National Grid
Electricity Transmission
Annual Summary 2014/15

Network Innovation Allowance

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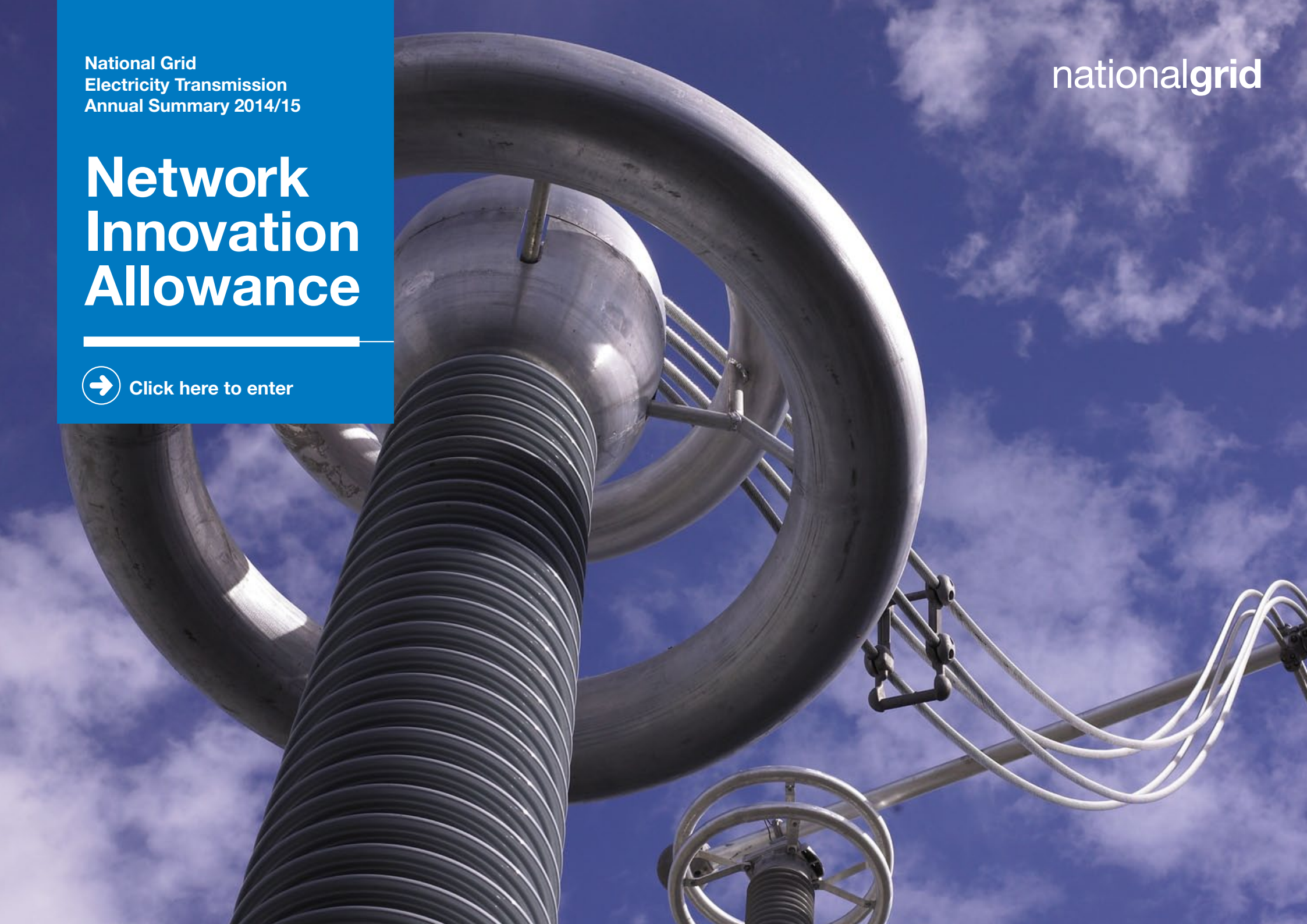
nationalgrid



Welcome

This is the second Annual Summary of National Grid Electricity Transmission's (NGET) projects under the Network Innovation Allowance (NIA). 2014/15 has been a year of enhanced focus on innovation in Electricity Transmission, with a number of successful initiatives implemented into our ways of working.

We have further enhanced our innovation capabilities and partnerships, delivering a balanced consumer-value focused portfolio of projects through our Network Innovation Allowance (NIA). We have also been successful in securing funding for our Smart Frequency Control (EFCC) Network Innovation Competition (NIC) project.

Innovation can be summed up as the act of matching what is needed with what is possible, to deliver a better outcome. The energy systems in Great Britain (GB) are undergoing fundamental changes. This, coupled with the changing ways in which consumers use energy, means that what is needed to maintain safe, reliable and affordable energy is rapidly evolving. At the same time, the pace of technology development is moving the art of what is possible at unprecendented rates.

Reflecting these changes, in 2014/15 we embarked on a review of our strategic innovation priorities, focusing on the best opportunities for both the GB System Operator (GBSO) and the England and Wales Transmission Owner (TO) to find ever better ways to meet the needs of electricity users.

During the year, we also completed our organisational design review for innovation. This will provide enhanced clarity of responsibilities and accountabilities for selecting, prioritising and delivering innovation projects and implementing successful outcomes into day-to-day business operations. A panel of Directors from all of National Grid's UK RIIO-regulated business has been established with accountability for our UK technology and innovation strategy.

> **We have done some fantastic work in innovation this year which you can find out more about in the rest of this document. In further testament to our achievements, it is pleasing to see a new conductor technology, tested through a series of our projects, now being proposed as the most efficient solution for increasing capacity on part of the network in Scotland.**

Our portfolio of innovation projects covers the full spectrum of our strategic priorities, with work progressing on opportunities reflecting long-term and short-term potential. To leverage the best value for GB consumers we have been proactively sharing the knowledge gained from our research and innovation activities with other network owners. This has been done through a knowledge sharing forum for the Onshore and Offshore Transmission Owners and System Operator, the Low Carbon Networks and Innovation conference in October 2014 in Aberdeen, and through regular direct contact between our engineers and partners in other networks.

J. Pettigrew.

John Pettigrew
Executive Director, National Grid

Our innovation strategy

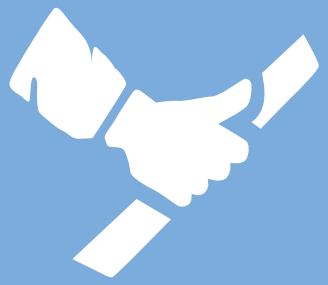
7

key areas

Our RIIO innovation strategy identified seven key strategy areas for our innovation activities for the first years of the RIIO T1 period. Our NIA projects and supporting activities have continued to advance state-of-the-art technology and best practice across all of these themes.

Safety

We continue to invest in the development of new products, processes and techniques to protect our staff, contractors and the general public. Of particular note has been the continued development and successful testing of ground breaking non-conductive safety screening suitable for use in our high voltage substations. This research will help mitigate the impact of risk management hazard zones on system operability and increase access for maintenance.



Reliability

Much of the GB transmission network we benefit from today was built in the 1950s and 1960s. Although many components were originally designed to last 40 to 50 years, our research into the causes of failure and ways to prevent it continues to enable us to improve the assessment of the true remaining operational life of key equipment such as transformers and protection systems. It also means we can develop ways to extend the operational life of many network components without comprising the high levels of reliability of the system.

Environment

Our portfolio includes a number of projects aimed at minimising the environmental impact of our assets and operations as well as facilitating the connection of low carbon sources of electricity. We have been continuing to research and assess ways in which we can make the most of the valuable resources embedded in our assets by exploring efficient ways to re-use or refurbish equipment, and where this is not possible or cost effective, to recover materials for recycling.

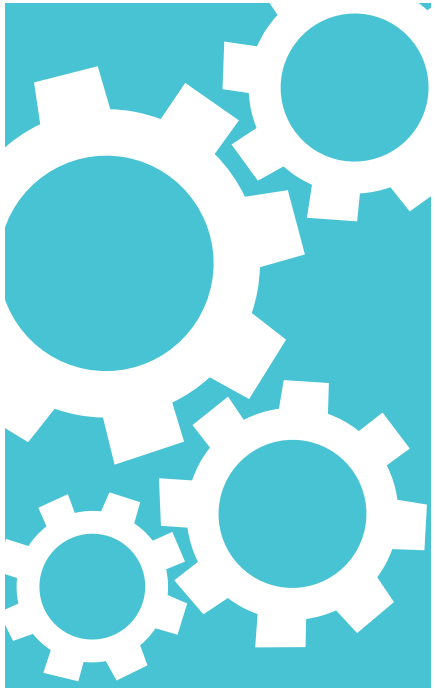
Our innovation strategy continued

Connections

Timely and affordable system access is a priority for our generation and demand customers. New generation connections are increasingly dominated by non synchronous generation, such as wind and solar, and are increasingly connected to the distribution networks. This requires a different approach to managing the electricity system as a whole, so we are working closely with the distribution network operators to understand better and find affordable solutions to maintain voltage and frequency stability on the network. This will make sure our networks are capable of connecting the volumes of renewable generation the market is driving and can operate in harmony with active distribution networks.

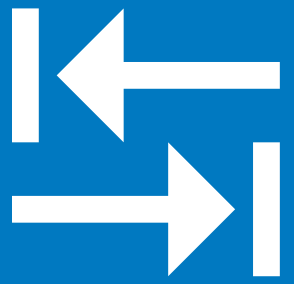
Commercials

The nature of Great Britain's electricity demand has been evolving rapidly and there are a number of ways in which it could be actively managed to reduce the cost of maintaining security of supply. We have continued to progress a number of projects aimed at making sure demand-side services are technically and commercially viable, through better understanding and modelling of future demand and reliable means of control and communication.



Strategic

Our strategic research ensures we are collaborating with a diverse range of institutions including universities, other utilities and industry groups to investigate next generation technologies in long-term research. We continue to enhance our network modelling and supply and demand capabilities, investigate how best to use the emerging technologies such as energy storage and support the development of new materials.



System Operation

As the GBSO we continue to advance innovation to facilitate smarter system operation, enabling the efficient and coordinated operation of the electricity network. Balancing the supply and demand for electricity on a second by second basis efficiently, and maintaining the stability of the system, is becoming ever more complex with around 8GW of solar generation across the country. Many of our research projects are directed at enhancing the sophistication of our forecasting models and exploring novel ways to respond ever more rapidly to disturbances to the network.

