Innovation Funding Incentive Annual Report 2008/09

Electricity Transmission & Gas Transmission

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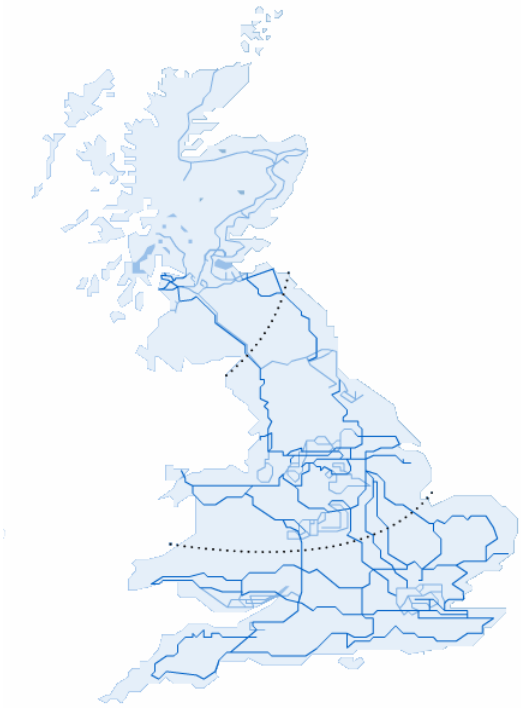
About National Grid's UK Transmission Businesses

National Grid is an international Electricity and Gas Company and one of the largest investor-owned energy companies in the world. We play a vital role in providing energy to millions of customers across Great Britain in an efficient, reliable and safe manner. We are committed to safeguarding the environment for future generations and providing all our customers with the highest standards of service.



Electricity Transmission

National Grid owns and maintains the high-voltage electricity transmission system in England and Wales, together with operating the system across Great Britain, balancing supply with demand on a minute by minute basis.

Gas Transmission

The National Transmission System (NTS) is the high pressure part of National Grid's gas transmission system and it consists of more than 7,300 Kilometres of top quality welded steel pipeline operating at pressures of up to 94 bar (94 times normal atmospheric pressure, over 1350 psi). The gas is pushed through the system using 26 strategically placed compressor stations. From over 140 off-take points, the NTS supplies gas to 40 power stations, a small number of large industrial consumers and the Local Distribution Zones (LDZs) that contain pipes operating at lower pressure which eventually supply the consumer.

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Introduction by Nick Winser, Executive Director

I am pleased to introduce this report, which relates to the second year of the Gas and Electricity Transmission Innovation Funding Incentive.

In the 2007/08 report I outlined some of the future challenges for electricity and gas transmission, all of which are equally relevant today. The need to mitigate the decline of UKCS and to manage the transition to a low carbon economy remain vital challenges and set the framework for the development of long term energy policy. In relation to gas transmission, I also highlighted the need for us to prepare for changing patterns of energy supplies. The potential role of Carbon Capture & Storage (CCS) in the transition to a low carbon economy is another important focus. For electricity, our challenges include the connection of new low carbon generation, overcoming capacity constraints on the network and enabling Smart technology to optimise network and customer choices.

Following a further year of embedding this incentive within our business and tackling some of the challenges highlighted, the benefits from the first years programme are starting to be reflected in new business policies & procedures and new approaches to existing problems within National Grid.

We know that the need for innovation continues to increase as the future challenges we face become ever clearer. With this in mind National Grid has increased its utilisation of the incentive. Broadly speaking we spent half of our IFI funding allowance in 2007/8 and for 2008/9 we invested approaching 75% (£1.9m) of the gas allowance and 120% (£7.7m) of the electricity transmission annual allowance on R&D. We aim to lever our spending, with the total costs for the programme for electricity amounting to greater than £51m and the gas programme to greater than £14m.

The Innovation Funding Incentive has again been utilised for our existing assets and there continues to be a number of vital areas which we are exploring to further enhance safety, capability and reliability whilst ensuring efficient use of expenditure. As a network owner and operator, we also need to determine how best to secure appropriate investment in Transmission scale deployment of new technologies involving capital intensive assets, these assets carry with them an increased level of risk that they will not operate exactly as designed when compared to existing technologies and an appropriate funding mechanism needs to be identified to allow these assets to be trialled.

I hope that you will find this second report an informative document on some of the challenges facing the UK energy industry and the innovative approach National Grid is undertaking to tackle these challenges.

Nick Winser

Executive Director

Document Structure

This document has been designed in order to comply with the Innovation Good Practice Guide for Energy Networks (ENA Engineering Recommendation G85 Issue2*)* and the contents of this document are listed below.

- Introduction from Nick Winser
- Document Structure
- Overview of 2008/2009 R&D Activities
- R&D Focus Areas
- Finance Overview & Benefits of Programme
- National Grid Electricity Transmission - R&D Detailed Reports
- National Grid Gas Transmission - R&D Detailed Reports

