. The final selection of Academic Institutions will be after the award of NIC funds.

5.2.2.5 Western Power Distribution

Learning captured throughout the project will be disseminated amongst key internal stakeholders – departments such as electrical and telecoms network planning, future networks, policy and standards teams, as well as the wider community, will be engaged with the expectation that knowledge generated will be incorporated into BAU activities as a result of *Telecoms Templates*.

5.2.2.6 Customers and Local Stakeholders

Interested parties, including the likes of local councils and their representatives, planning authorities, business leaders and other organisations will be kept abreast of project outcomes.

5.3. IPR

The project conforms with the default IPR requirements as set out in NIC Governance Document v2.0.

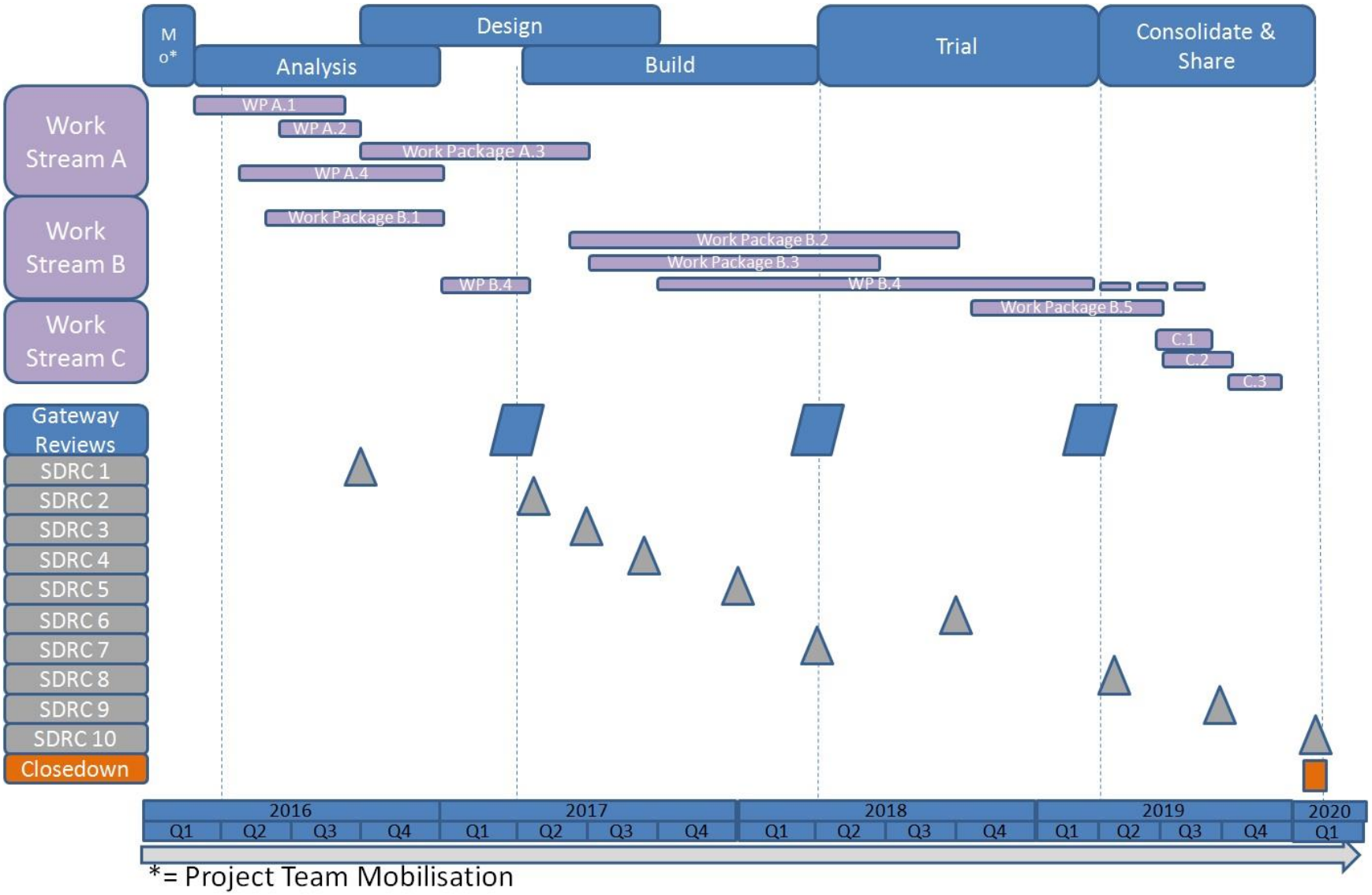


Figure 5.3 – Telecoms Templates Delivery Overview

Section 6: Project Readiness

Requested level of protection required against cost over-runs (%): 0%

Requested level of protection against Direct Benefits that they wish to apply for (%): 0%

6.1 Evidence of why the Project can start in a timely manner

Western Power Distribution is confident that the project can start in a timely manner. The importance of the project comes as the utility industry nears a cross-road regarding the evolution of Smart Grid Innovation into BAU delivery. The outputs of the project are an enabler to GB's transition towards a lower carbon economy, whilst also offering benefit in design, establishment and management of telecoms services – factors which will deliver service improvements for GB-wide distribution customers over the longer-term.

Due to the expected benefits, which will be delivered by *Telecoms Templates* for both generation and demand customers, consideration has been given in planning this Project for a timely start.

The following key focus areas provide the evidence that this Project is ready to start in January 2016:

1. Senior Management commitment and WPD's proven project governance framework is in place;
2. Engaging with WPD's internal stakeholders is complete;
3. Learning from the initiation of previous LCN Fund projects;
4. Building on previous IFI and LCN Fund projects;
6. Early FSP engagement with key stakeholders;
5. Streamlined procurement process and selecting Project collaborators;
7. Experienced Project delivery team already identified;
8. Project logistics and the Project Plan;
9. Engaging with customers; and
10. Initial industry baseline, early telecoms desktop review by Newcastle University

These elements are explained in more detail in the sections that follow. Sufficient time has been incorporated pre-mobilisation, between the funding award date and the planned start of *Telecoms Templates*, to ensure any risk of resource conflicts are eliminated.

WPD have already released an RFI to Industry collaborators to gauge the level of interest for likely participation in a project of this scale. The RFI identified that there was significant interest from technology vendors, service providers and technology consultancies to warrant a project of this scale. WPD have since issued a Pre-Qualification Questionnaire to select a Technical Consultancy to collaborate in project delivery. The next step is the issue of Request For Tenders and selection of suitable collaborator. The selected party will have tender issued with a view to contracts being in place upon a successful Telecoms Templates bid outcome.

WPD have existing framework agreements in place for Telecommunications Services and equipment as well as ancillary services and best value from the project will be realised

by utilising these where applicable. Where WPD engage with another DNO for the delivery of a trial, WPD would seek to use existing agreements held by the other DNO to, again, realise best value for the trial deliverables.

6.2 Evidence of how costs and benefits have been estimated

WPD have access to both BAU and innovative costs regarding the delivery of telecoms within real-world applications. This detailed knowledge of products, systems and environments has enabled a bottom-up review of the financial components of the project. These estimations have involved WPD Telecoms and WPD engineering departments to ensure that these costs are representative of the current market. Where required, WPD have also sought council from external experts to ensure assumptions made for systems which are to be developed are realistic.

Similarly the benefits have been collated from external publications – SGF WS3 Transform Model and ENA's Active Network Management 'Good Practice Guide' – alongside BAU DNO spend and finally the benefits associated with historic LCN Fund projects. We believe this approach provides a view of both the risk of not undertaking this project and also the benefit which could be realised via the availability of suitable telecoms within Smart Grid applications.

6.3 Evidence of the measures that WPD will employ to minimise possible cost overruns and shortfalls in Direct Benefits

- The costs have been collated using a top-down and bottom-up methodology ensuring continuity within the scope of the project and the Work Packages identified throughout.
- Vendor and supplier engagement has started in earnest throughout the FSP process, using both the responses received and the existing network of approved suppliers, WPD have validated the cost associated with commodity items and included these within the calculations providing a greater level of certainty throughout.
- A number of Work Packages (note: Section 6 holds the detailed schedule of works) have been created within the project to decompose the body of works attributable to each of the three workstreams (which include the three methods) being applied within the Project, providing a detailed overview of each area.
- WPD have demonstrated strong-governance throughout the delivery of previous LCNF projects, following the same process KPIs will be assigned and project tolerances established which will be monitored by WPD's senior management.
- The nature of the methods being trialled will allow for risk to be 'designed-out', whereby the Global Appraisal will demonstrate successes and failures of previous projects – the subsequent trials will be designed within the Laboratory testing and Field testing Methods to deliver maximum value to Ofgem and its stakeholders. Previous failures will be revised and improved to deliver the best-practice deliverables from the *Telecoms Templates* project.

Risk management processes will be implemented throughout the project to manage and mitigate the inherent risks throughout the delivery of the *Telecoms Templates* project. The project will employ a process similar to those demonstrated within innovation projects to-date; Figure 6.1 details the formal process. The risks will be captured within a RAID log, see Appendix 4: Project Risk Register and assigned an owner – based on

both the risk rating and the ability of the individual to manage risk. An example contingency plan is given in Appendix 5: Contingency Plan

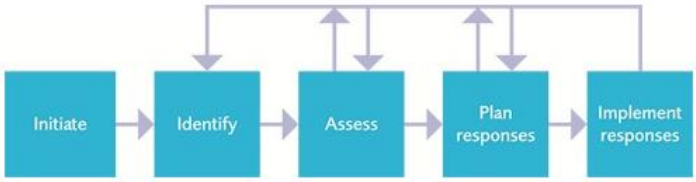


Figure 6.1 – Risk Management Process (APM, nd[5])

6.4 Verification of all the information included in the proposal

1. The Telecoms Template proposal has been prepared by Western Power Distribution in conjunction with Siemens and Newcastle University. Information has been sought from other potential Project collaborators and equipment suppliers throughout the FSP construction stage to confirm the assumptions made throughout the FSP process.

2. The bid has been prepared by an experienced team of engineers, individuals with both telecoms and electrical bias, led by a single Project Manager.

3. The proposal has been through independent checking and peer review processes to ensure the accuracy of information. The Full Submission Pro-forma has been reviewed by academic peers and industry experts to ensure the data provided is accurate and any assumptions stated correct.

4. Information from collaborators, service providers and equipment suppliers has been reviewed by WPD to ensure accuracy.

5. The Project submission has been reviewed and endorsed by WPD's Operations Director.

6.5 How the Project plan will still deliver learning in the event of fewer LCTs

The *Telecoms Templates* can demonstrate value to the industry as a whole in the form of both directive learning, establishing a best-practice approach to telecoms delivery and implementation within an increasingly connected world. The scale of LCT implementation from a GB network perspective will not hinder the outputs of the project for telecoms is acknowledged as a core requirement of expanding and increasingly intelligent BAU approaches within DNOs – the protection of disparate nodes within the network for example is often entirely dependent upon fibre-optic connectivity between these points.

Although the forecasted expansion of innovative, or smart, network management techniques will be driven in part with the growth of local embedded generation (LCT's such as solar PV, wind power or heat pumps), the increased volume of customer connections and the management of these links will grow the existing suite of approved network applications and the volume with which they are employed within the network. Therefore, the *Telecoms Templates* project will deliver necessary and timely direction to the DNOs, TSOs and wider utilities regarding the provision of a strategic approach to the delivery of telecoms solutions based on current and future network requirements.

6.6 Process to identify circumstances to suspend the Project

[5] Association of Project Management, (nd), 'Risk Management', [ONLINE], Available from http://knowledge.apm.org.uk/bok/risk-management

In-line with the formal practices which have been successfully applied and refined within previous WPD innovation projects, the following three-step review process will ensure that, if the project found itself in circumstances whereby the most appropriate course of action would be to suspend the project, pending Ofgem confirmation such steps could be taken.

6.6.1 Gateway Reviews

A series of gateway reviews have been planned for critical stages within the delivery lifecycle of the *Telecoms Templates* project. These include, though are not limited to, the review points identified within Figures 5.2 and 9.1.

The gateway reviews offer a formal review point, determining if the project can progress past its current position based on the information made available to-date. The review will include consideration of the technical, commercial and delivery efficiency, delivering further assurance to project stakeholders that the Project can progress unimpeded from this point onwards.

Within the gateway review, WPD senior management will provide a status for the project in accordance to the methodologies applied within previous LCNF projects. This Delivery Confidence Assessment will provide the Project team recommended actions, all of which will fall into one of the following categories;

1. Critical (Do Now): to increase the likelihood of a successful outcome, it is of the greatest importance that the Project should take action immediately;
2. Essential (Do By): to increase the likelihood of a successful outcome, the Project should take action in the near future. Whenever possible, essential recommendations should be linked to Project milestones and/or a specified timeframe;
3. Recommended: the Project would benefit from the uptake of this recommendation. If possible recommended actions should be linked to Project and/or a specified timeframe;
4. Halt the Project: the Project has exceeded the tolerances set and agreed at Project initiation and the situation is deemed to be irrecoverable. The Project is to be halted

6.6.2 Regular Project Review Meetings

WPD senior management, together with the Project Manager, will:

1. Be briefed on Project progress;
2. Review the Project Plan, cost model and the risk, assumptions, issues and dependencies (RAID) log;
3. Approve key outputs and milestones since the previous meeting;
4. Assess delivery against the Successful Delivery Reward Criteria;
5. Discuss and recommend Project changes;
6. Document and review actions; and
7. Assign an overall Red/Amber/Green (RAG) status to the Project, where red means the Project has severe delays affecting output, amber means the Project has delays affecting output or additional cost are required to deliver outputs on time and green means the Project is on time and budget.

6.6.3 Proactive Risk Management

WPD maintain a number of specialised risk management strategies. The Project risk controls are a subset of the overall risk management strategy, relating to the delivery of Future Networks Team projects. This proven and iterative approach is supplemented

with the directive telecoms risk management procedures implemented by WPD Telecoms, ensuring consideration of both electrical network and communication specialities throughout.

The risk management objectives are to:

- Ensure that risk management is clearly and consistently integrated into the project management activities and evidenced through the project documentation;
- Comply with WPD's risk management processes and any governance requirements as specified by Ofgem; and
- Anticipate and respond to changing Project requirements - these responses are developed to avoid, reduce, transfer or accept threats whilst also exploiting, enhancing, sharing or rejecting opportunities to increase the value of the Projects deliverables.

These objectives will be achieved by:

- Defining the roles, responsibilities and reporting lines within the team for risk management;
- Including risk management issues when writing reports and considering decisions;
- Maintaining a risk register;
- Communicating risks and ensuring suitable training and supervision is provided;
- Preparing mitigation action plans and contingency action plans;
- Disseminating progress and findings within WPD, ensuring the information is not siloed and best-practice followed; and
- Monitoring and updating risks and risk controls on a regular basis.

Section 7: Regulatory issues

7.1 Derogations

No derogations will be required for any of the three methods demonstrated within the *Telecoms Templates* project. As an iterative output of the project, the knowledge gained throughout the application of the three methods will improve utility understanding of how one can define 'fit-for-purpose' within a telecoms environment.

If appropriate such guidance, delivered within best-practice guides, the templates and Solutions Finder, can be used by the DNOs and third party expert groups (JRC et al) to refine internal policy and operations, achieving economies of scale in design and delivery and delivering further value to the customer. This strategic approach will then highlight any need for provision of alternate arrangements pertaining to spectrum, bandwidth, etc., to that which is currently available to the DNOs and utilities.

7.2 Licence consent

The Project does not require any additional License consents for the methods demonstrated.

7.3 Licence exemptions

The Project does not require any Licence exemptions for the methods demonstrated.

7.4 Changes to regulatory arrangements

The Project does not require any changes to regulatory arrangements for the methods demonstrated.

Section 8: Customer Impact

Generally communications requirements of smart grid applications reside at a level higher than the power distribution system itself. While conditions of the power network are the variables being monitored or controlled it is generally the case that a sensor or control interface, e.g. current transformer or tap change controller, will interface the communications to the power network.

This usually means that there is no direct disruption caused to the power networks through the deployment of the communications systems and hence no customer interruptions or outages would be expected as a result of the communications installation.

An exception to this might conceivably be where Power Line Carrier (PLC) is used as a communications medium, since this system requires direct electrical connection to the power lines themselves and will usually require these lines to be isolated. However PLC will not be deployed for its own purpose, but rather as an element of a wider smart grid application deployment and should this application require any interruption or outage then the PLC installation can be aligned to fit within this same window. By these means, further outages are avoided and once the PLC connection is in place it is likely to be capable of supporting further smart grid applications that may be required going forward without any further disruption to customers. Any and all customer impact will be detailed in the project customer communications plan.

Section 9: Successful Delivery Reward Criteria (SDRCs)

The Successful Delivery Reward Criterion (SDRC) have been developed for the *Telecoms Templates* project using the Specific, Measureable, Achievable, Relevant, Time-Bounded (S.M.A.R.T.) approach. Figure 5.3 provides a diagrammatic representation of the SDRC's alongside the work streams within.

SDRC-01 **Confirmation of Smart Grid Applications and Network Locations that are required to cover the scope of Telecoms Templates and completion of the Design Framework Methodology**

Across the varied terrain and working practices of DNOs in GB, there are broad requirements for communications solutions to suit many BAU and Smart Grid applications. The range of applications and the network situations in which they are situated across GB are assessed so that the project can target delivery of a comprehensive series of excellent, fit for purpose, Templates.
Evidence gathering and evaluation of the wider community's experience will confirm and strengthen the rationale for the specific investigations that are undertaken in the project. Defining the smart grid applications and their communications solution needs will lead to a clearly defined set of metrics against which performance can be measured in the Design Framework Methodology

Specific	Measurable	Achievable	Relevant	Time-bounded
Stakeholder engagement workshop and Smart Grid Service Evaluation Report	Workshop and report, including documented minutes for stakeholder dissemination. Smart grid service report.	The principles of target communications solutions and defining smart grid services developed at the FSP stage provides the basis for this.	Evidence from the wider community will confirm and strengthen the rationale for specific investigations. Metrics for smart grid services are essential.	To be submitted as part of Desktop Evaluation/ Templates Baseline, 30th Sep 2016.

EVIDENCE -

1. Workshop conducted with DNOs and other relevant stakeholders to probe experience in communication dependencies in smart grid projects.
2. Report shared with industry detailing the evidence collected during the workshop on the performance limitations experienced when using the dominant communication solutions.
3. Smart Grid Services review report, anticipated to contain chapters titled:
    a. Telecoms Encyclopaedia for Smart Grids (Issue 1)
    b. Metrics for measuring performance criteria
    c. Data requirements for smart grid applications
    d. Network Templates – An Industry Baseline

SDRC-02 **Template Feasibility Testing – Proof of Concept for Screening of Build Options**

Laboratory trials will be used to carry out high volumes of robust tests under controlled conditions on the candidate communications technologies. This benchmarking of industry practice and performance will provide unequivocal results, not confused by site-specific degradation effects, on which to base the upper limits of achievable functionality. The manner in which degradation takes place when non-ideal conditions are artificially introduced will provide the reference to which field trials are compared. The catalogue of

laboratory results can also serve as a valuable resource to DNOs for diagnosing poor performance on telecoms links.

Specific	Measurable	Achievable	Relevant	Time-bounded
Infrastructure Laboratory Trials	Delivery of a report from laboratory trials designed to benchmark telecoms hardware under a range of conditions.	Inclusion of a research organisation with the necessary expertise in power systems and communications technologies will provide the necessary expertise.	This activity complements the smart grid service evaluation report, providing the candidate solutions that can meet the service requirements.	To be submitted as part of Desktop Evaluation/ Templates Baseline.28th April 2017.

EVIDENCE -

1. Report containing the findings of a series of laboratory trials designed to:
    a. Determine the best-case communications performance under ideal laboratory conditions.
    b. Stress typical telecoms hardware, defining the limitations of products and approaches.
2. Summary document providing the key metrics

SDRC-03 **Site Selection and Build Design for Smart Grid Applications Service Trials**

At the core of the project, the testing of communications infrastructure on electricity distribution networks will produce the essential evidence to sit behind the Solutions Finder Solutions Finder tool. Although DNOs are familiar with deploying communications solutions, where field experience of specific technologies is less established vendors will be required to support the planning of deployments. At each site, the design process will be used to justify the matching of Smart Grid Services to Communication Technologies against the defined metrics.

Specific	Measurable	Achievable	Relevant	Time-bounded
Trial Methodology & Initial Project Selection.	Delivery of a report on the network trial areas selected for project infrastructure establishment.	Specific support will be obtained from suppliers of the communication variants within the project scope.	Will produce the evidence to sit behind the Solutions Finder tool.	To be submitted as part of Infrastructure Establishment, 30th June 2017.

EVIDENCE -

1. Report on the method that brings together the Smart Grid Service and Communication Technology.
2. Sites selected for trials.
3. Specification of smart grid service and communication technologies that will be tested at each site.

SDRC-04 **DNO Consultative Workshop**

A workshop will be held to attain engagement from the community that the project is heading in a direction that will show the best benefit for all DNOs. This is timed to be after the major design phases, but before the entire trial programme is locked down, so that amendments are possible that reflect the consensus view of the routes to greatest benefit for all.

Specific	Measurable	Achievable	Relevant	Time-bounded
DNO engagement workshop.	Workshop and report, including documented minutes for dissemination to DNOs.	Major design phases will be complete and ready for feedback.	Applicability to all of GB and thus future adoption is increased through consultation.	To be submitted as part of Infrastructure Establishment workstream, 29th September 2017

EVIDENCE -

1. Workshop conducted with DNOs to validate that the benefits from the project will be appropriate across the community.
2. Report shared with industry detailing the evidence collected during the workshop on the relevance of the approaches adopted in the project.

SDRC-05 **Design of the Solutions Finder tool**

By following a careful design process the Solutions Finder scope will meet the need to identify fit for purpose communications technologies, yet be controlled and managed within time and financial budget. The product will be measured against a User Requirements Specification and consequent Design Specifications. This blueprint will define the inputs, outputs and methods used by the Solutions Finder.

Specific	Measurable	Achievable	Relevant	Time-bounded
Detailed design of Solutions Finder.	Report on the development of the Solutions Finder specifications.	Experts will be approached within the project to deliver the solution	The Solutions Finder is a principle output of Telecoms Templates.	To be submitted as part of Infrastructure Establishment, 26th Jan 2018

EVIDENCE -

Delivery of a report on the detailed design of the Solutions Finder is anticipated to contain chapters titled:

1. Solutions Finder technical specification (URS).
2. Solutions Finder algorithm design.
3. Indicative Solutions Finder detailed outcomes.

SDRC-06 **Tested and updated Solutions Finder tool delivery**

Following trialling of the Solutions Finder methodology, formal release of the Beta version of the Solutions Finder will make this resource available to the wider DNO community. This will enable others to use the findings of Telecoms Templates in their organisations to plan the fit for purpose communications technologies for their smart grid applications.

Specific	Measurable	Achievable	Relevant	Time-bounded
Formal release of the Solutions Finder tool	Solutions Finder will be available to the DNO community for beta-testing.	Experts will be approached within the project to deliver the solution	During the project the Solutions Finder will be developed to meet the needs of the DNO community.	To be submitted as part of Infrastructure Establishment, 28th Sept 2018

EVIDENCE –

1. Delivery of the Beta Solutions Finder for use during trials.
2. Delivery of guide to support use of the Solutions Finder.

