Regulatory Report for DG Incentives, RPZs & IFI

Regulatory Year 2007/08

By Central Networks

Foreword

Our vision is to be recognised as the UK's leading Distribution Business.

This means leading in safety, performance, delivery and innovation to provide our customers with a reliable and safe network and great customer service.

Our Research, Development & Demonstration Strategy will enable us to deliver real benefits to our customers, and to improve our network for a secure and sustainable future.

As we play our part in the rewiring of Britain, we make investments into our power network to deliver a network for the future. The initiatives in our technical innovation portfolio will ensure that these investments make it possible for our network to fulfil its role at the heart of future energy systems. They will allow us to enhance and transform the network by actively managing it, providing system integration capabilities, and by enabling our customers to deliver low carbon energy schemes.

Central Networks is committed to helping government tackle the threat of climate change. Under the guiding principles of E.ON's Changing Energy movement, our Research, Development & Demonstration Strategy will contribute to the Government objectives of achieving 20% renewable energy generation by 2020, with a 60% reduction in CO_2 emissions by 2050. By Changing Energy, we can help to transform the future of the UK.

John Crackett
Managing Director - Central Networks

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1. Introduction

The Innovation Funding Incentive (IFI) and Registered Power Zones (RPZ) mechanisms were introduced by Ofgem with the Distribution Price Control Review which took effect on 1 April 2005 (DPCR4).

This report contains both the IFI and RPZ reports for the two licensed areas of Central Networks East and Central Networks West.

It covers the period from 1 April 2007 to 31 March 2008, and has been produced in accordance with the Distributed Generation Regulatory Instructions and Guidance (RIGs) issued by Ofgem and the Energy Networks Association (ENA) Engineering Recommendation G85 issue 2 - IFI Good Practice Guide (GPG G85/2).

In addition to reporting on activities in 2007/08, this report highlights a number of key projects currently underway and presents intentions for future work within these mechanisms.

1.1 Context

Introduced by Ofgem in April 2005, the IFI & RPZ mechanisms were designed to encourage Distribution Network Operators (DNOs) to apply innovation in the way they pursue the technical development of their networks. Together these schemes promote technical research and development projects that deliver value to consumers through financial, quality of supply, environmental or safety benefits.

Ofgem recognises that the risk/reward balance for innovative projects is distinctly different to that of a DNO's core business. The incentives provided by the IFI and RPZ mechanisms are designed to create a risk/reward balance that is consistent with research, development and innovation.

The proposed incentives were consulted on as an integral part of the DPCR4 process and were widely supported by a large majority of consultees. Ofgem's Regulatory Impact Assessment 22 sets out the case for the introduction of the IFI and RPZ mechanisms.

The two main drivers for providing these incentives were the increasing need for investment in end of life asset renewal which would better position the networks for the future, and the provision of connections for an increasing capacity of distributed generation. It is recognised that these are significant challenges which will only be addressed through the application of technical innovation in asset investment and operation of networks.

We welcome the revisions to the ENA G85 IFI Good Practice Guide as published in December 2007 (GPG G85/2). These allow for the application of innovation to further areas of concern for distribution networks. Additionally, the benefits assessment methodology developed as part of these revisions provides a more flexible approach to assessing the non-quantifiable benefits and risks associated with innovative projects, and incorporating these into project appraisal in conjunction with the economic aspects of a project.

Ofgem's commitment to the scheme for the post 2010 years is also welcomed by Central Networks as a major factor in enabling us to progress a wide ranging portfolio of projects.

1.2 IFI

The Innovation Funding Incentive is intended to promote research and development activities within distribution network companies. It provides funding for technical development projects that deliver value to end consumers through financial, quality of supply, environmental or safety benefits. A definition of technical within the context of this guide is given in the glossary.

IFI projects can embrace any aspect of distribution system asset management from design through to construction, commissioning, operation, maintenance and decommissioning. The detail of the IFI mechanism is set out in the Special Licence Condition C3, Standard Licence Condition 51 for Distribution Licences and the IFI Regulatory Instructions and Guidance (RIG). This can be summarised as follows:

A DNO may spend up to 0.5% of its Combined Distribution Network Revenue on eligible IFI projects, as defined by the industry Good Practice Guide G85/2. The DNO is allowed to recover from customers a significant proportion of its IFI expenditure. The percentage of project costs passed through to customers is set at 80% in 2007/08, reducing in 5% steps to 70% in 2009/10. This will revert to 80% in 2010/11 and remain at this level until 2014/15.

DNOs must openly report their IFI activities on an annual basis. These reports will be published on the Ofgem website. Ofgem will not approve IFI projects, but reserves the right to audit IFI activities if this is judged to be necessary in the interests of customers.

1.3 RPZ

The Registered Power Zones scheme is focused specifically on the connection of generation to distribution systems and encourages the development of new cost effective ways of connecting and operating generation.

The application of innovation in this area will deliver specific benefits to new distributed generators and broader benefits to consumers generally.

The RPZ mechanism is an extension of the Distributed Generation (DG) Incentive that was also introduced with DPCR4. The detail of the RPZ mechanism is set out in the Special Licence Condition D2 and Standard Licence Condition 51, with information and guidance provided in the Distributed Generation Regulatory Instructions and Guidance (DG RIGs). These mechanisms relate as follows:

The DG incentive allows DNOs to recover their generation connection costs by a combination of 80% cost pass through and an incentive per kW connected of £1.5/kW. This approach is expected to deliver a higher return to a DNO for generation connection schemes than other network investments.

