Electricity Transmission

Network Innovation Allowance

Annual Summary 2015/16

Welcome to our annual summary for 2015/16

We've made good progress with our innovation strategy in 2015/16. By continuing to work on a broad range of projects, acting on lessons learned and adopting a partnership approach, we're improving our capabilities, reducing costs and helping to provide more efficient, reliable transmission to the GB electricity system.

Over the past 12 months, we've concentrated on delivering maximum value through our innovation projects, using new technology and specialist partners to deliver genuine benefits for the industry and, most importantly, consumers.

One example is in Highbury, London, where we've successfully installed three 400 kV transformers which use a fire-resistant, synthetic ester oil as an insulator. It's a world-first which means a substation can be built in a densely-populated area where space is at a premium, ensuring safety and better supporting the local community's energy needs.

Managing the transition to a low-carbon future is a priority too. Whether it's the conversion of an existing substation in North Wales into a state-of-the-art innovation facility, or work to reduce solar PV forecasting errors and manage associated costs of solar, we're making good progress with projects that will safeguard the environment, improve reliability, minimise risk and deliver better value.

Our live trials of new insulating gas, Green Gas for Grid, is another good example, a world-first which could potentially replace one of the strongest greenhouse gases, sulphur hexafluoride (SF_6).

We understand the importance of sharing knowledge and expertise. This is exemplified by the creation of an Innovation Board in the Electricity Transmission Owner (ETO) part of our business, similar in style to the one we introduced for the Electricity System Operator (ESO) in 2014/15. These Boards combine expertise and forward planning to give our innovation a clear direction, and in turn help us manage, maintain and develop transmission assets in the best way.

Events like the Low Carbon Network Innovation Conference in Liverpool have proved an excellent opportunity to showcase our latest innovations too, and given us the chance to share learning with our peers in the industry.

This spirit of collaboration informs much of what we do. That's why it was especially pleasing to win the Built Environment category at the 2015 Institute of Engineering and Technology Innovation Awards. Our winning project, which focused on reducing noise created by some high capacity conductors, was a collaboration with the University of Manchester and 3M – and is a great example of what can be achieved through teamwork and shared effort.

As you'll see from this report, our portfolio of projects covers all aspects of our RIIO innovation strategy and encompasses a wide range of technology readiness stages. It's a diversity we're proud of, and one which reflects not just our methodical, staged approach to research and development, but also how our partnership approach can generate a wealth of exciting, innovative ideas.

We will strive to become even better in future, building on our successes so far to deliver greater value for consumers.

"We will strive to become even better in future, building on our successes so far to deliver greater value for consumers"

Nicola Shaw
Executive Director, UK
National Grid

Our innovation strategy

Our RIIO innovation strategy identified seven key strategy areas for our innovation activities for the first years of the RIIO T1 period (see below). Our Network Innovation Allowance (NIA) projects and supporting activities have continued to advance state-of-the-art technology and best practice. This information is presented in a number of ways over the following pages: by consumer value themes (pages 4-5), our range of assets and activities (page 6) and Technology Readiness Levels (page 7).

Seven key areas

Safety

We continue to develop new products, processes and ways of working to protect our employees, contractors and the public.

Reliability

Although many components of the grid were built to last 40 to 50 years, we check equipment regularly to better understand how long it can remain operational. We are able to do this while still maintaining a highly reliable system.

Connections

We are taking a new approach to managing the electricity system as a whole, considering the increase in non-synchronous generation. We are working closely with DNOs and utilities to improve our understanding and find affordable ways to maintain voltage and frequency stability on the network.

Strategic

Our strategic research ensures we collaborate with a diverse range of institutions. We continue to enhance our network modelling and supply and demand capabilities, while investigating new technologies such as energy storage and supporting the development of new materials.

Commercials

The country's demand is evolving rapidly and we are looking into ways that it could be actively managed to reduce the cost of keeping supplies secure.

Environment

A number of our projects aim to minimise the environmental impact of our assets and operations, as well as support the connection of low carbon sources of electricity. We are exploring ways of reusing or refurbishing equipment and recovering materials for recycling.

System operation

Balancing and maintaining a stable system is becoming more complex, with continually increasing solar generation connected across the country. We are researching methods to respond more rapidly to disturbances in the network.

Transmission Owner (TO) innovation consumer value themes

As the electricity transmission network owner for England and Wales, our innovation is focusing on four consumer value themes:

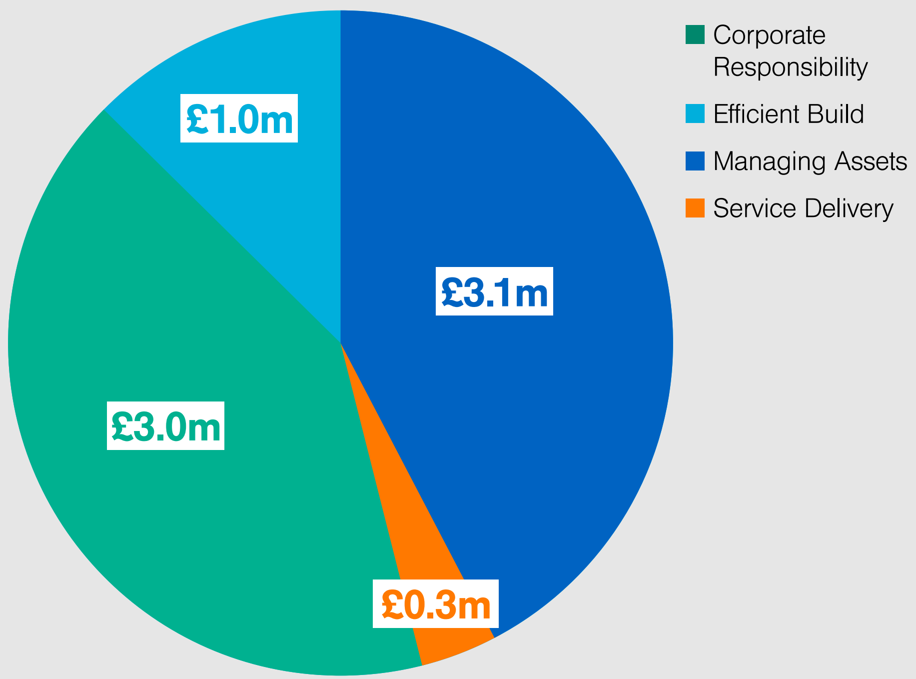
Managing Assets:
Managing assets throughout their lifecycle.

Efficient Build:
Building of new assets at lower capital and whole-life costs.

Service Delivery:
Developing new service-based propositions and business models.

Corporate Responsibility:
Always doing the right thing.

2015/16 spend by TO consumer value theme



GB System Operator (SO) innovation consumer value themes

As the electricity system operator for Great Britain, we are addressing the future challenges of operating the system securely, reliably and efficiently, while supporting low-carbon generation and helping to deliver affordability.

Demand:
Finding innovative ways to balance electricity generation with demand, through activities on the distribution side of the network.

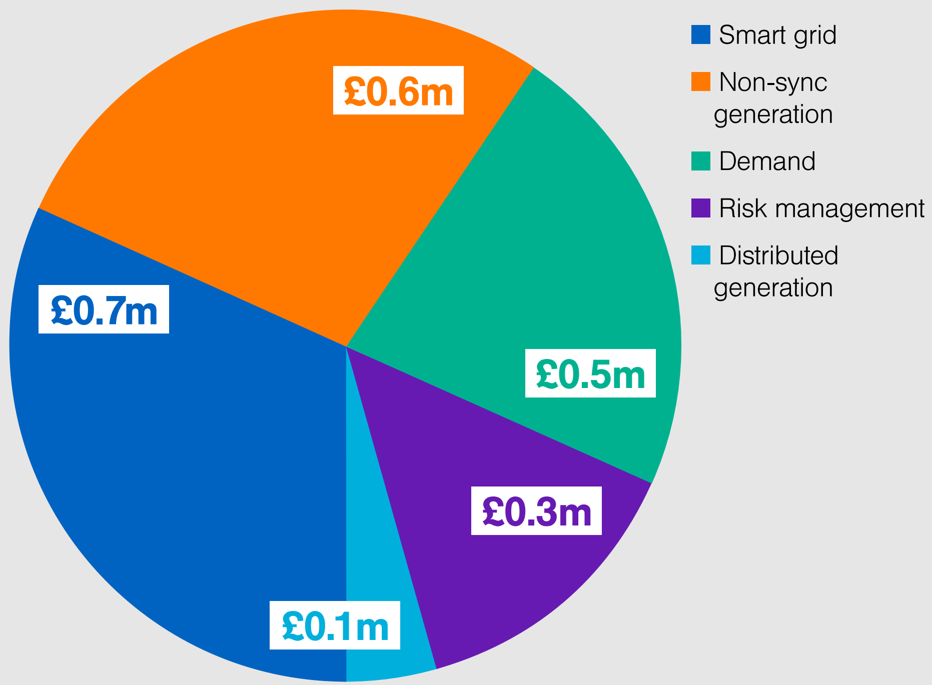
Operating with non-synchronous generation:
Learning to run the network with higher levels of non-synchronous generation, such as wind and solar.