SDRC-07 **Commencement of Project Field Trials**

Trials will be undertaken both in areas of network where Smart Grid Services have been attempted previously (Retro-fit) and completely new areas where services are to be delivered for the first time. The commencement of trials is marked in this SDRC by the delivery of a report detailing the Smart Grid Service requirement and process for the evaluation and selection of complimentary communications solutions. Issues arising in deployment will also be reported.

Specific	Measurable	Achievable	Relevant	Time-bounded
Retro-fit and new trials underway	Delivery of a report on the network trial projects' infrastructure establishment.	Specific deployment support will be obtained from suppliers of the applied communication variants.	Testing of communications infrastructure on electricity distribution networks is essential to populate the Solutions Finder and evaluator.	To be submitted as part of Infrastructure Establishment, 30th Mar 2018

EVIDENCE -

Reports on the lessons learnt in the deployment of the smart grid application and communication method. Anticipated to contain chapters titled:

1. Site descriptions.
2. Deployment process for communications infrastructure.
3. Integration with existing systems.

SDRC-08 **Completion of Smart Grid Application Template Trials**

Without live trials, the actual performance of the candidate communications technologies in delivering smart grid services will not be known. Unprejudiced investigation of the links and interfaces will provide the DNOs with the means to make informed decisions on the specification of fit for purpose communications infrastructure.

This will provide practical confirmation of the enhancements that the Telecoms Templates method provides in selecting the communications technologies used to deliver the smart grid service at each site. Fit for purpose communications will be shown to be delivered by the method. The close working of WPD and Surf Telecom makes this the ideal Network License area to carry out this project.

Specific	Measurable	Achievable	Relevant	Time-bounded
Trialling and Demonstrating the Telecoms Templates	Report on the trialling and demonstration of the Enhanced Testing/ Templates Development Method.	The previous steps control the arrival at this stage, reducing the risk of difficulties in the live trials.	Live trials validate the actual performance of the candidate communications technologies in delivering smart grid services.	To be submitted as part of Infrastructure Establishment, 26th April 2019

EVIDENCE -

Delivery of a report on the trialling and demonstration of the Enhanced Testing/ Templates Development Method; the report is anticipated to contain chapters titled:

1. Vendor 'best-practice' reports.
2. Performance specifications.
3. Experience from matching smart grid services to communications technologies.

4. Experience of interfacing communications technologies.

SDRC-09 **Lessons Learned and Dissemination with Industry Stakeholders**

A closedown report to summarise the knowledge generated, learning from the project and dissemination activities within Telecoms Templates.

Specific	Measurable	Achievable	Relevant	Time-bounded
Knowledge Capture & Dissemination	Project closedown report.	All the necessary materials will be produced throughout the course of the project.	Timely and appropriately constructed materials are vital to capturing the benefits of this innovation project.	To be submitted as part of Analysis & Dissemination, 27th September 2019

EVIDENCE -
Delivery of a report anticipated to contain chapters titled:

1. Details of knowledge and learning dissemination reports and presentations (Including links to publically available documents);
2. Details of trials Data (The contact details for requesting data will be included);
3. Details of Six-monthly progress reports submitted (Including links to these documents);
4. Details of Telecoms Templates presentations (Including links to publically available presentations).
5. Delivery of a report which highlights the process behind the creation of Telecoms Templates – demonstrating critical learning for the project applicable to other DNOs.
6. Release of the formal Solutions Finder Tool

SDRC-10 **Targeted Dissemination and Knowledge Transfer to Other GB Network Operators**

By attending this event, practitioners will become competent in the capabilities of the Solutions Finder and its underlying principles. The learning developed during the project; identification of smart gird services, selection of communications technologies, trials and Solutions Finder development will be used in the training package developed for this essential dissemination activity. By focussing this event on practitioners it will ensure that the capabilities of the Solutions Finder and underlying principles are understood by the technical personnel of the DNOs.

Specific	Measurable	Achievable	Relevant	Time-bounded
DNO Engagement & Training	Practitioner focussed event.	Reports will be available to develop into a training package.	Will facilitate understanding by the technical personnel of the DNOs.	To be submitted as part of Analysis & Dissemination – 31st January 2020

EVIDENCE -
Deliver a training event that covers:

1. Smart grid service requirements.
2. Candidate communication technologies.
3. Real-world performance problems
4. Solutions Finder capabilities.

Section 10: List of Appendices

Appendix	Description
1: Benefits Tables	a. Financial Benefits; The estimated net financial benefit of the project. b. Carbon benefits; Summary of the total carbon benefits the project is expected to deliver. c. Headline Benefits of Telecoms Templates
2: Maps and network diagrams to help explain the technical detail of the Project	Network topology and connectivity diagram and Technology and application matrix
3: Detailed Project Delivery Schedule	Detailed GANTT chart detailing the project activities and timelines
4: Project Risk Register	Document capturing the project risks and their severity
5: Contingency Plan	Document capturing the most severe project risks identified at the bid stage and provision of an appropriate contingency if the risk turns in to an issue
6: Project Delivery Organogram	Overview of the roles and responsibilities of each project supplier and an organogram of the project teams structure
7: Base-Case Cost Breakdown	Summarised description of the method used to determine benefits of a top down approach
8: Ofgem Cost Spreadsheet	Detailed cost spreadsheet showing the complete cost of the project and the spend per regulatory year
9: Stakeholder Letters of Support	Letters of support provided by organisations that see value in this project being awarded and delivered to add knowledge and learning to the electricity network industry
10: Detailed Project Trial Breakdown	Detailed description of the project approach including SGAM representation and trial methods
11: An Initial Review of Telecoms and their Suitability within modern electrical networks (Excerpt)	Review of communications experiences from wide ranging markets in the power environment
12: Glossary of Terms	Explanations of terms used throughout the bid documentation

Section 11: Addendum

Since original submission of the Full Submission Proforma for Telecoms Templates, a number of points of issue and questions have been raised by OFGEM. For clarity, the following points have been ammended following direct Q & A's as well as the responses to specific queries raised during the Bilateral presentations.

Page 2 Section 1.2	Revision to initial wording
Page 5 Section 2.1.1	Removal of diagram.
Page 12 Section 2.2	Addition of wording clarifying the Project Legacy
Page 15 Section 3	Diagram ammended to demonstrate the communications media deployed within funded LCNF projects to date.
Page 33 Section 6.1	Additional paragraph to address the procurement needs of the project if successful in funding request.
Page 50 Appendix 1c.	Paragraph wording ammended to address queries raised pertinent to the financial benefits realised with the delivery of the project.
Page 56 Appendix 2	Missing text added following '15 trials have been identified to address..'
Page 64 Appendix 5	Additional wording to clarify the four risks identified in the contincency plan submitted within the FSP.
P.s 78-98 Appendix 10	Additional wording and diagrams to expand the supporting information relevant to the three methods outlined in Appendix 10.

Appendix 1: Benefits Tables

KEY

Method	Method name
Method 1	Telecoms Templates (Inclusive of all methods detailed within the FSP)
Method 2	Not Applicable
Method 3	Not Applicable

1a. Financial benefits

Financial benefit (£m)								
Scale	**Method[1]**	**Method Cost**	**Base Case Cost**	**Benefit[3]**			**Notes**	**Cross-references**
				2020[2]	**2030**	**2050**		
Post-trial solution *(individual deployment)*	Telecoms Templates	£8.5m	£38m	-£0.45m	£8.83m	£29.51m	The figures used within the table are derived from the Smart Grid forum workstream 3 'Transform Model' work. This takes a holistic view of Smart Grid deployment costs across GB and apportions percentages to enablers, including telecoms. Hence the values stated are exemplary only.	The Base-Case costs and benefits, based on the Transform Model' are explained in more detail in Section 3 – Project Business Case.
Licensee scale	Telecoms Templates	£34m	£152m	-£1.84m	£36.31m	£118.05m	Number of sites:4 license areas which represents the total number of license areas under the responsibility of WPD	
GB rollout scale	Telecoms Templates	£119m	£532m	-£6.42m	£123.58m	£413.17m	Number of sites:14 license areas which represents the total number of license areas within the UK	

Notes

1) *WPD consider the three individual methods employed within telecoms templates to be necessary to deliver the full value of the strategic top-down approach to telecoms implementation within distribution networks. Therefore only one method has been identified within the tables above.*
2) *The benefits shown within the 2020 column are realised as a minus figure. This is due to the upfront cost of delivering a smart top-down investment in telecoms which would not be applied if the smart incremental approach was used. From 2030 onwards the financial benefits are positive within a deployment on any scale.*
3) *The benefits shown during 2020 - 2050 are cumulative, therefore the maximum potential benefit realised via the application of a Smart Top-Down Investment approach within telecoms would be £413.17m.*

1b. Carbon benefits

Capacity released and/ or environmental benefit (kVA/ kWh)								
Scale	**Method**	**Method Cost**	**Base Case Cost**	**2020**	**2030**	**2050**	**Notes**	**Cross-references**
Post-trial solution *(individual deployment)*	Telecoms Templates	n/a	n/a	n/a	n/a	n/a	The telecoms templates project will not directly realise any capacity release within the network, however the associated benefits of the smart top-down approach to telecoms will enable to transition to a low carbon economy and provide significant value to UK DNOs.	Appendix 1 demonstrates the importance of telecoms in releasing capacity and environmental benefits within Smart Grid applications.
Licensee scale	Telecoms Templates	n/a	n/a	n/a	n/a	n/a	As Above	As Above
GB rollout scale	Telecoms Templates	n/a	n/a	n/a	n/a	n/a	As Above	As Above

	Post-trial solution: [Explain any carbon and/ or environmental benefits which cannot be expressed as kVA or kWh]	n/a	n/a
	Licensee scale: [Explain any carbon and/ or environmental benefits which cannot be expressed as capacity or kVA or kWh]		
	GB rollout scale: [Explain any carbon and/ or environmental benefits which cannot be expressed as kVA or kWh]		

1c. Headline benefits of *Telecoms Templates*

The difficulties faced in assessing project benefits for the Telecoms Templates (TT) submission arise because telecommunications is a supporting activity to the power distribution mainstream, and also because the potential benefits are not based on a single localised project, but are across the entire network. It was therefore decided to evaluate benefits under two distinct headings:

1. The reduced cost over the 2020-2050 period of providing a communications infrastructure that could be realised by adopting an optimised 'top down' approach, instead of the 'bottom up' approach where each project adopts its own individual telecommunications technology, and

2. Avoiding delays to the roll-out of smart grid technology, and therefore delays to the cost and carbon savings they would create, caused by the extra time needed to resolve telecommunications issues in many cases.

Benefit Type 1 - Reduced Communications Costs

The potential reduction in overall communications infrastructure costs was derived from the Transform model, produced by Work stream 3 of the Smart Grid Forum (SGF) project. Further details of this project are detailed in Appendix 7 of the main submission. This project concluded that, in the absence of a co-ordinated 'top down' approach, the total cost of providing a fit-for-purpose communications infrastructure across the GB network would be **£532M**[6] over the 2020-2050 period**.** However, if a top down approach were adopted, this cost would reduce to **£119M,** an overall reduction of **£413M** over the 30 year period beginning in 2020. The aim of TT is to produce precisely this kind of top down approach, which has been noticeably absent from smart grid projects to date. It is therefore considered reasonable to claim this potential reduction as a benefit of the TT project.

As a reality check on these figures, the RIIO submissions of DNOs for the period 2015-2023 were consulted. The SGF 'bottom-up' estimate of £532M over 30 years equates to £17.7M per year, or (further dividing by 14 DNO franchises) to **£1.25M** per franchise area per year. This can be compared with the WPD RIIO estimate of **£1.47M** per franchise area per year, or with the Northern Powergrid RIIO estimate of £ **£ 2.81**[7] per franchise area per year (including some one off construction activities. It seems that the SGF estimates for 'business as usual' (bottom up) are realistic, and it is believed that their 'top down' estimates are equally realistic.

[6] Confirmed as undiscounted from Smart Grid Forum Workstream 3 document, Table 8.4 Page 103 and Table 8.5 Page 104.
[7] Where it has been possible to check, it has been confirmed that these totals and averages are based on undiscounted figures. If in some other cases they have been discounted in the original calculations by the DNO's concerned, then the raw totals would need to be increased accordingly.

Avoiding Roll-Out Delays

A consensus from many smart grid projects already reported (see Appendix 11) is that telecommunications issues have arisen which have affected deployment at project level, and would potentially be even more serious (because of the far greater volume of communications required) at roll-out to business as usual. At best it could delay implementation considerably, at worst it could preclude implementation altogether.

A number of Ofgem funded 'smart innovation' projects referenced in Table 1.1 below, received their funding based on creditable financial and carbon saving proposals from a successful UK-wide BAU roll-out. Most, although not all, projects report communications issues, indicating that all these savings are subjected to a **high level of risk** if the selected telecoms infrastructure fails to perform to meet the needs of the smart solution and electricity distribution industry as a whole. The savings which are at risk can be quantified as:

157.79 million tonnes of CO_2 reductions

£1.6 billion cost savings across the UK

The number and size of projects which may be carried out in the future, for deployment in 2020-2050, is almost impossible to estimate. This estimate is therefore based only on projects which had already been carried out, and for this purpose a subset of 16 projects was chosen (see Table 1.1). All of the referenced projects have been considered within these calculations with the exception of *Low Carbon London* which claims circa 14 times more carbon reduction than the next nearest project, and circa 8 times more UK-wide financial benefit than the next nearest project.

On this basis, 11 projects (A, B, C, D, E, G, H, K, L, M, O) claim a specific UK-wide carbon reduction, ranging from 0.7 MT up to 43.5 MT (for the largest project, CLNR), giving a total across the 11 projects of **157 MT**. Based on the CLNR rate of £6bn for 43.5 MT, this can be capitalised at around **£21.66bn**.

On the same basis, 12 projects (B, D, E, G, H, I, K, L, M, N, O, P) claim UK-wide cost savings ranging from £2M up to £1,500M (using the £659M figure for project M not the £3,700M), giving a total across the 12 projects of **£5.37bn**.

Adding these cost savings, already accepted by Ofgem as part of approved project submissions, to the capitalised carbon savings yields **£27.03bn** from 14 projects. This can be used as a baseline, although it is reasonable to expect that projects in future years would only serve to increase this figure.

The impact of Telecoms Templates on these projects will vary. At one extreme, the projects will have robustly accounted for their telecoms so well, that there is no benefit to be gained, however experience suggests that this is not the norm. At the other extreme, the failure of adequate telecoms could hazard the whole project for an indefinite duration. A median case could be that project UK-wide BAU implementation is delayed by 2-4 years while telecoms problems are corrected. We assume the more modest time scale of **2 years** in our benefits analysis.

Using a discount rate of **6**%, the 'cost' of a 2 year delay is approximately **12**% of anticipated project benefits. Although most projects report communications issues, not all do, so we assume that only **50**% of projects experience this 2 year delay, the benefits lost without Telecoms Templates approaches can be calculated at:

12% × 50% × £27bn = £1.62bn

On this basis, a claim of **£1.62bn** across the UK, for a £14M project, is in keeping with other LCNF projects. It can be explained that the evaluation of benefits for Telecoms Templates is not as clear and easily achieved than for electricity network projects, but that this claim is both conservative and realistic.

Table 1.1 – Comparison of Financial and Carbon Savings from LCNF Projects

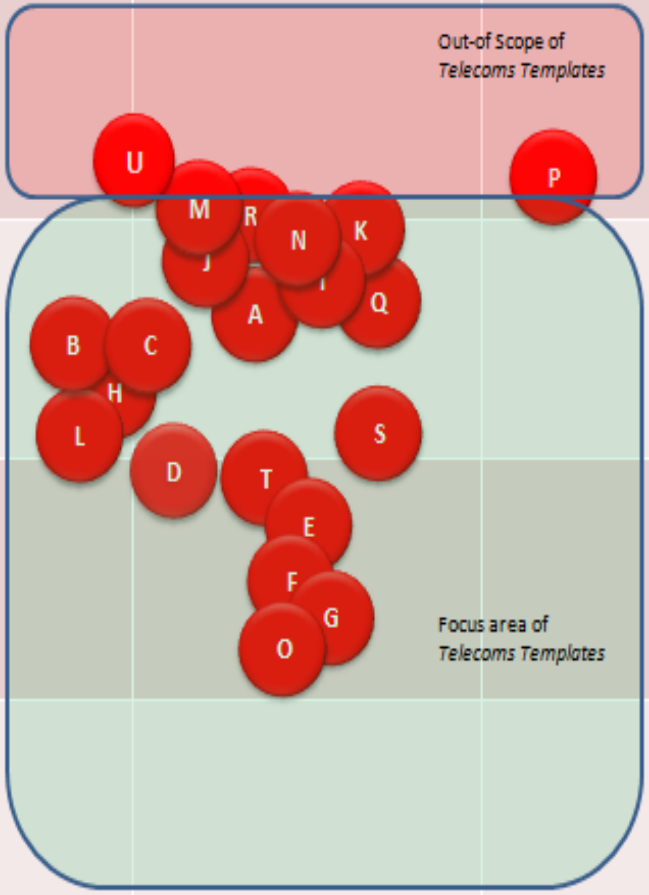
Project Ref	LCN Fund Project	CO_2 Savings (Estimated)	Net Financial Benefit (estimated)	Capacity Release
A	CLASS	Benefit to GB up to 237,888Tco2e over RIIO-ED1 (from DR) + 3,282,819Tco2e over RIIO-ED1 (from reactive power)		
		Expected to enable Total asset carbon deferral of 16,266 Tco2eq UK wide	Expected to defer a UK wide total of £75.9M expenditure on traditional re-inforcement	
B	Smart Street (eta)	Up to -30MTco2e UK wide Over 25 years	Savings over time Eta (scaled) compared to traditional -£2,273,050	
C	Customer-Led Network Revolution	43.5MT of carbon savings from 2020 equating to £6bn – UK wide		
D	My Electric Avenue	33.5MTco2e by 2030	£13.99M BY 2040	
E	Thames Valley Vision	34MTco2e between 2018 and 2050	£600M 2020-2050	
F	Accelerating Renewable Connections		£260m	
G	Flexible Networks for a Low Carbon Future	680KTco2e 2016 to 2050	£36.3M 2016 to 2050	
H	Flexible Plug and Play Low Carbon Networks	4.8MTco2e	£192m	
I	Flexible Urban Networks - Low Voltage	3.4ktonnes @ project level	£112.8m	162MW across GB – latter half of ED1 through ED2

Project Ref	LCN Fund Project	CO_2 Savings (Estimated)	Net Financial Benefit (estimated)	Capacity Release
				10.1MW @ Project Level
J	Low Carbon London	600 mtonnes between 2011-50 NPV of £29bn by 2050	£12bn NPV of financial benefits for customers up to 2050	
K	Smarter Network Storage (SNS)	588 ktonnes by 2040 £13.1m NPV	Net benefit to the consumer estimated at £0.7bn by 2040 £4.5m benefit	
L	FLEXDGRID	5.05 MtCO2/ year offset through facilitating 6GW of generation using Fault Level Mitigation Technologies	Maximum £1,075m across GB over a 10 year period using Fault Level Mitigation Technologies Minimum of £10m across GB - over a 10yr period using Enhanced Fault Level Assessment	
M	FALCON	32% reduction of the carbon cost for reinforcement on lines and cables (BAU) yields 680 ktonnes total estimate Based on GB wide rollout of FALCON method 2016-50 NPV of carbon benefits to 2030 estimated at "114m	Estimate of project net financial benefit is £1.2m Estimated savings for GB is £659m over a 20 year period Assumptions are the estimated GB 11kV network reinforcement cost (BAU) is £3.7b – 50% LC Penetration by 2030	
N	LV Network Templates	NPV of carbon benefits to 2030 estimated at £114m	£466.18m Calculated from@ benefit from microgeneration numbers incorporated into NG scheduling (£114.39m) Template re-use benefit (£4.04m) Reduction in transformer failure (£4.12m) Loss reduction benefit (£1.39m) Energy saving benefit (£13.38m) Network deferral – transformers benefit (£80.23m) Network deferral – cables benefit	

Project Ref	LCN Fund Project	CO_2 Savings (Estimated)	Net Financial Benefit (estimated)	Capacity Release
			(£210.63m)	
O	SoLa Bristol (deployment of BRISTOL method estimated as 2,480 locations in GB by 2030)	2015-30 total savings 1,452 ktonnes	2015-30 total benefits against BAU £36,753,600	
P	Equilibrium		£1.5bn GB wide by 2050 Financial benefit by 2030 at p[project level – EVA method = 10m SVO method = £26m FPL method = £9.4m	11,320 MVA GB wide by 2050 EVA method unlock 81MW SVO method unlock 194MW FPL method unlock 36MW

Table 1.2 – Differentiator Table

LCNF project focus	Voltage Constraint	Current/thermal constraint	Fault Level Constraint
EHV Network			
HV Network			
LV Network			
Demand Side			



Project Ref	LCN Fund Project	Telecoms Enabler Applied
A	Capacity to Customers	UHF/WIMAX/PLC/Fibre
B	CLASS	GPRS/ Fibre
C	Smart Street (eta)	GPRS
D	Customer-Led Network Revolution	GPRS/ Fibre
E	My Electric Avenue	GSM/ GPRS/ PLC
F	Northern Isles New Energy Solutions	TCP/IP
G	Solent Achieving Value from Efficiency	GPRS
H	Thames Valley Vision	GPRS/ UMTS
I	Accelerating Renewable Connections	Not specified
J	Flexible Networks for a Low Carbon Future	GPRS/ RF
K	Flexible Plug and Play Low Carbon Networks	RF Mesh
L	Flexible Urban Networks - Low Voltage	Not specified
M	Low Carbon London	GPRS
N	Smarter Network Storage (SNS)	n/a
O	Vulnerable Customers and Energy Efficiency	GPRS
P	FLEXDGRID	GPRS
Q	FALCON	WiMAX/TCP/IP
R	Low Carbon Hub	Fibre/ Microwave
S	LV Network Templates	UHF
T	SoLa Bristol	GPRS
U	Equilibrium	UHF

Appendix 2: Maps and network diagrams to help explain the technical detail of the Project

02.1 – Trial Topology Overview

This topology diagram demonstrates the hierarchy of control and information flow throughout the proposed trial areas. This image demonstrating the required governance levels which will be developed and applied within the trial networks to ensure pertinent information is captured within a generic manner throughout all trial network locations.

02.2 – Trial Matrix

The trial matrix demonstrates how the Telecoms Templates project will trial telecoms technologies within the four template areas, SCADA/ Protection/ Semi-Autonomous Control/ Management, addressing a mix a geographic constraints in the process.

15 trials have been identified to address 80% of the needs from UK DNOs, the potential scale of which is demonstrated within 'Figure 2.1 – Trial Matrix' of the Full Submission Proposal, albeit this focuses on current technologies only.

The Global Appraisal method, consisting of a review including current applications of telecoms within the DNO environment and also detailed industry engagement, will verify the assumptions within this matrix to ensure only pertinent technologies and systems are tested within the most appropriate environments to address this 80% of requirements.