2014/15 NIA portfolio overview

The evolving nature of the GB energy sector led us to embark on a review of our strategic innovation priorities in 2014/15, and look at the landscape we operate in as an electricity transmission business.

National Grid is in a unique position in having both the England and Wales Transmission Owner (TO) and the GB System Operator (GBSO) business areas. We focused our review on the best opportunities for both the TO and GBSO to find ever better ways to meet the needs of electricity users and deliver value to our consumers and stakeholders.

We maintain a balanced portfolio of innovation activities by looking at our projects in a number of ways. In the coming pages we provide an overview of our 2014/15 activities showing:

- which aspects of the Transmission Network or System Operator challenges our projects predominantly relate to;
- a qualitative assessment of the Technology Readiness Level (TRL), which gives an indication of relative maturity of the technology or solution being investigated; and
- how they align with nine challenge-and value-driven themes that illustrate the strategic priorities of NGET.

Many of our innovation projects touch on more than one aspect of the transmission system and more than one of the value themes: we have grouped our projects according to their predominant characteristic.

We invested £10m in progressing 110 NIA projects in 2014/15. The diversity of assets and activities at the heart of National Grid's Electricity Transmission operations is reflected in the nature of the subjects addressed by our portfolio. Our innovation approach allows us to explore a broad range of areas, all of which have the potential to introduce either lower-cost or lower-risk solutions, and often both.

For more information about our projects visit the Energy Networks Association Smarter Networks Portal

Aspects of the Transmission Network

System Operation

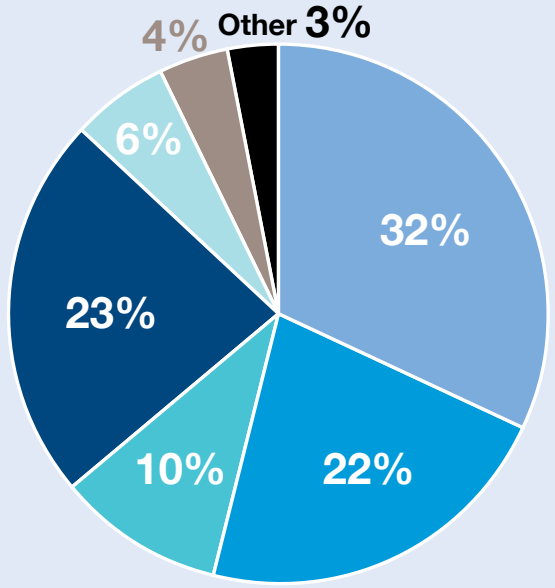
Substations

Overhead lines

High Voltage Direct Current (HVDC)

Underground cables

Safety, Health, Environment and Security (SHES)



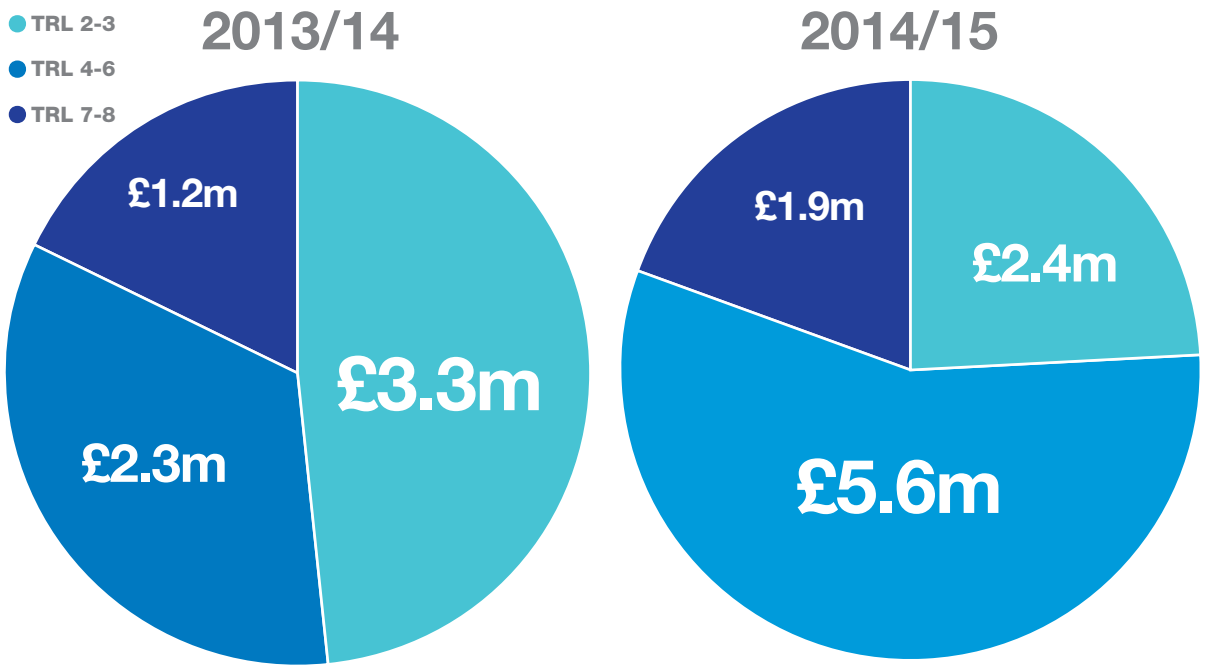
2014/15 NIA portfolio overview continued

Technology Readiness Level (TRL) is a scale from 1-9 which provides an indication of how close a technology or new operational practice is to becoming technically and commercially viable, and therefore ready to be adopted as routine in day-to-day business.

Our portfolio of projects spans the breadth of the Technology Readiness Levels 2 to 8. This diversity and strong mix of projects is a reflection of our staged approach that drives our business forward through the continuous development, trialling and refinement of new technologies and operating procedures.

Compared to last year, our innovation projects are progressing from research into the development and demonstration stages for implementation into the business. We continue to create new research projects.

> **"Our innovation projects are progressing from research into the development and demonstration stages"**



TRL explained

For the purposes of the NIA, the TRL levels are defined as:

2-3

Research: activity undertaken to investigate the issue based on observable facts.

4-6

Development: activity focused on generating and testing potential solutions to overcome the issue.

7-8

Demonstration: activity focused on generating and testing solutions on the network that takes them to a stage where they can be transferred to business as usual.

1&9

1 (Blue skies research) and 9 (Fully developed and tested and ready to be deployed) are not eligible for NIA funding.

Transmission Owner (TO) innovation value themes

Our goal is to be an industry leader in innovative technologies, processes and solutions for electricity transmission networks. Our approach is built around consumers, future technological developments and business objectives, and it is focused around four value-driven themes.

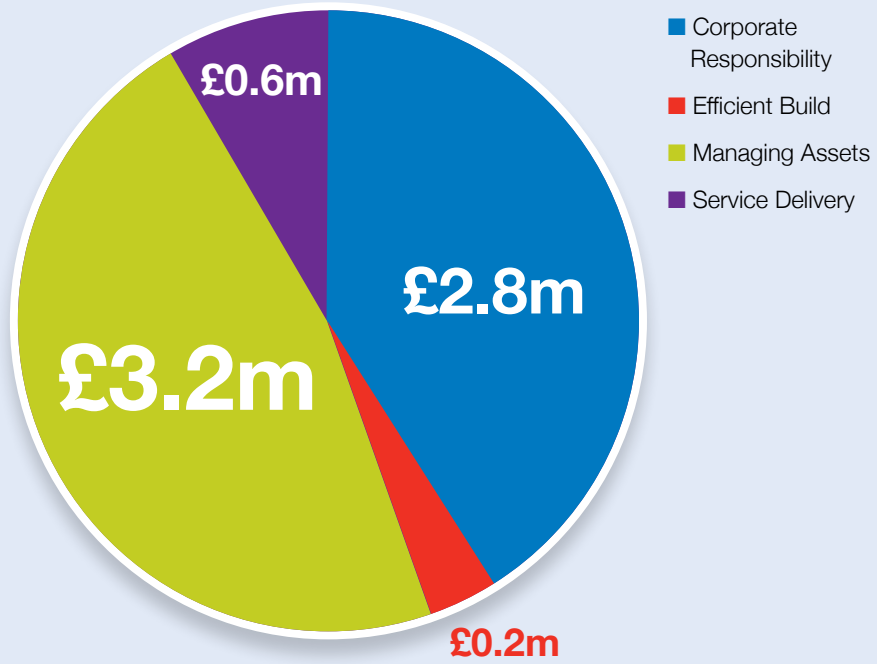
Managing Assets:
Developing ways to manage new and ageing assets more effectively. Benefits are maximised through the reduction in the ageing rate of the assets.

Efficient Build:
Developing ways to build new assets faster and at lower costs. Value is created by delivering the outputs of our capital investment plan for less.

Service Delivery:
Developing stakeholder and customer-focused capabilities through exploiting existing assets and developing new service-based business solutions aligned to customer needs. Benefits are maximised through the increase in boundary capacity or new services that customers value.

Corporate Responsibility:
Doing the right thing, including social responsibility, safety and sustainability, in all new developments. Our stakeholders place value on us ensuring we meet high standards in this area.

2014/15 spend by TO value theme



GB System Operator (GBSO) innovation value themes

There are many ongoing initiatives around energy supply, as well as a wider political and societal focus on affordability, the continued need for network security and enabling decarbonisation. We actively engage with stakeholders, informing and leading debate around Future Energy Scenarios (FES), the Electricity Ten Year Statement (ETYS) and our System Operability Framework, all of which we used to inform our views of how the future could unfold and inform our innovation programme theme areas. The five value themes identified provide a clearer focus for stakeholders and ensure we meet our RIIO requirements.

Demand:
Electricity demand and the net demand seen from the transmission network is impacted by increasing levels of distributed generation. This theme seeks to enhance our ability to forecast and model demand changes and to deliver new ways for demand to contribute to the secure and efficient operation of the transmission network.