Distributed generation:
Learning to deal with local generation connected to the distribution networks. We are also improving our forecasting to accommodate the changing nature of demand.

Smart grids:
Identifying and demonstrating smart solutions, such as communications technology, to improve transmission capacity and keep costs to consumers down.

Risk management:
As our system operator role evolves, we are learning how to manage new risks.

2015/16 spend by SO consumer value theme



2015/16 NIA portfolio overview

The GB energy sector continues to evolve at a rapid rate. Our innovation priorities for 2015/16 reflect the dynamic landscape we operate in as an electricity transmission business.

Overall, we invested £9.7m to progress 116 NIA projects in 2015/16. This included investing £174,000 in our successful Network Innovation Competition (NIC) Bid, now known as the Deeside project.

We review our innovation strategy to reflect the evolving nature of the GB energy sector, and in particular the roles that the England and Wales electricity transmission network owner and the GB system operator play in delivering value to consumers and our stakeholders.

Diverse activity

National Grid's Electricity Transmission work is characterised by diverse assets and activities, and this diversity is reflected in the subjects addressed by our NIA projects. Our innovation strategy allows us to explore a broad range of areas, all of which could potentially introduce lower cost/lower risk solutions, or bring safety or environmental benefits.

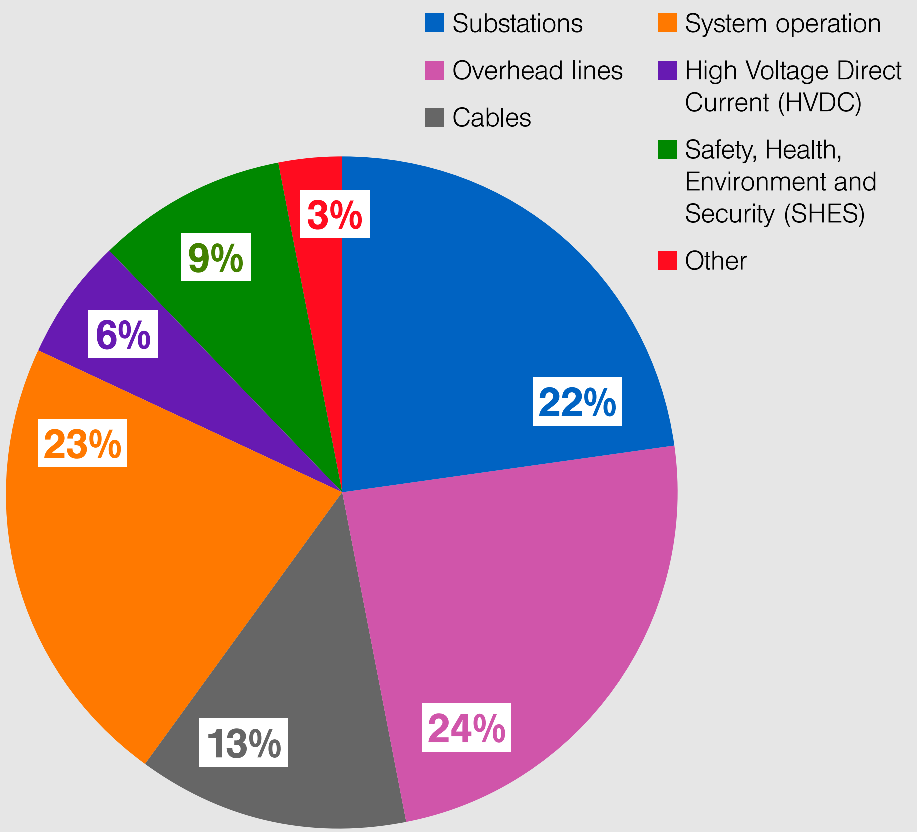
Last year, as well as relating our 2014/15 work to our RIIO innovation strategy, we also grouped our innovation portfolio into consumer value-driven themes, which are shown on pages 4 and 5. These remain central to the value we seek to deliver for consumers from our innovation portfolio.

Future network challenges

This year we have grouped our projects once again according to future network challenges. This reflects our most recent review of the present and future needs of the England and Wales electricity transmission network owner and the GB system operator.

Many of our innovation projects touch on more than one aspect of the transmission system and more than one of the network challenges. We have broken this down by the predmoninant areas of the network they have the most impact on (see right).

2015/16 portfolio balance

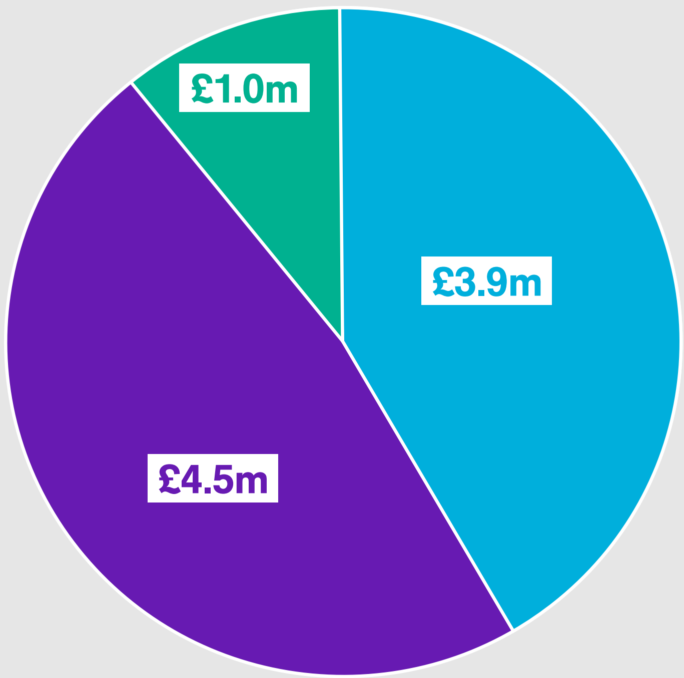


2015/16 NIA portfolio overview cont.

The Technology Readiness Level (TRL) scale runs from 1-9 and indicates 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 Technology Readiness Levels, from 2-8. This diversity and strong mix of projects reflects our staged approach to deliver continuous development, trialling and refinement of new technologies and operating procedures. We continue to create a number of new research projects too.

Spending on TRL levels 2-8 during 2015/16



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: with the emphasis on generating and testing potential solutions to overcome the issue.

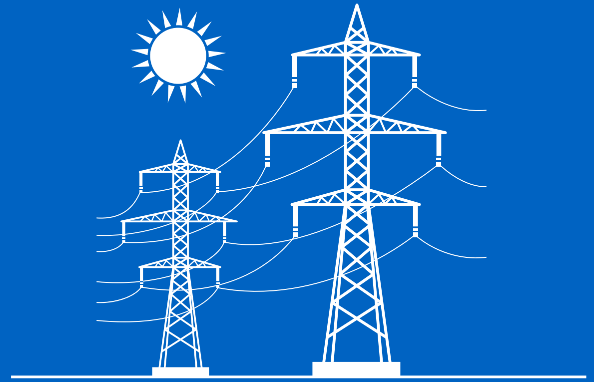
7-8 Demonstration: work focused on generating and testing solutions on the network that takes them to a stage where they can be transferred to business-as-usual.