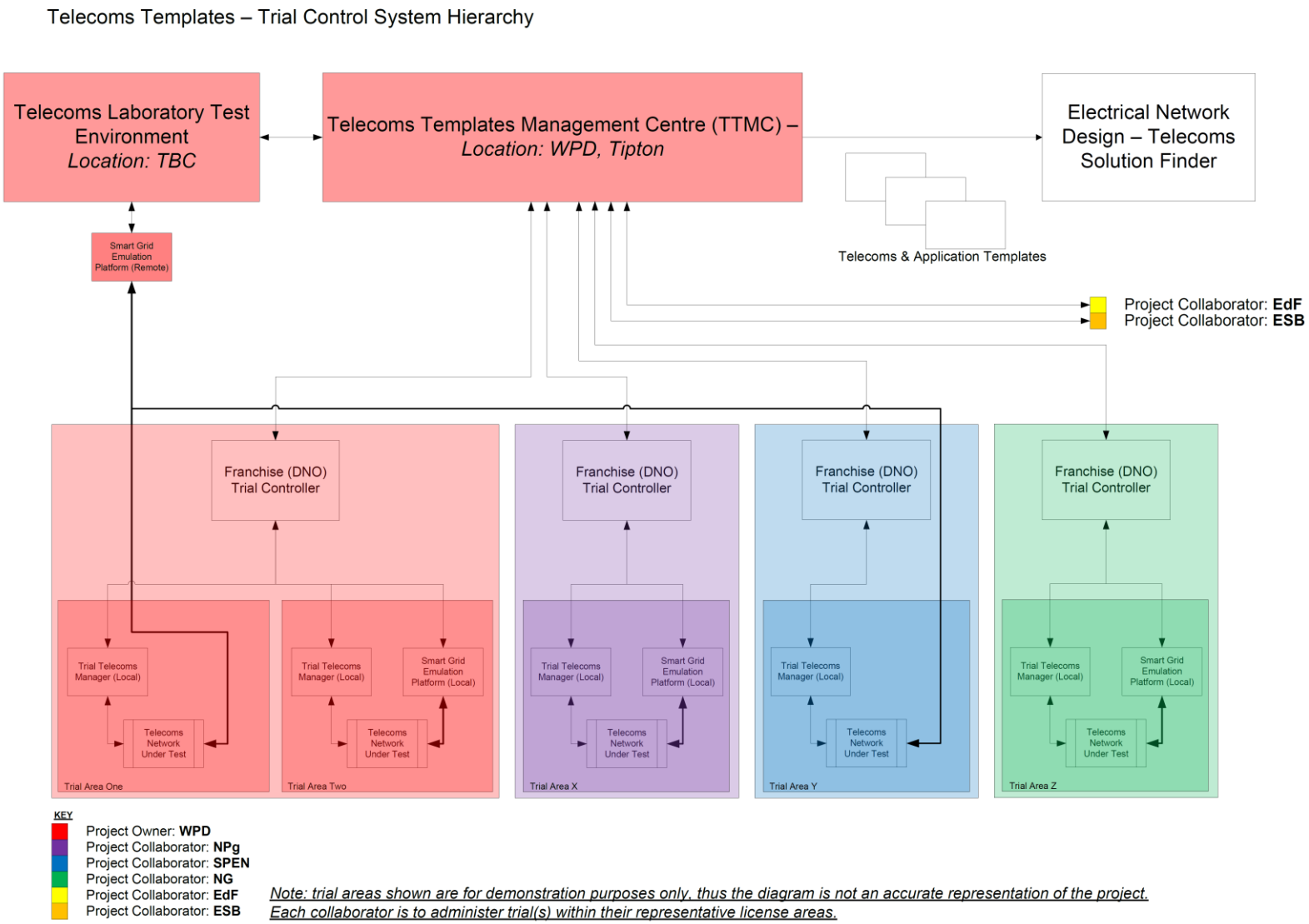


Figure 2.1 – Trial Topology Overview

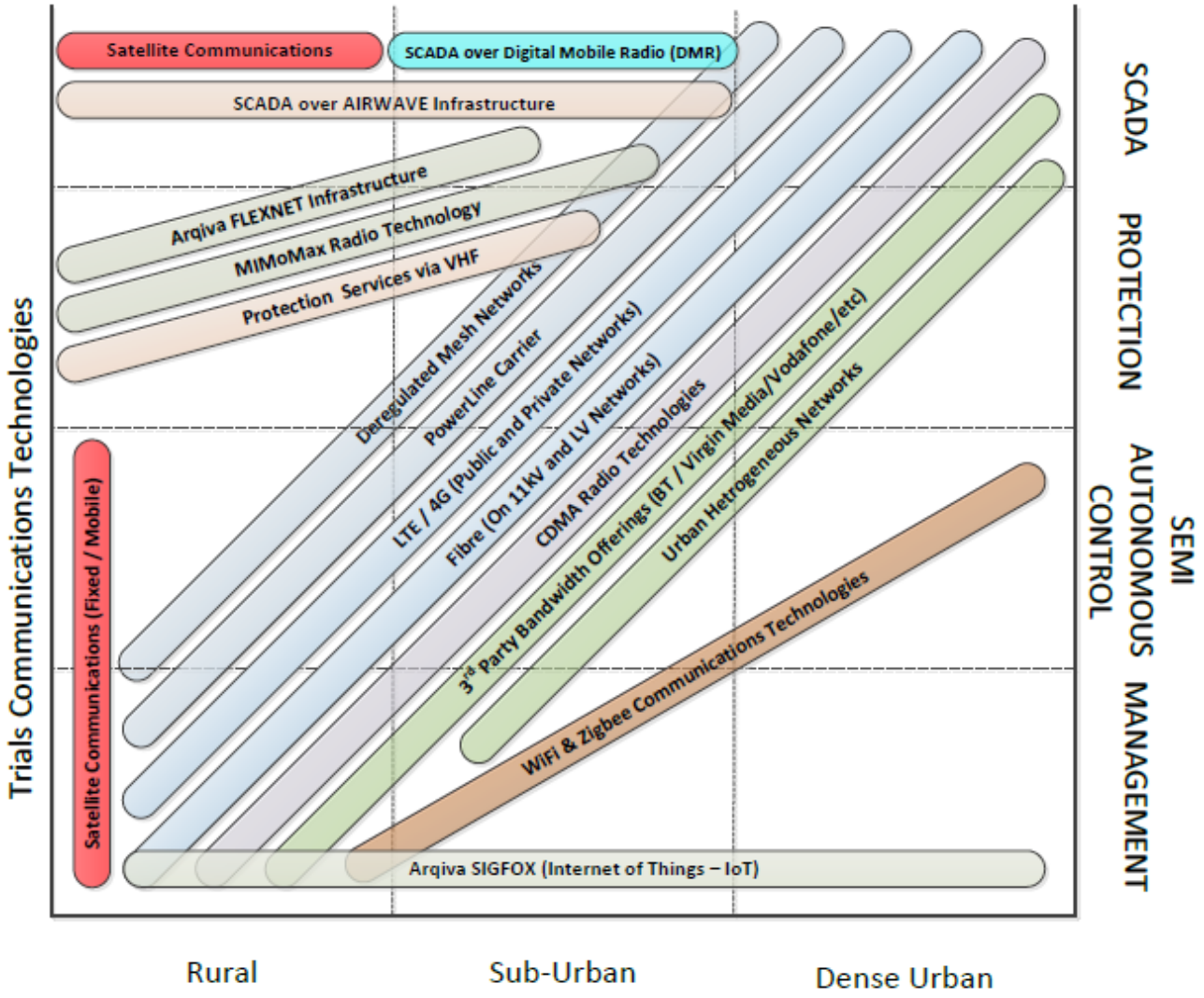
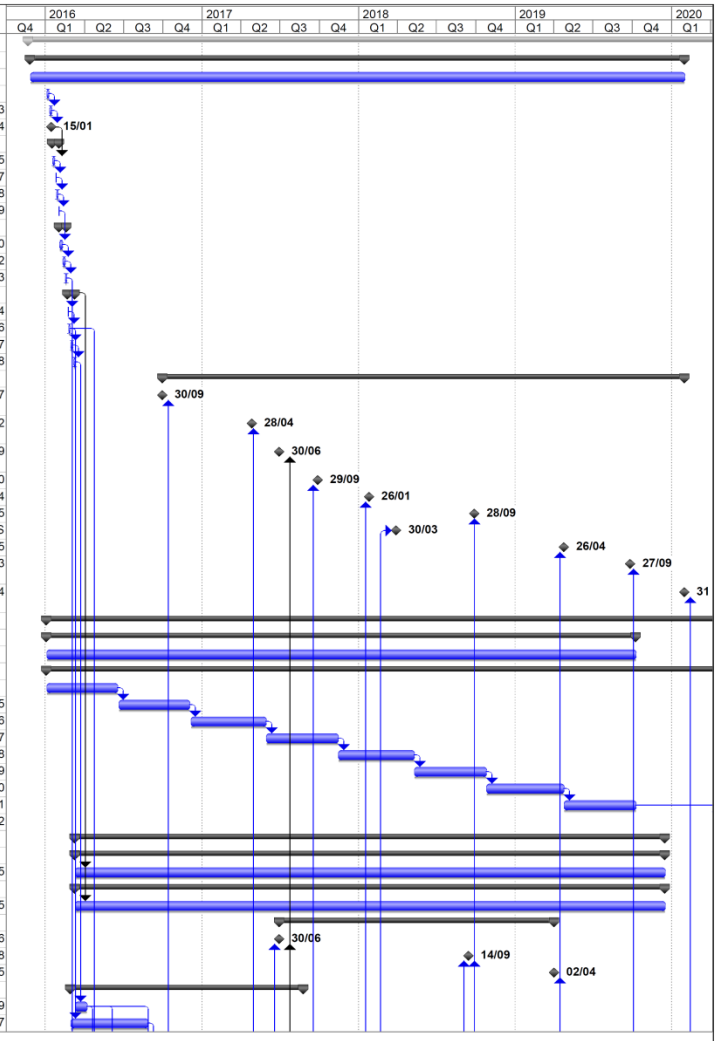


Figure 2.1 – Trial Matrix

Appendix 3: Detailed Project Delivery Schedule

ID	% Complete	Task Name	Duration	Start	Finish	Predecessors
0	0%	**WPD/ Telecoms Templates**	**1117 dys? on 23/11/15 hu 30/04/20**			
1	0%	**Project Management**	**1050 dys?**	**Fri 27/11/15**	**Fri 31/01/20**	
2	0%	Manage Project	1050 dys?	Fri 27/11/15	Fri 31/01/20	
3	0%	Produce PID	5 dys	Mon 04/01/16	Fri 08/01/16	
4	0%	PID Review	5 dys	Mon 11/01/16	Fri 15/01/16	3
5	0%	PID Approved	0 dys	Fri 15/01/16	Fri 15/01/16	4
6	0%	**Project Initiation**	**12 dys**	**Mon 18/01/16**	**Tue 02/02/16**	
7	0%	Consolidation in to existing governance structure	5 dys	Mon 18/01/16	Fri 22/01/16	5
8	0%	Establish Project Governance Requirements	2 dys	Mon 25/01/16	Tue 26/01/16	7
9	0%	Establish Project Tollerances	3 dys	Wed 27/01/16	Fri 29/01/16	8
10	0%	Confirm Escalation Process	2 dys	Mon 01/02/16	Tue 02/02/16	9
11	0%	**Bid Review**	**13 dys**	**Wed 03/02/16**	**Fri 19/02/16**	
12	0%	Review Aims	5 dys	Wed 03/02/16	Tue 09/02/16	10
13	0%	Review Objectives	4 dys	Wed 10/02/16	Mon 15/02/16	12
14	0%	Review Deliverables	4 dys	Tue 16/02/16	Fri 19/02/16	13
15	0%	**Mobilisation**	**13 dys**	**Mon 22/02/16**	**Wed 09/03/16**	
16	0%	Project Team Kick-Off Meeting	2 dys	Mon 22/02/16	Tue 23/02/16	14
17	0%	Update RAID Log	3 dys	Wed 24/02/16	Fri 26/02/16	16
18	0%	Set-Up Project Bank Account	5 dys	Mon 29/02/16	Fri 04/03/16	17
19	0%	Mobilisation to Design Gateway Review	3 dys	Mon 07/03/16	Wed 09/03/16	18
20	0%	**Project Deliverables**	**837 dys**	**Fri 30/09/16**	**Fri 31/01/20**	
21	0%	SDRC-1 - Establish clear Terms of Reference for the boundaries and dimensions of the Template Process and complete the Design Framework	0 dys	Fri 30/09/16	Fri 30/09/16	57
22	0%	SDRC-2 - Template Feasibility Testing – Proof of Concept for Screening of Build Options	0 mons	Fri 28/04/17	Fri 28/04/17	72
23	0%	SDRC-3 - Site Selection and Build Design for Smart Grid Applications Service Trials	0 dys	Fri 30/06/17	Fri 30/06/17	59
24	0%	SDRC-4 - DNO Consultative Workshop	0 dys	Fri 29/09/17	Fri 29/09/17	60
25	0%	SDRC-5 - Design of the Solution Generator tool	0 dys	Fri 26/01/18	Fri 26/01/18	64
26	0%	SDRC-6 - Tested and updated Solution Generator tool delivery	0 dys	Fri 28/09/18	Fri 28/09/18	65
27	0%	SDRC-7 - Commencement of Project Field Trials	0 dys	Fri 30/03/18	Fri 30/03/18	75SS
28	0%	SDRC-8 - Completion of Smart Grid Application Template Trials	0 dys	Fri 26/04/19	Fri 26/04/19	75
29	0%	SDRC-9 - Lessons Learned and Dissemination with Industry Stakeholders	0 dys	Fri 27/09/19	Fri 27/09/19	83
30	0%	SDRC-10 - Targeted Dissemination and Knowledge Transfer to Other UK Network Operators	0 dys	Fri 31/01/20	Fri 31/01/20	84
31	0%	**Project Reporting**	**1095 dys**	**Mon 04/01/16**	**Thu 30/04/20**	
32	0%	**Internal (WPD) Progress Reports**	**960 dys**	**Mon 04/01/16**	**Wed 09/10/19**	
33	0%	Monthly Updates to Snr Management	48 mons	Mon 04/01/16	Wed 09/10/19	
34	0%	**Ofegm Progress Reports**	**1095 dys**	**Mon 04/01/16**	**Thu 30/04/20**	
35	0%	1 - Six Monthly Report	6 mons	Mon 04/01/16	Fri 17/06/16	
36	0%	2 - Six Monthly Report	6 mons	Mon 20/06/16	Fri 02/12/16	35
37	0%	3 - Six Monthly Report	6 mons	Mon 05/12/16	Mon 29/05/17	36
38	0%	4 - Six Monthly Report	6 mons	Tue 30/05/17	Mon 13/11/17	37
39	0%	5 - Six Monthly Report	6 mons	Tue 14/11/17	Thu 10/05/18	38
40	0%	6 - Six Monthly Report	6 mons	Fri 11/05/18	Thu 25/10/18	39
41	0%	7- Six Monthly Report	6 mons	Fri 26/10/18	Wed 24/04/19	40
42	0%	8 - Six Monthly Report	6 mons	Thu 25/04/19	Wed 09/10/19	41
43	0%	Project Close-Down Report	0 dys	Thu 30/04/20	Thu 30/04/20	42
44	0%	**Project Meetings**	**960 dys**	**Thu 10/03/16**	**Mon 16/12/19**	
45	0%	**Project Team**	**960 dys**	**Thu 10/03/16**	**Mon 16/12/19**	
46	0%	Monthly	48 mons	Thu 10/03/16	Mon 16/12/19	15
47	0%	**Steering Group**	**960 dys**	**Thu 10/03/16**	**Mon 16/12/19**	
48	0%	Quartely	48 mons	Thu 10/03/16	Mon 16/12/19	15
49	0%	**Gateway Reviews**	**440 dys**	**Fri 30/06/17**	**Tue 02/04/19**	
50	0%	Design to Build	0 dys	Fri 30/06/17	Fri 30/06/17	59,61,66
51	0%	Build to Trials	0 dys	Fri 14/09/18	Fri 14/09/18	62,65,68
52	0%	Trials to Share	0 dys	Tue 02/04/19	Tue 02/04/19	75
53	0%	**Work Stream A - Desktop Evaluation/ Templates Baseline**	**384 dys**	**Mon 29/02/16**	**Fri 25/08/17**	
54	0%	(A.1) Stakeholder Interviews & Workshops - Design Input	1 mon	Thu 10/03/16	Wed 06/04/16	19
55	0%	(A.1) Desktop Evaluation	6.5 mons	Mon 29/02/16	Fri 26/08/16	17

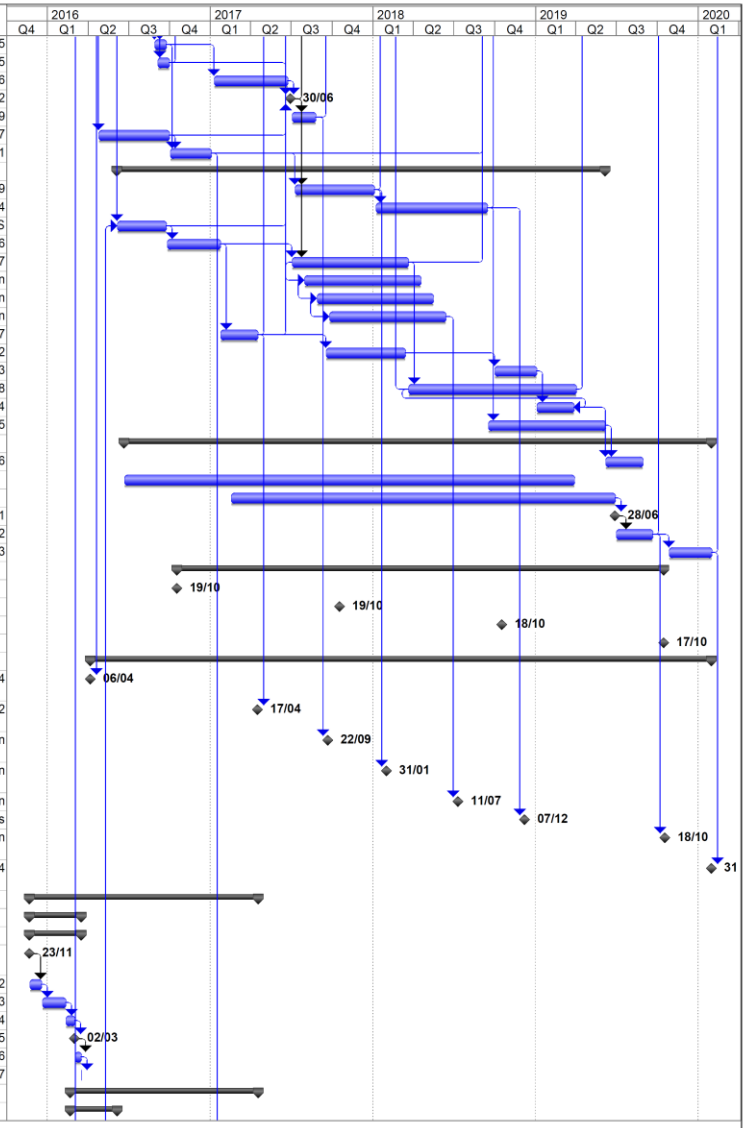


Project: WPD/ Telecoms Templates
Date: Fri 24/07/15

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

Page 1

ID	% Complete	Task Name	Duration	Start	Finish	Predecessors
56	0%	(A.2) Development of Metrics	1 mon	Mon 29/08/16	Fri 23/09/16	54,55
57	0%	(A.2) Templates Baseline V1	1 mon	Mon 05/09/16	Fri 30/09/16	55
58	0%	(A.3) Network Trial Area Identification	6 mons	Mon 09/01/17	Fri 23/06/17	56
59	0%	(A.3) Trial Area Confirmation	0 dys	Fri 30/06/17	Fri 30/06/17	58,57,72
60	0%	(A.1) Trial Design Dissemination Workshop (DNOs)	2 mons	Mon 03/07/17	Fri 25/08/17	59
61	0%	(A.4) Laboratory Test Environment Design	5.75 mons	Mon 25/04/16	Fri 30/09/16	17
62	0%	(A.4) Laboratory Test Environment Establishment	3 mons	Mon 03/10/16	Mon 02/01/17	56,61
63	**0%**	**Work Stream B - Infrastructure Establishment & Trials**	**761 dys**	**Mon 06/06/16**	**Thu 06/06/19**	
64	0%	(B.2) Solution Finder Design (URS)	6 mons	Mon 10/07/17	Wed 03/01/18	62,59
65	0%	(B.2) Solution Finder Build	9 mons	Mon 08/01/18	Fri 14/09/18	64
66	0%	(B.1) Smart Grid Emulator & TTMC Design	4 mons	Mon 06/06/16	Fri 23/09/16	54,116SS,123SS
67	0%	(B.1) Smart Grid Emulator & TTMC Development	4 mons	Mon 26/09/16	Mon 23/01/17	66
68	0%	(B.3) Site Infrastructure Development (WPD Network Build)	9 mons	Mon 03/07/17	Wed 21/03/18	59,67
69	0%	(B.3) Site Infrastructure Development (NG Network Build)	9 mons	Mon 31/07/17	Wed 18/04/18	68SS+1 mon
70	0%	(B.3) Site Infrastructure Development (SPEN Network Build)	9 mons	Mon 28/08/17	Wed 16/05/18	69SS+1 mon
71	0%	(B.3) Site Infrastructure Development (NPg Network Build)	9 mons	Mon 25/09/17	Wed 13/06/18	70SS+1 mon
72	0%	(B.4) Laboratory Trials (Proof of Concept)	3 mons	Tue 24/01/17	Mon 17/04/17	67
73	0%	(B.4) Laboratory Trials (Field Trial Support/ Lab Platform Refinement)	6 mons	Mon 18/09/17	Wed 14/03/18	72
74	0%	(B.4) Laboratory Trials (Template Refinement)	3 mons	Mon 01/10/18	Thu 03/01/19	73
75	0%	(B.4) Field Trials (Repeat Trials - Lab)	13 mons	Thu 22/03/18	Tue 02/04/19	68
76	0%	(B.4) Templates Baseline V2	3 mons	Fri 04/01/19	Thu 28/03/19	75SF+12 mons,74
77	0%	(B.5) Solution Finder Trials	9 mons	Mon 17/09/18	Thu 06/06/19	65
78	**0%**	**Work Stream C - Analysis & Dissemination**	**910 dys**	**Wed 22/06/16**	**Fri 31/01/20**	
79	0%	(C.1) Finalise BAU Templates Creation Process	3 mons	Fri 07/06/19	Thu 29/08/19	77,76
80	0%	(C.1) Capture Monitoring Data	35 mons	Wed 22/06/16	Fri 29/03/19	
81	0%	(C.1) Lab & Field Trial Analysis	30 mons	Thu 16/02/17	Fri 28/06/19	
82	0%	(B.2) Final Templates & Solution Finder Issue	0 dys	Fri 28/06/19	Fri 28/06/19	81
83	0%	(C.2) Learning Dissemination	3 mons	Mon 01/07/19	Fri 20/09/19	82
84	0%	(C.3) DNO Training	3 mons	Mon 28/10/19	Fri 31/01/20	83
85	**0%**	**Conferences**	**758 dys**	**Wed 19/10/16**	**Thu 17/10/19**	
86	0%	NIA/ C 2016	0 dys	Wed 19/10/16	Wed 19/10/16	
87	0%	NIA/ C 2017	0 dys	Thu 19/10/17	Thu 19/10/17	
88	0%	NIA/ C 2018	0 dys	Thu 18/10/18	Thu 18/10/18	
89	0%	NIA/ C 2019	0 dys	Thu 17/10/19	Thu 17/10/19	
90	**0%**	**Workshops**	**964 dys**	**Wed 06/04/16**	**Fri 31/01/20**	
91	0%	WS 1 - Knowledge Capture, Telecoms Limitations within Electrical Networks	0 dys	Wed 06/04/16	Wed 06/04/16	54
92	0%	WS 2 - Laboratory Trials, Defining a Suitable Approach to the Assessment of Telecoms in a Clean Environment	0 dys	Mon 17/04/17	Mon 17/04/17	72
93	0%	WS 3 - Trial Area Identification, Dissemination of Agreed Trials/ Methodology	0 dys	Fri 22/09/17	Fri 22/09/17	60FS+1 mon
94	0%	WS 4 - Design of the Solutions Finder, Dissemination of Propsed Tool Functionality	0 dys	Wed 31/01/18	Wed 31/01/18	64FS+1 mon
95	0%	WS 5 - Implmenting Telecoms Network Infrastructure for 'Live' Trials	0 dys	Wed 11/07/18	Wed 11/07/18	71FS+1 mon
96	0%	WS 6 - The Solutions Finder Tool, An Introduction to its Functionality	0 dys	Fri 07/12/18	Fri 07/12/18	65FS+3 mons
97	0%	WS 7 - How to Deliver Fit-For-Purpose Telecoms Within Electrical Networks	0 dys	Fri 18/10/19	Fri 18/10/19	83FS+1 mon
98	0%	WS 8 - How to Integrate Templates and the Solutions finder into BAU activites	0 dys	Fri 31/01/20	Fri 31/01/20	84
99	**0%**	**Tender Processes**	**353 dys**	**Mon 23/11/15**	**Tue 18/04/17**	
100	**0%**	**Services**	**76 dys**	**Mon 23/11/15**	**Thu 17/03/16**	
101	**0%**	**Services 1 - Academic Collaborator**	**76 dys**	**Mon 23/11/15**	**Thu 17/03/16**	
102	0%	Provision of 'Early Learning' Telecoms Report - Clarify Academic Support Requirement	0 dys	Mon 23/11/15	Mon 23/11/15	
103	0%	Produce/ Release PQQ & Analyse Responses	20 dys	Mon 23/11/15	Fri 18/12/15	102
104	0%	Produce/ Release ITT & Analyse Responses	30 dys	Mon 21/12/15	Wed 10/02/16	103
105	0%	Post Tender Negotiations, Risubmission & Analyse Responses	15 dys	Thu 11/02/16	Wed 02/03/16	104
106	0%	Tender Award	0 dys	Wed 02/03/16	Wed 02/03/16	105
107	0%	Form Collaboration Agreement/ Stand Still	10 dys	Thu 03/03/16	Wed 16/03/16	106
108	0%	Sign Collaboration Agreement	1 dy	Thu 17/03/16	Thu 17/03/16	107
109	**0%**	**Systems & Goods**	**296 dys**	**Mon 22/02/16**	**Tue 18/04/17**	
110	**0%**	**Supplier 1 - Telecoms Templates Management Centre**	**76 dys**	**Mon 22/02/16**	**Mon 06/06/16**	