Overview of 2008/2009 programme

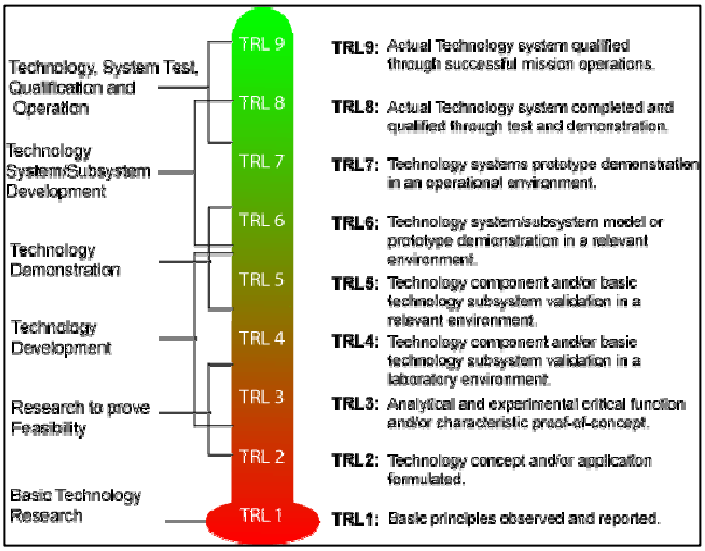
Our approach for this second year of the Innovation Funding Incentive (IFI) has again been one of extensive collaboration and active discussion with all our stakeholders. Wherever practicable we have sponsored collaborative R&D with other organisations who share common objectives as well as maximising the benefit of IFI money for UK consumers through working with other Electricity Transmission and Distribution companies and the UK Gas Distribution companies. We have in place collaboration agreements with Manchester, Southampton, Strathclyde and Cardiff universities as well as Germanischer Lloyd (previously Advantica) to aid in the delivery of R&D. This arrangement gives us cost effective access to high quality research resources; National Grid is extending this to include other key UK universities in the electricity and gas sectors.

We are a member of the Energy Research Partnership, an influential 50/50% government and industry group which aims to establish the forward R&D agenda for UK. We are working closely with our key equipment suppliers to ensure their own R&D programmes are geared to delivering products which will meet the challenges we face. In addition we are developing relationships with organisations such as the Energy & Physical Sciences Research Council, the Technology Strategy Board, and the Energy Technologies Institute to ensure a coordinated approach to R&D in the energy sector.

Finally it is becoming clear that, as IFI serves us well for the immediate R&D programme, a gap is opening up ahead as we seek to satisfy the intensifying demand for new technology to facilitate a low carbon energy infrastructure. Of particular importance will be the likely need to sponsor large scale demonstrator projects (i.e. pre deployment) to prove new technology will work on a real transmission network. We are therefore pleased to join Ofgem in their RPI-X@20 Innovation workstream which is looking at this issue.

R&D Focus Areas

Figure 1 Explanation of Technology Readiness Levels



As part of this report National Grid would like to highlight the broad range of ideas and issues that currently make up our Research and Development portfolio. As part of this broad range we have projects at different phases of development and technical maturity. In order to highlight the different levels of maturity that we are currently exploring, all the areas mentioned in the foreword will have an indication of their technology readiness level (TRL).

The TRL indicates how close a technology is to becoming both technically and commercially viable and can be seen in Figure 1. The bottom level on the TRL, Level 1 relates to research with no obvious purpose more commonly known as "Blue Sky Research", Level 9 on the TRL scale indicates products/information readily available with no development required. Currently National Grid's R&D activities have been focussed between TRLs two and eight. This range ensures that National Grid balances both tactical and strategic projects within its portfolio but also ensures that the innovation money is being used for innovation activities and not purchasing existing solutions.

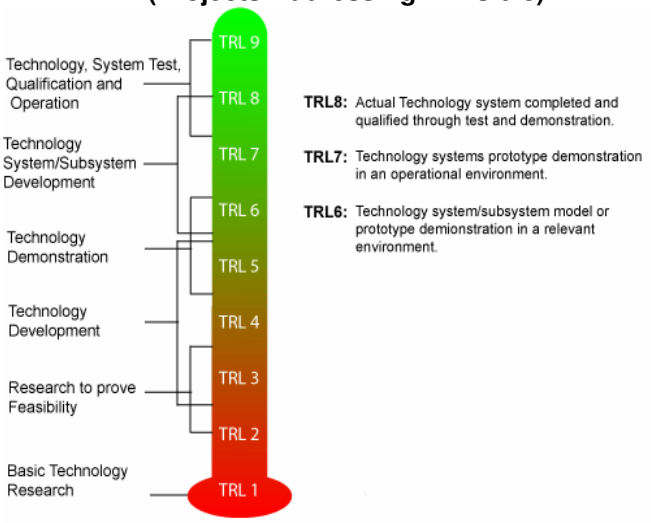
The projects highlighted in the following pages will give a flavour of the differences between the TRLs and illustrate National Grid's approach to maintaining a balanced portfolio.

Projects Focussed on Improving Health and Safety and Efficiency in Maintenance Activities (Electricity).

As part of our continued focus on improving health and safety, National Grid has utilised part of its IFI funding to develop equipment and techniques which are designed to improve safety and reduce occupation health issues. The examples below highlight the work done in the area of new maintenance techniques for overhead lines and towers.

Within National Grid the Maintenance Delivery Electricity (MDE) development team has been focussed on improving both Health and Safety and efficiency by continually assessing equipment and techniques for carrying out the routine maintenance tasks and addressing tasks currently undertaken manually. Below is a brief summary of the projects undertaken within 2008/9 financial year. These projects build upon the success achieved during the first year of IFI.

(Projects Addressing TRLs 6-8)



Powered Ladder Access Basket – this project was initiated to provide a suitable access/egress system and working platform for linesmen whilst working on suspension insulator sets. A number of successful field trials have been completed over the last 12 months. A final production unit is in manufacture and approval will then be sought for full deployment prior to roll out to site.