1 and 9 1 ('blue sky' research) and 9 (fully developed and tested and ready to be deployed) are not eligible for NIA funding.

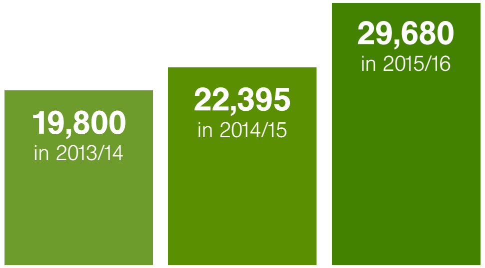
NIA in numbers

Here's a quick summary of Electricity Transmission's achievements in NIA-funded projects during 2015/16.

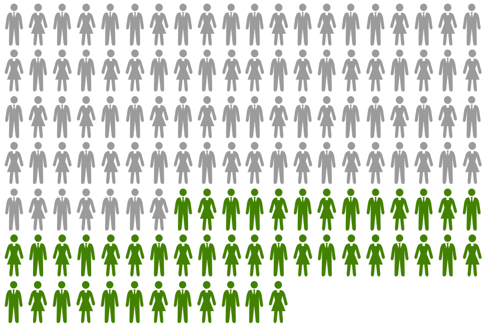
More than **15** projects completed in 2015/16



24 new projects up and running



Hours that have been devoted to NIA research and development by our internal teams



132 people have been working on NIA projects in 2015/16, compared to 87 in 2014/15

116 projects being progressed across a broad portfolio of subjects, the highest number ever

£9.7m invested in NIA activities

£7.3m was spent to fund external suppliers, specialists and research bodies

Innovating together

Click these symbols below and over the page to find out more

Effective collaboration and excellent supplier relationships have remained central to our successes in innovation during 2015/16. We can achieve best value from our investment in innovation and deliver benefits to consumers more effectively by working in partnership. This has been evident in four ways: working with partners, listening to others, participating in industry events and innovating beyond the NIA framework.

1. Working with partners

153

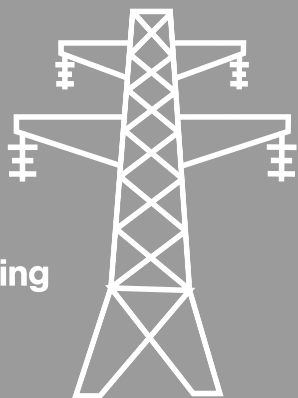
We worked with 153 suppliers and partners on our portfolio of NIA innovation projects including universities, other licensed network operators (LNOs), distribution network operators (DNOs), infrastructure suppliers and technology companies, many of them small or medium-sized enterprises (SMEs).

£21m

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

We have been collaborating with:

▶ three contractors – CLC Contractors, PDC Utility Services and Fountains Group – to test ways to capture the paint and debris that is shed from the towers' structural steelwork during maintenance.



▶ the Department of Meteorology at the University of Reading to explore the clustering effects of major offshore wind developments. We have completed a detailed investigation into the wind resource for a particular day when large fluctuations in wind speeds caused a large error in wind power forecasting. This work is helping us create a way to identify weather patterns that could cause serious errors in forecasting, so that system operators and energy consumers can avoid greater costs.

Innovating together

1. Working with partners continued

We have been collaborating with:

▶ **DNOs Electricity North West, SSE and UK Power Networks, plus power engineering consultants EA Technology, on the DIVIDE (DNO Investigation into Voltage Interaction and Dependency Expectation) project. This is making sure that the demand-generation balance can be managed effectively as the proportion of low carbon generation increases.**

▶ **the Valuing Nature Network. We're supporting their Business Impact School, funded by the Natural Environment Research Council (NERC), helping early career researchers to develop research projects that address the needs of business.**

2. Listening to others

Innovative approaches to substation design have enabled us to meet the needs of our consumer, UK Power Networks (UKPN), as well as those of Islington Council.

UKPN asked for a new grid connection. With no spare substation capacity available, we extended the connection point to UKPN's Islington site by building a substation at Highbury, on a site earmarked for regeneration.

Working in partnership with Islington Council, consulting engineers Arup and equipment suppliers Siemens, we built the first 400 kV substation specifically designed to recover heat from its transformers to support a 'green' urban residential development. Innovations include:

- New switchgear, using less sulphur hexafluoride
- Enhanced fire-resistant transformers using the synthetic ester Midel 7131 for cooling, reducing the need for fire bunds and freeing up more land for homes and shops
- Low-noise coolers
- Heat exchange technology to supply surplus energy to an adjacent school, flats and retail units.

Innovating together

We have a regular programme of wider collaboration, too. It enables us to share new learning from our own innovation work and find out what other innovators have discovered. National Grid employees have participated in conferences, events, and high profile industry meetings across the country.

3. Out and about

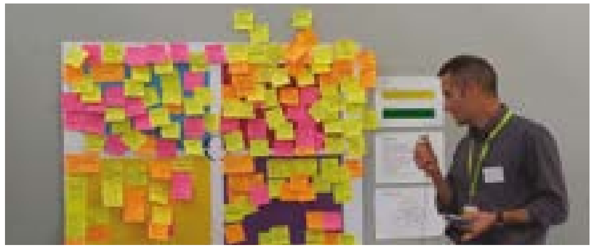
We made our second appearance at the annual Low Carbon Network and Innovation (LCNI) conference (pictured right). Displays and talks by our engineers explained the work we're doing to keep the grid balanced as the proportion of energy from renewables grows, as well as our innovative work to find more environmentally friendly replacements for the oils, gases and other consumables we use.

Other highlights included:

- Stuart Bailey, Head of Sustainability and Climate Change, meeting with HM Treasury late in 2015 as part of our remit with the Aldersgate Group. This is an alliance of business leaders working to encourage industry to adopt new approaches to sustainability
- Head of UK RIIO Delivery, Chris Bennett, speaking at Utility Week Live about the challenges facing the energy industry and our role in finding solutions
- Director Phil Sheppard giving a presentation at the second annual Utility Week Future Networks Conference in Birmingham.

We've attended many other events including:

- **The World Forum on Natural Capital**
- **The 5th B4E (Business for the Environment) Climate Summit**
- **Innovation Days, Brunel University Institute of Energy Futures**
- **The IET (Institution of Engineering and Technology) International Conference on Resilience of Transmission and Distribution Networks**



4. Beyond NIA

Outside the NIA/NIC framework, we're working with numerous businesses and organisations. Together we are developing innovative approaches to reduce our own carbon emissions and to play our part in transforming thinking on decarbonisation and sustainability.

- We're working with DNOs, the distributed generation community, Ofgem and the Department of Energy & Climate Change (DECC) to make access to networks easier for low carbon energy developers.
- We chair the Linear Infrastructure Network's (LINet's) steering group (pictured above), developing ways to incorporate 'green infrastructure' alongside other transport, water and energy infrastructure.

Transmission owner

Modelling the tape corrosion process for oil-filled underground cables

Modern asset management focuses on balancing risk, cost and performance throughout the life of assets. Understanding the future risk and performance of transmission assets is particularly important to help plan investment and capital expenditure.

Around 180km of underground oil-filled cables operated by National Grid were built during the 1960s and 1970s. As it stands, they will need replacing in the next 10-20 years, costing billions of pounds. Optimising their life will therefore deliver significant benefits for UK consumers.

However, monitoring the condition of cables is challenging. Firstly, the cables are typically installed in urban areas that are difficult and expensive to access. Secondly, each cable has a different design, installation environment and operational history.

State-of-the-art modelling

National Grid has conducted a number of innovation projects to understand how underground cables degrade. In this particular project, it's collaborating with Leicester University to investigate the mechanics and corrosion process of materials to determine more accurately the cable's remaining life.

This work has developed a novel corrosion-fatigue mathematical model which incorporates condition monitoring data, historical information and mechanical degradation models to better predict the remaining life of the cables. Following investigation into how condition-monitoring information taken at various points on the cable impacts on the accuracy of the model's prediction, the team is able to quantify the error margins involved in the modelling of the individual degradation curves for each cable.

National Grid's pioneering research connects the information obtained from condition monitoring and the physical and mechanical approach that is used in the asset design and operations. This means a more detailed understanding, and more effective management, of the life of assets. It is also of significant academic importance, with a number of publications produced in this field (e.g. Corrosion Science) as a result of this work.