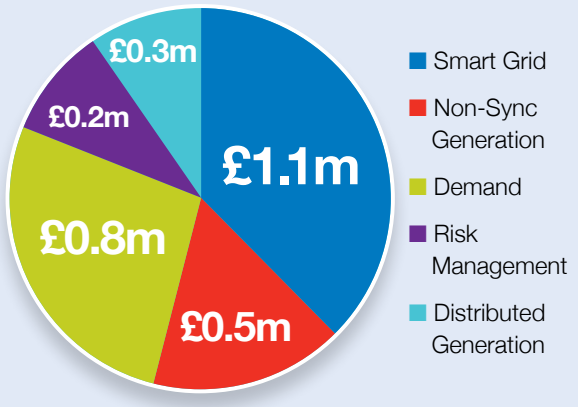
Operating with Non-Synchronous Generation:
With increasing levels of renewable generation including wind and solar, as well as increased HVDC interconnection with other networks, there is less synchronously connected generation supporting the GB system. With lower inertia, the GB network is more likely to be disrupted by unplanned events. This theme is assessing these limitations to find ways to operate the GB network with higher levels of non-synchronous generation.

Distributed Generation:
A larger proportion of new generation is being connected at distribution rather than transmission voltage levels. Often, the GBSO does not have visibility of this generation or the ability to affect its operation. This theme looks to extend our capability to model and forecast distributed generation, and to develop strategies to securely and efficiently operate the network with very high levels of distributed generation.

Smart Grids:
Given the scope to co-ordinate and manage many different assets across transmission and distribution networks, Smart Grids can provide new options for the design and operation of the electricity networks. This theme is intended to identify smart solutions to transmission challenges, quantify their value and demonstrate how they can be used to provide new services and increase transmission capacity.

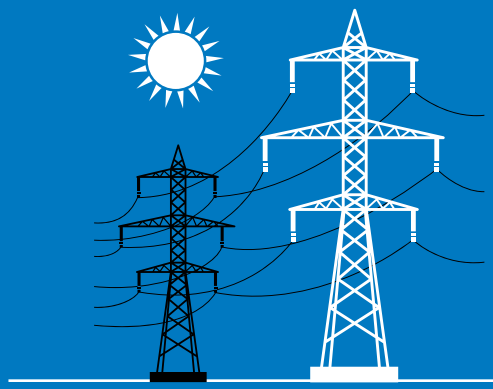
Risk Management:
As system operation becomes more complex, with increasing numbers of generators and more active distribution networks, new risks emerge. As well as generation, demand and transmission risks, there are system information risks and human error risks as increasing quantities of information are processed. This theme aims to better understand and manage these complex risks in our evolving role as GBSO.

2014/15 spend by GBSO value theme



NIA in numbers

Here's an overview of Electricity Transmission's achievements in the Network Innovation Allowance during 2014/15.

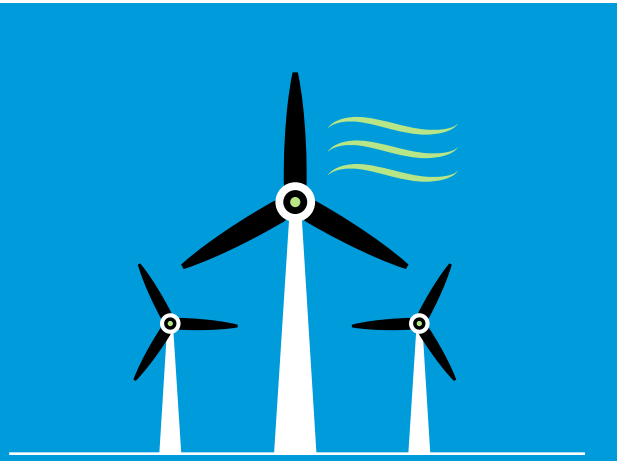


14 new projects started

During 2014/15, National Grid Electricity Transmission employees worked more than

22,500 hours on innovation projects

70% more personnel were involved compared to last year



96 active projects

£6.9m of Network Innovation Competition (NIC) funding contribution secured for our Electricity Frequency Control Capability (EFCC) project

We're working with three other network licensees on their successful NIC projects and collaborating on five Low Carbon Network Fund (LCNF) projects

EXPENDITURE

75%+ or £7.7m of the NIA was spent on external suppliers, specialists and research establishments

£10m was invested in innovation, a 50% increase on last year

£20m of non-NIA funding was leveraged through larger projects in which National Grid was a co-funder

Innovating together

Effective collaboration and excellent supplier relationships remain at the heart of our success in innovation during 2014/15. We recognise that there are significant benefits for consumers by working in partnership with our peers in the industry, academia and those from other sectors, and we will continue to look for new opportunities in the future.

1 Working with the industry

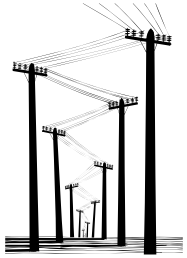
125

We worked with more than 125 suppliers and partners on our portfolio of NIA innovation projects, in particular academic institutions, other licensed network operators (LNOs) and a range of specialist technology or infrastructure suppliers, many of them small and medium sized enterprises (SMEs).

Our three licensed networks (Gas Transmission, Gas Distribution and Electricity Transmission) are working with SKM Enviros to develop a toolkit to increase re-use of our resources and assets, which we hope will shape the industry's approach.

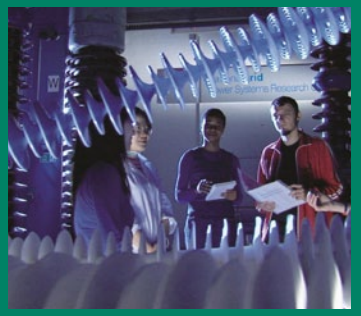
We're also collaborating with:

The Department of Meteorology at the University of Reading to look at the clustering effects of major offshore wind developments.



SP Energy Networks, the University of Strathclyde and the Energy Technology Partnership to look at how overhead line capacity is affected by the increased use of renewable generation.

Distribution networks and the ENA to assess what impact increasing levels of renewable generation will have on the transmission and distribution networks.



2 Listening to others

Overhead line conductors can be noisy and in certain circumstances this can have a detrimental effect on the local environment.

In Cheshire we have been working closely with the local community to find a solution to noise problems and are trialling alternative solutions which are designed to be quieter.

Residents were invited to visit the National Grid High Voltage Laboratory at the University of Manchester to help them understand the problem and potential solutions.

Click here to read in depth about this project

Innovating together continued

Our collaborative approach extended into the wider industry too, with National Grid employees and teams playing a part in a series of events and conferences dedicated to thought leadership in the fields of energy and business.

3 Out and about

2014/15 was our first year presenting at the Low Carbon Network and Innovation (LCNI) conference held in Aberdeeen. During the event, 23 of our engineers presented the latest output from their innovation projects, shared our learning and discussed future challenges.

Some of the other events we got involved with included the:

- Hubnet Symposium
- Electric Power Research Institute (EPRI) European Power Delivery and Utilisation Taskforce
- European Network of Transmission System Operators for Electricity (ENTSOe) Research and Development Committee
- iTESLA project dissemination event (European transmission system operators)
- Eighth UHVnet (Universities High Voltage Network) Colloquium.

We are actively engaging with developers of energy storage projects to understand better how they may benefit the transmission network in the future.

4 Beyond NIA

Outside of the NIA/NIC framework, we're working with a range of charities and other conservation organisations, government agencies and land owners who have National Grid equipment on their site. The aim is to reduce our impact on the environment through new and innovative ways.

- **In an industry first, Natural England granted us a corporate bird licence.**
- **We're developing new partnerships with a range of regional wildlife trusts.**
- **We're leading the way on Visual Impact Provision.**

> **Heat recovery systems have been retrofitted to super-grid transformers without the need for outages**

Click here to read in depth about this project

Transformer heat recovery trial improves thermal efficiency and environmental performance

National Grid has trialled innovative heat recovery systems in three substations, utilising waste heat, a by-product from electricity transformers, to provide heat and hot water to adjacent buildings.

This non-invasive, sustainable method of harnessing energy reduces substation demand for low voltage electricity supplies, reduces National Grid's impact on the environment and supports local communities.

Trial installations at Melksham, Bishops Wood and Cardiff East substations are helping National Grid to understand the performance and potential efficiency gains from three different variations of heat recovery system in different substation environments.

In each case, heat recovery systems have been retro-fitted to super-grid transformers without the need for outages. Installation work started in 2013/14 at Melksham, but the majority of the work, plus development and installation at Bishops Wood and Cardiff East, was largely completed in 2014/15.

Pushing the boundaries

The installation at Melksham, a large site with numerous office buildings, has pushed the technological boundaries by testing the capability of waste heat recovery over long distances. This project has successfully installed a long ground loop to transfer energy recovered in water glycol from super-grid transformers to a central plant room which serves two operational buildings.