Portable Earthing Trailer – this project aims to provide a mechanical aid when installing portable earths in substations. The concept evaluation has been completed with the main criteria being fully investigated. The design of the aid is nearing completion. The manufacture of the first prototype is expected to begin during June 2009. Once the prototype is complete, extensive field trials will be undertaken to ascertain if the initial design meets the functional specification. These trials will also allow valuable feedback to be obtained from site which will guide the project to a final specification.

Earthwire Platform – this platform is being developed to provide a suitable access/egress platform whilst carrying out maintenance on earthwires. The initial prototype has been trialled, identifying a change to the specification and design parameters. The second prototype has been manufactured and tested. Field trials are to be completed to ascertain the suitability of the current design and any required design changes.

Severn Cable Tunnel Access/Egress Trolley – this project will deliver a powered trolley which will aid the movement of equipment into and out of the 2km Severn cable tunnel and can double up as a rescue aid in case of injury to a person down the cable tunnel. Final trials have been completed successfully. Further investigations are to be undertaken in 2009 to ascertain if the trolley can be utilised in any other cable tunnel.

Trolley Jump Kit – the aim is to develop a lightweight jump kit which will be used to allow suspension insulators to be passed within the overhead line conductor trolleys. First prototypes of new jump kit have been trialled and a number of improvements identified. A second prototype has now been manufactured and tested. Field trials are now required to ensure the new equipment works efficiently and to identify any further modifications.

Development of Yoke Plates – this project will deliver a number of bespoke lightweight yoke plates used to carry out routine maintenance tasks. Two yoke plates (A and V) are complete, two yoke Plates (O and L) are currently in the design phase. The purpose for the redesign is to reduce the weight of the yoke plates which will reduce the manual handling risks. The developed yoke plates are to be approved and made available to overhead line teams.

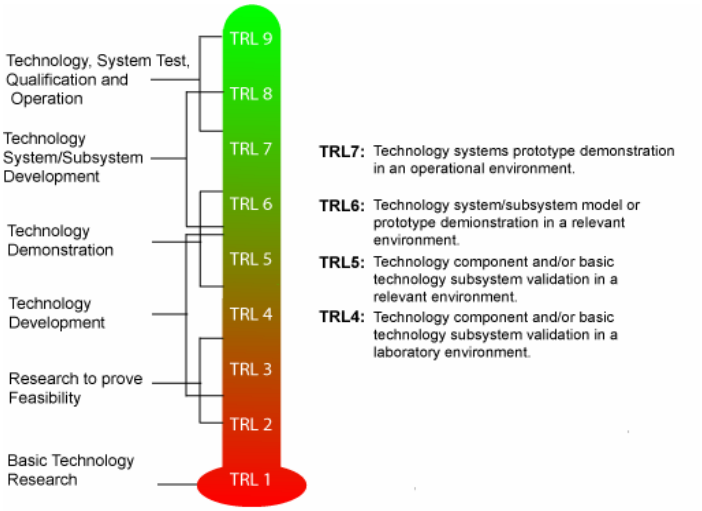
Earthwire Lifting Beam – This project is developing a lightweight lifting beam for suspension tower peaks to provide a lifting point for the replacement of earthwire suspension fittings. An initial design has been manufactured and tested. Extensive trials successfully completed. A possible improvement to the design and a reduction in weight is currently being investigated.

The plan for 2009/10 is to progress the current projects to completion and to identify any further improvements to maintenance procedures.

Identifying and Managing Corrosion (Gas)

(Projects Addressing TRLs 4-7)

The pictures below show some extreme examples of external corrosion on National Grid Gas Transmission's above ground assets, most of these would warrant immediate maintenance action. Due to the age of the gas transmission network, the incidence of such cases is now reaching the level where alternative maintenance practices need to be considered. Without some new approaches to the maintenance of pipework coatings, there will be a significant increase in repair and replacement costs and the increasing potential for corrosion-related failures.



National Grid is therefore investigating:

- Techniques to reduce the cost and resources required to conduct reactive repairs to the coatings on above ground pipework assets, involving the identification of single coat paint systems that can be used to perform local patch repair on existing paint coatings.
- Potential use of overcoat treatments to extend the life of existing coatings, without the need to remove the original coating and rebuild from bare metal.
- Non-invasive techniques to locate areas of hidden corrosion, for example under insulation cladding or between the pipework and its supports, such that cladding and supports are only dismantled where maintenance is actually required.

The general objectives of these work programmes are to make more efficient use of a finite maintenance resource and to introduce a more proactive approach, rather than simply relying on reactive maintenance.

Additionally, National Grid is investing in a highly leveraged programme of research into external corrosion through its membership of Pipeline Research Council International (PRCI). The programme of projects which National Grid contributes to is worth $723k this year (increasing from $473k the previous year). This

programme is investigating technologies for the identification and evaluation of coating disbondment, the characterisation of in-line inspection tool data, and the location and characterisation of corrosion in difficult-to-inspect areas. This programme therefore dove-tails well with the previously mentioned work programmes.

Also, under the theme of corrosion, National Grid is currently investigating:

- How corrosion and other deterioration mechanisms are affecting the ability of block valves to operate effectively. Such valves are used to isolate lengths of the pipeline network safely for maintenance and would be relied upon in the event of a major pipeline failure.
- Whether the scheduling of in-line inspection (ILI) of pipelines can be optimised to focus ILI activity where it is most needed without compromising on safe operation of the gas transmission network.
- Whether fire protection coatings can be applied to firewater pipework systems, so they can be constructed above ground to be maintained more effectively and efficiently in the event of corrosion.