The undergrounding of electricity cables at Ross-on-Wye

Click here to read in depth about this project

"Optimising the underground cables' life will deliver significant benefits for UK consumers"

Transmission owner

TOPICS (Transformer oil passivation and impact of corrosive sulphur)

National Grid has collaborated with the School of Chemistry at the University of Southampton and the Tony Davies High Voltage Laboratory (TDHVL), to identify key developments in the area of oil passivation.

Laboratory-based experiments and the investigation of service-aged transformers have led to a greater understanding of the chemical effects of oil passivation.

Improvements to the understanding of copper sulphide formation are ongoing and analysis of the oil for copper and sulphur at trace levels may offer an opportunity to detect problems in service. The same testing may also be useful in understanding which oils could lead to silver corrosion through oil regeneration.

Innovative techniques

The silver corrosion parts of the TOPICS project have now concluded. To get to that stage, the university's research assistant worked closely with National Grid's Oil Management Unit to change the way we carry out regeneration and prevent the oil becoming corrosive.

In addition, the project deliverables were increased in the last 12 months to enable a new technique to be tested (Static Secondary Ion Mass Spectrometry – SSIMS) that will speed up the project's implementation into business as usual.

Innovative techniques used for surface analysis led the team to conclude that although the passivation level commonly used is indeed effective, adding twice as much is the optimal option. It is likely that this conclusion will lead to a specific recommendation that will potentially affect practice within the industry in future.

As a result, National Grid will increase the concentration of passivations as required. This will be reflected in a revised TGN (E) 158 for oil management. The project performed well and this work will assist in reducing the risk of transformer failure and unreliability resulting from corrosive sulphur in oil.

Click here to read in depth about this project

Transmission owner

Marine sediment controls on HV cable performance

To ensure the prolonged and reliable operation of HV submarine cables, it is vital to determine how heat generated during power transmission along the cable is dissipated in the surrounding environment.

There has been very little investigation into how HV cables perform thermally when buried under the seafloor, compared with land cables. Conventional thought has been that a large body of seawater above the cable acts as a major heat sink. However, the effectiveness of this process will actually be controlled by heat transfer through the marine sediments burying the cable.

Along a typical submarine cable route there will be a variety of sedimentary grain sizes, ranging from mud to gravel. Due to the dynamic nature of the seabed, burial depths can also vary with time (local height differences of several metres can occur on timescales from hours to years).

Challenging perceptions

National Grid has worked with the University of Southampton to assess the impact of the sedimentary structure of the seabed on the heat dissipation and thermal performance of buried submarine cables. This has been undertaken through fundamental numerical modelling and laboratory-based experiments.

Finite Element Modelling (FEM) of heat dissipation from operational submarine HV cables has challenged the common perception that heat transfer is purely undertaken by conduction (as occurs for onshore cables).

The FEM models demonstrate that in fine-grained, low-permeability sediments (clays, silts), heat is transferred through conduction. However, in sediments composed of larger grain sizes and with higher permeabilities (fine sand to gravel) convection is a significant, and in many cases the primary, mechanism for heat transfer.

If the cable burial depth in conductive sediments is subsequently changed, either through overburial by bedform migration or shallowing/exposure due to scour, it can result in a significant change in the efficiency of conductive heat transfer. By contrast, heat transfer efficiency remains unchanged in convective sediments undergoing the same sedimentary processes.

Critical findings

To test these FEM results the University of Southampton has also undertaken prototype scale, 2D laboratory experiments. The results confirm that low permeability (coarse silts) sediments are purely conductive. At intermediate permeabilities (fine sands) a transition from conductive to convective heat transfer occurs when the surface cable temperature changes from c. 20°C to 36°C above ambient. In high permeability (very coarse sands) convective heat transfer dominates even at the lowest operating temperatures.

These findings are critical to understanding the operational performance of the cables, as convective heat transfer would increase cable current ratings: something neglected in existing standards.

In collaboration with National Grid, the University of Southampton will now test these theories in the field, by comparing high-resolution geophysical and geologically-derived 3D ground models with Distributed Temperature Sensor (DTS) data from operating cables.

“These findings are critical to understanding the operational performance of the cables, as convective heat transfer would increase cable current ratings: something neglected in existing standards”

Click here to read in depth about this project

Transmission owner

RESNET (Resilient Networks): the resilience of the UK electricity network to climate change

The electricity supply industry operates under high expectations of reliability. These networks are not only challenged directly by the future climate itself, but also through the increased use of electric road vehicles, electric heating and cooling.

The aim of the RESNET project is to develop and demonstrate a comprehensive approach to analyse, at a national scale, climate-related changes in the reliability of GB's electricity system. It will also produce tools for quantifying the value of adaptations that would enhance its resilience.

The project team has developed a weather generator for producing scenarios of spatially-coincident weather extremes in future climates, on a national scale. This enables a weather-typing approach to Regional Climate Models, and as a result, allows explicit scenarios of future electricity demand and supply to be generated. Models were created relating to the changes in the failure rate of individual network components, based on the severity of weather-related events.

A robust methodology has been employed for using climate change data and combining it with thermal models for different asset classes (eg. overhead lines, cables and transformer ratings, both season and static/dynamic).

The RESNET findings to date will inform the specifications of National Grid's replacement circuit ratings software in the near future. This will include consideration of RESNET's impact on ratings of circuits and circuit components (overhead lines, cables and transformers). In addition, the work will also inform National Grid's climate change adaptation report, due in 2016.

Click here to read in depth about this project

Transmission owner

Induced voltages and currents on transmission overhead lines under safe working practices

National Grid has worked with Cardiff University to explore further and reassess maximum levels of induced current and voltage, which inform working practices on or near high-voltage lines.

The aim of this work is to develop simple and straightforward guidance for safe working practices in proximity to high voltages. The National Safety Instruction Guidance document (NSI 4) assumptions have been reviewed via the NSI 4 working group, supported by a number of scenarios, simulated using an Electromagnetic Transients Program (EMTP) model. Steady-state and transient circuit models were set up for the induced voltage and current calculations, using the EMTP computer simulations.

Theoretically, the research has shown that the levels of induced voltage and current are much lower than previously thought, suggesting that a reduction in the earthing required to maintain safe working could be possible. However, the results are based on computer simulations and will need to be verified by 'real world' data.

During 2016 specifically designed voltage and current measuring devices will be fitted to a number of de-energised conductors where the adjacent circuit is still live. The data collected will be sent to Cardiff University and results simulated in the EMTP model. The simulated data and field data will be compared, and the process iterated several times across the network to ensure accurate comparisons.

If the simulations prove accurate, this may demonstrate that safe working can be maintained with reduced earthing, which would enable cost savings and lead to lower resource requirements and shorter outages.

Click here to read in depth about this project

System operator

Enhanced Frequency Control Capability (EFCC)

Achieving the UK's carbon reduction targets will mean significantly increasing renewable energy sources, which will in turn reduce system inertia. As a result, the system will be more vulnerable to frequency disturbances that can significantly increase the cost of running the network.

National Grid needs to find ways of increasing the volume and speed of frequency response in a cost-effective way for the end consumer. New, faster response solutions are required that combine renewables, demand-side resources and other new technologies.

The system frequency in Great Britain is 50Hz. Significant deviations in frequency can affect the whole power system and, in the worst case, result in cascading events that lead to partial or total system blackout. If the frequency starts to deviate, rapid response facilities can be called on to rebalance the grid. Sufficient generation must be held in automatic reserve to be ready to manage all circumstances that might result in frequency variations.

Saving consumers money

The aim of this project is to develop an innovative monitoring and control system, which will obtain accurate frequency data at a regional level, calculate the required rate and volume of response, and enable this response to begin.

The system will demonstrate how rapid response can be achieved through a combination of new technologies (like solar PV, storage and wind farms), demand-side resources and the fast start-up of thermal power plants. A fully-optimised and coordinated model will be developed, which uses the best mix of responses, followed by an appropriate commercial framework before roll-out.

By combining an innovative technological solution with a fresh commercial framework, new generation technologies will effectively compete with existing technologies in the balancing services market. We estimate that this could reduce costs to end consumers by about £150m to £200m per year in the 2020s.