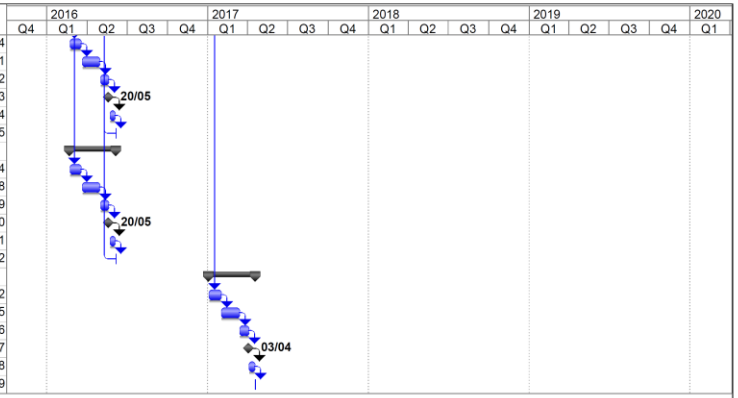


Project: WPD/ Telecoms Templates
Date: Fri 24/07/15

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

Page 2

ID	% Complete	Task Name	Duration	Start	Finish	Predecessors
111	0%	Produce/ Release PQQ & Analyse Responses	20 dys	Mon 22/02/16	Fri 18/03/16	14
112	0%	Produce/ Release ITT & Analyse Responses	30 dys	Mon 21/03/16	Fri 29/04/16	111
113	0%	Post Tender Negotiations, Risubmission & Analyse Responses	15 dys	Mon 02/05/16	Fri 20/05/16	112
114	0%	Tender Award	0 dys	Fri 20/05/16	Fri 20/05/16	113
115	0%	Form Collaboration Agreement/ Stand Still	10 dys	Mon 23/05/16	Fri 03/06/16	114
116	0%	Sign Collaboration Agreement	1 dy	Mon 06/06/16	Mon 06/06/16	115
117	**0%**	**Supplier 2 - Network Application Emulation Platform**	**76 dys**	**Mon 22/02/16**	**Mon 06/06/16**	
118	0%	Produce/ Release PQQ & Analyse Responses	20 dys	Mon 22/02/16	Fri 18/03/16	14
119	0%	Produce/ Release ITT & Analyse Responses	30 dys	Mon 21/03/16	Fri 29/04/16	118
120	0%	Post Tender Negotiations, Risubmission & Analyse Responses	15 dys	Mon 02/05/16	Fri 20/05/16	119
121	0%	Tender Award	0 dys	Fri 20/05/16	Fri 20/05/16	120
122	0%	Form Collaboration Agreement/ Stand Still	10 dys	Mon 23/05/16	Fri 03/06/16	121
123	0%	Sign Collaboration Agreement	1 dy	Mon 06/06/16	Mon 06/06/16	122
124	**0%**	**Supplier 3 - Solution Finder**	**76 dys**	**Tue 03/01/17**	**Tue 18/04/17**	
125	0%	Produce/ Release PQQ & Analyse Responses	20 dys	Tue 03/01/17	Mon 30/01/17	62
126	0%	Produce/ Release ITT & Analyse Responses	30 dys	Tue 31/01/17	Mon 13/03/17	125
127	0%	Post Tender Negotiations, Risubmission & Analyse Responses	15 dys	Tue 14/03/17	Mon 03/04/17	126
128	0%	Tender Award	0 dys	Mon 03/04/17	Mon 03/04/17	127
129	0%	Form Collaboration Agreement/ Stand Still	10 dys	Tue 04/04/17	Mon 17/04/17	128
130	0%	Sign Collaboration Agreement	1 dy	Tue 18/04/17	Tue 18/04/17	129



Project: WPD/ Telecoms Templates
Date: Fri 24/07/15

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

Page 3

Appendix 4: Project Risk Register

Risk Ref. No.	Risk Status	Risk Frequency	Owner	High Level Definition "There is a risk that..."	Impact	Probability	Proximity	Rating	Raised by	Raised on	Risk Start Date	Target Date	Last Updated	Review Date	Cause "...because of..."	Effect "...leading to..."	Mitigation Action Plan	Signs that the risk is about to occur or become an Issue
Next No.	Dropdown list	1=Timebound/One-off 2=Ongoing/Recurring 3=Not started	Responsible for mgmnt	Details of the Risk	Score 1-5 (see guide)	Score 1-5 (see guide)	Score 1-5 (see guide)	Auto Calculated	Who raised the Risk?	when was it raised?	When does this risk become relevant (eg: installation risks will not occur until the after the procurement process)	Target Date for Resolution	Last date the risk was updated	Date risk rating should be reviewed	What will Trigger the Risk?	What will happen if it occurs?	How will this Risk be avoided?	
R001	Assigned	1	GMc	Insufficient WPD resource is available for delivery	4	2	3	24	bid team	07.07.15	07.03.16	26.02.16	16.07.15	N/A	High workload due to a contribution of asset maintenance, ED1 schedmes and DG connections	Workstreams 2 and 3 would not be deliverables, workstream 1 would offer reduced value	Engage with senior stakeholders and the project sponsor to ensure they are aware of the projects resource requirements prior to the delivery of the project.	Slippage to the project delivery programme.
R002	Assigned	2	GMc	Programme slip due to external factors (force majeure) - SDRC late delivery	5	2	2	20	bid team	07.07.15	07.03.16	30.01.20	16.07.15	N/A	Delays in workpackage delivery from key suppliers to the project	SDRC delivery would be put at risk	Build and maintain realistic schedules within the project, engage with experts at a bid stage to ensure assumptions are appropriate. Additional contingency built into the programme.	
R003	Assigned	1	GMc	Insufficient interest from potential project partners/ suppliers - limiting the knowledge generated within the project	4	2	2	16	bid team	07.07.15	07.03.16	26.02.16	16.07.15	N/A	Limited responses from vendors in the form of ITT's and/ or reduced trial collaborator input	Limited knowledge generated within the project	Early engagement with vendors and collaborators alike has provided support for the timley need for the project. Letters of support (collaborators) and a positive response from an early ITT (vendors/ suppliers) have mitigated the risk within the FSP stage	Lack of commitment from third parties
R004	Assigned	2	GMc	Insufficient or inconclusive knowledge from the application of templates within previous 'Smart Application' projects available	5	2	3	30	bid team	07.07.15	07.03.16	30.12.16	16.07.15	N/A	Insufficient data within existing project close-down reports and the inability to contact those involved with specific projects	Limited knowledge capture within the Global appraisal	WPD have a telecoms department which have a skillset second to none within the DNO world. With this existing personal networks are available to ensure discussions can be scheduled with the appropriate personel to request pertinent information. An early report has been commissioned by WPD tasking Newcastle University to review som existing projects. This will set up a working knowledge base which can be expanded thereafter within the main project.	Lack of support from collaboating parties
R005	Assigned	1	GMc	Project costs associated with the procurement of high value items are significantly higher than expected	5	2	4	40	bid team	07.07.15	07.03.16	30.01.18	16.07.15	N/A	Procurement stage of the project returns significantly higher costs than those included within the submission spreadsheet.	Project contingeny being used or issue logged and escalated to project board. Halting of the project, re-evaluating the project and highlighting to Ofgem.	Intimate knowledge of telecoms spend available from ED1 business plans - these costs have been used to build up the hardware and service elements of the project finances. Running of RFI process to gather additional cost information.	Responses from ITTs are higher in value than expected
R006	Assigned	1	GMc	Insufficient resources are available to develop joint approaches/solutions between power and comms teams	4	1	3	12	bid team	07.07.15	07.03.16	30.01.18	16.07.15	N/A	High workload and current levels of cross boundary experience	Delays could occur while resourcing and solutions are identified	In general the projects being developed under Telecoms Templates are intended to operate in parallel with live power systems and not have direct interoperation. Cross functional skilling will not necessarily be required.	
R007	Assigned	2	GMc	Technical language of power and comms teams leads to misunderstanding of scope and requirements	3	3	2	18	bid team	07.07.15	07.03.16	30.01.18	16.07.15	N/A	Common terms associated with both principles could cause confusion during delivery	Ambiguity in design and delivery	The creation of a 'Telecoms Encylopedia' which will contain appropriate descriptions of both telecoms and electrical network terminology	Confusion within the delivery team
R008	Assigned	3	GMc	Development of metrics for evaluation measurement prove under/over-defined	5	2	2	20	bid team	07.07.15	07.03.16	30.01.18	16.07.15	N/A	Unplausable results from any stage of trials which arent' representative of the application or technology	Generic approach to measurement proves unsuitable	Suitable metrics for telecoms and their application will be determined during a detailed review of systems to-date. These can be refined throughout each stage of testing, whilst including stakeholder feedback during the appropriate workshops.	
R009	Assigned	2	GMc	Vendor engagement/ testing proves existing technology 'interoperability' is not as described by the vendor	4	3	1	12	bid team	07.07.15	07.03.16	26.02.16	16.07.15	N/A	Vendor products do not operate as expected	Extension to testing phase or inconclusive results	The laboratory testing will provide foil for poor products. Any which fail in the lab environment will not be subject to field testing	Integration of technologies is unsuccessful
R010	Assigned	3	GMc	Lab trials deliver contrasting information to that provided as an output of the field trials	4	2	1	8	bid team	07.07.15	07.03.16	26.02.16	16.07.15	N/A	Uncomparible data from the trial streams	Effort to analyse the differences	A robust trial plan will ensure the delivery of a detailed data set which can be analysed to determine the best-practice for integration of telecoms and electrical network applications.	
R011	Assigned	1	GMc	Lack of suitable laboratory resources to perform laboratory trials	5	1	2	10	bid team	07.07.15	07.03.16	30.06.18	16.07.15	N/A	Either vendors will not supply hardware for trial or procurement issues are noted	A trial which lacks sufficient variety	Early engagement of vendors within the process procure or source test hardware. Via the RFi process, ensure there is always more than one supplier for every telecoms approach	Project under delivers
R012	Assigned	1	GMc	Lack of suitable trial areas available within the WPD license areas to deliver UK DNO-wide learning	3	2	3	18	bid team	07.07.15	07.03.16	26.02.16	16.07.15	N/A	Another business unit requires the site	Different site required	Redundant sites will be identified and designed so that technoogies can be included in these if required	A business unit indicates that the site is no longer available
R013	Assigned	1	GMc	Selected sites for new collaborator trial installations become unavailable	3	2	3	18	bid team	07.07.15	07.03.16	26.02.16	16.07.15	N/A	Another business unit requires the site/ Geographical limitations proove too challenging	Different site required	Early engagement with senior stakeholders will ensure sufficent attention is drawn to the trial requirements and the indended lcoations.Redundant sites will be identified and designed so that technoogies can be included in these if required	A business unit indicates that the site is no longer available

R014	Assigned	1	GMc	Selected sites for retro-fit collaborator trial installations become unavailable	3	3	3	27	bid team	07.07.15	07.03.16	26.02.16	16.07.15	N/A	Another business unit requires the site/ Geographical limitations proove too challenging	Different site required	Early engagement with senior stakeholders will ensure sufficent attention is drawn to the trial requirements and the indended locations.Redundant sites will be identified and designed so that technoogies can be included in these if required	A business unit indicates that the site is no longer available
R015	Assigned	1	GMc	Insufficient scale of LCT's or end-users available within a network to fully 'stress' the technologies trialled	4	2	2	16	bid team	07.07.15	07.03.16	26.02.16	16.07.15	N/A	The trials will not deliver the learning required to demonstrate scalability of systems going forward	Templates are unsuitable	Suitable trial locations chosen. Development of network emulators to demonstrate systems at scale within field and lab environments	Project under delivers
R016	Assigned	2	GMc	Experienced/correct resource unavailable for correct installation of trial telecommunications equipment	3	2	1	6	bid team	07.07.15	07.03.16	30.06.18	16.07.15	N/A	Physical limitations with field trials witnessed due to installation/ commissioning failures	Unsuitable data collection/ return	Detailed trial design acknowleding potential issues which could be faced Provide training/ demonstrations to installation teams within the lab to ensure they are competent to fit	Non-functional or intermittent communications causing unreliable data return
R017	Assigned	3	GMc	A lack of viable data sources to be included (manually) within the solution finder - limiting the functionality of the tool within 'Project' operation	4	3	1	12	bid team	07.07.15	07.03.16	30.06.18	16.07.15	N/A	3rd parties will not release/ price out the inclusion of underlying data sources for inclusion within the Solutions Finder	A limited operation within 'Project mode'	Engage with manufacturers through a RFI process to understand their capabilities and intent to supply	Detail and accuracy 'trust' levels of offered solutions from Solutions Finder are lower than desired
R018	Assigned	2	GMc	Project costs associated with labour intensive activities (e.g. solution finder development) have been underestimated	4	3	1	12	bid team	07.07.15	07.03.16	30.06.18	16.07.15	N/A	Procurement stage of the project returns significantly higher costs than those included within the submission spreadsheet.	Project contingeny being used or issue logged and escalated to project board	Ensure project scope is clearly defined and designed to achieve required learning without undue scale	Responses from ITTs are higher in value than expected
R019	Assigned	3	GMc	The network emulation tool functionality is not interoperable or suitable to sufficiently validate technical approaches	5	3	1	15	bid team	07.07.15	07.03.16	30.01.17	16.07.15	N/A	Limited cross-over with existing electrical network design algorithms/ tools for integration within the Solutions Finder.	Increased development effort	Ensure that design scope and specification avoids uneccessary specialisation for integration with existig tools. Use open standard interfaces for connectivity as far as possible.	Project under delivers
R020	Assigned	2	GMc	The complex and varied nature of the trials to be performed under Telecoms Templates makes management of the technical systems under test difficult	4	2	3	24	bid team	07.07.15	07.03.16	26.02.16	16.07.15	N/A	Trial data not consistent / lack of information to develop standard templates	Templates are unsuitable	Design/ delivery of universal trial management platforms Emmulator build to deliver concise learning	Project under delivers
R021	Assigned	1	GMc	Communications is on trial and the Smart Grid applications emulation will permit stress to be applied to these systems to failure point potentially creating major outages in these systems where problems occur	4	2	3	24	bid team	07.07.15	07.03.16	26.02.16	16.07.15	N/A	Stressed communications networks	Customer outage	Design of trial sites will mitigate the risk of any customer outages - no electrical network applications will be used, meaning a physical disconnect between the customers supply abd the stressed networks.	Unauthorsised loss of supply
R022	Assigned	2	GMc	Where third party, public, infrastructure communications systems are on trial there will be no ability to influence the management or performance of these systems	5	2	3	30	bid team	07.07.15	07.03.16	30.06.18	16.07.15	N/A	Unco-operative suppliers/ vendors	Limited meaningful testing of the hardware and platforms	Early engagement of vendors and suppliers. Choose more than one supplier/ vendor for each product/ application and ensure necessary visibility is included in contracts with third parties.	Unexplainable inadequacies in installed 3rd party systems
R023	Assigned	3	GMc	Due to the dispersed and wide ranging technical nature of the trials performed under Telecoms Templates there will be wide ranging security risks to the connected systems.	4	3	2	24	bid team	07.07.15	07.03.16	26.02.16	16.07.15	N/A	Unauthorised access to the test platform	Data loss or duplication of data	Testing system security within the safe lab environment prior to application within the field will limit unsuitable technologies being applied. Use third party penetration testing organisation to trully assess the security of systems, diagnosing failure points which can be addressed before BAU application	Project under delivers
R024	Assigned	1	GMc	External technical developments impact on relevancy of concept and/or require change to concept direction	3	2	1	6	bid team	07.07.15	07.03.16	26.02.16	16.07.15	N/A	New technologies being delivered too late within the project lifecycle	post-project template development	Provision of processes to integrate further technological advancements within the project tools to assist with specific DNO concerns	Limited learning regarding future technologies
R025	Assigned	2	GMc	A partner/supplier may withdraw from the project or have oversold their solution	4	2	2	16	bid team	07.07.15	07.03.16	30.12.18	16.07.15	N/A	Misunderstood technical requirements or misinterpretation of solution	Delay in schedule, inability to achieve SDRCs	Create a clear functional requirement for the procurement stage Consider if activity is critical, understand if the activity can be delivered by an existing partner/supplier or seek new resource Through the RFI process, ensure there is always more then one supplier for every activity	Partner/supplier under delivers
R026	Assigned	1	GMc	Technologies/Solutions do not deliver the anticipated benefits with the delivery of fit-for-purpose telecoms	4	2	3	24	bid team	07.07.15	07.03.16	26.02.16	16.07.15	N/A	Technology/Solution not performing as expected and modelled	Project will deliver negative learning	Engage with manufacturers through a RFI process to understand their capabilities Ensure that the scope and specification of the technologies and solutions is clearly designed and tested prior to implementation If appropriate, select two different manufacturers to de risk the trial	Project under delivers
R027	Assigned	1	GMc	Lack of business buy in / support for the project from key departments including planning, design, control, policy and telecomms	4	2	4	32	bid team	07.07.15	07.03.16	26.02.16	16.07.15	N/A	Any of the business sections refusing to support the project	Potential project termination, delays, high cost	Engagement with identified senior stakeholders Identification of the most appropriate Project Sponsor Sharing the project goals and the importance of the learning to key WPD stakeholders	Lack of response or escalation of intent not to support
R028	Assigned	2	GMc	Changes to Key Personnel	3	2	4	24	bid team	07.07.15	07.03.16	26.02.16	16.07.15	N/A	Move to another project	Loss of key project knowledge	Rigorous and robust documentation of work. Induction Package to aid new starters.	Projects/business restructures
R029	Assigned	2	GMc	Manufacturers do not want to be involved in NIC projects due to project publication	3	2	3	18	bid team	07.07.15	07.03.16	26.02.16	16.07.15	N/A	Negative learning is often shared on LCNF/ NIC projects	Minimal suitable suppliers available	Identify Telecoms Templates is a NIC Fund project at the RFI stage	Few tenders received
R030	Assigned	1	GMc	Monitoring points cannot be accessed due to substation locations (i.e. On customer premises)	3	2	3	18	bid team	07.07.15	07.03.16	26.02.16	16.07.15	N/A	Specific locations of the equipment to be monitored	Other monitoring points / different network having to be used	Preparation and co-ordination with the customer to access their property/substations on their site Learn from other LCNF/ NIC projects who have experienced the same issues	Site is unavailable to be accessed
R031	Assigned	1	GMc	Terms and conditions cannot be agreed with suppliers	4	2	3	24	bid team	07.07.15	07.03.16	26.02.16	16.07.15	N/A	Lack of understanding of the NIC requirements or IPR requirements	Significant delays and/or re-tendering for supplier	Include standard WPD T&C's and IPR requirements in the pre bid RFI Ensure that the full T&Cs of the proposed contract are provided at tender stage	Cannot reach a contractual agreement with a supplier

Appendix 5: Contingency Plan

Contingency Plan

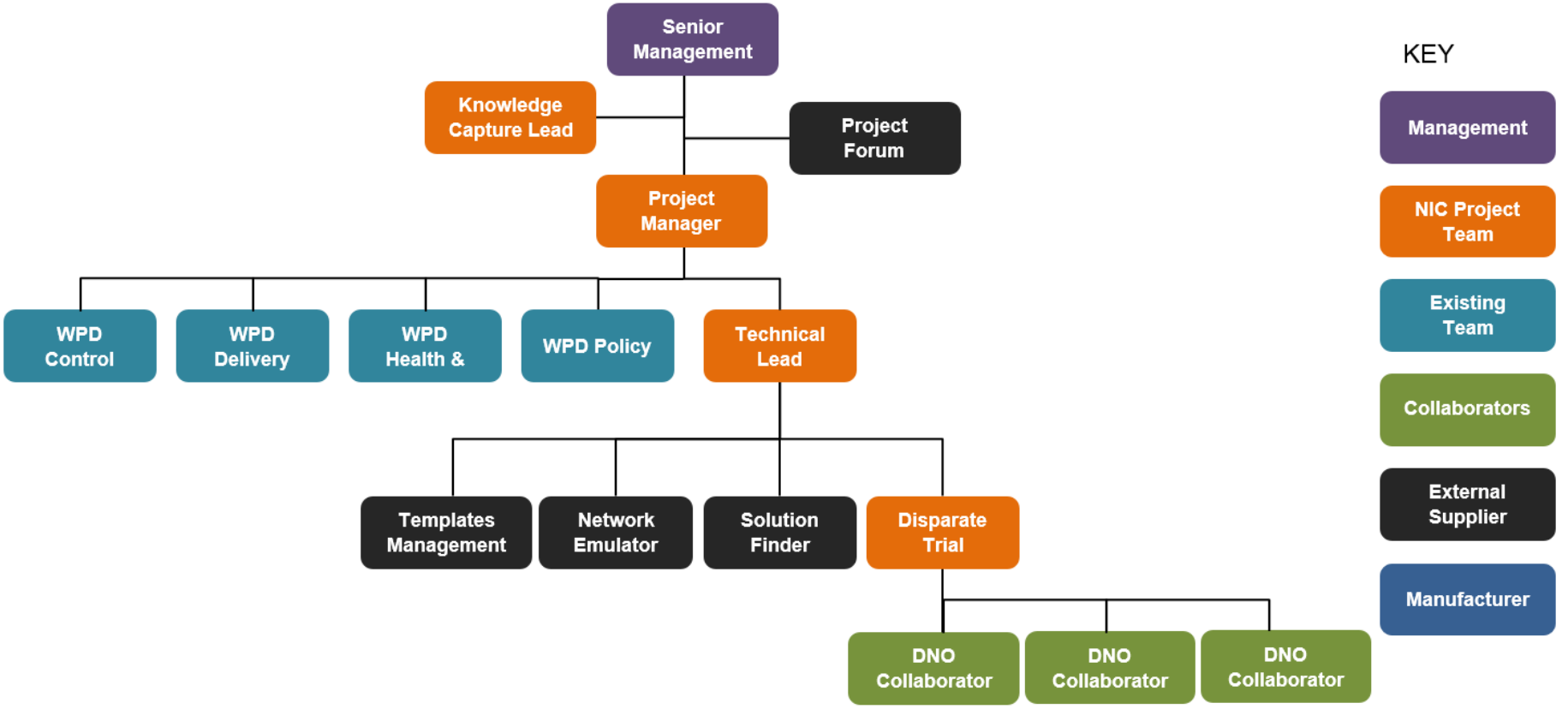
A contingency plan has been written for the first four risks acknowledged within the Risk Register. All risks throughout the project will be continually monitored and appropriate risk will be referred/ escalated to the project board. Below are details of how we will mitigate against significant risks becoming an issue and the associated contingency plans for these risks.