National Grid has also been working on the scoping of further work programmes which will commence early next yea in the following areas:

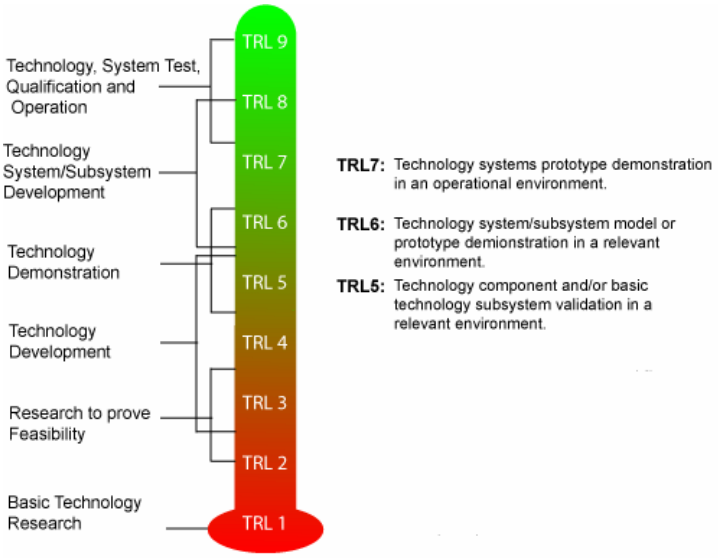
- The identification and evaluation of alternatives to cadmium plating for pipe joint fasteners on above ground assets. Cadmium plating is easily damaged, allowing corrosion to develop, and exposure to cadmium is also recognised as a potential health hazard.
- The identification and evaluation of more reliable alternatives to nitrogen buffering, that is typically utilised between pipelines and their protective sleeves, where a pipeline crosses major roadways. Loss of nitrogen pressure or contact between the pipeline and its coating could result in corrosion, which is extremely costly to repair as well as being highly disruptive to the motoring public.

Liquid Contamination (Gas)

(Projects Addressing TRLs 5-7)

National Grid's National Gas Transmission system is operated as a dry system. However, in a typical year there will be several serious incidents of liquid contamination within the National Gas Transmission System (NTS).

Upstream process failures can allow liquids, such as glycols, methanol or gas condensate, to contaminate the gas. Alternatively, the composition may be such that liquid condenses out of the gas flow as the pressure and temperature of the gas change through the network, despite no significant liquid content being evident at the entry point.



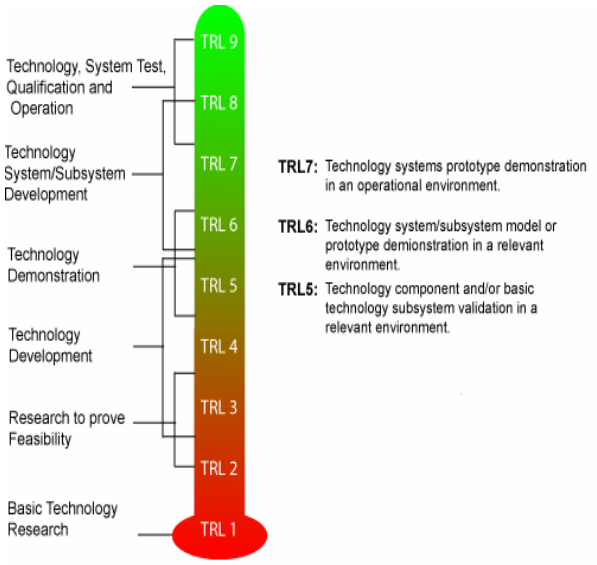
Once they are in the system, liquids can interfere with measurement equipment, for example, they can affect the behaviour of flow measurement devices and contaminate the impulse tubing on pressure measurement devices. Liquids can be a problem for maintenance crews, for example, when venting pipework for maintenance or valve bodies to test leak tightness, the presence of liquids in the vented gas can lead to oily liquid fall-out over the immediate environment. Liquids are also thought to damage gas turbines that power the compressors on the network, because they use the line gas as fuel. The result can be more frequent major overhauls of the gas turbine engines. Liquids can also damage equipment owned by large industrial customers. The annual bill to repair damage and compensate customers is estimated to be in excess of £1m.

The standard measurement installations at the entry points to the national gas transmission system are only designed to measure components in the gas up to C6 (hexane). They cannot detect liquids or the types of components that cause condensation downstream. National Grid is therefore evaluating whether an array of alternative methods could do this, as well as providing at least some indication of the quantities involved. A high pressure pipework test loop has been established at the Spadeadam Test Facility operated by GL Industrial Services to provide a platform to evaluate the alternative methods. It is hoped that cameras installed inside the test loop will also give National Grid a valuable insight into the behaviour of liquid contaminants within a pipework system.

National Grid is also preparing to evaluate the performance of an IRIS centrifuge, which is designed for relatively small pipework systems to separate out and collect any entrained liquids. It will be evaluated on the fuel supply into a gas turbine at one of its compressor stations, where liquid contamination has been a recurrent problem.

Climate Change

(Projects Addressing TRLs 5-7)



National Grid has been involved in a groundbreaking study to consider the effects of climate change on the energy industry. The 14-month Energy Project 2 (EP2) has involved National Grid working with the Met Office and ten other energy companies to establish what effect climate change will have on the industry's infrastructure. This was completed in November 2008.