Click here to read in depth about this project

EFCC

could save end consumers £150m to £200m per year in the 2020s

System operator

Developing a new communication method using system frequency

Click here to read in depth about this project

National Grid is currently exploring new opportunities in demand-side response (DSR), a scheme which financially incentivises consumers to change their electricity demand at peak times. This requires more remote communication with consumers, so they can offer the right kind of balancing services to the grid.

To support DSR, the SAMUEL project aims to develop a new way of communicating through the electricity grid. Its general principle is to use system frequency – which naturally fluctuates throughout the day as the balance between supply and demand changes – as a communication channel.

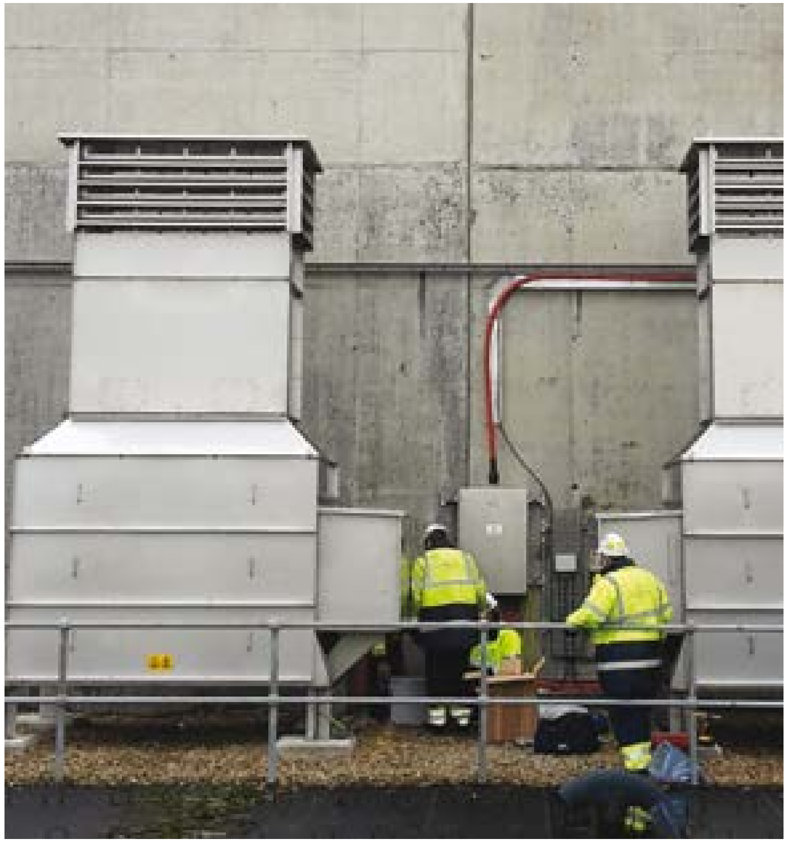
By using a set of resistive load banks around the network to change the demand to a very small extent, the system frequency can also be changed to a small degree. Sensors detect these changes in the system frequency, which can be used to encode messages, with such messages then used to control DSR services.

Benefits to end consumers

Developed and patented by Reactive Technologies, this new Grid Data and Measurement System (GDMS) means signals can travel through the entire grid, including the distribution network.

Over the past few months, signals have been sent and received successfully at various locations. Research shows that it is possible to modulate the grid frequency by using a distributed set of loads. Data can therefore be transmitted through the whole grid, building a broadcast system suitable for communicating with new demand-side response providers.

This project will therefore provide an opportunity for small providers, including domestic loads, to participate in the balancing process. By helping a new group of people provide DSR, SAMUEL can reduce the costs of balancing as we transition to a low-carbon future with more distributed energy.



System operator

Investigation into voltage interaction and dependency expectation

Click here to read in depth about this project

A critical service that National Grid uses to manage the electricity network in times of system stress is called voltage reduction. Managing system voltages is a very important activity and there are compliance standards for safe and secure operation of the electricity system.

By instructing a distribution network operator (DNO) to reduce their voltage (while remaining within standards), a reduction in electricity demand is achieved while continuing to meet consumer needs. This service has been very successful in the past when required, but analysis has shown that due to industry trends it has become less effective and other services are being used as well.

The DIVIDE project is a collaboration between National Grid, DNOs and technology consultancy EA Technology to understand why the effectiveness of this voltage reduction service has fallen, and to examine strategies to reverse this trend. The project will investigate changes over the past 10 years that will make managing system voltages more challenging in future. The DIVIDE project will help simulate the latest trends in the electricity industry from a voltage perspective.

Improving our understanding

As part of National Grid's work to manage system voltages, extensive simulation is undertaken so that future trends and their implications can be fully understood before they become a problem.

During the first year of the project, National Grid has worked closely with the DNOs to improve modelling and understanding of demand response to voltage control, as part of the broader objectives of this project.

This will allow better understanding of demand control capability and, where possible, design improvements to it.

During the next stage of the project, starting this year, there will begin trials of voltage control to achieve demand reduction at times of high and low demand. This will include understanding the effect that embedded generation plays in affecting these capabilities.

In a third and final stage of the project, the findings will be used to improve forecasting of how voltage control might evolve over the next decade, so that the UK electricity supply can be managed effectively and economically.

Secure and cost-effective

The research will lead to new learning in terms of voltage dependent load modelling, as it relates to the transmission system net demand, which has not been updated since the 1970s.

The main benefit of this project will be to improve understanding of demand response to voltage control. This will allow both the DNOs and National Grid as GBSO to continue to provide demand control as an alternative to demand disconnection. Ultimately, this will be one of a suite of measures that enables the UK electricity supply to be managed in a secure and cost-effective way.

System operator

Making the most of solar PV generation

National Grid is committed to facilitating UK targets for producing more energy from renewable sources. Recent trends have shown that good progress is being made within the electricity industry.

National Grid has been involved in extensive research and development to assist in identifying new issues that the integration of renewable energy brings, and identifying opportunities to meet targets while maintaining reliability and security of supply.

In the UK, photovoltaic (PV) generation has grown enormously in the past five years. The total installed capacity has increased to almost 11GW and there are more than 700,000 installations across the country. The installation rate of 1GW per year of newly installed solar PV capacity is expected to continue through to 2020.

National visibility

The current research being undertaken by National Grid is to address two primary concerns. The first is that the vast majority of solar PV installations are not obliged to provide the system operator with metering data – which means that their energy production is 'invisible' to the control centre. The second aspect is that the ability to forecast the power output of solar PV is not robust enough.

National Grid has two ongoing projects to address the production visibility of solar PV installations. One project has installed solar panels and a weather station at three of our sites to provide live metering to the control centre PV forecasting system. The second project has been carried out in partnership with the University of Sheffield to estimate the total real-time energy produced from solar PV across Great Britain. When successful, these projects will significantly improve the real-time visibility of solar PV across the country.

Some success has been achieved already where early data from these projects has been used to improve the national electricity demand forecast.

Two more projects have been established and they will focus on forecasting accuracy. One project will work in partnership with the Met Office to help provide improved solar irradiation forecasts. The second project has been set up with Reading University Meteorology Department to look at new ways to enhance weather forecasting to support solar PV energy production forecasting.

Click here to read more about these four projects.

"When successful, these projects will significantly improve the real-time production visibility of solar PV across the country"

Transmission owner

Updates on last year's highlights

PROJECT NAME

Rapid deployment ballistic screens

PROJECT DETAILS

Mitigating the risk of failure from porcelain-clad assets such as current transformers, circuit breakers and bushings has posed a challenge for the industry in recent years. Last year, a solution was introduced to keep personnel safe and also address the limitations of other solutions including: substation access, system maintenance and operation. The rapid deployment ballistic screen is capable of withstanding fragments of porcelain in the rare event of a porcelain-clad asset exploding.

RESULTS AND LEARNING

Last year we reported that carefully controlled tests had demonstrated with confidence that the screen can withstand the ballistic impacts expected from ceramic debris of porcelain clad assets if they explode. This year the findings from these tests were used to design, build and deploy a number of screens at a National Grid substation in the north-west of England.