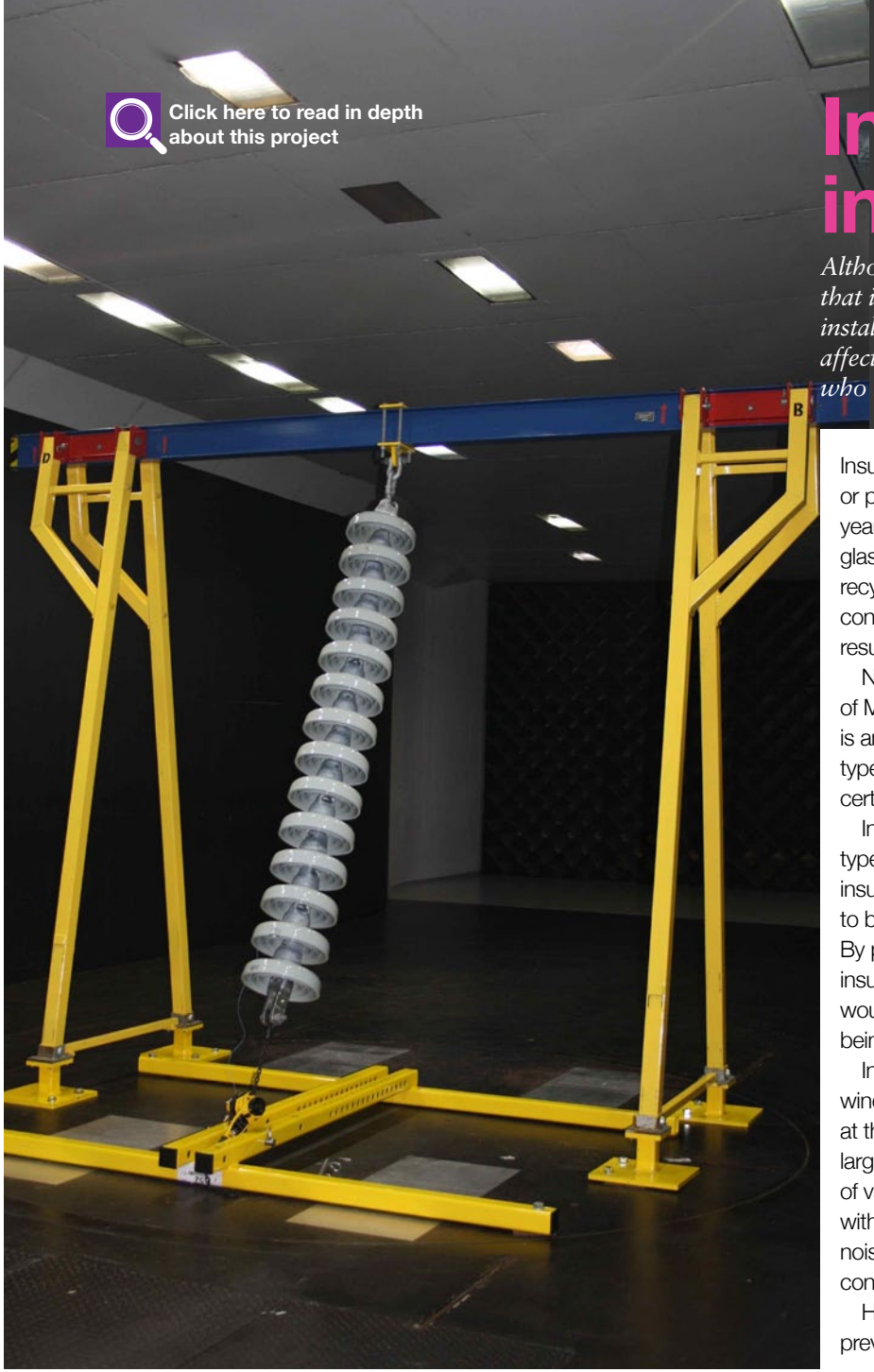
Smart radiators have also been installed, using up to 60% less energy than conventional radiators. The use of fan-assisted heat exchangers within the unit reduces water content, which in turn increases the overall performance of the system and heat distribution.

Benefiting the local community

At Bishops Wood the heat recovery system uses a single plant room to provide space heating and hot water to the substation offices – the first transformer heat recovery system to incorporate a domestic hot water circuit. The system also heats an adjoining environmental education centre, which demonstrates National Grid's potential to provide surplus heat for the benefit of the local community.

These offices also benefit from high energy, high output radiators, which will provide an alternative unit heater to benchmark against the other two systems.

At Cardiff East substation, monitoring of a third installation will test the adaptability of the technology for transformer installations in open air. The systems are being carefully monitored and results to date have favourably proven the concept of transformer heat recovery and its adaptation to different site and transformer topologies.



Click here to read in depth about this project

Investigation of Aeolian insulator noise

Although insulators used on the electricity transmission network have a shape that is designed to minimise noise and undergo rigorous type testing prior to installation, in recent years insulator noise has been a source of complaints from affected communities. Most commonly, these noise complaints come from people who live near overhead line routes refurbished with glass insulators.

Insulators can be made of glass, porcelain or polymeric materials, but in recent years National Grid has preferred to install glass insulators because they are readily recyclable. However, under certain wind conditions insulator strings may resonate resulting in an audible tonal noise.

National Grid has worked with University of Manchester to determine whether there is an inherent design flaw in the insulator type that was leading to audible noise under certain wind conditions.

Investigations have aimed to develop a type test that will identify and remove 'noisy' insulators, reducing the potential for this to become an issue for local communities. By preventing the initial installation of these insulators on the network, this type test would also limit the need to replace them for being too noisy.

In May 2014 National Grid conducted wind tunnel tests on different insulator types at the Motor Industry Research Association's large scale wind tunnel. The noise behaviour of various insulator types was consistent with experience in the field (i.e. that some noise can occur, but over a limited range of conditions).

However, one insulator type that had previously passed type-registration was found to readily produce audible tones across a wide range of angles and wind speeds. The type registration of this design was subsequently suspended pending further investigation.

As a result, University of Manchester has been supplied with samples of insulators to carry out further investigation and fundamental modelling of Aeolian mechanisms. The goal is to establish why the problematic glass insulator type was prone to wind noise and to support future insulator technical specification reviews.

An improved approach to testing

The outputs of this work have fed into a review of the audible noise requirements in National Grid's technical specifications for insulators, which are due to be issued later in 2015. An improved approach to Aeolian noise testing is included, and will be made available to other transmission owners.

National Grid is also planning to install monitoring equipment on an overhead line route where a range of insulator types are fitted, to understand their behavior once deployed in the field. Learning from the Aeolian Insulator Noise NIA funded innovation project is being used to inform this work.

Rapid deployment ballistic screens

Mitigating against the risk of failure from porcelain-clad assets such as current transformers (CTs), circuit breakers and bushings has posed a challenge for the industry in recent years.

To date, the problem has been addressed predominantly by introducing sizeable risk management hazard zones at substation sites.

Although necessary to keep personnel safe, this approach has posed challenges for substation access, system maintenance and operation.

To overcome these restrictions, National Grid is developing a rapid deployment ballistic screen, capable of withstanding all fragments of porcelain from extremely rare asset failure.

Quick and effective deployment

This project aims to deliver an effective, modular and easily-deployed ballistic screen which, if successfully trialled and mass produced, would provide alternative mitigation and enable network asset owners to respond quickly and effectively to asset defects.

The screen's modular design could allow entire ballistic walls to be assembled quickly. Additionally, the use of a concrete or water-filled ballast (filled once deployed, to add mass) means that the system is lightweight and transportable.

This year, carefully-executed tests, supported by high-speed video footage, have confidently demonstrated that the screen can withstand the ballistic impacts expected from ceramic debris of porcelain-clad assets during catastrophic failure. In the most recent trials this was demonstrated with oil-filled Current Transformers/ Voltage Transformers (CT/VTs) that had been previously removed from the transmission network.

> **Test findings will be used to design, build and deploy a pilot ballistic screen at a National Grid site**

Improved safety and better substation access

During destructive tests, the ballistic screens were moved closer to the CTs and CT/VTs than safety clearances in a substation would allow. By doing this, the system's ballistic capability was confirmed under conditions that were more severe than the screen would be required to withstand. Tests also demonstrated that the screen's polycarbonate protective surface, which could also be exposed to a shower of electrically vaporised metal during a catastrophic failure, could withstand the extremely high temperatures of expected molten metal particulates for the duration of such an event.

Test findings will be used to design, build and deploy a pilot ballistic screen at a National Grid site. The location will be chosen to provide access to other network operators to maximise the understanding and use of the technology developed. Key benefits of mass production include improved safety measures, better substation access for maintenance, and a reduced impact of hazard zones on system operability.

Click here to read in depth about this project

Audible noise assessment of High Temperature, Low Sag ACCR conductors

The GB electricity transmission network faces a growing challenge to increase power transfer capability, driven in part by the increased diversity of electricity generation sources and demand patterns.

High Temperature, Low Sag (HTLS) conductors enable increased power-carrying capability from existing overhead line routes without strengthening or rebuilding associated transmission towers, optimising the use of existing infrastructure.

Operational experience has demonstrated that some HTLS conductors show increased corona (electrical discharge) in dry weather, and more adverse audible noise in wet weather compared with traditonal lower capacity conductors.

National Grid has funded research at University of Manchester, generating new understanding of the complex factors contributing to conductor audible noise behaviour, including the conductor's grease, strand shape, surface properties and electrical stress patterns

These findings, alongside those of a previous NIA-funded innovation project – the trial and performance assessment of Aluminium Conductor Composite Reinforced (ACCR) – identified that 3M's HTLS conductor may offer favourable noise performance compared with other HTLS conductor types.

Focused noise trials

The 3M ACCR HTLS conductor was selected for focused noise trials in 2014/15 to confirm its noise performance merits. By installing three spans of the ACCR conductor between towers to replace another HTLS conductor in an area of known overhead line noise, National Grid has

tested its comparative noise performance via state-of-the-art audio and visual monitoring equipment.

The round stranded, ungreased design of the 3M conductor means that contaminants like dust and pollen, which can cause 'noisy' electrical discharge, are less likely to stick to the conductor surface. Most significantly, stable water droplets, which can lead to a highly audible wet weather 'hum', are less likely to remain on the conductor surface. The 'wet noise' behaviour of the ACCR conductor is not only more favourable than alternative HTLS conductors, but also the original conductor it replaces.

The ACCR conductor also uses a stringing method common to other widely used conductors, meaning it can be a "drop-in" replacement, benefiting the supply of fittings and long-term maintenance.

Improved noise performance

The ACCR solution supports cost effective whole-life network reinforcement for consumers, with less adverse environmental noise impact than previous solutions.

Following replacement of three spans with the trial ACCR conductor, improved noise performance was immediately noticeable, with night surveys in dry weather confirming almost complete absence of corona. Although the conductor does produce noise in wet weather, the impact and duration are reduced and local residents have reported favourable noise performance during the trial. This conductor may therefore allow National Grid to achieve increased transmission capacity while minimising local noise disturbance.

Click here to read in-depth about:

- this project
- the ACCR project
- Scottish Power's roll out proposal

Enhanced weather modelling for Dynamic Line Rating (DLR)

Evolving generation and demand patterns are resulting in changing flows on the transmission network and increasing constraint costs. Building more circuits or increasing circuit capacity is both time consuming and costly. One alternative is to utilise the existing network more effectively by enhancing the existing asset thermal capability using Dynamic Line Ratings (DLR).

DLR provides a different means of increasing capacity based on weather conditions. This project is looking at how historic weather data can be harnessed to forecast the prevailing capacity along an overhead line route – hours and days ahead of real-time.

When complete, we hope to incorporate this learning into existing techniques to calculate overhead line rating enhancements based on weather forecasts, expanding the timescales when this can be done and incorporating DLR into investment and operational planning.

The significant benefit to consumers would be the ability to make operational decisions that reduce the cost of operating the system and potentially avoid or defer reinforcement works following the connection of new low-carbon generation.