The contingency plan provided below, offers consideration of how WPD will manage all risks within the project – to demonstrate the process applied, WPD has highlighted the first four risks presented within the Risk Register (Appendix 4) and expanded to show the proposed mitigation and contingencies. During the delivery of the project, all risks regardless of their rating, will be managed and mitigated accordingly.

R001: Insufficient WPD resource is available for delivery
Mitigation • Senior Stakeholders and Project sponsor are aware of project resource expectations prior to project award/delivery **Contingency** • Evaluate the resource requirements in timely intervals and address shortfalls • Seek to reduce any duplication of tasks at the planning stages • Additional resource will be drawn from BAU activities and backfilled
R002: Programme slip due to external factors (force majeure) – SDRC Late delivery
Mitigation • Build and maintain realistic schedules within the project. • Engage with experts at the bid stage to ensure delivery assumptions are appropriate **Contingency** • The combination of laboratory tests (Method 2) and field trials (Method 3) can offer alternative means of addressing programme slip • The participation of several collaborators may offer alternative approaches to achieving timely delivery of SDRC's
R003: Insufficient interest from potential project collaborators – limiting the knowledge generated within the project.
Mitigation • Early engagement with collaborators and vendors alike, has provided support for the timely need for the project. • Letters of Support and a positive response from an early Invitation to Tender (vendors/suppliers) have mitigated the risk within the FSP stage. **Contingency** • WPD are ideally placed to deliver the Telecoms Templates project outputs in the event of low interest from third parties through the capabilities of WPD Telecoms. While a broader project with wider learnings would undoubtedly result from the widest collaborator engagement, WPD are still capable of delivering against the project needs. • Support and engagement could be sought from parallel industry sectors.
R004: Insufficient or inconclusive knowledge from the application of templates

within previous 'Smart Application' projects available.
Mitigation • WPD have an internal Telecommunications skillbase which is well adapted to delivering Smart Application projects. • Early report commissioned by WPD via Newcastle University to review existing projects sets up a working knowledge base. **Contingency** • In cases where results of performance of communications in previous projects are unclear or inconclusive the use of iterative laboratory trialling will avoid premature, costly, field deployments. • Essentially poor data at early stages will mean that the metric values attributed to either communications capability or application requirements may be erroneous. The iterative processes used within Telecoms Templates will permit refinement of these values through the course of the project.

Appendix 6: Project Delivery Organogram



Appendix 7: Base-Case Cost Breakdown

Financial Benefits

The financial benefits of the project were largely calculated using the information within the SGF WS3 'Transform model' costings for installing and operating a telecoms network out to 2050 using both a 'Smart incremental investment' and 'top-down design approach' in Comms and Control. The WS3 BAU approach is effectively a managed, piecemeal approach to selecting, developing and deploying communications systems as required on a case by case basis. This is seen as the most efficient conventional telecoms methods currently in use on the GB Distribution System. These costs (i.e. the Base Case Costs) were then compared to the costs of replicating the Telecoms Template outputs, as a top down approach, once the project has been proven successful, at a single license area, WPD scale (four license areas) and GB wide (fourteen license) scale - the Method Costs.

The difference between the Base Case Costs and the Method Costs, including the anticipated spend profiles of both approaches have been used to calculate the financial benefits which would occur at 2020, 2030 and 2050. The SGF WS3 'Transform model' is seen as an economic assessment of DNO telecoms costs using both Smart incremental investment' and a top-down design approach out to 2050.

Base Case Costs

From the SGF WS3 'Transform Model' a number of Smart Grid elements and application enablers were isolated for individual consideration as to how their costs would impact the overall value of taking Smart Grid into business as usual over the period to 2050. One of the enablers identified as having potentially significant impact on the cost of deploying Smart Grid techniques is 'Comms and Control platforms between variant solutions' - this is the focus area of Telecoms Templates project.

Using the 'Transform Model' term of 'Smart incremental investment' in Comms and Control, effectively a managed, piecemeal approach to selecting, developing and deploying communications systems as required on a case by case basis then this element was identified as a potential cost of **£532m** at a GB scale. Infrastructure investment costs and concerns which have been witnessed within the WPD FALCON and Heads of the Valleys LCNF projects delivered via a similar incremental deployment of communications on a project by project basis are reflected within Figures 3.2 and 3.3 shown in the Business Case of the Telecoms Templates FSP.

Further details of the Base Costs can be found in Appendix 1.

Method Costs

In relation to the costs of the project and the cost reduction realized during GB-wide roll-out, the following assumptions have been made:

- With the completion of the Global Appraisal the delivery of fit-for-purpose telecoms during the roll-out period is expected to nullify any further cost throughout the period 2020-2050.

- The combination of laboratory and field trials are expected to confirm that a well formed laboratory trial area can be used to develop and trial communications technologies post-completion of the project itself. Therefore no field trial costs have been included within the method costs post 2020.
- Efficiency savings in areas such as travel/ expenses, contingency and dissemination will be realized within the delivery of post-project solutions, a consideration which has been factored into these costs.
- All telecoms solutions trailed would be used in future roll outs in equal proportions to the trials in the telecoms templates project.

Replications

It has been assumed that no project replications will occur by 2020, as the project trial is due to be completed by early 2020. Thereafter the delivery of a templates process and improvement in best-practice will deliver direct value to the industry. Given the central role in which communications play within the delivery of BAU and Smart Grid applications, the outputs from this project would be replicated for future BAU and Smart Grid applications ensuring the most appropriate, long term communications solution is installed.

Associated Benefits

Additionally to the Base Case benefits the Telecoms Templates project offers further associated benefits in terms of financial and carbon savings.

Appendix 1 of this FSP submission – Benefits Tables – provides a breakdown of the agreed financial and carbon benefits offered by previous LCNF projects which have reliance upon communications. In total these are very significant numbers and will help the UK deliver on its commitment to addressing the energy trilemma. The potential fiscal and carbon reduction benefits from the listed projects are £1.6bn and 157.79MTCO2 respectively.

These benefits will only be recognised however if the enablers to their deployment are fit-for-purpose and there is wide industry recognition, see letters of support in Appendix 9, that this is not the case with the key enabler for Smart Grid application deployment – communications.

Unless action is taken to address communications as an enabler, with a top-down design approach as recommended through the SGF WS3 work then the figures above are at risk, either through delay in achievement or inability to deliver.

Telecoms Templates will enable the achievement of efficient, effective and reliable Smart Grid application deployment through the systematic development of communications definition, design and selection processes.

Summary

The Financial Benefits for the Telecoms Templates project, scaled up to licensee and GB rollout levels are presented in Appendix 1. At GB scale, a financial benefit of £413m is anticipated.

Appendix 8: Ofgem Cost Spreadsheet

NIC Funding Request		2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	Total		
Cost	*From Project Cost Summary sheet*									
	Labour	71.67	340.39	380.50	298.02	275.95	-	1,366.53		
	Equipment	-	-	-	-	-	-	-		
	Contractors	103.10	1,462.46	1,840.06	1,317.58	1,025.88	-	5,749.08		
	IT	-	3,009.20	1,261.89	705.27	-	-	4,976.36		
	IPR Costs	-	-	-	-	-	-	-		
	Travel & Expenses	11.37	178.27	230.01	164.70	128.23	-	712.59		
Payments to users & Contigency		20.68	554.48	412.50	276.17	158.90	-	1,422.73		
	Decommissioning	-	-	-	-	-	-	-		
	Other	-	-	-	-	-	-	-		
	Total	206.83	5,544.81	4,124.96	2,761.74	1,588.96	-	14,227.29		
External funding	*Any funding that will be received from Project Partners and/or External Funders - from Project Cost Summary sheet*									
	Labour	-	-	-	-	-	-	-		
	Equipment	-	-	-	-	-	-	-		
	Contractors	-	-	-	-	-	-	-		
	IT	-	-	-	-	-	-	-		
	IPR Costs	-	-	-	-	-	-	-		
	Travel & Expenses	-	-	-	-	-	-	-		
Payments to users & Contigency		-	-	-	-	-	-	-		
	Decommissioning	-	-	-	-	-	-	-		
	Other	-	-	-	-	-	-	-		
	Total	-	-	-	-	-	-	-		
Licensee extra contribution	*Any funding from the Licensee which is in excess of the Licensee Compulsory Contribution - from Project Cost Summary sheet*									
	Labour	-	-	-	-	-	-	-		
	Equipment	-	-	-	-	-	-	-		
	Contractors	-	-	-	-	-	-	-		
	IT	-	-	-	-	-	-	-		
	IPR Costs	-	-	-	-	-	-	-		
	Travel & Expenses	-	-	-	-	-	-	-		
Payments to users & Contigency		-	-	-	-	-	-	-		
	Decommissioning	-	-	-	-	-	-	-		
	Other	-	-	-	-	-	-	-		
	Total	-	-	-	-	-	-	-		
Initial Net Funding Required	*calculated from the tables above*									
	Labour	71.67	340.39	380.50	298.02	275.95	-	1,366.53		
	Equipment	-	-	-	-	-	-	-		
	Contractors	103.10	1,462.46	1,840.06	1,317.58	1,025.88	-	5,749.08		
	IT	-	3,009.20	1,261.89	705.27	-	-	4,976.36		
	IPR Costs	-	-	-	-	-	-	-		
	Travel & Expenses	11.37	178.27	230.01	164.70	128.23	-	712.59		
Payments to users & Contigency		20.68	554.48	412.50	276.17	158.90	-	1,422.73		
	Decommissioning	-	-	-	-	-	-	-	Check Total = to Initial Net Funding request	
	Other	-	-	-	-	-	-	-	in Project Cost Summary	
	Total	206.83	5,544.81	4,124.96	2,761.74	1,588.96	-	14,227.29	**OK**	
Direct Benefit	*from Direct Benefits sheet*									
	Total	-	-	-	-	-	-	-		
Licensee Compulsory Contribution / Direct Benefits	*from Project Cost Summary sheet*									
	Labour	7.17	34.04	38.05	29.80	27.59	-	136.65		
	Equipment	-	-	-	-	-	-	-		
	Contractors	10.31	146.25	184.01	131.76	102.59	-	574.91		
	IT	-	300.92	126.19	70.53	-	-	497.64		
	IPR Costs	-	-	-	-	-	-	-		
	Travel & Expenses	1.14	17.83	23.00	16.47	12.82	-	71.26		
Payments to users & Contigency		2.07	55.45	41.25	27.62	15.89	-	142.27		
	Decommissioning	-	-	-	-	-	-	-	of Total Initial Net Funding Required	
	Other	-	-	-	-	-	-	-	**OK**	
	Total	20.68	554.48	412.50	276.17	158.90	-	1,422.73	Check that **Total** is = or > than	
									Total Direct Benefits	
									OK	
Outstanding Funding required	*calculated from the tables above*									
	Labour	64.51	306.35	342.45	268.22	248.35	-	1,229.88		
	Equipment	-	-	-	-	-	-	-		
	Contractors	92.79	1,316.22	1,656.06	1,185.82	923.29	-	5,174.17		
	IT	-	2,708.28	1,135.70	634.74	-	-	4,478.72		
	IPR Costs	-	-	-	-	-	-	-		
	Travel & Expenses	10.24	160.44	207.01	148.23	115.41	-	641.33		
Payments to users & Contigency		18.61	499.03	371.25	248.56	143.01	-	1,280.46		
	Decommissioning	-	-	-	-	-	-	-	Check that Total is =to	
	Other	-	-	-	-	-	-	-	Total Outstanding Funding required	
	Total	186.14	4,990.33	3,712.46	2,485.57	1,430.06	-	12,804.56	**OK**	
balance	12,614.94	0.00	7,438.47	3,826.27	1,397.03	(6.92)	0.03	12,614.94		
interest		0.00	100.27	56.32	26.12	6.95	(0.03)	189.62		
								12,804.56	-	

click this button to calculate the NIC funding request

Bank of England interest rate			0.5%		**NIC FUNDING REQUEST £**			**12,614.94**		
interest rate used in calculation			1.0%							
RPI adjustment		2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/2023	2023/2024
Index		267.6	275.9	284.4	293.2	302.3	311.7	321.4	331.3	341.6
Annual inflation		3.10%	3.10%	3.10%	3.10%	3.10%	3.10%	3.10%	3.10%	3.10%

n.b the Second Tier Funding Request calculation should use the Bank of England Base rate plus 1.5% on 31 June of the year in which the Full Submission is made.

Appendix 9: Stakeholder Letters of Support

NETWORKS

ESB Networks Ltd
Fón +353 1 676 5831

Gary McElroy
Infrastructure Manager,
Western Power Distribution
Pegasus Business Park
Herald Way
Castle Donington
DE74 2TU
England
Date: 10th July 2015

Dear Mr. McElroy;

I am writing in relation to your recent presentation to the JRC/JAG meeting on your proposed 'Telecoms Templates' and 'Solutions Generator' project for Smart Grid applications. Utilities in the UK and Ireland face the same issues with respect to planning and deployment of telecommunications to support the electrical network.

WPD's proposal has the potential to simplify and optimise the planning and deployment process. ESB Networks supports WPD's proposed project and encourages Ofgem to look favourably on WPD's submission to its Network Innovation Competition

Yours sincerely,

Noel Rushe
Manager, Strategy & Technology, Telecom Services
ESB Networks

Directors: Margaret Sayers, Donal Flynn, Dee Geraghty, Gina Quin, John Redmond
Registered Office: Clanwilliam House, Clanwilliam Place, Dublin 2 Ireland. Registered in Ireland No. 405172

Gary McElroy,
Infrastructure Manager (Midlands),
Surftelecoms, Western Power Distribution,
Pegasus Business Park, Herald Way
Castle Donington,
DE74 2TU

15-June-2015

Dear Gary,

Please accept this letter as our intended support by SP Energy Networks for WPD's NIC Telecoms Templates proposal as defined in your email of 08/06/15 to Howard Downey (a copy of which is attached to this letter).

We would also like to partner with WPD on the delivery of the below 'templates' within the scope of WPDs LCNF Telecoms Templates proposal and in doing so would accept WPDs overall authority of the project.

1) Use of 'standard' 3G/4G. We're keen to understand the full lifecycle costs of such solutions in addition to longevity, reliability, availability, resilience and scalability (Technical Parameters). Via our parent company, Iberdrola, we already have significant experience in the use of 4G in Spain for Smart Metering/ Smart Grids and the subsequent benefits and limitation that apply to that territory. We are keen to establish the benefits and limitations of such 3G/4G implementation within the UK.

2) Use of the 4G Emergency Services Network (subject to contract award and implementation by the UK Government). We, SPEN, already use the existing Airwave Tetra system and subsequently have a TEA2 license that will entitle us to use the 'new' ESN. Again as above we're keen to establish the full life cycle costs in addition to the 'technical parameters'.

3) Use of broadband / 'bonded pair' Ethernet services via BT Openreach. We already have some experience of the use of such in Scotland but this is not representative of a UK telecoms template as the sites were selected based on the BTOR exchanges already being 'unbundled' by the teleco. We've also trailed broadband at 33kV S/S with varying success but are keen to understand the lifecycle costs and technical parameters for lower voltages applications.

4) Use of other 3rd party national / regional infrastructure wireless data services. We are in the service area for the Flex Net Arqiva smart metering 'UHF' solution that Ariqva are proposing can be used for other services, as before we would need to understand at what costs and how does it perform?

We hope the above meets with your approval and look forward to working with you.

Yours Sincerely

James Yu PhD CEng MIET MITL
Future Networks Manager

James Yu

SP Energy Networks

JRC Ltd
Dean Bradley House
52 Horseferry Road
London SW1P 2AF
☎ +44 20 7706 5199
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info@JRC.co.uk

Western Power Distribution (WPD) submission to the Electricity Network Innovation Competition (NIC)

Background

1. As intelligence spreads throughout energy networks, the need for resilient and reliable communications increase. These telecommunications requirements can be met in a number of ways, namely:

- Public telecommunications networks, such as the fixed networks providers BT and Virgin Media, or the mobile network operators Vodafone, O2, EE and Three;
- Private Commercial network operators such as Eutelsat, Network Rail Telecoms or Airwave;
- Licence-exempt services such as WiFi, Zigbee and Bluetooth; or
- Self-provided telecoms.

2. Although many requirements can be met by public telecoms providers and licence exempt services, they may not be suitable for the most demanding requirements. In these cases the utility may need to engineer dedicated telecoms networks.

3. The Joint Radio Company Ltd (JRC) specialises in radiocommunications supporting critical utility telecommunications, and where operated through private radio systems, managing the radio spectrum needed to operate these services.

5. The Low Carbon Network Fund (LCNF) and related initiatives have tested many innovative solutions to meet the challenge of upgrading utility networks, but several have found the communications element wanting. In addition, telecoms suitable for the test phase may be inadequate to migrate a concept to 'business as usual' if dependence on secure communications is a critical success factor.

6. As well as involvement in UK Smart Grid development, JRC is participating in a number of initiatives in Europe and beyond.

7. JRC recognises the benefits that a *Telecoms Template* would bring to UK utilities and enthusiastically supports this Western Power Distribution (WPD) project.

Project Concept

8. The concept of the project – to share knowledge and promote best practice in telecommunications for smart grids – is a vital objective and mirrors to some extent work undertaken by the International Telecommunication Union (ITU) similarly to

promote telecommunications knowledge and best practice. This in undertaken though a series of handbooks published by the ITU. If this project is successful, it may be possible to promulgate its work through an ITU handbook for the benefit of the UK.

Workstream A

9. JRC could participate in this part of the project through the desktop evaluation of existing communications techniques. There are a vast number of technologies being deployed around the world in support of Smart Meter and Smart Grid developments. Because of JRC's involvement in the Utility Telecoms Councils in Europe, the USA, Canada, Latin America and Africa, we have an opportunity to learn from world-wide experience.

10. A unique feature which JRC would bring to the project is awareness of the radio spectrum regulatory provision on a global basis. Where technology depends on access to radio spectrum, it is important to understand whether the necessary radio spectrum might be available in the UK, and if only in a different frequency band, the effect this might have on the operation of the equipment. For example, some successful smart grid solutions in the USA do not have equivalent radio spectrum available in the UK, and the alternative spectrum available in the UK has lower bandwidth and power, undermining the viability of the technology in a European environment.

Workstream B

11. There is no 'one-size-fits-all' solution as utilities have to operate in a wide variety of conditions which influence technology choices such as:

- Market structure, whether there are large numbers of small players or dominant large players.
- The level of vertical integration in the market.
- The geographic terrain over which the utility operates.
- Whether the service area of the utility is rural, urban, dense urban or mixed.
- Whether the utility infrastructure is mainly above or underground.
- The legacy telecoms provision in the utility, especially if it owns or has access to radio towers or fibre.
- The climatic conditions, and whether subject to seismic movement.
- The maturity of the commercial telecoms market.
- The compatibility of the energy regulation with telecoms regulation.
- Customer expectations and reliance on utility provision.

12. When considering a wireless technology solution to a problem, there are a wide range of parameters to be taken into account which are not always immediately apparent, for example the effect of rain on radio propagation and interference between differing radio services.

13. JRC would be keen to be involved in any technology trials. There are a number of technologies currently being promoted as the solution to Smart Grid communications, but which must be assessed against UK utility requirements. Examples might include:

- LTE in the 400 MHz band where the technology is spoken about as the solution to a multitude of problems, but the commercial viability is still very much in doubt in a utility environment.
- 'Cellular IoT' which appears to be a replacement for the 2G mobile GPRS – only better – but is as yet unproven.
- 5G technology which is spoken of as the ultimate solution beyond 4G/LTE, but again needs assessing in its suitability for critical utility operations.
- A variety of proprietary low-power long-range radio technologies (such as SigFox, LoRa and Weightless) which need to be investigated.

Workstream C

14. Having undertaken the work, dissemination is a vital part. JRC is experienced in sharing technological findings and has organised industry technical briefings itself where required.

Carbon Plan

15. This project will contribute to the Carbon Plan by exploring communications technologies capable of supporting the concepts developed by other projects as they migrate from the test to 'business-as-usual' phase. It is often found that the communications technologies used in the exploratory phase of a project prove the concept, where 90% availability is adequate, but are unable to sustain the concept as it moves into 'business-as-usual' where the technology must deliver results at the 99.999% availability level in terms of reliability, security and geographic reach/building penetration. This higher level availability must be delivered within an acceptable overall cost envelope if the concept is to prove commercially viable.

16. A further element of work under this network project will be to evaluate the energy required to operate the telecoms element of any solution to ensure there is a net reduction in carbon from deployment of the technology. Most estimates of the energy consumed by telecoms networks places them in one of the larger categories of electricity users, and therefore any measures which can be taken to reduce energy consumption by telecoms networks makes a valuable contribution to the overall reduction in greenhouse gas emissions.

Project Partners

17. JRC brings benefit to the collaboration as an SME (Small or Medium sized Enterprise), a category of business the government wish to encourage to participate in R&D projects.

18. Because radio waves do not respect national borders, radio regulation is essentially an international process which gives JRC European and broader international connections. As this project progresses, it would be valuable to grasp any opportunities for wider collaboration, especially through European research programmes.