Contractors installed the screens on site alongside National Grid engineers, to allow the engineers to learn more about how the screens should be erected. A number of factors were considered in the demonstration including location and proximity to assets and overhead lines. The learning from this trial will now enable some minor screen modifications to make installation easier and the writing of detailed installation procedure for erecting screens on a live substation.

BENEFITS TO CONSUMERS

Using this learning, National Grid is considering options for wide-scale deployment of the screens at substation sites as an alternative to existing methods. This will allow for improved safety measures, better substation access for maintenance and a reduced impact of risk management hazard zones on system operability. The deployment of screens will be prioritised on the basis of where the most pressing system access issues are.

PROJECT NAME

Synthetic ester Midel 7131

PROJECT DETAILS

The synthetic ester based oil, Midel 7131, is a reduced fire hazard liquid alternative to mineral oil, which has the potential to assist compact transformer design. During 2013/14 a Midel 7131-filled transformer test rig was built and successfully tested. Following this proof of concept, in 2014 National Grid had the confidence to award a competitively tendered contract to design and build three Midel 7131-filled 400 kV transformers with integrated heat recovery systems, for use at a new inner London substation at Highbury where space is at a premium.

RESULTS AND LEARNING

The three Highbury transformers were installed and commissioned over the autumn and spring of 2015/16 and completion of the heat recovery system installations is expected during 2016/17. In addition to its fire resistant qualities, Midel 7131 is believed to have a less hazardous impact on the environment than the traditionally used mineral oil.

National Grid has recently begun work to test the biodegradability of the Midel 7131 oil. The new project will consider the options available for accelerated degradation, and will investigate whether the existing secondary containment solutions (bunds) are appropriate for applications where Midel is used, or whether more suitable alternatives may exist.

BENEFITS TO CONSUMERS

The Highbury transformers have been specifically designed to occupy a smaller footprint than normal and so offer a solution for other sites where space is at a premium. Heat recovery systems have also been integrated into the transformers and these will provide heating to flats, retail units and a neighbouring school.

In addition to its fire resistant qualities the Midel will have a further advantage over mineral oils if proven to be biodegradable, as it may pose less risk to the environment.

Transmission owner

Updates on last year's highlights

PROJECT NAME

T-Pylon structure and composite testing

PROJECT DETAILS

This project involves 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. Previously, these insulators have only been installed vertically on substations. Last year further mechanical load testing was carried out on the insulators in a horizontal position, as they are used on T-Pylons.

RESULTS AND LEARNING

During 2015/16, mechanical testing of the tower structures was completed. The towers were loaded to replicate extreme wind conditions, ice loading and a variety of other conditions. The insulators were also mechanically tested to understand their performance under maximum loads.

Electrical testing was carried out on the insulators, to their maximum electrical performance. Electrical testing of the insulators identified a challenge for one of the insulator units under certain conditions. This has helped National Grid and our supplier to ensure a solution that meets all requirements.

During 2016/17 vibration testing will be undertaken on the insulators to ensure they can withstand the Aeolian vibrations induced on the overhead line system. Further electrical testing will be carried out on the post insulator, which forms part of a flying angle insulator array.

BENEFITS TO CONSUMERS

The T-Pylon's innovative design is up to one third lower in height 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 be another step towards introducing T-Pylons into the network. Completion of composite insulator testing will also ensure sufficient availability of approved supplier options to deliver a deployable solution.

PROJECT NAME

Aluminium Conductor Composite Reinforced (ACCR)

PROJECT DETAILS

High-Temperature, Low-Sag (HTLS) overhead line conductors allow conventional conductors to be replaced with a more efficient conductor of similar size. This means more power can be transported without rebuilding or replacing infrastructure. Following a successful trial of the 3M Aluminium Conductor Composite Reinforced (ACCR) on a decommissioned line, a live test was carried out on a 15km HTLS energised section of the network.

RESULTS AND LEARNING

Building on the results of the 3M trial, National Grid completed a noise assessment of the 3M ACCR after installing the conductor on three spans of a route where there were known noise problems. The results showed audible noise reduction compared with other widely used conductors.

The stringing technique and associated fixtures and fittings for the ACCR conductor are compatible with the 'traditional' All Aluminium Alloy Conductor (AAAC), used widely across the transmission system. This therefore has potential to save both time and money in reconductoring schemes where use of HTLS conductors is desirable.

During 2015/16, National Grid trialled another conductor in the HTLS family to help stimulate market competition. A trial installation of the Nexans Aluminium Composite Carbon Core (ACCC) conductor took place at National Grid's training centre at Eakring to develop installation techniques for use on the UK transmission network. Conductor fittings and installation tools from several manufacturers were also trialled during the installation.

BENEFITS TO CONSUMERS

Following the successful installation trial of the new variant, National Grid is now seeking deployment opportunities on the transmission network for the range of HTLS conductors. In 2016 National Grid will identify an appropriate capital scheme that can support a live installation of the HTLS conductor types. Development of the tools and fittings for the new conductor will continue and the Nexans conductor will be type-registered for use on the UK transmission network.

System operator

Updates on last year's highlights

PROJECT NAME

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

PROJECT DETAILS

As more renewables connect to Europe's electricity transmission grid and decarbonisation increases, the transmission network is becoming more complex. National Grid needs to redesign and reconfigure systems so that the network can continue to operate efficiently and securely. This project addresses the fact that today's analytical tools may not be usable in the future, because of the unpredictability of renewable resources and new complex control devices.

RESULTS AND LEARNING

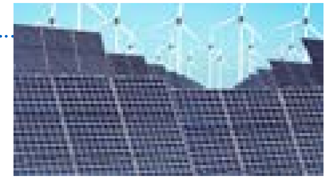
The project has resulted in a computer program and software that will enable us to analyse the European electricity grid as it is today, and how it might be configured in future. This will become more necessary over time as more renewable generation connects, introducing more uncertainty and the need to explore a greater number of scenarios. The tools and software currently available do not have enough capability to do this.

This work forms part of a European-funded project that has examined all aspects of power system management. The large-scale project has moved forward through collaboration with many transmission companies. Innovation funding has been used to support National Grid's contribution to this European initiative.

BENEFITS TO CONSUMERS

Ultimately, we will develop and validate an open, interoperable toolbox that can support the future operation of a pan-European grid. We'll develop software that can assess the security of power system situations from two days ahead of real time and suggest preventative or remedial actions. This will increase security of supply to consumers, as partners across Europe work together to make the network more coordinated when the system is under stress.

PROJECT NAME



Control and protection challenges in future converter-dominated power systems

PROJECT DETAILS

As non-synchronous generation (NSG) such as wind and solar, together with high voltage direct current (HVDC) links, is developed, the proportion of it on the GB network is increasing. This project explores the impact of NSG and the consequences that this brings.

RESULTS AND LEARNING

National Grid has produced a series of research papers, including two that were submitted and accepted at the Protection Automation and Control World Conference in July 2015.

The papers identify grid protection problems in European grid codes and describe how future converters can do more to stay connected and continue to operate when grid voltage conditions are unbalanced. Two further papers, presented at the Renewable Power Generation Conference in October 2015, look into relay response times and system strength issues and propose new HVDC converter control schemes with innovative solutions.

This research will present results from university laboratory converter devices and realistic converter models, which will enable the simulation of these converters under different electricity system conditions.

BENEFITS TO CONSUMERS

The project aims to reduce the amount of technical constraints on NSG, which will lower costs and support a greater percentage of renewable power generation in the GB power system. It will also identify fit-for-purpose protection functions, to ensure that a grid composed of different generation mixes remains stable in a low carbon future.

System operator

Updates on last year's highlights

PROJECT NAME

Enhanced weather modelling for Dynamic Line Rating

PROJECT DETAILS

Changing generation and demand patterns have altered flows on the transmission network and this in turn has increased constraint costs. Possible solutions include building more circuits and increasing circuit capacity, but both are time-consuming and costly. One alternative is to use the existing network more effectively by enhancing its thermal capability. This technique is called Dynamic Line Rating (DLR), which offers a different way of increasing capacity based on weather conditions. DLR looks at harnessing historical weather data to forecast the prevailing capacity along an overhead line route. This can be done hours and days ahead of real time.