Click here to read in depth about this project

Facilitating Enhanced Network Capacity Evaluation (FENCE)

A second capacity-related project linked to the DLR work has also been completed. The FENCE project was a feasibility study to verify the potential of pursuing an Enhanced Network Capacity Evaluation (ENCE) system.

The work focused on a small section of the GB network in South West England. The three aims were to identify the best technical approach in designing a demonstrator ENCE system, to develop a set of criteria to maximise the benefit, and to identify the proportion of constraints that are thermal, thereby indicating potential future savings.

The work has verified that suitable algorithms exist to support the necessary prediction technologies. Likewise the necessary monitoring equipment is in place to support most applications. We also conducted a comprehensive survey of user groups within NGET, covering all planning horizons and confirming that the proposed system architecture could be readily accommodated, alongside a detailed assessment of technical risks.

A more detailed evaluation of the potential savings from avoiding constraints will now be undertaken.

Innovative tools for electrical system security within large areas (iTESLA)

BritNed is a HVDC project connecting the UK to the Netherlands

Click here to read in depth about this project

As more renewable sources of energy are connected to Europe's electricity transmission grid and the pace of decarbonisation increases, the system will need to be redesigned and reconfigured so that it can continue to operate efficiently and ensure security of supply.

This long-term transition will make pan-European transmission networks more complex, with impacts on both normal and emergency operations.

Maintaining security of supply while Europe's transmission grid becomes ever more interconnected is a challenge that requires a co-ordinated Europe-wide response. The iTESLA project aims to develop and validate an open inter-operable toolbox – essentially a new set of analytical tools – which can support the future operation of a pan-European grid.

The concept of iTESLA is underpinned by recognition that the analytical tools in place today will not necessarily be fit-for-purpose in future due to a number of factors. These include more intermittent and unpredictable sources of renewable generation, new complex controllable devices (particularly HVDC) being introduced, more controllable electricity demand, the increasing difficulty of building new overhead transmission lines and development of the single European energy market.

National Grid is one of the partners on the project, which will see the creation of a new suite of software-based tools – capable of assessing the security of power system situations from two days ahead to real-time. The software will also provide advice on the relevant preventative or remedial actions required.

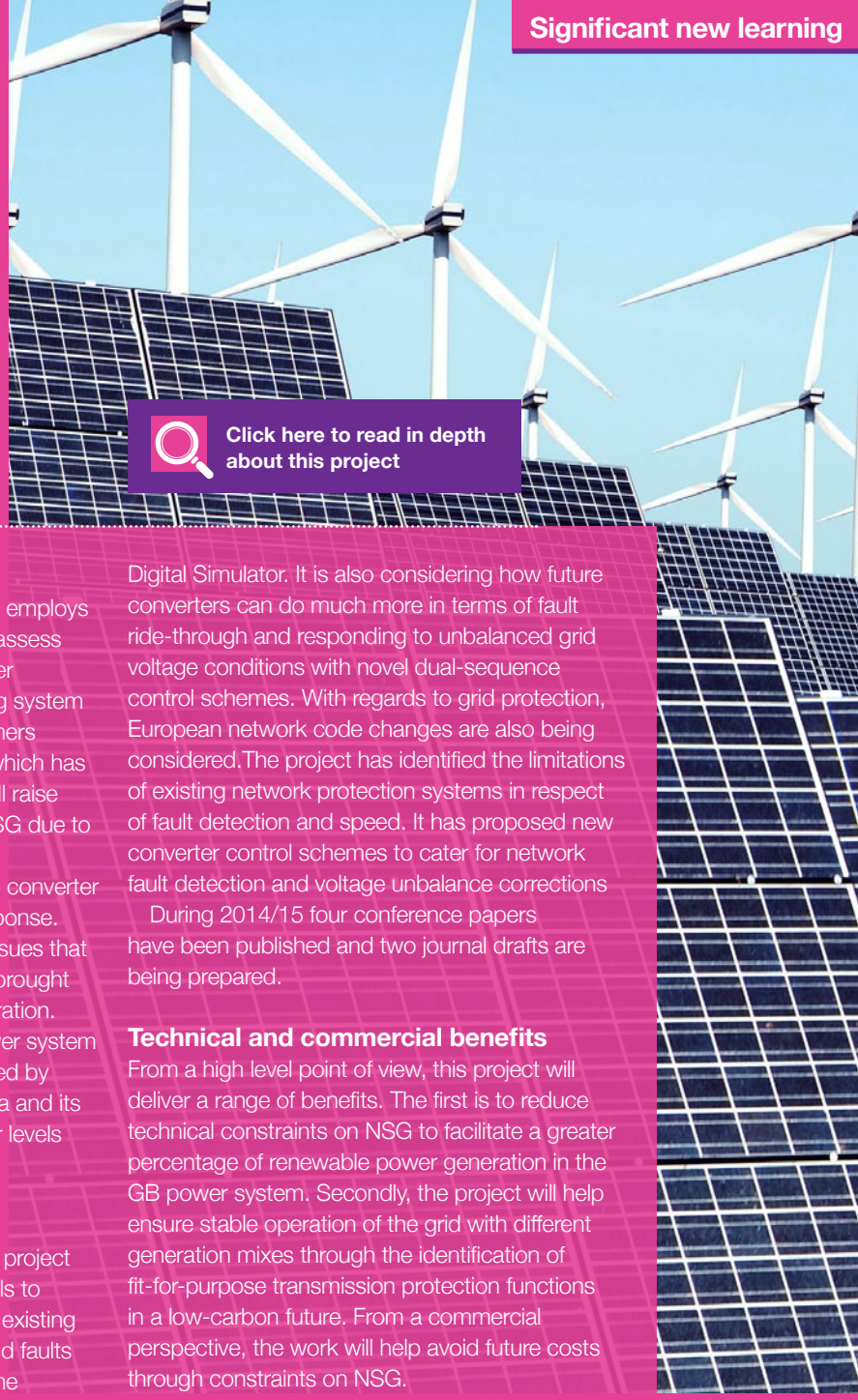
A unique perspective

In addition, the toolbox will allow Transmission System Operators (TSOs) to address network simulations of their own system, of co-ordinated regional systems, or the whole pan-European system. Giving input from a TSO perspective, National Grid is supporting development of improved co-ordination between TSOs, enabling the correct focus across European partners regarding the most critical system states.

The island nature of National Grid's operations means that we can provide a unique perspective on defence and restoration plans, sharing our strategies for supply restoration in case of emergency operation and blackouts.

From a consumer perspective the true value of the iTESLA project is increased security of supply, with partner nations working together to create a more resilient pan-European network and a more co-ordinated response during times when the system is under stress.

Control and protection challenges in future converter-dominated power systems



Click here to read in depth about this project

The proportion of non-synchronous generation (NSG) on the GB network is increasing as wind and solar generation and HVDC links are developed. This project explores the impact of high-volume power electronic converters as the main interfaces of NSG. It also seeks to resolve National Grid's challenges in operating a future GB power system with higher levels of NSG. To do this, we are considering new control and protection schemes to help remove barriers and allow us to operate with much higher levels of converter-interfaced generation.

> **"This work will reduce technical constraints to facilitate a greater percentage of renewable power generation in the GB power system"**

Control elements

The control-orientated part of the project employs a simplified GB power system model to assess system dispatch and investigate controller aspects. This will raise awareness among system operators, owners and generator customers about the nature of a future power grid which has significantly different characteristics. It will raise awareness of potential constraints on NSG due to angular instability and other factors.

The work will also propose new HVDC converter control schemes with fast frequency response. This will help address system-strength issues that are due to lower levels of system inertia brought about by having less synchronised generation. The effect of synthetic inertia on GB power system frequency containment is being addressed by quantifying the amount of synthetic inertia and its potential impact on operation with higher levels of NSG.

Protection elements

The protection-orientated element of the project has established detailed converter models to investigate protection issues. It is testing existing relay settings and reactions to various grid faults using University of Strathclyde's Real-Time Digital Simulator. It is also considering how future converters can do much more in terms of fault ride-through and responding to unbalanced grid voltage conditions with novel dual-sequence control schemes. With regards to grid protection, European network code changes are also being considered.The project has identified the limitations of existing network protection systems in respect of fault detection and speed. It has proposed new converter control schemes to cater for network fault detection and voltage unbalance corrections

During 2014/15 four conference papers have been published and two journal drafts are being prepared.

Technical and commercial benefits

From a high level point of view, this project will deliver a range of benefits. The first is to reduce technical constraints on NSG to facilitate a greater percentage of renewable power generation in the GB power system. Secondly, the project will help ensure stable operation of the grid with different generation mixes through the identification of fit-for-purpose transmission protection functions in a low-carbon future. From a commercial perspective, the work will help avoid future costs through constraints on NSG.

Managing distributed generation effects

The connection of increasing levels of electronically-connected generation, such as wind and solar power, to the GB electricity transmission network is leading to a reduction in system inertia. This makes the system more vulnerable to Rate of Change of Frequency (RoCoF) effects.

These RoCoF issues have a potentially significant bearing on the cost of operating Britain's electricity network. If we do not make sure that the system is robust enough to cope with lower inertia, we face increases in system operating costs of up to £250 million a year by 2018/19 and further increases thereafter.

These extra costs would be incurred because balancing services would be needed to curtail in-feed losses and synchronise additional generators to provide inertia. This would in turn displace renewable generation such as wind.