19. In terms of Academic Partners, JRC has good connections with Surrey University which hosts the international 5G Innovation Centre and would be a prestigious collaborative partner. Although utilities are cautious in perceiving the benefits 5G technology might bring to the industry, government is committed to 5G and a collaboration with the Centre would be a very positive relationship.

Customer Impact

20. Customers benefit from the economic efficiencies facilitated by improved telecoms, but there is a substantial additional benefit from resilient utility communications able to sustain connectivity in the absence of mains-electrical power. Resilient communications enable power to be restored more quickly when supplies are interrupted for any reason.

21. Resilient communications also enable a utility to gather data on their network if it is disrupted for any reason, and convey meaningful information to customers. Even where it does not enable the utility to restore supplies more quickly, if customers can be informed of the reason for the interruption and advised of restoration progress because the utility has resilient communications, customers are better able to plan around the incident and are likely to have a more positive view of the outcome.

22. Customers increasingly expect to have real time information on incidents: advanced and resilient communications systems deliver improved customer perception and ultimately satisfaction.

23. In some countries, the electricity distribution companies have served isolated communities by providing broadband data services to customers who have no alternative provision. Although the UK has not chosen to go down the pathway of substantive use of utility infrastructure to deliver broadband services to customers in remote areas, it may be valuable to comment with the *Telecoms Template* on this aspect of utility telecoms solutions in case the situation changes in the UK in future.

Adrian Grilli
Managing Director
JRC Ltd
16 July 2015

RIIO NIC NETWORK INNOVATION COMPETITION

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Engineering & Physical Sciences

Institute for
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22 July 2015

Dear Mr Gary McElroy

The University of Surrey 5G Innovation Centre would be interested in exploring options to collaborate with the Western Power Distribution project if successful in the Network Innovation Competition. 5GIC is the first in the world to start investigations into advanced future telecom technologies in close cooperation with more than 22 international companies.

5G is the next generation mobile and wireless connectivity system. The objective is that 5G should offer far greater capacity and be more responsive to users' needs, more energy-efficient and more cost-effective than anything that has gone before.

The perceived need for 5G networks is being driven by the increasing demand for mobile data and the emergence of the Internet of Things (IoT), through which billions of devices will become connected. In the future, technologies such as Smart Cities and Smart Grids will require high resilience/reliability and much shorter network response times to enable very rapid reactions. At the same time there is a pressing need to reduce end user costs (to ensure applications are widely accessible) and to minimise energy consumption.

To meet these requirements, a range of tactics need to be employed including:

- more accurately predicting user demand so that applications perform bandwidth-heavy tasks; and
- making better use of all available wireless networks for ultra-high reliability.

It has been envisaged that 5G network will be flexible enough to evolve, adapt and grow to meet the requirements for as yet unforeseeable applications. 5GIC is currently rolling out a £30M wide area testbed on the university campus initially based on 4G (LTE-advanced) and IoT and will be gradually enhanced with 5G technologies.

The involvement of the 5G Innovation Centre in this Networks Project will enable electricity distribution companies to benefit from leading edge telecommunications research to deliver the most advanced and cost effective solutions to energy consumers.
I wish you all the success in your bid and look forward to cooperate on this exciting project.

Yours sincerely

Professor Rahim Tafazolli
Director, ICS and 5GIC

THE QUEEN'S ANNIVERSARY PRIZES
FOR HIGHER AND FURTHER EDUCATION
2011

Gary McElroy
Western Power Distribution
Pegasus Business Park, Herald Way
Castle Donington DE74 2TU, United Kingdom

28th of July 2015

Dear Gary

I am pleased to confirm EDF Energy's support for WPD's proposed "Telecoms Templates" project in trying to address the barriers preventing the business as usual roll out of Smart Grids technologies which are essential to solve the energy challenges that the UK will have to face towards a low carbon, affordable and secure energy future. The Telecoms challenge is impacting the entire Energy Industry and its capability to transition this sector for the benefit of the end customer.

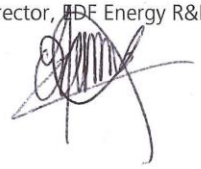
EDF Energy is one of the UK's largest energy companies and its largest producer of low-carbon electricity. A wholly-owned subsidiary of the EDF Group, one of Europe's largest energy groups, we generate around one fifth of the UK's electricity and employ around 15,000 people. We supply electricity and gas to around 5.5 million residential and business customers, making us the biggest supplier of electricity by volume. Our R&D activities are an integral part of our business, creating value and preparing future growth drivers. This is demonstrated within EDF Group through availability of world class facilities, labs and over 2000 people, working in seven centres across the world (three near Paris, one in the UK, one in Germany, one in Poland and one in China).

EDF group, leveraging on its R&D expertise and its operational know-how as the main DNO (ERDF) in France, is also looking at tackling the challenge that WPD is proposing to address. Our R&D activities have contributed to specify the G3-PLC which is a standardised OFDM PLC technology in order to answer the operational requirements of ERDF to increase the visibility and the controllability of the distribution grid. ERDF and EDF R&D have joined their effort in the SoGrid trial to demonstrate the capabilities of the G3-PLC technology as a shared IPv6 backbone for multiple smart grid use cases and other business needs, thus optimizing costs associated with installing, maintaining and operating multiple telecommunication infrastructures.

We would be delighted to envisage any collaboration and shared learning dealing with the use of PLC for Smart Grids and support this project with our experience in PLC deployment. WPD's proposal aims to deliver not only learnings but more importantly key solutions to enable Smart Grids solutions to be widely adopted and change the way the Energy System is operating and bringing value for the whole UK. EDF Energy definetly supports the project and would encourage a favourable decision on WPD's submission to the Network Innovation Competition.

Yours sincerely

Xavier Mamo
Director, EDF Energy R&D UK centre



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Appendix 10: Detailed Project Trial Breakdown

The following text aims to describe the project trial philosophy in detail, establishing the rationale for the approaches that will be used and introduces the telecoms technologies which are to be considered during the project.

Telecoms as applied in the context of this project, is a broad term that covers long and short haul connectivity requirements. Effective long haul systems, of which UHF radio is a prime example, have been available for many years and their applications to power systems have developed in parallel with the power distribution networks themselves.

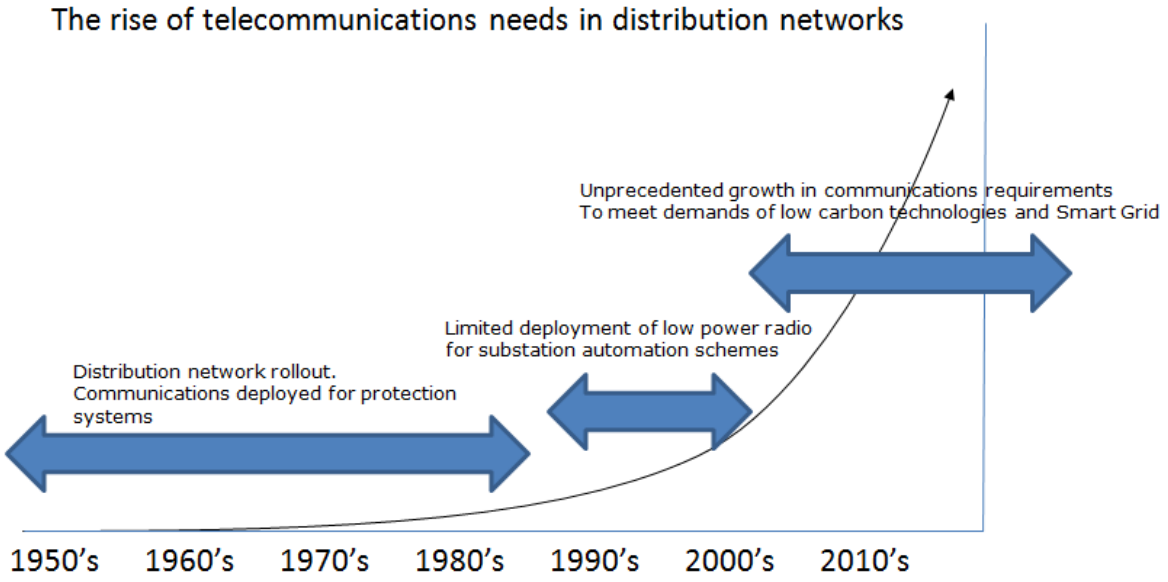
Because telecoms have until now been largely limited to the core of the power distribution networks, typically not extending beyond primary substations, and as a result of their parallel development power system network planners have become largely familiar with their characteristics and capabilities.

Technological advances have enabled lower power, more precise radio transmission systems to be developed, alongside the ability to embed monitor and control functions into ever smaller devices. This has made ultra short haul, often meshed, communications become more realistic for power system applications.

To a large extent this has led to the concept of the Internet of Things (IOT) however where this clearly applies to the Information Technology (IT) domain there is a real possibility that the underlying technologies have a role to play in the Operational Technology (OT) domain, perhaps for DNO applications. For example, as monitoring of the distribution networks extends into feeders and pole mounted transformers, the data transfer requirements of these monitoring devices might be supportable through platforms such as Zigbee or similar.

The ability of telecoms to support a broad range of data transmission requirements has in no small part led to the innovation around Smart Grid that has been demonstrated through projects including those developed through LCN and NIC funding. Understandably the prime focus of these projects has been to develop an understanding of the benefits of the approaches under test to deliver value to customers in the electrical networks. However this has led to a dichotomy where insufficient effort has been put into understanding the communications part of the challenge resulting in poor performance and creating a major hurdle to business as usual transition.

For each Smart Grid application that is identified there exist multiple telecoms approaches that are potentially suitable and this has led to an exponential growth in technical combinations that is represented in the diagram below.



The real value of Telecoms Templates approaches in the future of DNO Smart Grid deployments is in their ability to deliver fit-for-purpose telecoms for the OT requirements with a very high degree of trust in the outcome.

Today power distribution networks planners deliver schemes for such applications as distance protection and SCADA that are often based on their knowledge and trust, from experience, of the abilities of established technologies such as UHF radio. Telecoms Templates will develop experience in the wider range of more recent telecoms technologies that are available, to deliver fit-for-purpose OT requirements for Smart Grid applications.

Desktop/Lab approach

The deployment of emerging telecoms systems, by definition, is not well understood, particularly for the OT domain of power systems. The number of variables around signal propagation, mesh density/integrity and throughput expose practical trials to considerable risk. This example highlights why a detailed Global Review and carefully structured laboratory trials are a necessary approach to defining the fit-for-purpose capability of such systems against clearly defined Smart Grid application templates.

Retrofit approach

Considerable thought analysis and scrutiny has been expended in the design of previous innovation projects to ensure that the data has been generated to quantify how Smart Grid applications can deliver real value to the DNO community. In general the project outcomes have delivered useful learning.

However in many cases it has been a particular challenge to provide an OT infrastructure that was adequate, suitable and specifically fit-for-purpose for the applications under trial. Through ingenuity and creativity many projects have been adapted to deliver data and value in spite of the OT shortcomings. Without development of a systematic approach to OT, there is not a viable way for the UK DNO to continue smartening up and delivering the carbon and financial savings required through the RIIO price control periods ahead.

This is addressed by Telecoms Templates enacting a number of practical trials in the real world environment, with clearly defined processes, to specify, design and implement fit-

for-purpose telecoms for retrofit of existing projects where a sub-optimal OT solution has been identified.

Through this approach the real benefit of the improved OT delivery capability of the Telecoms Template developed telecoms systems can be measured and compared like-for-like with that of the previously deployed systems and the data gathered during the lifetime of the original projects.

These projects will have local management and control as well as delivering real time data on the telecoms systems to the centralised Telecoms Templates project management centre.

New project approach

Through this approach, the Telecoms Templates team will engage with a developing project (e.g. WPD Equilibrium) as it moves through the scoping, development, design and implementation phases. Equilibrium would retain its position and purpose as a project in its own right, but integration of the Telecoms Templates processes throughout would demonstrate the ability of the embedded approach to OT telecoms selection to deliver right first time, fit-for-purpose, communications infrastructure for the application requirements.

A further advantage of this approach is that both projects benefit from the synergies of their implementation. Specifically, Telecoms Templates will benefit through the ability to gather data from both the Equilibrium application together with the telecoms network management systems through the centralised Telecoms Templates project management centre.

Future approach

Current telecoms approaches, such as UHF radio and Pilot pairs as examples, though well understood and still entirely applicable to DNO needs are reaching their inherent limits. In the case of UHF radio the spectrum has finite capacity and this is close to saturation in dense urban areas such as parts of Birmingham city centre. While Pilot pairs are showing clear signs of gradual aging combined with the cumulative effects of external damage through the years.

Through its innovative combined approaches of creating templates for application requirements and telecoms capabilities with a DNO industry specific set of metrics, Telecoms Templates can be applied in a 'what if' approach to future OT needs.

By looking holistically at the currently available telecoms systems and services available in a specific geographic domain and comparing these with predictions from models of OT requirements of future distribution system needs, it will be possible to design an overall OT architecture through the Solution Finder tool and templates suite.

The Solution Finder tool will be run with a variety of different weightings and application requirements to consider wide ranging scenarios for a specific area and identify the most financially beneficial fit-for-purpose solutions.

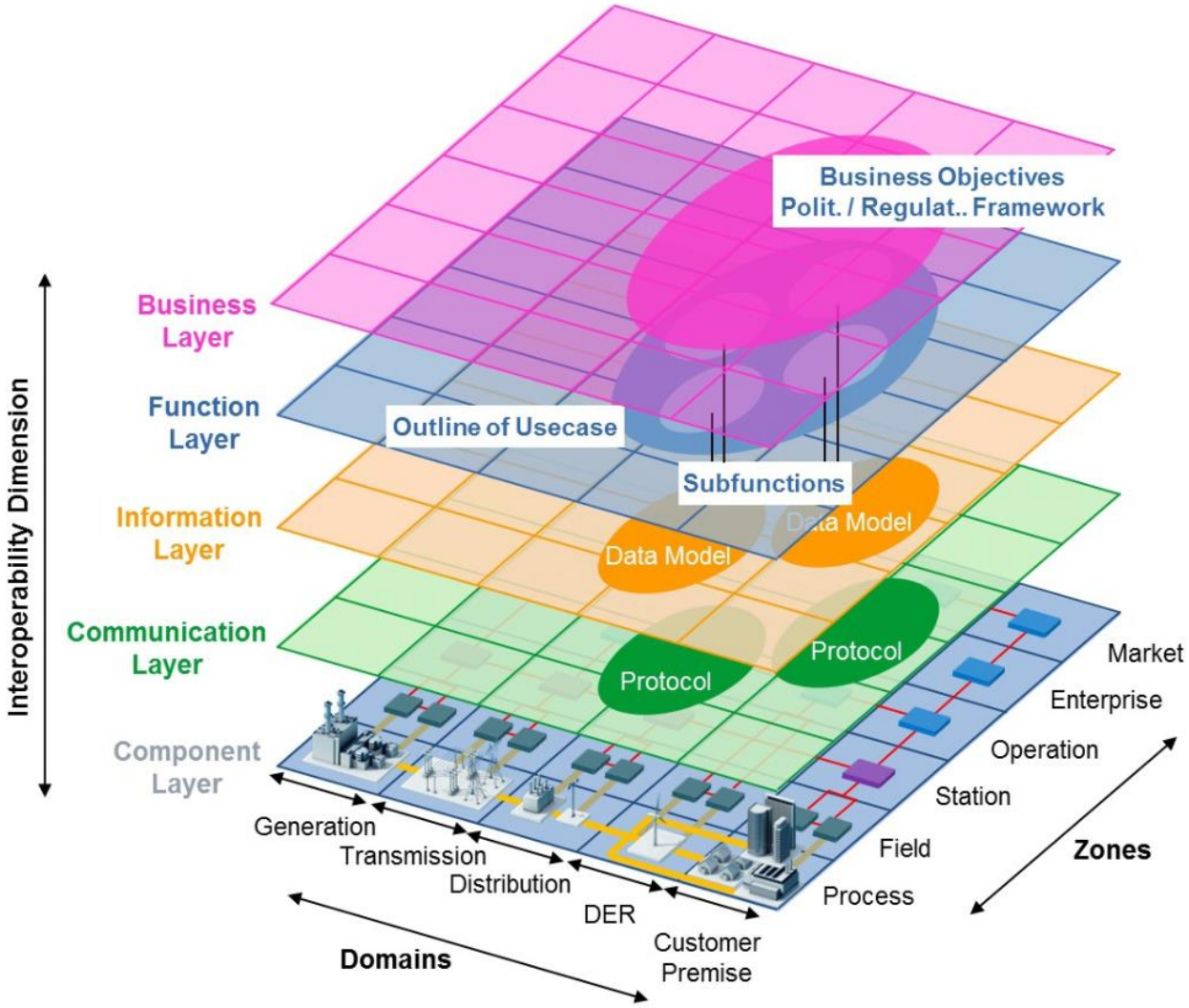
While specific Smart Grid services to be included in the trial approaches will only be identified during the Global Desktop review (Method 1) as part of the Telecoms Templates process the services will include specific applications within the areas of SCADA, Protection, Semi-Autonomous Control and Diagnostics.

Communication Technology selection

The Global Review will provide a long-list of communication technologies that are to be considered in Telecoms Templates. Datasheet specifications and enquiries to providers will be used to populate the performance metrics for each technology. The scope of telecoms types from the review will include, but is not limited to the following:

- Fixed satellite SCADA, VSAT & TSAT – GBPN, Wales & West Utilities or Northern Gas Networks.
- Mobile satellite SCADA as promoted by a number of vendors (uncertain of reference cases)
- WiMax – WPD Falcon & CenterPoint Energy, Houston.
- LTE – National Grid Electricity and RWE/Eon (Germany).
- ADSL SCADA – National Grid Gas and water industry examples.
- Deregulated Mesh networks (Silver Spring Networks) – GBPN and EDP (Portugal).
- MiMoMax protection – Scottish Power and Orion (New Zealand).
- Powerline protection over VHF, UHF & uW radio – NPG.
- SCADA over MPT1327 PMR network – ENW.
- SCADA over a DMR network - Energa, Poland.
- TETRA telemetry & telecontrol – Creos, Luxembourg.
- CDMA – Alliander, Netherlands.
- Airwave Solutions telemetry (NINES project, Sheltand).
- GPRS (GBPN or Scottish Power).
- Fibre (the ESB/Vodafone joint venture might be a good example of a collaborative approach).
- Commercial private fibre network – National Grid/Vodafone (former Cable & Wireless network).
- WiFi & Zigbee (examples drawn from GB Smart Meter experience).
- PLC (from SSE trial in GB, or deployments in France by ERDF, Spain by Iberdrola or Italy by ENEL).
- Classical microwave network (WPD, NPG or ENW).
- UHF SCADA point-to-multipoint (WPD for 9.6 kbit/s or NPG for 64 kbit/s mimomax).
- VHF SCADA point-to-multipoint (being developed now by the water industry).
- 'Long range radio' with Sensus technology deployed by Arqiva in their UHF spectrum.
- SigFox technology being deployed by Arqiva for M2M in GB.
- 'Cellular IoT' as an M2M technology being rolled out by Vodafone and trialled in the water industry.
- Vodafone PAKNET (used by SSE, assuming it will continue to be available)

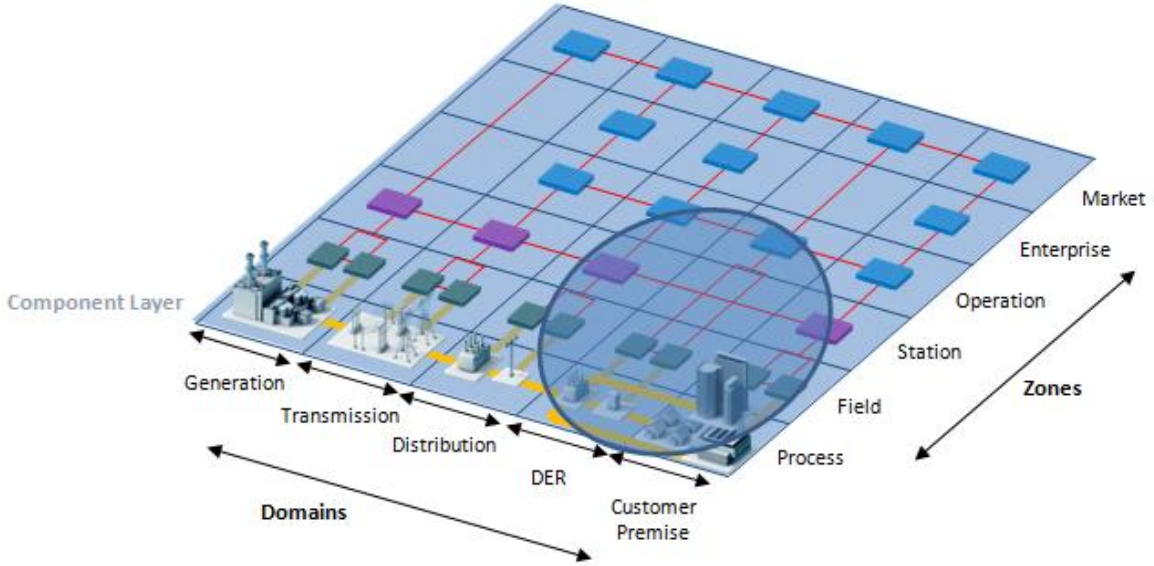
It is important to recognise that Telecoms Templates as a project is looking from a different perspective to previous projects and this is perhaps best explained through the SGAM model.



SGAM (Smart Grid Architecture Model)

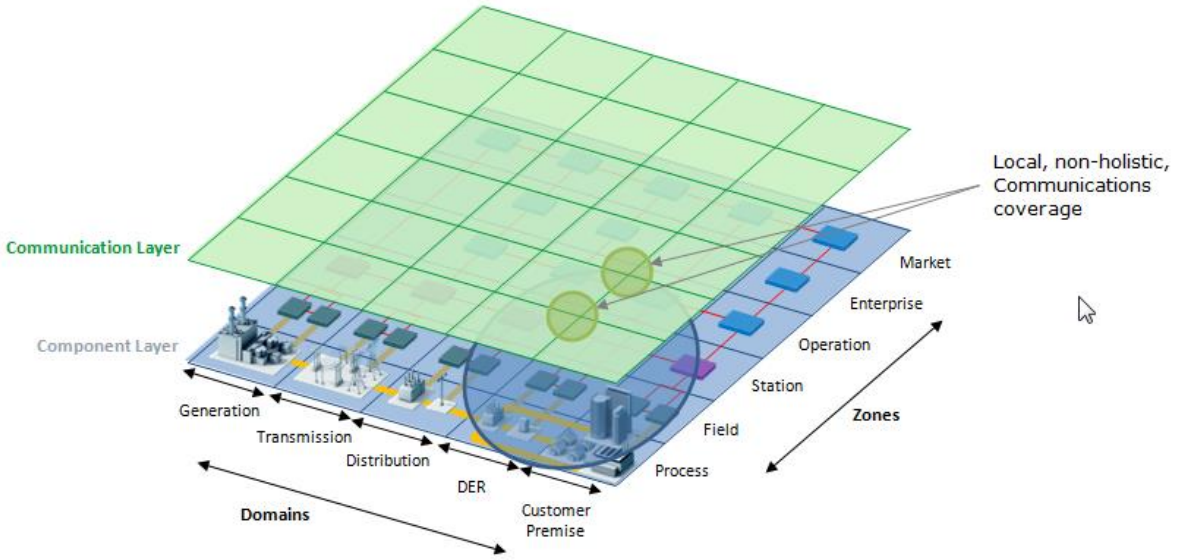
While the majority of previous Smart Grid projects have had elements of their control and connectivity residing in the Communication layer they have primarily been concerned with applications in the Component layer. Telecoms Templates is different, this project sees not only the control and communication in the Communication Layer, but also the physical elements under trial, the communications equipment itself.