RESULTS AND LEARNING

National Grid is incorporating the discoveries from the weather data forecasting technique comparison. This will establish a model to determine different weather combination possibilities and the impact of these on the available overhead line ratings. It will also quantify the probabilities of the line operating temperature being exceeded and establish realistic near real-time DLR forecasts. The project will identify the methods of forecasting weather data, as well as indicating appropriate levels of risk to avoid exceeding operating conditions.

BENEFITS TO CONSUMERS

There could be a significant benefit to consumers through reduction of system operating costs and less need for reinforcement works.

PROJECT NAME

UK-wide wind power: extremes and variability

PROJECT DETAILS

National Grid has collaborated with the University of Reading to look at ways of improving wind power forecasting methods. The Meteorology department at the University of Reading suggested the use of Re-analysis data to examine long-term trends in weather. This was a new area of expertise to National Grid at the time and it was useful to see things from a fresh perspective.

The Re-analysis data allows trends over the past 30 years to be examined and difficult questions addressed, including, "Will storms become more intense and more frequent?" and "Will the weather be easier or more difficult to predict?" Answering these questions will help National Grid operate the grid better, which will – in turn – benefit consumers.

RESULTS AND LEARNING

The research has led to a greater awareness within National Grid of weather scenarios that are likely to create large fluctuations in wind power output. It will enable us to assess the possibility of future extreme weather conditions and their impact on GB system operations, help to improve forecasting, and lead to a better understanding of how far into the future we can forecast accurately. The research will support secure operations and inform our investment decisions on system reinforcements, long-term balancing services and information systems.

BENEFITS TO CONSUMERS

Accurate forecasts will reduce costs as we will be able to reduce the amount of generation held in reserve and they will also increase system security so that the correct amount of reserve is available when an extreme event happens.

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	PARTNER
NIA_NGET0083	Cable Oil Regeneration	Enervac Corporation Midlands Truck & Van Limited Utilise JSM Construction Stewart Signs
NIA_NGET0087	Cable Installation Design & Innovation Project (CIDIP)	University of Southampton
NIA_NGET0055	Electromagnetic Transients (EMT) in Future Power Systems – Phenomena, Stresses & Modelling	SINTEF Energi AS
NIA_NGET0107	Stakeholder Attitudes to Electricity Infrastructure	University of Exeter
NIA_NGET0113	Control of Debris and Dust from the Treatment of Grade 4 Tower Steelwork (G4T)	Fountains Environmental Limited PDC Protective & Decorative CLC Contractors Spencer Coatings
NIA_NGET0130	Determining a Threshold for Magnetophosphenes Perception at 50Hz	Lawson Health Research Institute
NIA_NGET0133	Identifying Opportunities and Developments in Electric and Magnetic Fields Research	Inannacon Market Opinion Research Resource Strategies Torrance
NIA_NGET0137	Noise Assessment of ACCR Conductor	Bruel & Kjaer UK
NIA_NGET0141	T-Pylon Structure and Composite Insulator Testing	Europea de Construcciones Metálicas Russell Ductile Castings STRI AB Valmont SM A/S EPL Composite Solutions Allied Insulators Group Lapp Insulators GmbH GbF
NIA_NGET0149	Investigation of Aeolian Insulator Noise	Cranfield University School of Management University of Manchester Campbell Associates
NIA_NGET0112	Enhanced AC and DC Safety Voltage Limits Assessment	Cardiff University
NIA_NGET0124	EPRI EMF 2014	EPRI Solutions

Corporate responsibility continued

Click here to read about this project

NGET	PROJECT NAME	PARTNER
NIA_NGET0013	Tablet Interface for a SF6 Mass Flow Top-up Device	DILO Armaturen und Anlagen GmbH
NIA_NGET0018	Potentials and Profiles Around Earth Electrodes and Opposite-side Injection for Large-area Earthing	Cardiff University
NIA_NGET0171	EPRI EMF 2015	EPRI Solutions
NIA_NGET0079	Rapid Deployment Ballistic Screen	Access Design and Engineering RS Components UK Doble PowerTest Photron (Europe) C3 Global Radnor Range
NIA_NGET0099	Thermal Efficiency Trials	Rook Services
NIA_NGET0025	Feasibility Study For Sustainable Substation Design	Ove Arup and Partners
NIA_NGET0180	EPRI EMF 2016	EPRI Solutions
NIA_NGET0074	SF6 Capture and Leakage Repair	Cape Industrial Services University of Liverpool Siemens Transmission & Distribution Jacobi Carbons Furmanite International (Kendal)
NIA_NGET0163	SF6 Management and Alternative Gases	Cardiff University

Demand

NGET	PROJECT NAME	PARTNER
NIA_NGET0085	UK Regional Wind: Extreme Behaviour and Predictability	University of Reading
NIA_NGET0097	Development of Dynamic Demand Models in DIgSILENT PowerFactory	Cardiff University
NIA_NGET0110	Electrical Demand Archetype Model (EDAM2)	Energy Savings Trust
NIA_NGET0114	Industrial and Commercial Gas & Electric Scenario Modelling	Ove Arup Partnership
NIA_NGET0120	Evolution of Energy Storage and Demand Management Services	EA Technology Electricity Storage Network
NIA_NGET0134	Granular Voltage Control (GVC)	Powerperfector Limited
NIA_NGET0138	Frequency Sensitive Electric Vehicle and Heat Pump Power Consumption	Element Energy Limited
NIA_NGET0156	DNO Investigation into Voltage Interaction and Dependency Expectation (DIVIDE)	EA Technology

Distributed generation

Click here to read about this project

NGET	PROJECT NAME	PARTNER
NIA_NGET0020	Modelling of Embedded Generation within Distribution Networks and Assessing the Impacts on Load Profile at Transmission Level Grid Supply Points (GSPs)	University of Bath
NIA_NGET0142	Assessment of Distributed Generation Behaviour during Frequency Disturbances	ECOFYS Germany GmbH Energy Networks Association
NIA_ENWL003	Review of Engineering Recommendation P2/6	Energy Networks Association

Efficient build

NGET	PROJECT NAME	PARTNER
NIA_NGET0153	Life Cycle Costing and Valuation Optimisation (iCASE Award)	University of Bath
NIA_NGET0084	Optimisation of Node Configuration for Offshore Supergrid	Imperial College London
NIA_NGET0166	VSC-HVDC Model Validation and Improvement (iCASE)	University of Manchester
NIA_NGET0143	Transient and Clearances in the Future Electrical Transmission Systems (iCASE Award)	University of Manchester
NIA_NGET0164	Evaluation of a Novel Variant of ACCC HTLS Conductor	Nexans Benelux SA
NIA_NGET0064	Alternative Bus Bar Protection Solution	Schweitzer Engineering Laboratories
NIA_NGET0168	A New Independent Methodology for P&C Coordination Studies Using Real Time Digital Simulation	University of Birmingham
NIA_NGET0104	Proof of Concept of IEC 61850 Process Bus Technology	ABB Group
NIA_NGET0162	Digital Substation – Virtual Site Acceptance Testing & Training	University of Manchester
NIA_NGET0122	Identification and Mitigation of Large Equipment Transport Issues	Wynn’s