£250m

The potential increase in costs by 2018/19 if the RoCoF challenge is not addressed

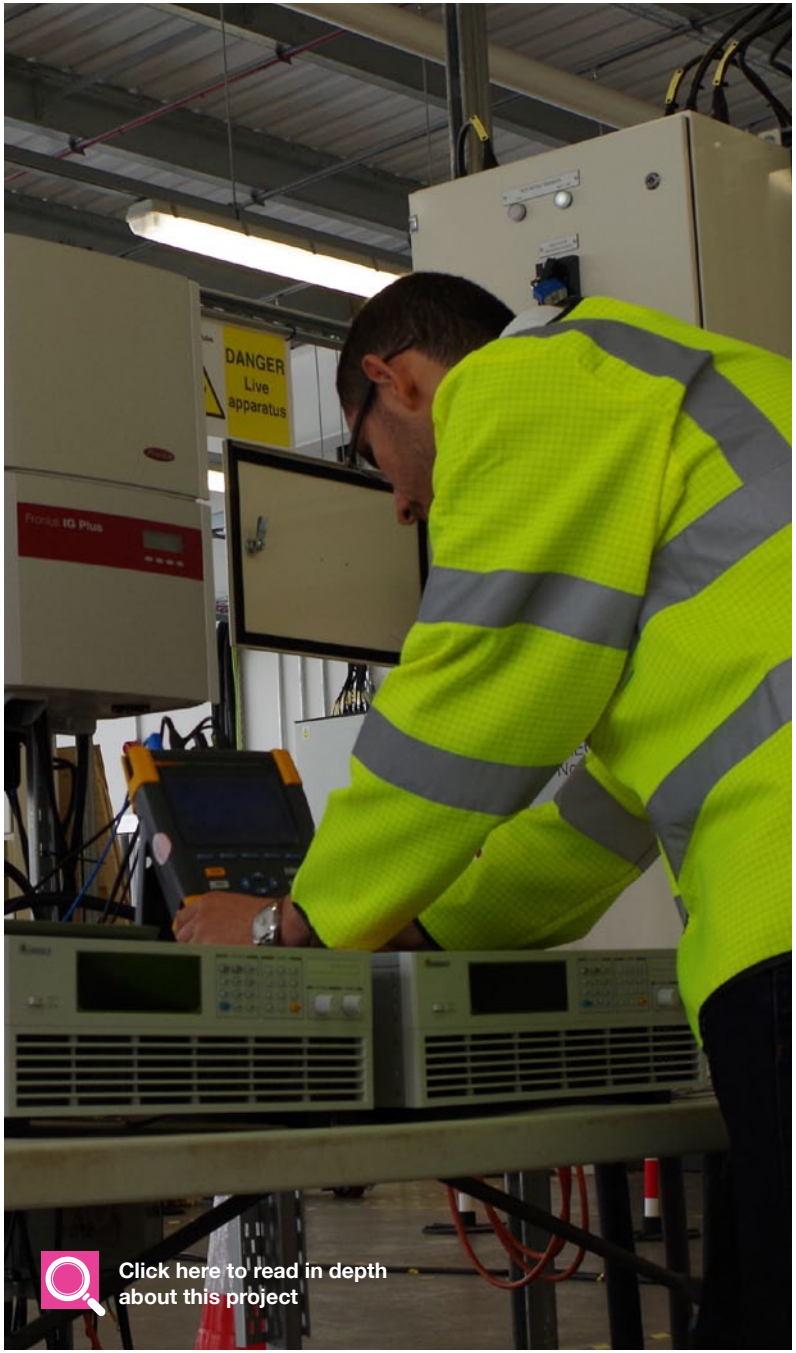
More efficient and reliable operation

This research, supported by National Grid as GBSO and the GB Distribution Network Operators (DNOs), builds on earlier work to assess the behaviour of larger (greater than 5MW) distributed generation installations under high RoCoF conditions.

It will provide a clearer understanding of smaller (less than 5MW) distributed generation installations that use RoCoF as a loss of mains protection and how these installations would behave in the event of system disturbances.

The research will allow more efficient and reliable operation of the GB system, both at the transmission and distribution levels. The key objectives are to reduce operational costs while enabling increased system access for intermittent generation types, including renewables.

At present, no comprehensive information exists for loss of mains protection for distributed generation installations below 5MW. The first stage of this work is creating a GB view, by DNO area, of such distributed generation. The second stage involves evaluating the feasibility of using higher RoCoF protection settings for distributed generation.



Click here to read in depth about this project

Updates on last year's highlights

Click here to read about last year's summary

In last year's summary, we highlighted several key innovations in the field of electricity transmission which had provided National Grid with invaluable insights into how we can do things even better. These projects have continued to make good progress over the last 12 months, and below we summarise what's been achieved during that period.

PROJECT NAME

CABLE EXTRACTION

PROJECT DETAILS

Decommissioning of underground oil-filled transmission cables currently requires continued maintenance to prevent contained cable oil from leaking into the surrounding environment

Last year, National Grid outlined development of an efficient 'no dig' cable extraction solution enabling valuable materials to be recycled and avoiding costs associated with monitoring redundant cable assets. The project aims to extract cables from the ground at low cost and with minimal disruption to the local environment.

The method uses a unique collet gripper system alongside novel application of directional drilling. This loosens back-fill material around the cable at selected extraction points and pulls the cable out, allowing the void to be filled or replaced with a duct for future use.

RESULTS AND LEARNING

This technique has been trialled in conjunction with existing transmission works at Kingsnorth and Ross-on-Wye, with an 80% extraction success rate on two different back-fill materials. A third trial is planned in 2015 on a decommissioned cable at High Marnham, with a different back-fill, for which alternative cost effective extraction methods will be considered.

BENEFITS TO CONSUMERS

Upon successful completion of these trials, we will assess the extent to which these techniques can be applied to National Grid's existing 50km of decommissioned buried cables. We will also consider their applicability to the 270km (at time of writing) of transmission cable anticipated to decommission in the next six years.

Click here to read about this project

PROJECT NAME

400KV SYNTHETIC ESTER FILLED TRANSFORMER PILOT PROJECT

PROJECT DETAILS

In 2013/14, National Grid worked with two partners to complete an NIA project to build and test a synthetic ester (MIDEL 7131) filled transformer test rig. MIDEL 7131 is a reduced fire hazard liquid alternative to mineral oil which has the potential to assist compact transformer design.

RESULTS AND LEARNING

Successful lightning impulse testing at 400kV was carried out in line with National Grid and IEC specifications. This provided the confidence to commission the design and build of a 240MVA 400/132kV synthetic ester-filled transformer. In February 2014 a competitively-tendered contract was awarded to Siemens to supply three such transformers filled with MIDEL 7131, for a new-build substation at Highbury in London. In March 2015, National Grid engineers, working closely with Siemens, witnessed the successful test of a commercially-offered 400kV, MIDEL 7131 filled, heat-recovered transformer.

BENEFITS TO CONSUMERS

Although modern transformers are less prone to fires than ever, incidents are possible. Consequently, high-voltage transformers have been located more than a specific distance from occupied premises. Following successful testing though, MIDEL 7131's high-fire point means it is now possible to place high voltage transformers in closer confines in urban areas, reducing occupation of useful space. The transformers also feature a heat recovery system and in Highbury, more than 1MW of waste heat will be recovered and used to heat a neighbouring school.

Click here to read about this project

Updates on last year's highlights

PROJECT NAME

T-PYLON STRUCTURE AND COMPOSITE TESTING

PROJECT DETAILS

Last year, significant learning was gathered in the development of the T-Pylon. NIA-funded work on the project relates to the certified mechanical testing of the T-Pylon structures to validate structural design and manufacturing processes, as well as mechanical and electrical testing of new composite diamond-shaped insulators.

RESULTS AND LEARNING

Construction of the first five T-Pylon spans was completed in May 2015 at the National Grid Eakring facility. Certified mechanical testing is expected to be completed in September 2015, as all test structures have been delivered to the Abiensa test facility in Spain for the first two test phases. Working insulator solutions have been developed by three suppliers and successfully mechanically tested to mitigate supply challenges. A tension solution has been tested and type registered. During 2015/16 further mechanical load testing will be carried out on the insulators due to their orientation, which have previously only been installed in a vertical position on substations.

BENEFITS TO CONSUMERS

The T-Pylon's innovative design is up to one third lower than the conventional steel lattice pylon and aims to reduce visual impact at a lower cost than buried cable. Successful completion of mechanical load tests will assure long-term reliability and assist development of a deployable T-pylon solution that can be considered alongside these investment options. Completion of composite insulator testing will also ensure sufficient availability of approved supplier options to deliver a deployable insulator solution.

Click here to read about this project

PROJECT NAME

TRIAL AND PERFORMANCE ASSESSMENT OF ACCR

PROJECT DETAILS

As a High-Temperature, Low-Sag (HTLS) overhead line conductor, Aluminium Conductor Composite Reinforced (ACCR) allows conventional conductors to be replaced with a conductor of similar size, but higher thermal rating, so that more power can be transported down an existing overhead line route without rebuilding or replacing infrastructure. National Grid undertook installation trials of 3M's HTLS conductor at their OHL Training Centre at Eakring. This was followed by a live test on a 15km energised section of the network between High Marnham and West Burton. To evaluate noise reduction benefits an additional three spans of ACCR have been installed on both circuits of the Deeside – Daines route (see page 15 for specific ACCR noise trials).

RESULTS AND LEARNING

The trials' success means that National Grid is actively seeking deployment opportunities on the transmission network. The ACCR conductor will be considered where increased power carrying capability is required from existing infrastructure together with reduced noise impact, as this solution can offer favourable noise performance over previously trialled HTLS conductors. An example of deployment is the Sellindge to Dungeness 400kV reconductoring scheme, where the ACCR conductor is being considered for a number of overhead line spans close to a noise sensitive area, and SPT is also proposing to use it on their network.

BENEFITS TO CONSUMERS

The ACCR HTLS conductor is being considered by National Grid alongside other capacity reinforcement solutions for consumers. This is due to its ability to increase ratings and minimise transmission structure reinforcement requirements, but with less adverse audible noise impact than previous HTLS solutions.

In a further NIA project (Evaluation of a Novel Variant of ACCC HTLS conductor), National Grid plans to trial the mechanical properties of another HTLS variant, with the objective of introducing UK market competition in HTLS conductors.

Click here to read about this project

Updates on last year's highlights

PROJECT NAME

CLUSTERING EFFECTS OF MAJOR OFFSHORE WIND DEVELOPMENTS

PROJECT DETAILS

As new wind farms are built across Great Britain, the geographical distribution will change. Many of the new wind farms will be in large clusters located offshore. The concern that this project addresses is whether the wakes from neighbouring wind farms will interact and make the output of these new wind farms less predictable. This project uses advanced weather modelling techniques to forecast the creation and behaviour of these wakes and also their interactions with other wind farms.

RESULTS AND LEARNING

Recent simulations indicate that wind farm wakes can be established up to 20km downwind of the wind farm for particular atmospheric conditions. The next stage of the project is to compare these simulations with real data from the output of the wind farms. This will help to build confidence in the simulation and is an important step towards making use of the more detailed analysis in the Electricity Control Room for operational decisions.