Previous LCNF funded projects have concentrated on delivering Smart grid applications within the shaded area of the Component Layer as shown below.



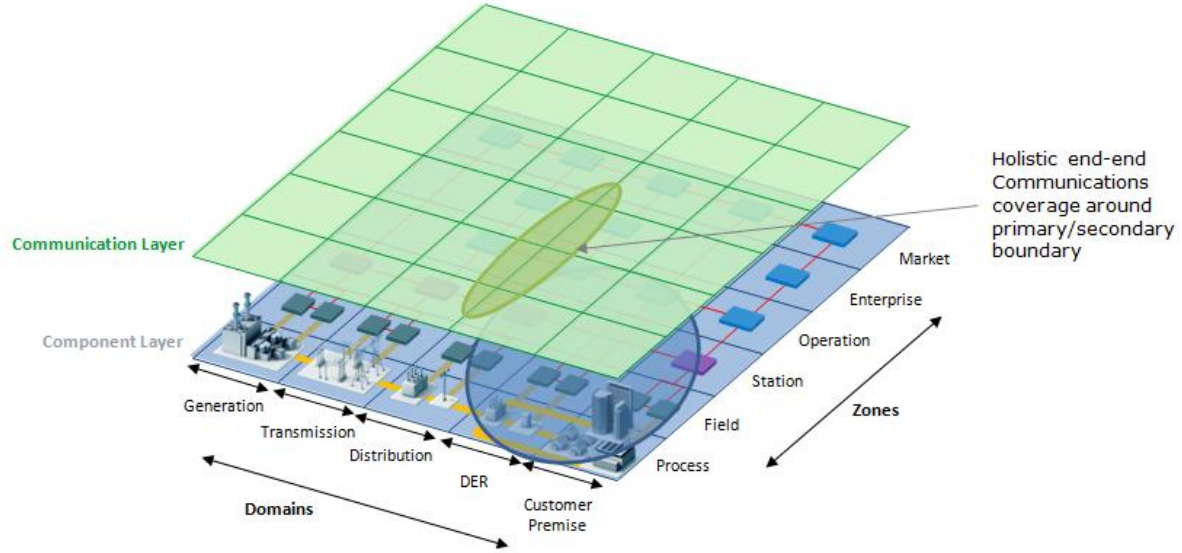
Primary focus region of most previous LCNF projects

As described in the body of this submission there have been communications requirements on the majority of previous projects, but the way these have been defined and delivered without a holistic approach can be seen on the SGAM representation of the Component and Communication layer coverage below.



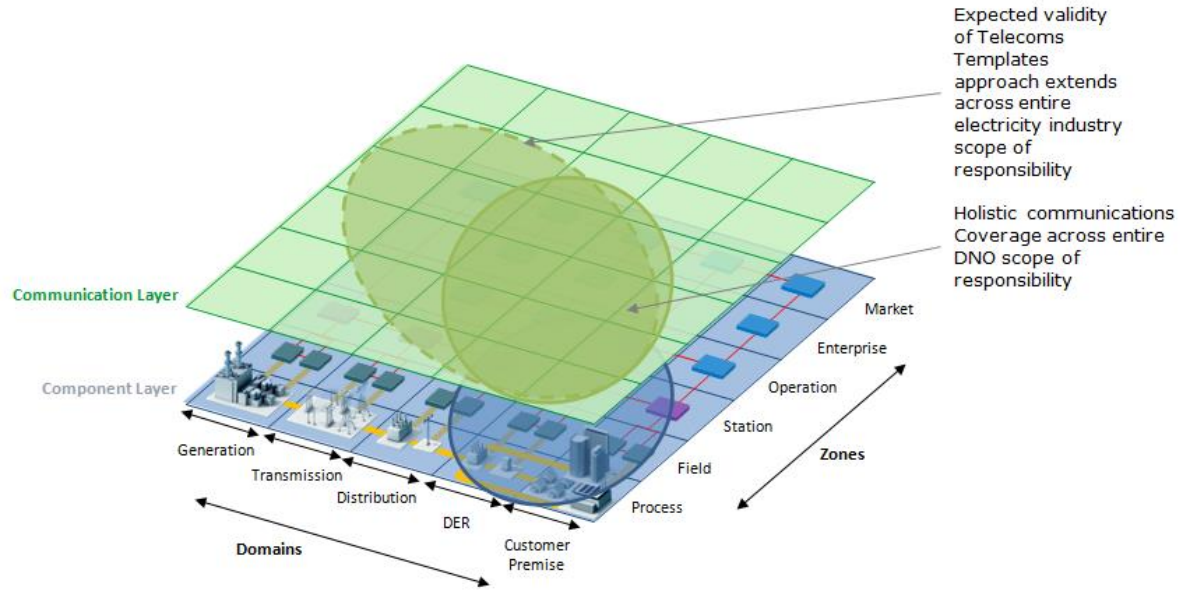
Discontinuous Communication layer regions of previous projects

Development through the course of the FALCON project delivered a more holistic approach to communications delivery, although from a bottom up rather than top down approach as proposed within Telecoms Templates. The result of this communications development in the FALCON project can be seen as represented by a 'slice' of coverage at the Communication Layer, below.



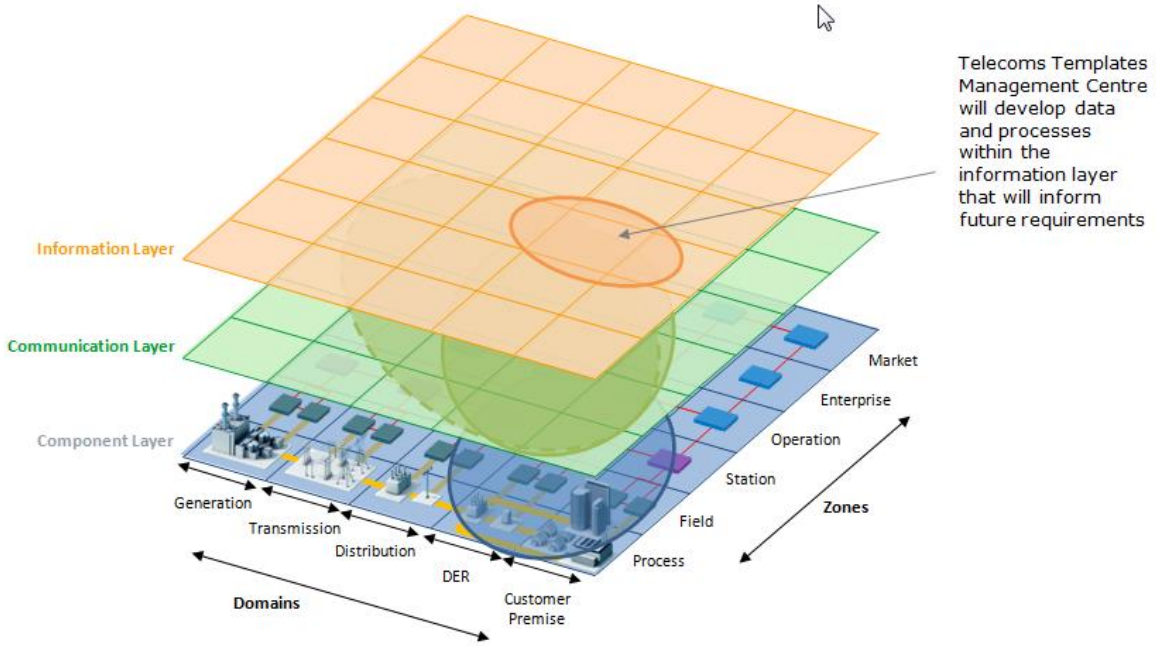
Developed, connected Communication Layer 'slice' in FALCON project

The Telecoms Templates project with its 'top down' approach to communications selection and design will deliver the capability of delivering cohesive, connected communications capability across the entire DNO area of responsibility in both Smart grid applications and BAU as shown in the diagram below. Additionally it is expected that the approach taken and outcomes delivered will also have applicability in the broader System Operator environment.



Communication Layer coverage achievable through Telecoms Templates approach

As a further benefit Telecoms Templates, through its structured approach to communications design, selection and management will also deliver learning in the SGAM Information Layer where the TTMC will reside, as shown below.



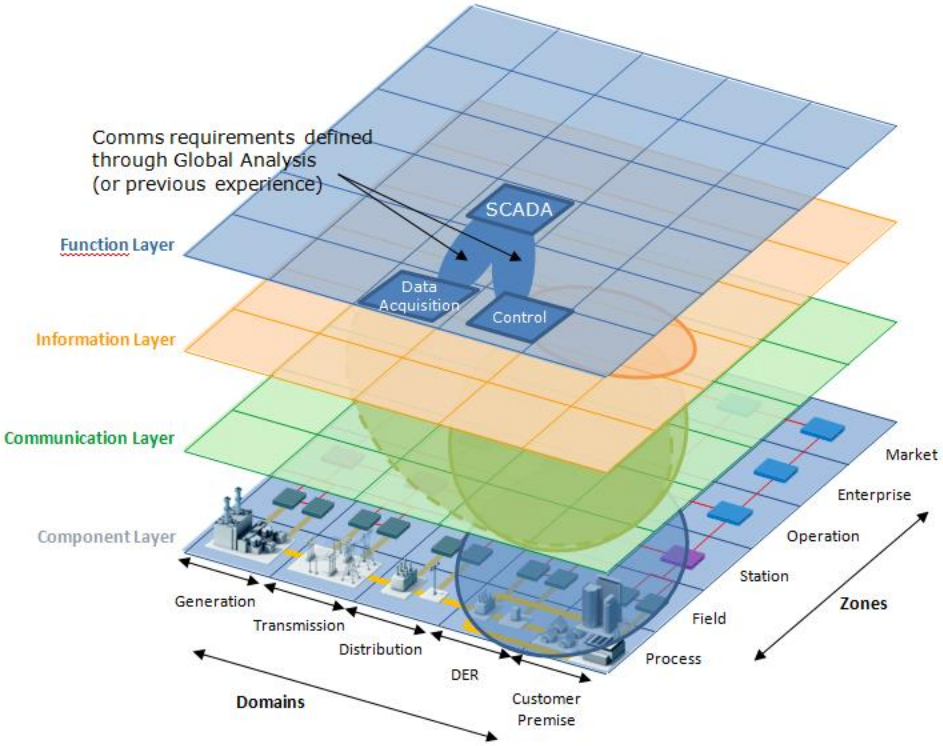
SGAM representation of Telecoms Templates regions of coverage

Relationship of the Function Layer in Telecoms Templates project.

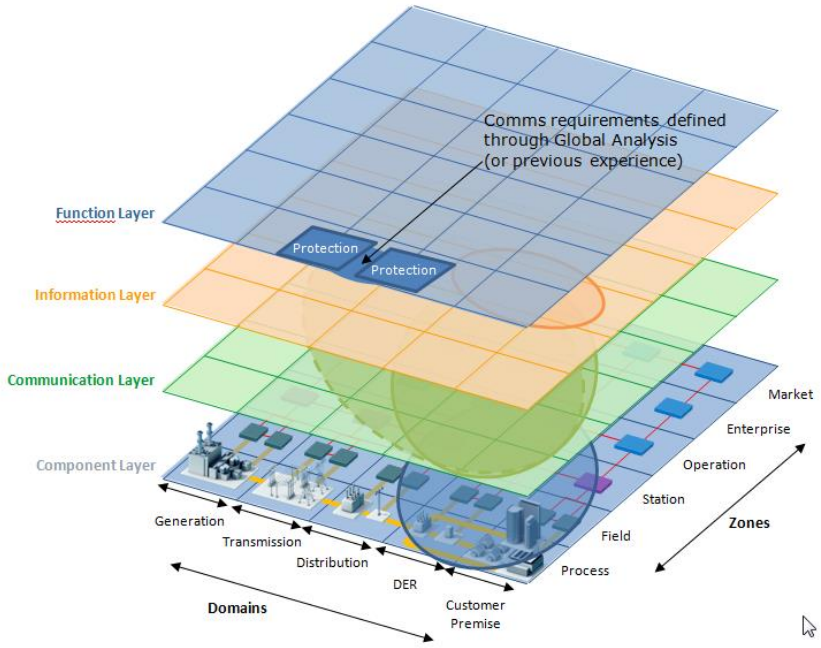
From the '**Smart Grid Coordination Group Document for the M/490 Mandate Smart Grids Reference Architecture'** the following statement is made in respect of the Function layer.

The function layer is intended to represent functions and their interrelations in respect to domains and zones. Functions are derived from the use case by extracting its functionality. In this example the step-by-step analysis provides the functions of the uses case. The interrelation between functions is implicitly derived from the exchanged information.

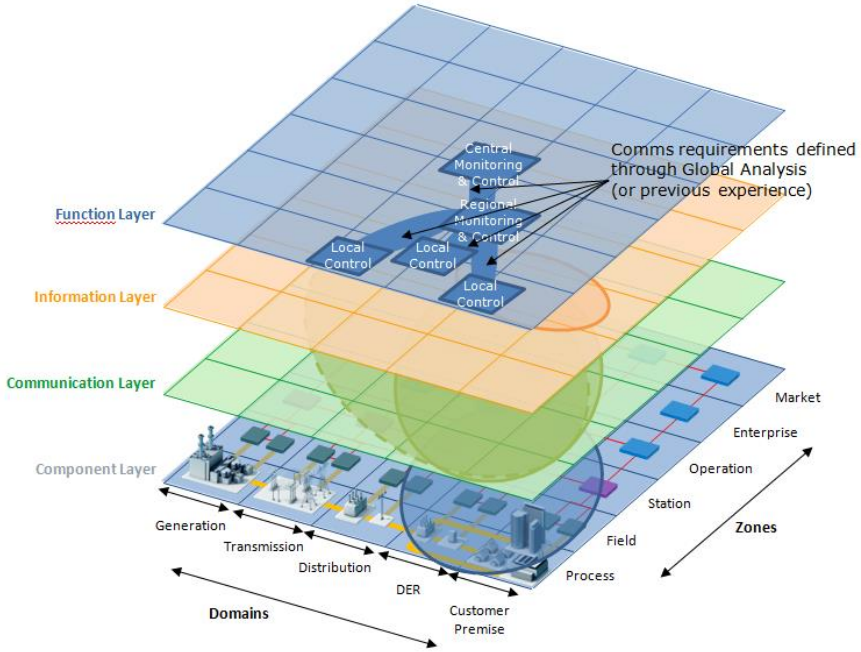
The primary role of the Function layer for Telecoms Templates project is in representation of the telecommunication connectivity requirements of the particular Smart Grid application, eg: SCADA, Protection, Autonomous and Semi-Autonomous Control, Remote Management, Monitoring and Diagnostics. The precise requirements of each application (and there will be many of these forming subsets of the above listed four primary types) will only be precisely defined through the full Global Analysis method, however in principle the application of the SGAM in representing application function is shown in the following diagrams.



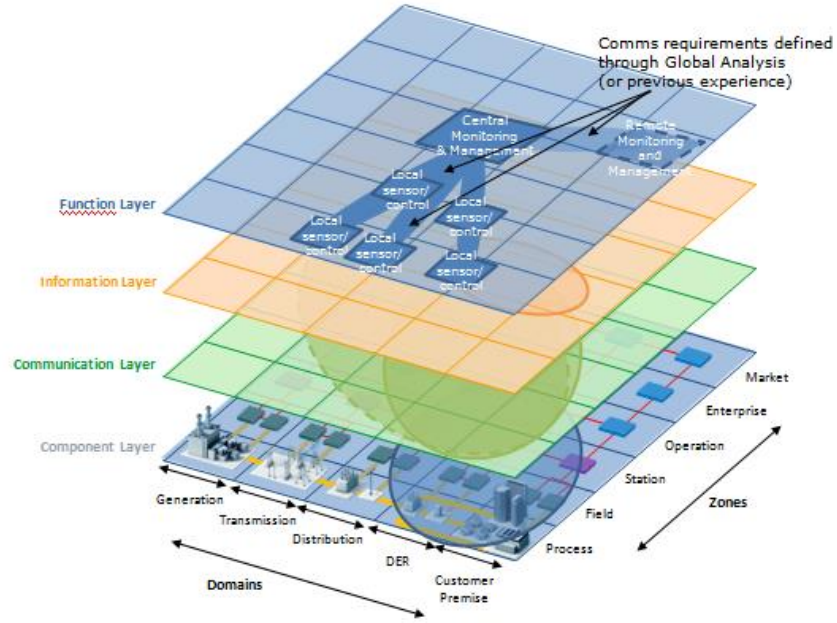
Function Layer representation of generic SCADA application



Function Layer representation of generic Protection application



Function layer representation of generic Autonomous and Semi-Autonomous Control application



Function layer representation of generic Remote Management, Monitoring and Diagnostics application

Combined method approach of Telecoms Templates project

The role of this project is clearly definable as determining optimal fit-for-purpose telecoms solutions for the enablement of developing Smart Grid applications into business as usual.

This simple statement, however, belies the complexity of the problem being addressed. Telecoms is an entirely separate, parallel, environment to that of power distribution systems, it has its own set of rules, challenges, requirements and even to some extent language. Since the scope of this project extends across the breadth of Smart Grid applications at all levels of distribution networks – across the entirety of the UK – then for each of these instances all valid telecoms technologies and services should be identified, evaluated and scored for 'fit-for-purpose'. This is the goal of Telecoms Templates. Additionally though the project intends to ensure retention of the data produced for permanent ongoing benefit of the entire UK DNO community through the process of templating. This process will record both the telecoms requirements of all Smart Grid applications, as well as the capabilities of all telecoms technologies and services identified as valid and applicable through the combined methods of the project.

The process is performed for every Smart Grid application with many applications being progressed through to Laboratory Testing and a smaller number, probably 15, being demonstrated further through enhanced, field, testing. This is iterative and ongoing so that all three methods are being utilised simultaneously through a large part of the project duration.

Method 1 – Global Appraisal

The Global Appraisal method is described in section 2.1.2 of the main FSP document, however it's practical application in combination with the other 2 methods is deserving of greater explanation than the FSP template permits.

An academic collaborator will be selected for a role in the Telecoms Templates project to provide detailed understanding of Smart Grid and telecoms projects, alongside a facility suitable to host the Smart Grid Test Laboratory.

As academic collaborators in the Global Appraisal process they will bring academic rigour to the evaluation of white papers, reports and other documents relating to the deployment of telecoms in Smart Grid applications around the globe. The objective through Method 1 is clear, identify which technologies and services have been trialled or deployed – as well as any that have not – in the Smart Grid environment and develop an initial set of metrics that can fully 'notationally describe' their capabilities against application requirements.

This process is not expected to be easy, initial studies of reports into telecoms performance in Smart Grid applications indicate that the level of detail provided is scant at best. In several cases reports on projects that suffered severe underperformance through telecoms unsuitability contain comments along the lines of 'telecoms did not perform as expected through the project'.

A considerable part of the Global Appraisal will be involved with establishing direct contact with report writers and project owners to establish the true issues encountered and capture these findings using a common language and format. At present there is

insufficient knowledge in the DNO community to specify fit-for-purpose telecoms for any given Smart Grid application primarily because there is no clear understanding of the application requirements in this respect.

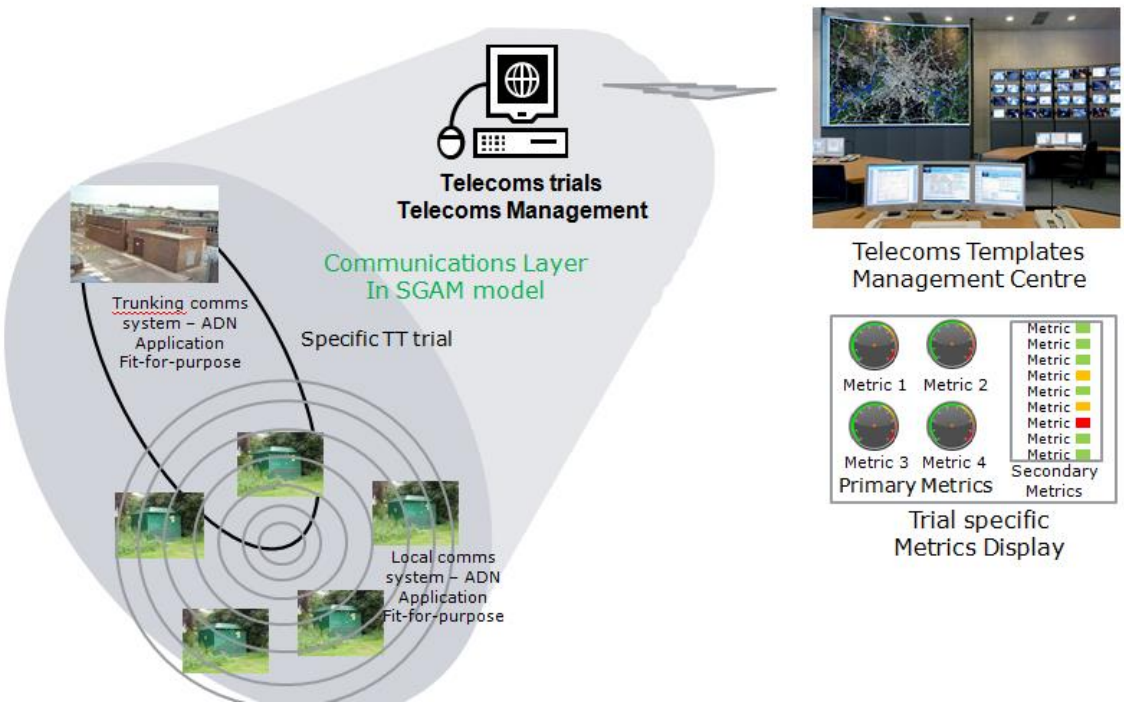
The Global Appraisal method will as an additional, and vital, output deliver an encyclopaedia of terms and language from the two converging worlds of power distribution and telecoms. Confusion arises at a basic level from terms such as 'narrowband' and 'broadband' that each have at least two current usages in the telecoms vocabulary. A 'sub' in the power environment (substation) has a very different meaning to a 'sub' in the telecoms world (subscriber) and, although seemingly trivial, such misunderstandings have led to many costly misunderstandings to date.

Further to these activities the Global Appraisal also drives the templating process that is the core of the whole project. From the detailed analysis of previous experience and global telecoms technology scouring process the initial set of measurement and evaluation metrics will be defined that feed the successive methods. The comparison of application needs and telecoms capabilities against these metrics will deliver the initial suite of templates that will underpin the selection of scenarios for Method 2 and ultimately Method 3.

Finally, in terms of the process, the outcomes and findings from both Methods 2 and 3 will be fed back into the Global Appraisal to iteratively improve the detail and resolution of both the templates and underlying metrics to ensure that Telecoms Templates have ongoing currency for the UK DNO community.