EP2 project was carried out with industry experts to bring the science very close to practical business application instead of it being just theory. EP2 investigated a number of issues including soil conditions and their impact on cables; how the urban heat island might change so the industry can plan city infrastructure; the relationship between electricity network resilience and weather; a tool to predict sea surges at sites of interest (e.g. LNG sites); and climate models and wind projections. Potential changes in demand are another key factor as higher temperatures could increase electricity requirements during the summer, as air conditioning units become more widely used. This is, however, balanced by lower demand in the winter.

Key findings from the project are:

- With a few exceptions, such as the thermal ratings of equipment and apparatus, there is currently no evidence to support adjusting network design standards.
- The risk profile for transformers will be affected. Design thresholds of temperature will be exceeded more often and there will be more hot nights in cities.
- Soil conditions will change. Higher temperatures and seasonal differences in soil moisture are expected. Future conditions could be included in cable rating studies by increasing average summer soil temperatures in the models by approximately 0.5°C per decade.
- The output of thermal power stations (and in particular Combined Cycle Gas Turbines) could be suppressed with higher air temperature meaning lower air density and, in turn, lower mass flow. Conditions at each location should be considered, especially during re-design or new build and, if appropriate, adaptation planned.
- Historical climatologies are no longer valid because climate is not stationary. The new climatologies that take account of climate change are already being adopted and will improve demand forecasting and planning out to 10 years ahead.
- Wind resource is uncertain and understanding future resource represents a significant challenge.

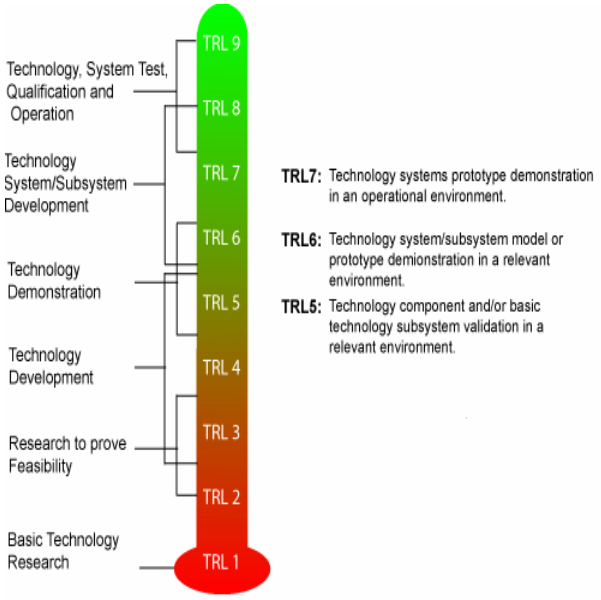
Although we don't yet have the answers, this project has highlighted possible strategies for improving industry knowledge.

National Grid initiatives in adaptation include:

- **Improve** flexibility of energy supplies to cope with incremental climate and sudden extreme weather related demand changes.
- **Increase** electricity network resilience to more frequent storms, extreme high winds, future flooding.
- **Reduce** vulnerability of energy transmission infrastructure to high temperatures and sea-level rise and flooding.
- **Increase** energy production from weather-dependent renewable sources

Carbon Capture and Storage (Gas)

(Projects Addressing TRLs 5-7)



National Grid is commencing investigations into possible future reuse of some of its high pressure natural gas transmission pipelines to transport anthropogenic Carbon Dioxide (CO_2) from power stations and heavy industry to storage offshore.

The Scotland and Humber regions in England have been identified as offering some of the best opportunities for Carbon Capture and Storage (CCS) in Europe, with power stations and other heavy industry close to the North Sea oil and gas fields which, when depleted, could provide storage for their CO_2 emissions (i.e. sequestration sites).

CCS networks in Scotland and Humberside could together result in a reduction of up to 78 million tonnes of CO_2 (60 for Humberside and 18 for Scotland) going into the atmosphere every year. That's equivalent to taking nearly all of Britain's cars off the road.

Alongside this substantial reduction in greenhouse gas emissions, CCS would also bring benefits to security of electricity supply by allowing coal to remain part of a future diverse low carbon energy mix. Coal generation, with its flexible output, could play a valuable role in meeting the UK's future energy requirements alongside a large proportion of intermittent wind generation and relatively large nuclear generators. In a recent consultation entitled "Proposed disposal of part of the National Transmission System (NTS) for Carbon Capture and Storage" published on the 8th April 2009, Ofgem highlight that " The Government believes that CCS is a particular important way of reducing emissions given that a significant percentage of the increase in the world energy demand is expected to be met by fossil fuels….the Government argues that the ability of CCS to reduce emissions could help to meet the UK's growing energy needs and maintain the security of the UK's energy supply"

National Grid is exploring opportunities to apply its expertise in gas pipelines to CCS. It is looking at developing networks where clusters of power stations or other heavy industry adopting CCS use the same pipeline infrastructure. This would be much more practical and economic than the wasteful duplication of each building its own separate pipeline (i.e. on a point to point basis). We are supporting a broad range of R&D in this area although this report only details those elements where IFI funding is being utilised.

Carbon Capture & Storage Research

In order to properly consider the opportunities and challenges mentioned above, National Grid has developed and commenced a programme of Research and Development, which is focused on ensuring the safety and reliability of the NTS and associated assets, whilst transporting gaseous phase CO_2. National Grid has utilised a proportion of its IFI money to fund this programme. The programme has been based on similar work, which was carried out for natural gas in the 1970s and 1980s and which forms the basis of the safety justification for National Grid's high pressure transmission network.