BENEFITS TO CONSUMERS

Work done on this project is part of a portfolio of effort to minimise wind power forecast errors and thus save the industry and the consumer money. The work builds on expertise that is already present at University of Reading in Energy Meteorology and Advanced Weather Forecasting Science.

Click here to read about this project

PROJECT NAME

A COMBINED APPROACH TO WIND PROFILE PREDICTION

PROJECT DETAILS

Many current wind farms are in complex terrain such as mountainous regions in Scotland or offshore locations near the coast. This means that the forecast value of wind speed can be quite different to the actual value of wind speed at particular points in time.

The project we are undertaking with University of Sheffield looks at the fundamental mathematics of the Computational Fluid Dynamics and combines this with techniques from the signal processing body of knowledge. The aim is to create algorithms that will be accurate and computationally-efficient and therefore help to reduce wind power forecast error.

RESULTS AND LEARNING

The work so far has revealed some errors in the fundamental mathematics of the quaternion-valued gradient operator. This has now been correctly formulated and published in a paper by the team. Confidence in the approach of combining Computational Fluid Dynamics with signal processing has been gained. This approach has not been tried by any other research institution.

BENEFITS TO CONSUMERS

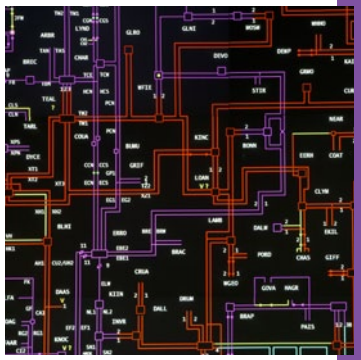
The hope for this work is that the algorithms will not only be a breakthrough in forecasting accuracy but will allow the methodology to be inverted. Doing this will provide a way of mathematically deriving the optimal positions of wind turbines for planned wind farms to maximise energy capture for all wind conditions. This will be of benefit to the entire wind energy sector as well as National Grid.

Click here to read about this project

Updates on last year's highlights

PROJECT NAME

REACTIVE POWER EXCHANGE APPLICATION CAPABILITY TRANSFER (REACT)



PROJECT DETAILS

Managing voltage levels on the grid during minimum demand periods is problematic. The root cause is the significant decline in reactive power (Q) relative to active power (P). The REACT project was launched with University of Manchester to understand how voltages can be kept within statutory limits and to analyse the issues around voltage control.

RESULTS AND LEARNING

The first stage of work in year one was network focused replication and understanding of the Q/P decline, and establishing an appropriate modelling program. Year two has focused on load change and a third year of research has been proposed looking at specific operational, specification and investment measures to address the Q/P decline.

In stage one of the project, the team has successfully related effects within distribution systems to the impact at the transmission interface. In doing so, the project has identified that data being used to plan the distribution system has been understating the reactive power being generated by those networks by around 15-20%, either because of a high proportion of undergrounding or underlying inaccuracies in the original modelling.

BENEFITS TO CONSUMERS

REACT has illustrated how reactive power is transferred to the transmission interface and the benefit of balancing reactive power within the distribution systems rather than at the interface. This is changing the appreciation of the factors behind Q/P decline, and alongside further analysis, is expected to improve future Q/P ratio forecasting.

Click here to read about this project

PROJECT NAME

ADVANCED NETWORK CONTROL AND DEMAND RESPONSE TECHNOLOGIES

PROJECT DETAILS

Lower system strength and higher levels of non-synchronous generation are posing new challenges for the GB electricity network. This project has looked at innovative ways to make the transmission system smarter in future.

RESULTS AND LEARNING

The advanced network control project has been run in partnership with Imperial College and was split into three specific areas of research: advanced control system strategies, system resilience through the use of more complex control schemes, and demand management technology implementations.

Effective network control technologies have been identified and evaluated through the work. Further work being implemented as part of the Enhanced Frequency Control Capability NIC project will build on this.

BENEFITS TO CONSUMERS

The work will benefit transmission systems users and consumers by helping to reduce carbon emissions and system operational costs through delivering improved overall system operability.

Click here to read about this project

Project portfolio

For further information on our full project portfolio and to see our project progress reports for the projects listed below, please click on the icon or visit the Energy Networks Association Smarter Networks Portal at: www.smarternetworks.org

Corporate Responsibility

Click here to read about this project

NGET	PROJECT NAME	13/14 STRATEGY	PARTNER
NIA_NGET0107	Stakeholder Attitudes to Electricity Infrastruture	Overhead lines	University Of Exeter
NIA_NGET0113	Control of Debris and Dust From The Treatment of Grade 4 Steel Work (G4T)	Overhead lines	CLC Contractors Fountains Environmental PDC Protective & Decorative Spencer Coatings
NIA_NGET0112	Enhanced ACDC Safety Voltage Limits	SHES	Cardiff University
NIA_NGET0124	EPRI EMF	SHES	EPRI Solutions
NIA_NGET0141	T-Pylon Structure and Composite Testing	Overhead lines	Allied Insulators Group Eaves Machining EPL Composite Solutions Europea De Construcciones Metálicas LAPP Insulators GMBH STRI Ab Valmont SM A/S
NIA_NGET0137	Noise Assessment of ACCR Conductor	Overhead lines	Bruel and Kjaer UK
NIA_NGET0133	Identifying Opportunities and Developments in EMF Research	Overhead lines	Inannacon Resource Strategies Torrance
NIA_NGET0130	Determining a Threshold For Magnetophosphenes Perception at 50Hz	Overhead lines	Lawson Health Research Institute
NIA_NGET0149	Investigation of Aeolian Insulator Noise	Overhead lines	Campbell Associates Cranfield University School Of Mgt
NIA_NGET0055	Electromagnetic Transients (EMT) in Future Power Systems – Phenomena, Stresses and Modelling	System Operation	Sintef Energi AS
NIA_NGET0018	Potentials and Profiles Around Earth Electrodes and Opposite-side Injection For Large-area Earthing Systems	Substations	Cardiff University
NIA_NGET0079	Rapid Deployment Ballistic Screen	Substations	C3 Global Doble Powertest Photron (Europe) Radnor Range
NIA_NGET0025	Feasibility Study For Sustainable Substation Design	Substations	Ove Arup And Partners
NIA_NGET0074	SF6 Capture and Leakage Repair	SHES	Cape Industrial Services

Corporate Responsibility continued

Click here to read about this project

NGET	PROJECT NAME	13/14 STRATEGY	PARTNER
			Furmanite International
			Jacobi Carbons
			Siemens Transmission and Distribution
			University Of Liverpool
NIA_NGET0087	Cable Installation Design and Innovation Project (CIDIP)	Cables	University Of Southampton
NIA_NGET0083	Cable Oil Regeneration	Cables	Enervac Corporation
			JSM Construction
			Midlands Truck and Van
			Stewart Signs
			Utilise
NIA_NGET0099	Thermal Efficiency Trials	Substations	Rook Services

Efficient Build

NGET	PROJECT NAME	13/14 STRATEGY	PARTNER
NIA_NGET0104	Proof of Concept of IEC 61850 Process Bus technology	Substations	ABB Group
NIA_NGET0122	Identification and Mitigation of Large Equipment Transport Issues	Substations	Wynns
NIA_NGET0143	Transient and Clearances in the Future Electrical Transmission Systems (ICASE Award)	Overhead lines	The University Of Manchester
NIA_NGET0064	Alternative Bus Bar Protection Solution	Substations	Schweitzer Engineering Laboratories
NIA_NGET0067	Trial and Performance Assessment of ACCR Conductor (3M)	Overhead lines	3M United Kingdom
			Graz University Of Technology
			Zeck Gmbh
NIA_NGET0084	Optimisation of Node Configuration For Offshore Supergrid	HVDC	Imperial College
NIA_NGET0080	400kV Synthetic Ester Filled Transformer Pilot Project	Substations	Alstom Grid UK

Managing Assets

NGET	PROJECT NAME	13/14 STRATEGY	PARTNER
NIA_NGET0102	13kV Shunt Reactor Refurbishment	Substations	ABB Engineering Services
NIA_NGET0103	Modelling The Tape Corrosion Process For Oil-filled Underground Cables	Cables	University Of Leicester
NIA_NGET0109	Bushing and Instrument Transformer Test Tap Connection Condition Assessment Tool	Substations	Elimpus
			Elisys Engineering
			Process Parameters
NIA_NGET0117	Bulk Oil Circuit Breaker Bushing in Situ Refurbishment	Substations	Narec Development Services
NIA_NGET0118	Understanding and Improving Condition, Performance and Life Expectancy of Substation Assets	Substations	The Watt
NIA_NGET0116	Combustable Gases in Redundant Oil Filled Cables	Cables	Utilise

Managing Assets continued

Click here to read about this project

NGET	PROJECT NAME	13/14 STRATEGY	PARTNER
NIA_NGET0115	Cable Stripping Truck	Cables	Utilise
NIA_NGET0123	EPRI Substations	Substations	EPRI Solutions
NIA_NGET0140	OHL Condition Assessment	Overhead lines	Brunel University
NIA_NGET0135	Enhanced Sensor Development (iCASE)	Substations	The University Of Manchester
NIA_NGET0136	Impact of Seabed Properties on Ampacity and Reliability of Cables (ICASE Award)	Cables	University Of Southampton
NIA_NGET0148	Network Reliability Asset Replacement Decision Support Tool	Substations	The University Of Manchester
NIA_NGET0147	Condition Monitoring of Power Transformers	Substations	The Watt
NIA_NGET0146	Assessment of Electronic (analogue and Numeric) Protection Equipment End of Life Mechanisms	Substations	Quanta Technology
NIA_NGET0040	Magnetic Models For Transformers	Substations	Cardiff University The University Of Manchester
NIA_NGET0017	Oil/paper Insulation HVDC Performance	Substations	University Of Southampton
NIA_NGET0014	Transformer and System Reliability	Substations	Gnosys UK The University Of Manchester
NIA_NGET0044	Transformer Oil Passivation and Impact of Corrosive Sulphur (TOPICS)	Substations	Doble Powertest Nynas IOM University Of Southampton
NIA_NGET0033	Wireless Condition Monitoring Sensors with Integrated Diagnostics	Substations	University Of Strathclyde
NIA_NGET0038	Design of a Smart Tool For Detecting Hidden Errors in Protection Setting Files	Substations	University Of Strathclyde
NIA_NGET0003	Simulation of Multi-terminal VSC HDVC System by Means of Real Time Digital Simulator (RTDS)	HVDC	Converteam UK The University Of Birmingham University Of Aberdeen
NIA_NGET0053	RESNET	System Operation	The University Of Manchester
NIA_NGET0045	Multi-terminal VSC HVDC Operation, Control and AC System Integration	HVDC	The University Of Manchester
NIA_NGET0054	Load Cycling and Radial Flow in Mass Impregnated HVDC Submarine Cables	HVDC	Sintef Energi AS Statnett Sf
NIA_NGET0011	Detection and Measurement of ACSR Corrosion	Overhead lines	Hydro-Québec Southampton Dielectric Consultants Straker Films Limited
NIA_NGET0073	Partial Discharge Monitoring of DC Cable (DCPD)	HVDC	University Of Southampton
NIA_NGET0042	HVDC EngD - Richard Poole	HVDC	Manitoba HVDC Research Centre
NIA_SHET0008	Nanocomposite Elec Insulation Material	HVDC	Gnosys Uk
NIA_NGET0082	Rating Impact of Non-isothermal Ground Surface (RINGS)	Cables	C3 Global Doble Powertest University Of Southampton