Method 2 – Laboratory Testing

The following diagram illustrates how a trial under Telecoms Templates, while physically rooted in the power distribution environment, operates in the Communication layer of SGAM. Hence the data and control functions of the trials within the project will be under the management of a centralised Telecoms Templates Management Centre to be established within the project.

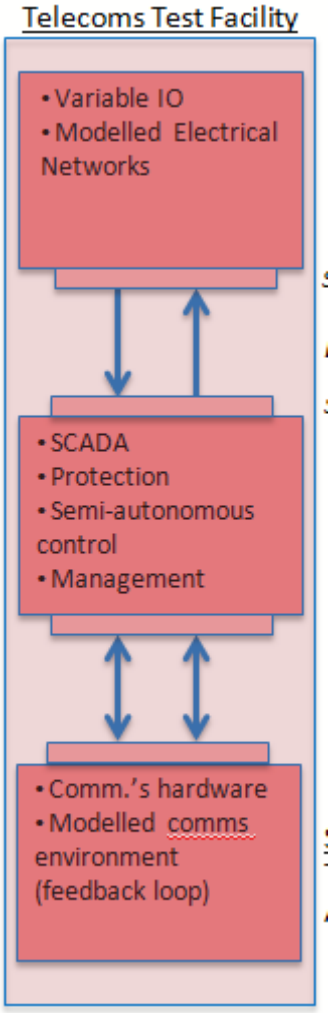


Telecoms Templates – working in the Communication layer

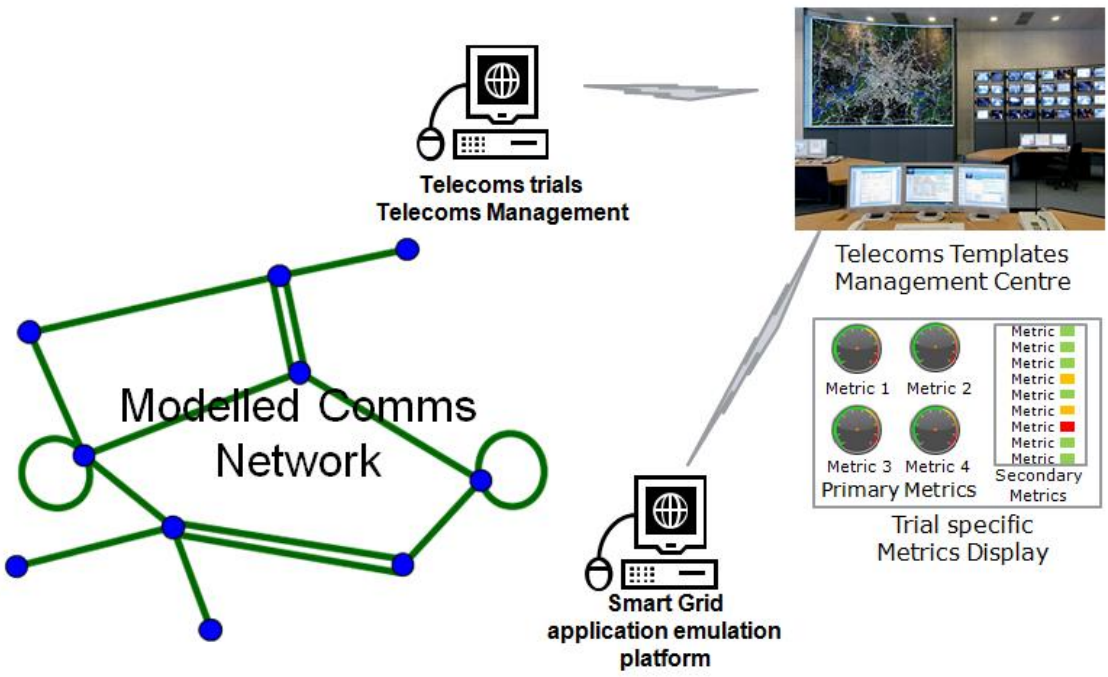
Method 2, is a Laboratory trial process using a modelled communications network alongside a modelled Smart Grid environment with both a telecoms network management system, operating in the SGAM Communications layer, and a Smart Grid services emulation platform, operating in the SGAM Component layer.

The structure of the Laboratory test facility is multidimensional operating simultaneously in both the Smart Grid application and telecoms environments to validate the telecoms technology or service under test against its baseline template in normal, abnormal and stressed environments appropriate to the nature of the scenario.

The combination of physical Smart Grid modelling alongside software simulation for scaleability coupled with the same capability in terms of telecoms are represented in the diagrams below, both logically (upper diagram) and practically (lower diagram).



Laboratory Trial configuration, logical – Method 2



Trial configuration – Method 2

Smart Grid Application Emulator

The network application emulation platform will generate data that is representative of the applications that are under investigation. This data is channelled through the communication technologies under test to a receiving point so that a detailed record of the level of success against the required performance criteria can be made. In cases where a return signal is also required, the relative success of this is also considered within the test.

A function to change the prevailing system state will be included so that the network can be simulated under conditions including; Intact, Fault and Storm. The demand on the communications channels will change under these conditions and the relative importance of information will be different.

Laboratory testing

Laboratory testing serves three main purposes; benchmarking of communication technology performance under ideal and degraded conditions, de-risking field-trial deployments and providing methods and infrastructure to perform future communication technology assessments.

Benchmarking

Datasheet and providers specification do not necessarily give the whole picture of technology performance in-situ. In addition to each technology type used to transmit data, interfaces between technology types are recognised as a further area of difficulty, which is not straightforward or in some cases even possible to assess in a paper based exercise.

A further area that is difficult to study without carrying out practical tests is the reduction in the performance metrics as faults and degradation factors are introduced into the communication system. These mechanisms are not limited to; interference, faulty connections, increased transmission distances, increased data transmission requests and adverse atmospheric conditions. By covering a range of faults and

degradation factors, the expected performance reductions that will be experienced in the field will be estimated for verification in the field testing.

De-risking

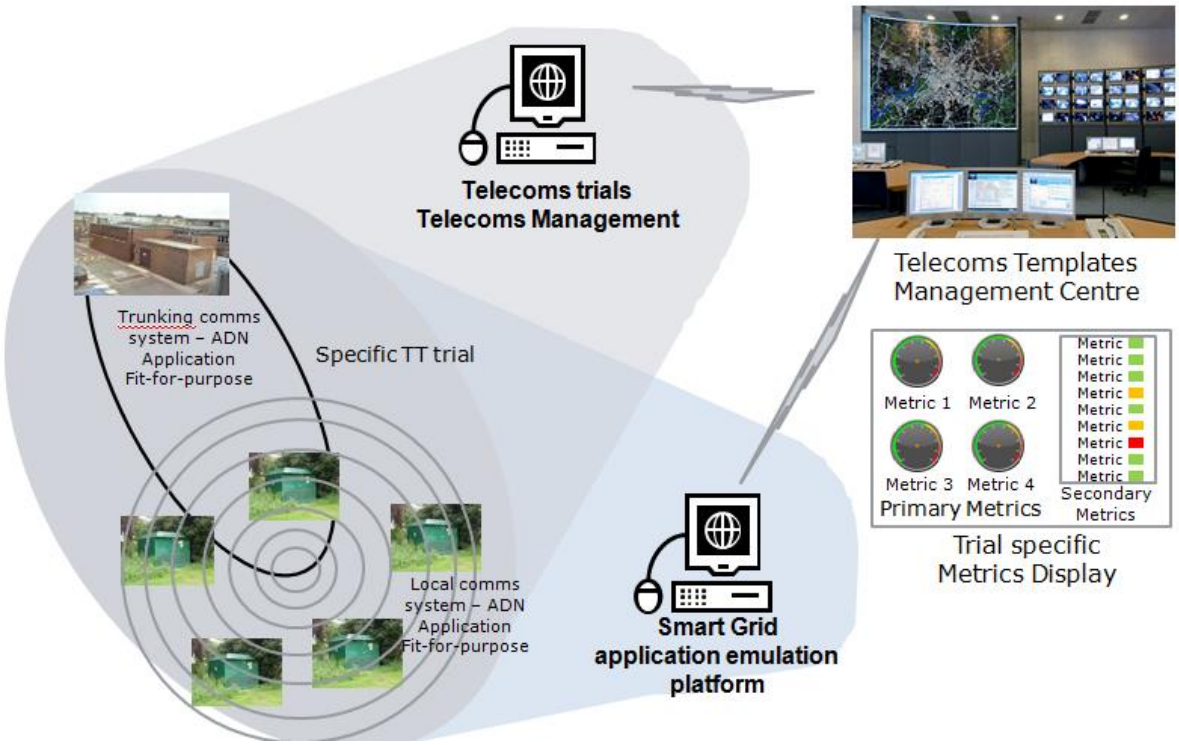
By trialling end-to-end communications systems in the laboratory, the field deployment of communication technologies will be significantly de-risked. Experience has shown that assembling disparate communication technologies, especially from multiple vendors can require a high degree of troubleshooting, which is especially resource intensive if carried out in the field. Sites are often remote and multiple staff may be required at multiple sites.

Field testing

Technologies that make it through laboratory testing with fit-for-purpose performance metrics relative to particular Smart Grid Applications will go through to the field testing stage of Method 3.

Future technology assessments

After field testing has taken place, the recorded performance will be matched against the measured performance in laboratory testing. Across the range of trials that took place a mapping will be made that shows the distribution of faults and degradation factors that were actually experienced. Given this information, when new communications technologies are proposed by vendors, they can be run through a laboratory testing regime that is representative of the field trial experience. In this way, new technologies can be representatively tested for their ability to service Smart Grid Applications, without the need to go to a full-scale field testing stage.



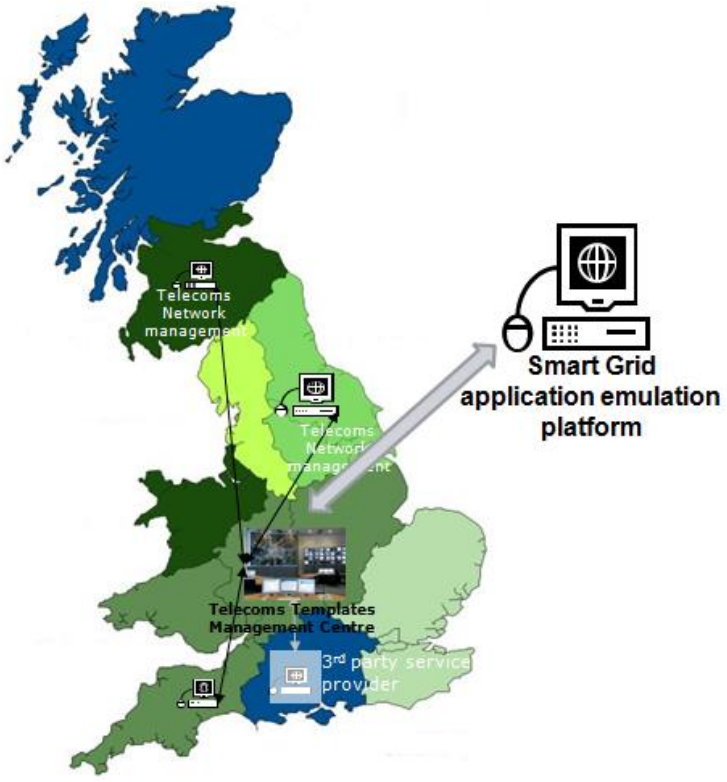
Enhanced Telecoms Templates testing – Method 3

Method 3 extends the principles of Method 2 into field testing by replacing the modelled telecoms network with real communications infrastructure whilst simultaneously including operation in both the SGAM Communication and Component layers. This two

layer monitoring provides a triangulated approach to system monitoring of whole system operation and contributes to the robust methodology consistent throughout the Telecoms Templates project.

Site Selection

By working with project supporters from Network Licence areas beyond those operated by WPD, Telecoms Templates has access to network configurations, terrain and operating practices that are broadly representative of GB. By also gaining the support of international operators (ESB and EdF), situations that are not seen at present on the GB networks, but are expected to develop with time, will also be incorporated into the Telecoms Templates process.

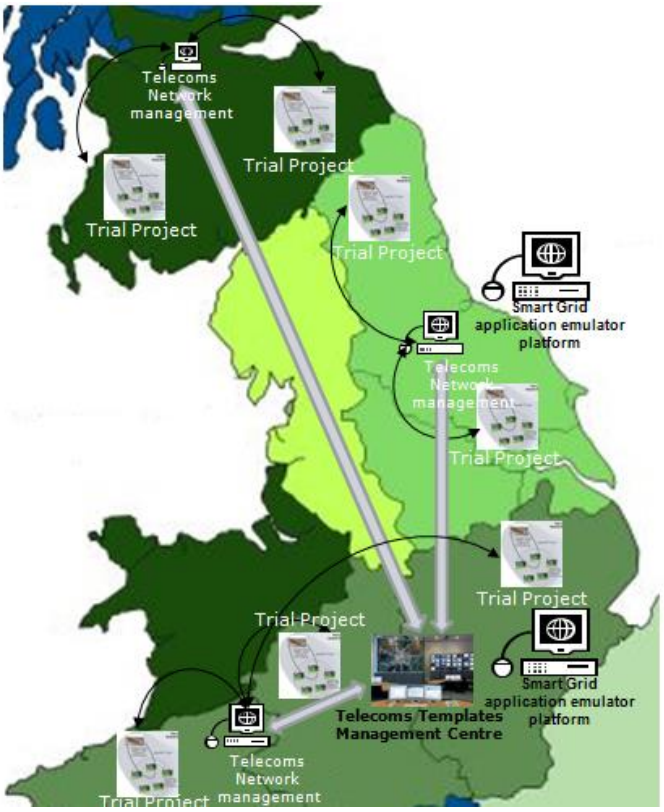


Physical deployment of Method 3 trials

A central Telecoms Templates Management Centre (TTMC) will be established to gather all data generated within the trials, both under Method 2 and Method 3.

A small number of Telecoms Network management platforms, established as part of the Telecoms Templates project, will be located within external collaborators franchise areas. These will collect the Communications layer data and provide operational management of the telecoms systems deployed within that region. These Telecoms Network management platforms will have communications links established directly to the TTMC.

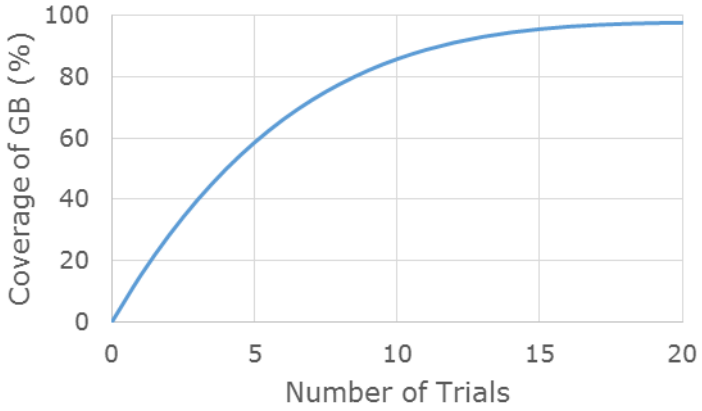
Where a telecoms service is procured from a third party it is possible that the data required on the service could be delivered from a management system within that operator. This would need to be specified to interface to the TTMC and an example of this arrangement is shown (in Hampshire) as a shaded Telecoms Network management platform.



Spatial relationship of trial elements – exemplary

As the illustrations show, there are a number of platforms and communications links required in support of the Method 3 trials and these will be delivered and supported through the Telecoms Templates project.

Telecoms Templates sites will cover rural, sub-urban and urban locations; flat and mountainous; and underground, surface and pole-mounted equipment. Sites will be in order for selection on the basis of replication potential across GB in line with the principle of diminishing marginal utility, whereby each additional trial site adds relatively fewer replication opportunities, as illustrated in the curve below.



Note that this illustration is relative to Smart Grid Applications that are already identified and it is recognised that the 'Coverage of GB' scale is a continually expanding target as new applications are devised and implemented.

Technology matching

Of the fifteen sites that are selected for field testing, the Global Review and Laboratory testing will provide a number of potential communications solutions. In situations where there are several competing technologies, these will be installed in parallel, at the same site, carrying the same communications traffic.

Trialling method

Smart Grid Emulators developed for the laboratory testing will be used to generate the data to be transmitted by the communication solutions at the field testing sites. The evaluation methods used in the laboratory will be transferred to the field testing environment so that direct comparisons can be made.

Appendix 11: An Initial Review of Telecoms and their Suitability within modern electrical networks (Excerpt)

The first stage of the Telecoms Templates project is to carry out a global appraisal of work which has already been done on the effectiveness of different telecommunications technologies and systems for supporting power networks.

In order to maximise the value for money of the Telecoms Templates project, by reducing the time needed for this first stage, it has been decided to carry out a preliminary appraisal independently of the present request for funding, and before the start of the proposed project. It is anticipated that this preliminary appraisal will be completed by October 2015. This Appendix is a summary of some of the findings already reached, being an overview of 35 relevant papers presented at the CIRED conference held in Lyon, France in June 2015.

The most useful papers were those which considered wider issues of overall communications network architecture, such as where best to use different technologies (broadband, fibre, power line carrier). A paper from Belgium (CIRED reference 1291, detailed references for all papers will be included in the full preliminary appraisal report) was particularly relevant. Another paper from Germany (795) stressed the importance of carrying out ICT planning at the start of any project, in combination with power network planning, not afterwards when the range of options could have become limited. This paper also specified a number of relevant metrics for assessing telecommunications effectiveness, and proposed possible standards using these metrics.

A French paper (120) gave an overview of 160 different smart grid projects from across the globe, including their communications aspects. It concluded that 'While current power systems are based on a solid information and communications infrastructure, the smart grid needs a different and more complex one, as its dimension is much larger'. Another French paper (737) described a newly constructed power systems test platform, which included communications aspects. This is similar to what is proposed in Telecoms Templates, and it is anticipated that learning from and possibly collaborating with some of the largest European distribution operators (in particular ERDF in France and ENEL in Italy) will be valuable.

Turning from overview papers to specific applications, the most common was the automation of MV networks, including self-healing networks where autonomous systems will need different levels of communications. Papers from Germany (184), France (1439), Portugal (1049), Sweden (398), Belgium (1291) and Brazil (1343) were useful here, as was a Europe-wide report on the findings of the CIGRE 6.25 working group (1323). From the UK, a report on the SSE Isle of Wight MV self-healing network (936) also included communications aspects.

Smart Grids tend to include implementing monitoring and control at LV which was previously only considered for MV. This clearly has substantial communications implications, including a large increase in data volume as each MV primary typically feeds around 100 LV secondary substations. Several papers addressed these implications, in particular from Italy (694), France (1644)(638), Portugal (1334) and Belgium (1179), as well as one from WPD's own Hook Norton project (755), whose communications issues provided one of the incentives for the present Telecoms Templates proposals. One consequence of moving more into LV is the growing need for a more multi-layered communications network to support the complexity of smart grid, and some papers addressed options for this and made recommendations. Examples were from France (1439), Germany (1167), Netherlands (1426) and Croatia (1018).

Telecommunications are also important within the substation itself (e.g. using Ethernet). Papers which focused on this application were from the UK and France (224) (638) and Germany (669). Other areas of application with interesting papers were on fault location

[8]from Portugal (387), on protection systems from USA (1421), Netherlands and Singapore (318) and Finland (214), on managing severe weather events from Portugal (346, 351). A number of papers also addressed issues around cyber security, and the implications for this of different communications systems, in particular one from ABB in many countries (557), one from Brazil (1477), and the paper from the WPD Hook Norton project already referred to (755).

Other papers addressed more commercial aspects of power network telecommunications. Where third party providers are involved, the nature of service level agreements can affect the design and operation of the communications network, as described by one paper from Slovenia (541). The number of DG customers who can be connected, how fast, at what cost, and with how much curtailment, is another commercial aspect, which was considered by papers from Italy (1517), and from the UKPN network in the UK (735).

The final group of papers considered here was on issues of data quantity and quality. These were from Germany (521) (1167), Netherlands (1426) and from the UK (395), specifically the ENW voltage reduction project. Topics addressed included communications delays, detailed infrastructure specification, and the need to scrutinise data quantity to see how much it could be reduced, thereby mitigating the problem.

It can be seen from this brief survey that the field covered by the proposed Telecoms Templates project is far from empty. There are many researchers from across the world whose experience will be useful in enabling the project to make a quick start, applying and building on that experience to deliver maximum effectiveness from the very beginning.

[8] Note – all references from the above are taken from the CIRED 2015 conference unless specified otherwise – all associated papers can be found within the link below. A formal reference list will be included within the formal release of this white paper.
http://cired2015.org/programme/full-programme

Appendix 12: Glossary of Terms

Glossary of terms used within the Telecoms Templates project.

Additional to the standard application of a glossary to identify acronyms and terms used within a specific document and wider industry usage, here alternative applications within different industries (eg: power distribution and telecoms) are considered as well as further variations where encountered.

Term	Meaning	PD use	Comms use	Other
2G	2nd Generation mobile GSM standard		Yes	
3G	3rd Generation mobile GSM standard +384kb/sec data		Yes	
4G	4th Generation mobile with high data rates, similar to WiMax		Yes	
5G	5th Generation mobile standard based on 5GHz radio		Yes	
ADN	Agile Distribution Network	Yes		
ADSL	Asymmetrical Digital Subscriber Line		Yes	
ALT	Automatic Load Transfer	Yes		
APN	Access Point Name		Yes	
Broadband	Line data rate above 2Mb/s		Yes	
Broadband (Spe)	Wide spectral band			PLC
CDMA	Code Division Multiple Access (radio)		Yes	
CIoT	Cellular Internet of Things		Yes	
DAR	Dynamic Asset Rating	Yes		
DG	Distributed Generation	Yes		
DMR	Digital Microwave Radio	Yes	Yes	
DNO	Distribution Network Operator	Yes		
DSR	Demand Side Response	Yes		
EES	Electrical Energy Storage	Yes		
FO	Fibre Optic		Yes	
GPRS	General Packet Radio Service		Yes	
LTE	Long Term Evolution		Yes	
M2M	Machine to Machine		Yes	
MN	Meshed Networks	Yes	Yes	
Narrowband	Line data rate below 2Mb/s		Yes	
Narrowband (Spe)	Narrow spectral band			PLC
Ofcom	Office of Communications		Yes	
Ofgem	Office of Gas and Electricity Markets	Yes		
PDH	Plesiochronous Digital Hierarchy		Yes	
PLC	Power Line Communication	Yes	Yes	
SCADA	Supervisory Control and Data Aquisition	Yes	Yes	
SDH	Synchronous Digital Hierarchy		Yes	

SDSL	Symmetrical Digital Subscriber Line			
SHE	Safety, Health and Environment	Yes	Yes	
SIM	Scenario Investment Model	Yes		
Sub (Abbr)	Substation	Yes		
Sub (Abbr)	Subscriber		Yes	
TETRA	Terrestrial Trunked Radio		Yes	
UHF	Ultra High Frequency (radio)	Yes	Yes	
VHF	Very High Frequency (radio)	Yes	Yes	
VF	Voice Frequency (300-3000kHz)		Yes	
VSAT (TSAT eur)	Very Small Aperture Terminal (satellite)		Yes	
WiFi	Local Area Wireless Networking		Yes	
WiMax	Worldwide interoperability for Microwave Access		Yes	
WPD	Western Power Distribution	Yes		