The R & D for gas phase CO_2 transportation work contains a number of areas including:-

- Composition and quality standard
- Environmental and pipeline routeing
- Fracture propagation (small and large scale testing)
- Safety related (e.g. hazard/risk distances, dispersion modelling etc.)
- Network design (e.g. integrity and mechanical design aspects etc.)

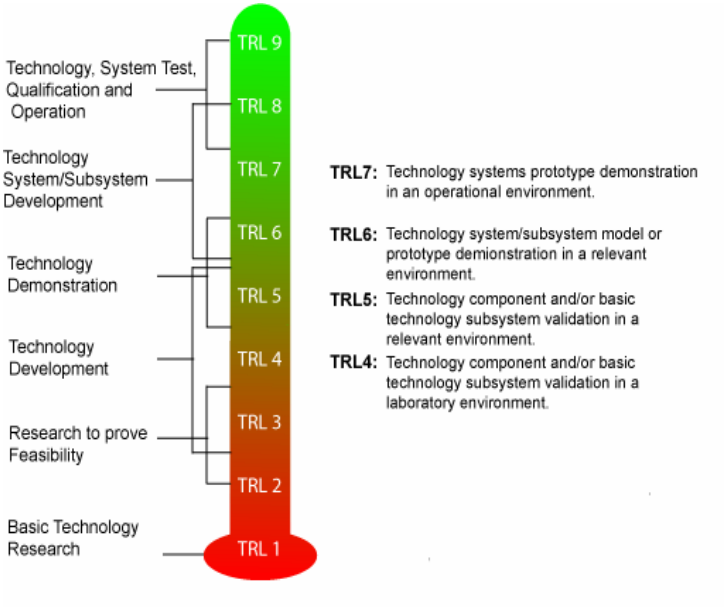
Future Networks (Electricity)

(Projects Addressing TRLs 4-7)

This programme of work is vital to delivering the 2030/2050 low carbon economy. Broadly the work can be divided into two discrete subsections:

1. Projects which assess, model and examine the impact of renewable generation (offshore and onshore), low carbon energy sources, intermittency, flexible demand, etc. on established networks, assets and technologies.

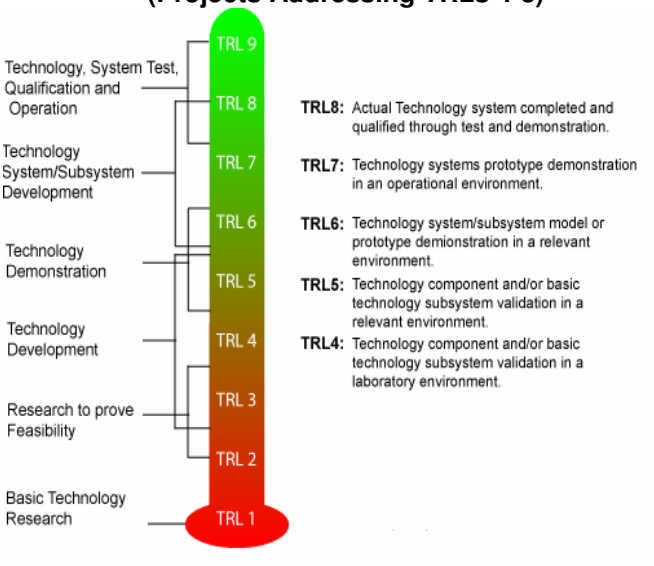
2. Projects which seek to extend and enhance the capability and capacity of the transmission network and thereby enable the full utilisation of demand and generation connections with minimum constraints.



Delivery of the 2030/2050 low carbon economy requires a number of fundamental areas to be examined, for example how to Black Start a network with a completely different generation and demand configuration, how to ensure dynamic stability is achieved in the presence of unconventional generation controllers together with series capacitors and integrated HVDC systems, delivery of power quality within the required limits, possible deployment of low voltage demand disconnection and regulation schemes, and facilitation of demand side management. These work elements link into the various European and International interests in this area including FENIX (European funded collaboration), and FlexNet (EPSRC funded Supergen collaboration) as well as the EPRI projects which we sponsor. They also aim to deliver solutions which meet recommendations made by the Electricity Networks Strategy Group Accelerated investment in this key area, including demonstration and deployment of new technology, should be anticipated in future IFI reports.

Dynamic Assessment of Short Circuit Loading of Substation Structures (Electricity)

(Projects Addressing TRLs 4-8)



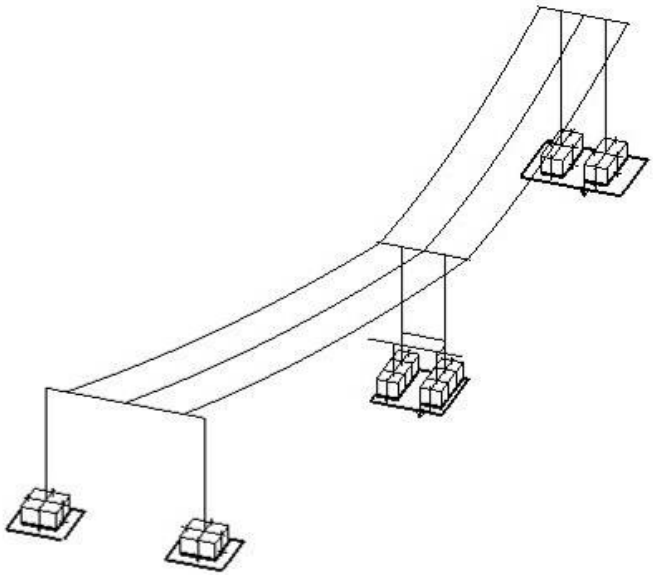
The assessment of substation civil structures under short circuit loading conditions often indicates they have insufficient strength when consideration is being given to reuse following the up-rating of electrical capacity. Intuitively this did not seem to be correct and therefore National Grid instigated a sponsored research project to review the structural assessment methods and explore whether more sophisticated techniques could better take account of the transient nature of the short circuit. Consulting Engineers Mott MacDonald examined the problem and were able to develop a non-linear finite element analysis technique to model the conductor trajectories more accurately and subsequent loads imparted onto these structures, removing a lot of the conservatism inherent in established methods.