Managing Assets continued

Click here to read about this project

NGET	PROJECT NAME	13/14 STRATEGY	PARTNER
NIA_NGET0048	Cables With Long Electrical Sections	Cables	University Of Southampton
NIA_NGET0057	DC Circuit Breaker Technologies	HVDC	The University Of Manchester
NIA_NGET0019	Reliability Assessment of System Integrity Protection Schemes (SIPS)	Substations	The University Of Manchester
NIA_NGET0036	Thermomechanical Forces in XLPE Cable	Cables	University Of Southampton
NIA_NGET0060	Application of DC Circuit-breakers in DC Grids	HVDC	Cardiff University
NIA_NGET0010	Optimised Location for Surge Arresters on the Transmission Network	Substations	Cardiff University
NIA_NGET0015	Dinorwig Thermal Cycling and Cable Rating	Cables	Doble Powertest University Of Southampton
NIA_NGET0088	Transformer Research Consortium	Substations	The University Of Manchester
NIA_NGET0091	Impact Assessment of Seismic Analysis on Electricity Towers and Substation Equipment / Structures	Substations	Mott Macdonald Uk
NIA_NGET0092	Partial Discharge (PD) on Existing HV Cable	Cables	Doble Powertest Elimpus NDB Technologie Inc Prysmian Cables and Systems
NIA_NGET0093	Online Gas-in-Oil Analysis on Existing HV Cables	Cables	Doble Powertest Invisible Systems University Of Reading
NIA_NGET0035	Long Term Performance on Silicon-based Composite Insulators	Overhead lines	The University Of Manchester
NIA_NGET0024	Composite Cross Arms Study	Overhead lines	Kelvin Construction Co The University Of Manchester

Service Delivery

NGET	PROJECT NAME	13/14 STRATEGY	PARTNER
NIA_NGET0043	Live Line Working Equipment	Overhead lines	Airbus Helicopters UK Ashbrook Engineering Services Bond Aviation Group Broadcast Media Services Cunningham Design Eurocopter UK Hiatco New And Renewable Energy Centre Oxford Computer Consultants Rotary Wing T M Utley Offshore The University Of Manchester

Service Delivery continued

Click here to read about this project

NGET	PROJECT NAME	13/14 STRATEGY	PARTNER
			TTI Testing
			University Of Southampton
NIA_NGET0056	Humber SmartZone Pilot Project	Other	Ampacimon Global Substation Solutions The University Of Manchester
NIA_NGET0046	Flexible Rating Options For DC Operation	HVDC	University Of Southampton
NIA_NGET0047	Dynamic Ratings For Improved Operational Performance (DROP)	Cables	University Of Southampton
NIA_NGET0012	Induced Voltages and Currents on Transmission Overhead Lines Under NSI 4 Working Practices	Overhead lines	Cardiff University

Smart Grids

NGET	PROJECT NAME	13/14 STRATEGY	PARTNER
NIA_NGET0105	Enhanced Weather Modelling for Dynamic Line Rating	System Operation	University Of Strathclyde
NIA_NGET0111	Facilitating Enhanced Network Capacity Evaluation (FENCE)	System Operation	Oxford Computer Consultants University Of Southampton
NIA_NGET0119	SAMUEL	System Operation	Reactive Technologies
NIC_SPTEN01	VISOR - Visualisation of Real Time System Dynamics Using Enhanced Monitoring	System Operation	Alstom Grid UK Elisys Engineering
NIA_NGET0155	Open Source Interconnector Modelling	System Operation	Baringa Partners
NIA_NGET0023	Quantifying Benefits and Risks of Applying Advanced Network Control and Demand Response Technologies to Enhance Transmission Network Performance	System Operation	Energy Networks Association Imperial College

Non-Sync Generation

NGET	PROJECT NAME	13/14 STRATEGY	PARTNER
NIA_NGET0106	Control and Protection Challenges in Future Converter Dominated Power Systems	System Operation	University Of Strathclyde
NIA_NGET0128	Clustering Effects of Major Offshore Wind Developments	System Operation	University Of Reading
NIA_NGET0129	Investigation of Sub- Synchronous Interactions Between Wind Turbine Generators and Series Capacitors	System Operation	Imperial College
NIC BID	NIC BID Development 2014	System Operation	DNV Kema GL Noble Denton Parsons Brinckerhoff

Non-Sync Generation continued

Click here to read about this project

NGET	PROJECT NAME	13/14 STRATEGY	PARTNER
NIA_NGET0039	A Combined Approach to Wind Profile Prediction	System Operation	The University Of Sheffield
NIA_NGET0016	UK-wide Wind Power:Extremes and Variability	System Operation	University Of Reading
NIA_NGET0028	Impact of Extreme Events on Power Production at the Scale of a Single Wind-farm	System Operation	University Of Reading

Demand

NGET	PROJECT NAME	13/14 STRATEGY	PARTNER
NIA_NGET0114	Industrial and Commercial Modelling	System Operation	Ove Arup Partnership
NIA_NGET0110	Electrical Demand Archetype Model (EDAM2)	System Operation	Energy Savings Trust
NIA_NGET0120	Evolution of Energy Storage & Demand Management Services	System Operation	EA Technology Electricity Storage Network
NIA_NGET0134	Granular Voltage Control	System Operation	Power Perfector
NIA_NGET0138	Frequency Sensitive Electric Vehicle and Heat Pump Power Consumption	System Operation	Element Energy
NIA_NGET0085	UK Regional Wind: Extreme Behaviour and Predicatibilty	System Operation	University Of Reading
NIA_NGET0097	Development of Generic Dynamic Demand Model in DigSILENT Power Factory	System Operation	Cardiff University

Risk Management

NGET	PROJECT NAME	13/14 STRATEGY	PARTNER
NIA_NGET0144	Integrated Electricity and Gas Transmission Network Operating Model	System Operation	The University Of Manchester
NIA_NGET0052	Mathematics of Balancing Energy Networks Under Uncertainty	System Operation	Heriot-Watt University
NIA_NGET0059	Protection and Fault Handling in Offshore HVDC Grids	HVDC	Sintef Energi AS
NIA_NGET0058	Scalable Computational Tools and Infrastructure For Interoperable and Secure Control of Power System.	System Operation	Brunel University
NIA_NGET0095	Visualisation of Renewable Energy Models	System Operation	University Of Reading

Distributed Generation

NGET	PROJECT NAME	13/14 STRATEGY	PARTNER
NIA_NGET0139	PV Monitoring Phase 1	System Operation	Gmi Renewable Energy Group Invisible Systems
NIA_NGET0142	Assessment of DG Behaviour During Frequency Disturbances as System Inertia Reduces	System Operation	Energy Networks Association
NIA_NGET0020	Modelling of Embedded Generation Within Distribution Networks and Assessing the Impacts on Load Profile at Transmission Level Grid Supply Points (GSPs)	System Operation	University Of Bath Imperial College

Contact us

During the year we received proposals and interest in developing innovative projects from a range of organisations, as well as from within National Grid.

All the proposals brought forward are reviewed to assess alignment with our innovation strategy; potential to deliver value for our stakeholders; requirements for, and implications of, implementation into our day-to-day business; and eligibility for funding, whether through the NIA or other sources.

The projects sanctioned through this governance process make up a portfolio that is balanced across:

- a wide range of transmission asset types and system operational aspects;
- a range of ways in which we can deliver value, whether reducing costs or understanding and mitigating new or emerging operational challenges; and
- short-, medium- and long-term time horizons.

We have specific innovation leaders in each of our four transmission directorates: Electricity Transmission Asset Management and Construction/Capital Delivery, both representing the England and Wales Transmission Owner; and Market Operations and Transmission Network Services, both representing the GB System Operator.

Each project we take forward is assigned a senior sponsor, a project manager and a subject area technical lead. Accountability for the delivery of each project and the implementation of successful outcomes is clearly attributed to one of our four business directorates.

If you have a project proposal contact us at box.InnovationTransmission@nationalgrid.com **and we will connect you with the relevant business area.**

John Zammit-Haber

ELECTRICITY TRANSMISSION ASSET MANAGEMENT is accountable for the maintenance of the assets that make up the Transmission Network and deciding on the infrastructure investment necessary to extend and maintain the Electricity Transmission Network in England and Wales.

Neil Williams

CAPITAL DELIVERY is accountable for all construction activities associated with the National Transmission system for both gas and electricity, from development through to delivery with a strong focus on safety, reliability and value.

Martin Bradley

MARKET OPERATIONS is accountable for the real-time planning and operation of GB's Electricity Transmission System. Its role includes market facilitation, production of energy scenarios spanning near- and long-term horizons together with real-time operational data in order to enable and support efficient stakeholder and customer participation in these markets.

John West

TRANSMISSION NETWORK SERVICES is accountable for network development strategy, customer connections and developing and maintaining electricity market rules.

Paul Auckland

RIIO DELIVERY is accountable for ensuring that the aims and requirements of the RIIO regulatory framework are achieved at an NGET portfolio level, so we deliver benefits to consumers and transparency to all our stakeholders.