Managing assets

Click here to read about this project

NGET	PROJECT NAME	PARTNER
NIA_NGET0015	Dinorwig Thermal Cycling and Cable Rating	University Of Southampton Doble PowerTest
NIA_NGET0036	Thermomechanical Forces in XLPE Cable	University of Southampton
NIA_NGET0048	Cables With Long Electrical Sections	University of Southampton
NIA_NGET0082	Rating Impact of Non-isothermal Ground Surface (RINGS)	University of Southampton Doble PowerTest C3 Global
NIA_NGET0092	Partial Discharge (PD) on Existing HV Cable	Elimpus Limited NDB Technologie Inc Prysmian Cables & Systems Limited Doble PowerTest
NIA_NGET0093	Online Gas-in-Oil Analysis on Existing HV Cables	University of Reading Invisible Systems Doble PowerTest
NIA_NGET0103	Modelling the Tape Corrosion Process for Oil-filled Underground Cables	University of Leicester
NIA_NGET0115	Cable Stripping Truck	Utilise
NIA_NGET0116	Combustible Gases in Redundant Oil-filled Cables	Utilise
NIA_NGET0136	Impact of Seabed Properties on Ampacity and Reliability of Cables (iCASE Award)	University of Southampton
NIA_NGET0135	Enhanced Sensor Development (iCASE)	University of Manchester
NIA_NGET0042	HVDC EngD - Richard Poole (Connection of Nuclear Powerstations via HVDC)	Manitoba HVDC Research Centre University of Hertfordshire
NIA_NGET0045	Multi-terminal VSC HVDC Operation, Control and AC System Integration	University of Manchester
NIA_NGET0054	Load Cycling and Radial Flow in Mass Impregnated HVDC Submarine Cables	SINTEF Energi AS Statnett SF
NIA_NGET0057	DC Circuit Breaker Technologies	University of Manchester
NIA_NGET0060	Application of DC Circuit Breakers in DC Grids	Cardiff University
NIA_NGET0073	Partial Discharge Monitoring of DC Cable (PDDC)	University of Southampton
NIA_NGET0182	Feasibility Study on Suitability of Protection Policy for Future Energy Scenarios (FES – CDT)	University of Manchester
NIA_NGET0011	Detection and Measurement of ACSR Corrosion	CMS Cameron McKenna Hydro-Québec Southampton Dielectric Consultants Straker Films Limited
NIA_NGET0158	EPRI Overhead Circuits 2014	EPRI Solutions
NIA_NGET0150	EPRI Underground Transmission 2014	EPRI Solutions

Managing assets continued

Click here to read about this project

NGET	PROJECT NAME	PARTNER
NIA_NGET0024	Composite Cross-Arms Study	University of Manchester Kelvin Construction Co
NIA_NGET0035	Long Term Performance of Silicon Based Composite Insulators	University of Manchester
NIA_NGET0140	OHL Condition Assessment	Brunel University Amey OWR
NIA_NGET0181	Classification of Wind Exposed Overhead Line Spans	Digital Engineering
NIA_NGET0038	Design of a Smart Tool for Detecting Hidden Errors in Protection Setting Files	University of Strathclyde
NIA_NGET0146	Assessment of Electronic (Analogue and Numeric) Protection Equipment	Quanta Technology
NIA_NGET0010	Optimised Location for Surge Arresters on the Transmission Network	Cardiff University
NIA_NGET0109	Bushing and Instrument Transformer Test Tap Connection Condition Assessment Tool	Elimpus Limited Elisys Engineering Process Parameters Invisible Systems GE Grid Solutions (UK)
NIA_NGET0158	EPRI Overhead Circuits 2014	EPRI Solutions
NIA_NGET0123	EPRI Substations 2014	EPRI Solutions
NIA_NGET0147	Condition Monitoring of Power Assets (COMPASS)	The Watt Power System Consulting
NIA_NGET0148	Network Reliability Asset Replacement Decision Support Tool	University of Manchester
NIA_NGET0172	EPRI Substations 2015	EPRI Solutions
NIA_NGET0053	RESNET	University of Manchester ECAS (UK)
NIA_NGET0040	Magnetic Models for Transformers	Cardiff University University of Manchester
NIA_NGET0044	Transformer Oil Passivation and Impact of Corrosive Sulphur (TOPICS)	Nynas IOM University of Southampton Doble PowerTest
NIA_NGET0088	Transformer Research Consortium	University of Manchester
NIA_NGET0102	13 kV Shunt Reactor Refurbishment	ABB Engineering Services
NIA_NGET0091	Impact Assessment of Seismic Analysis on Electricity Towers and Substation Equipment/Structures	Mott MacDonald UK
NIA_NGET0165	Transformer Rating Modelling Tool Enhancement	Southampton Dielectric Consultants University of Southampton
NIA_NGET0160	Feasibility of Risk-Based Network Planning	University of Manchester

Managing assets continued

Click here to read about this project

NGET	PROJECT NAME	PARTNER
NIA_NGET0117	Bulk Oil Circuit Breaker Bushing in Situ Refurbishment	Narec Development Services
NIA_NGET0017	Oil/Paper Insulation HVDC Performance	University of Southampton
NIA_NGET0173	EPRI Overhead Circuits 2015	EPRI Solutions

Non-Sync generation

NGET	PROJECT NAME	PARTNER
NIA_NGET0128	Clustering Effects of Major Offshore Wind Developments	University of Reading
NIA_NGET0016	UK-wide Wind Power: Extreme and Variability	University of Reading
NIA_NGET0028	Impact of Extreme Events on Power Production at the Scale of a Single Wind-farm	University of Reading
NIA_NGET0039	A Combined Approach to Wind Profile Prediction	University of Sheffield
NIA_NGET0106	Control and Protection Challenges in Convertor	University of Strathclyde
NIA_NGET0129	Investigation of Sub-Synchronous Interactions Between Wind Turbine Generators and Series Capacitors	IC Consultants
NIA_NGET0170	PV Monitoring Phase 2	University of Sheffield

Risk management

NGET	PROJECT NAME	PARTNER
NIA_NGET0059	Protection and Fault Handling in Offshore HVDC Grids	SINTEF Energi AS
NIA_NGET0052	Mathematics of Balancing Energy Networks Under Uncertainty	Heriot-Watt University
NIA_NGET0058	Scalable Computational Tools and Infrastructure for Interoperable and Secure Control of Power System	Brunel University
NIA_NGET0095	Visualisation of Renewable Energy Models	University of Reading
NIA_NGET0100	REACT – Reactive Power Exchange Application Capability Transfer	Energy Networks Association ECAS (UK)
NIA_NGET0144	Integrated Electricity and Gas Transmission Network Operating Model (iCASE Award)	University of Manchester
NIA_NGET0159	Black Start Alternative Approaches	DNV GL (formerly DNV KEMA) Mott MacDonald UK

Service delivery

Click here to read about this project

NGET	PROJECT NAME	PARTNER
NIA_NGET0047	Dynamic Ratings for improved Operational Performance (DROP)	University of Southampton
NIA_NGET0046	Flexible Rating Options for DC Operation	University of Southampton
NIA_NGET0056	Humber SmartZone Pilot Project	Ampacimon Global Substation Solutions University of Manchester Invisible Systems
NIA_NGET0012	Induced Voltages and Currents on Transmission Overhead Lines Under NSI 4 Working Practices	Cardiff University
NIA_NGET0043	Live Line Working Equipment	Ashbrook Engineering Services Bond Aviation Group Bond Helicopters Europe Cunningham Design Limited Eurocopter UK New and Renewable Energy Centre Oxford Computer Consultants RS Components UK University of Manchester University of Southampton Broadcast Media Services Hiatco Airbus Helicopters UK

Smart grid

NGET	PROJECT NAME	PARTNER
NIA_NGET0023	Quantifying Benefits and Risks of Applying Advanced Network Control and Demand Response Technologies	Energy Networks Association Imperial College London
NIA_NGET0105	Enhanced Weather Modelling for Dynamic Line Rating (DLR)	University of Strathclyde
NIA_NGET0119	Project SAMUEL – Grid Data and Measurement Systems	Reactive Technologies
NIA_NGET0154	Smart Grid Forum Work Stream 7 – DS2030	Energy Networks Association
NIA_NGET0155	Open Source Interconnector Modelling: Phase 1	Baringa Partners
NIA_NGET0161	Detection and Control of Inter-Area Oscillations (DACIAO)	University of Warwick
NIA_NGET0167	South East Smart Grids (SESG)	Siemens Transmission and Distribution
NIA_NGET0125	EPRI Grid Operations and Control 2014	EPRI Solutions

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

We have specific innovation leaders within National Grid Electricity Transmission (NGET): Electricity Transmission Asset Management and Capital Delivery, both representing the England and Wales Transmission Owner; and the System Operator, represented by Business Change and Network Capability.

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 to one of our business functions.

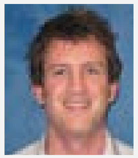
If you have a project proposal contact us at box.InnovationTransmission@nationalgrid.com and we will connect you with the relevant business area.

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.



Jon Davies

BUSINESS CHANGE is accountable for maintaining a holistic view of all the change initiatives across the System Operator, coordinating and prioritising the portfolio of work, as well as ensuring changes are delivered with a controlled, consistent approach.

Graham Stein

NETWORK CAPABILITY is accountable for network development strategy, consumer connections, long-term planning and the improvement of system operability.

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.