The project has now reached the end of the development stage and has begun to be implemented in a small number of cases where there are significant benefits for National Grid in reusing the structures. To date structures in more than 10 locations have been evaluated including configurations of a more complex nature which were beyond the capability of previous methods. This has had a positive impact on corporate risk for National Grid as previously the behaviour of particular structure types was unknown and potential for failure during a short circuit event undefined.

Based upon demolition and reconstruction costs reported by the Alliances, it is estimated that capital costs in the region of £1 million have already been saved on the early deployment of the technique. Additionally, where the retention of structures has been achieved, associated benefits include reduced health and safety risk, scheme programme reduction and support of sustainability targets.

Typical substation gantry structure

Modelled representation of a substation bay circuit



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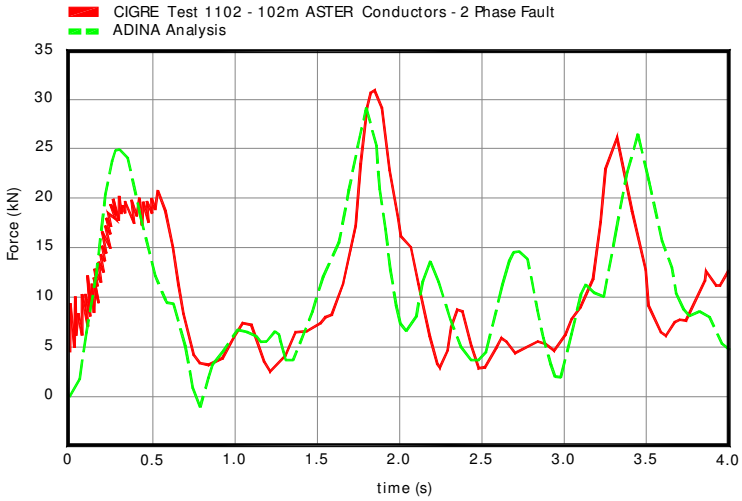
Correlation between full-scale test data (CIGRE technique) and Dynamic Analysis Technique results (ADINA new technique)



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Cable Asset Lives (Electricity)

The purpose of this work was to review and develop our understanding of the factors affecting the asset lives of oil-filled cable. The benefits from conducting this research would provide National Grid with further understanding of the deterioration mechanisms of oil filled cables as well as develop the ability to understand better the assessment of risks, costs and performance. This work builds on previous research initiated at National Grid's research laboratories in Leatherhead.

There were initially 3 phases to the project:

- Review and development of our understanding of the life limiting factors for each element of an oil filled cable system.
- Develop a cable health scoring system
- Develop a deterioration model to represent the degradation mechanisms of oil-filled cable systems.

An extensive report detailed the life limiting factors of cable systems, which included a review of the cable itself (oversheath, metallic sheaths, fluid filled paper and polypropylene/paper laminate (PPL) insulation, and the dielectric fluids), oil systems (tank design and construction, gauges, transducers, pipes etc), the bonding system, cooling systems, cable sealing end support structures and civil works (the cable laying environment such as trenches, troughs and ducts). An asset health scoring system has been developed which carries out an assessment of each cable's current condition.

A spreadsheet based deterioration model has been developed to establish, based on the cable construction, which elements of the cable system are most likely to deteriorate. The model has default values for each component's asset life profile and has the capacity to be updated with forensic results. These will confirm the remaining useful life for each cable component and hence provide a more accurate assessment of the cable's life.

Deterioration mechanism: reinforcing tape corrosion

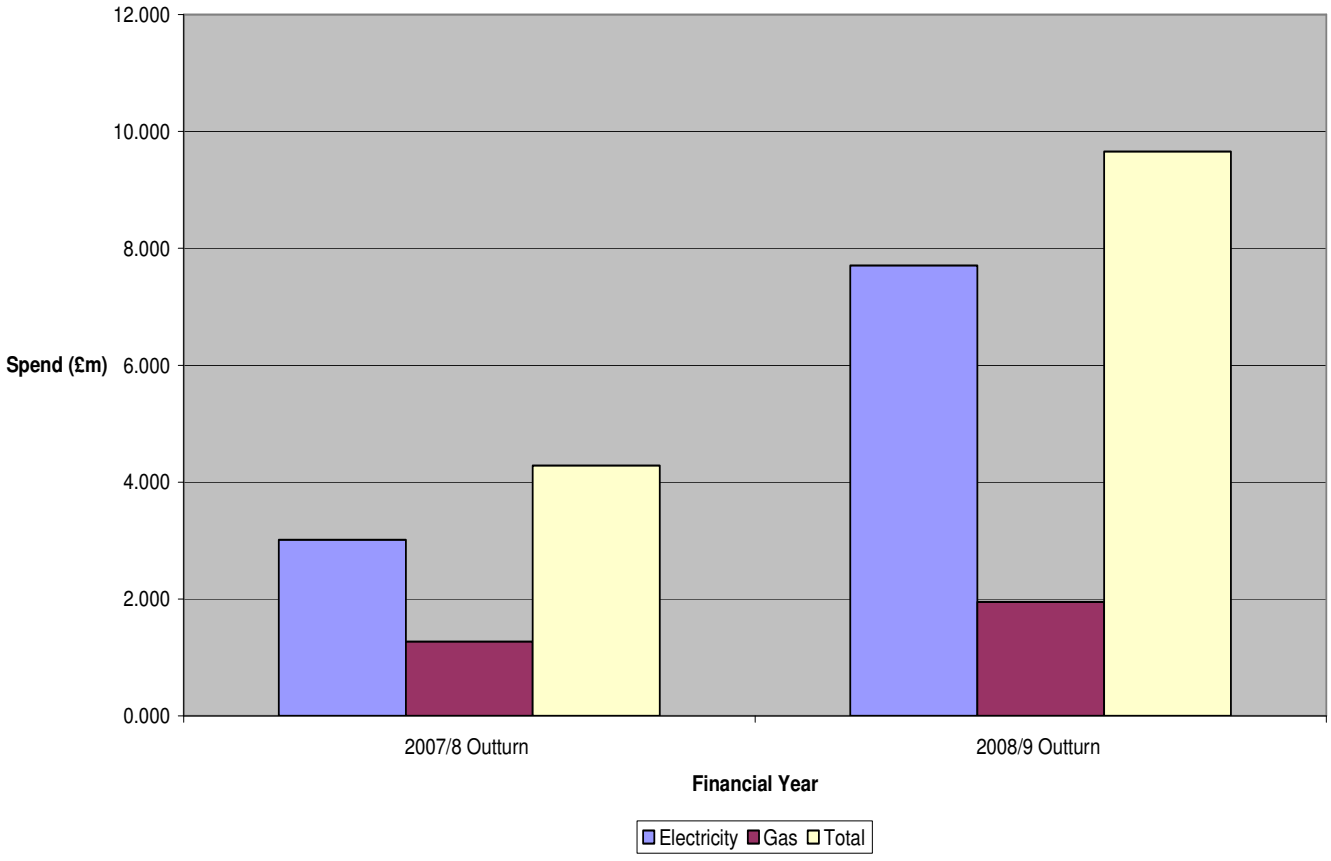
Reinforcing tape failure results in the lead sheath being unable to contain the oil pressure, leading to 'bulging' of the sheath and, eventually, oil leaking from the cable causing environmental and reliability performance issues.

Finance Overview & Benefits of Programme

This section of the report gives the financial information associated with the 2008/09 programme. Over the next few pages the allowance for the 2008/09 and the amount carried over from 2007/08 into 2008/09 are explained, the amount spent for 2008/09 is highlighted and compared to the 2007/08 IFI spend and the 2008/09 spend is broken down to highlight where we are currently utilising the IFI money. In line with R&D Management Good Practice, reported costs are for value of work done to the end of March 2009 rather than costs invoiced to that date.

	NGET	NGG	COMBINED
Network Revenue	£1,147m	£526m	£1,673m
2008/09 IFI Allowance	£5.737m	£2.632m	£8.369m
Allowance carried over from 2007/08	£2.393m	£1.256m	£3.650m
Total Allowance	**£8.130m**	**£3.888m**	**£12.019m**
Number of Active projects	128	45	173
External expenditure	£6.745m	£1.705m	£8.450m
Internal Expenditure	£0.963m	£0.245m	£1.208m
Total Expenditure	**£7.708m**	**£1.950m**	**£9.658m**
Unused IFI Allowance carried forward to 2009/2010	0	£0.682m	£0.682m

Comparison of 2007/08 & 2008/09 IFI Spends



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Assessing Financial Benefit

The R&D outputs form an integral part of National Grid's core asset management activities – finding solutions to technical problems and managing risk. Benefits are achieved as a result of the overall R&D programme with multiple projects contributing to a single asset area or issue.

Benefits from the programme are achieved in the form of:
Direct costs e.g. through reduced planned capital expenditure or refurbishment.
Avoided costs e.g. deferred investment, reduced failures, establishing condition of equipment to feed in to capital or maintenance plans and improved ratings.
Managing risk e.g. understanding the application of new technology, understanding the impact of changing generation and minimising the impact of our networks on the environment
Health and Safety e.g. improving maintenance techniques to reduce injuries and occupational health issues.
Strategic direction e.g. working with others to address sustainability in the energy industry, developing new engineers and scientists, maintaining awareness of new technology in the industry including direct involvement in directing energy R&D in the UK.

The benefits from the 2008/9 programme will be predominately achieved through avoided costs and risk mitigation (passed on to the customer via efficient operation) with an element being direct costs savings. Typical financial benefits are estimated based on implementation of the R&D for a 5 year period (time to achievement of benefits depends on the project and implementation timescales, varying from one to ten years). These benefits are factored into our Opex and Capex plans and contribute to the efficiency challenges under the current Price Review. The portfolio of projects also delivers a series of non financial benefits such as safety, health and environmental and security of supply benefits or will be used to assess benefit for future innovation.

Specific project benefits are identified where applicable in the detailed reports.