If a DNO employs genuine innovation in its connection of a generation scheme(s), it can seek to register the connection scheme with Ofgem as an RPZ. Ofgem will assess, using the published criteria ("Further Details of the RPZ Scheme - Guidance Document", April 2005), whether the scheme qualifies as an RPZ. For all designated RPZs the incentive element of the DG Incentive is increased for the first five years of operation by £3/kW. In any year, a DNO's additional revenue from RPZ schemes is capped at £0.5M.

The estimates made by DNOs as part of the DPCR4 process indicated that some 10GW of generation could be connected in the next five years. This generation could connect at every distribution voltage level bringing new system design and operating challenges.

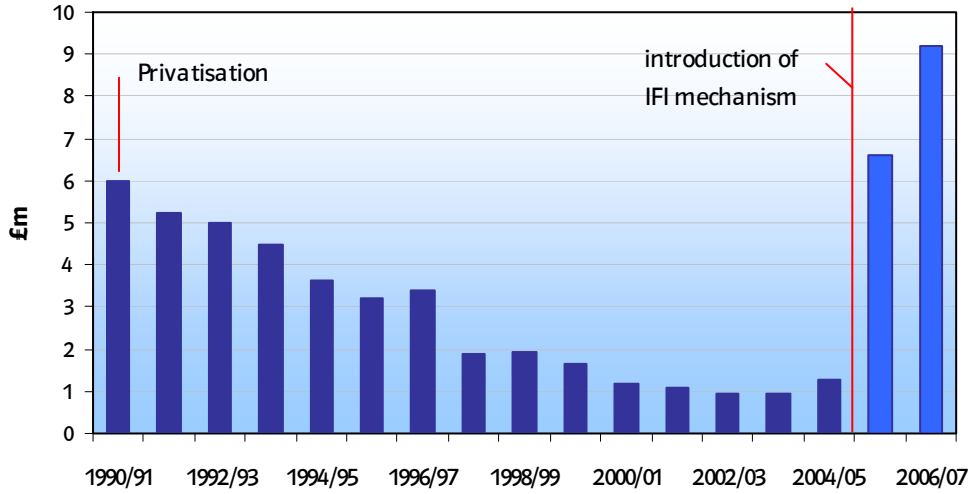
1.4 Summary of National Research & Development

Ofgem's IFI mechanism provides a clear example of the successful promotion of innovation within UK industry.

This incentive has directly led to investment in a portfolio of projects within the UK electricity distribution industry, which address a wide range of issues and engage with a variety of providers from business and academia at a critical time for the industry. In addition it has led to increased collaborations between the UK network operators.

Figures suggest that the UK Distribution Companies' combined Research & Development (R&D) spend dropped steadily from ~£6m per year at privatisation to under £1m in 2003/04. The introduction of the IFI mechanism in April 2005 has seen R&D expenditure increase rapidly to over £9m per year in 2006/07 as shown below, with significant financial, customer, social and environmental benefits forecast.

Distribution Company Spend on Network R&D



1989/00 to 2003/04 data represents the collaborative spending on R&D by DNOs through a single provider
October 2004 to 2006/07 data shows reported total IFI investment (including early start projects from Oct 2004 to Apr 2005)

2. Company Structure

Central Networks is the electricity distribution business for the Midlands, formed by the amalgamation of East Midlands Electricity and Midlands Electricity distribution businesses. We are part of E.ON, one of the world's largest power and gas companies.

As the second largest electricity network operator in the UK we bring power to 4.9 million customers across Central England through 133,000km of underground and overhead cables - enough to go round the Earth four times - and via almost 97,000 substations.

We cover an area from the Peak District in the north to parts of Bristol in the south, and from the Welsh Borders to the Lincolnshire Coast. Our core activities include the design, installation, commissioning, inspection, maintenance and repair of electricity distribution networks.

Central Networks' vision is "to be recognised as the UK's leading Distribution business" by achieving leading performance levels, maintaining effective and efficient delivery, and by applying innovation to provide our customers with a reliable and safe network and great customer service.

We are developing an active sustainability agenda incorporating the guiding principles of E.ON's Changing Energy initiative and Central Networks is rightly proud to have developed the UK's first RPZ.

3. Overview

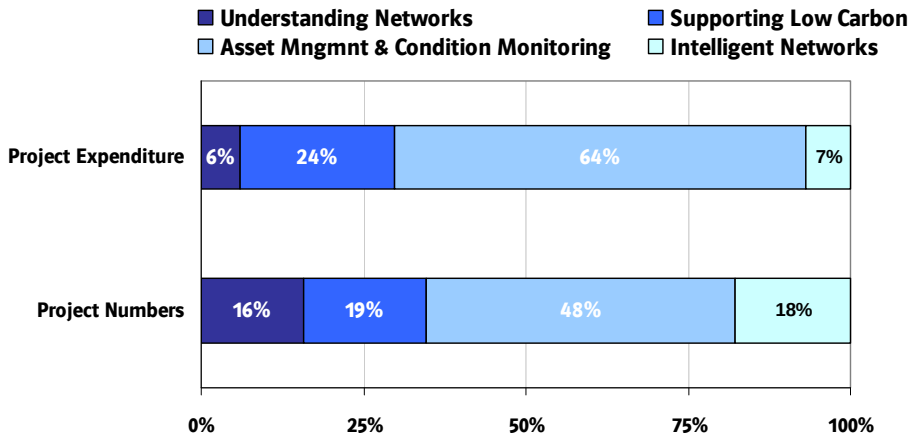
3.1 Central Networks' Objectives

The objectives of Central Networks' Research, Development and Demonstration are designed to be consistent with supporting Central Network's five strategic priorities, satisfy the requirements of E.ON UK's Changing Energy strategy and support E.ON's low carbon agenda. The four Key Themes of the R,D&D programme are:

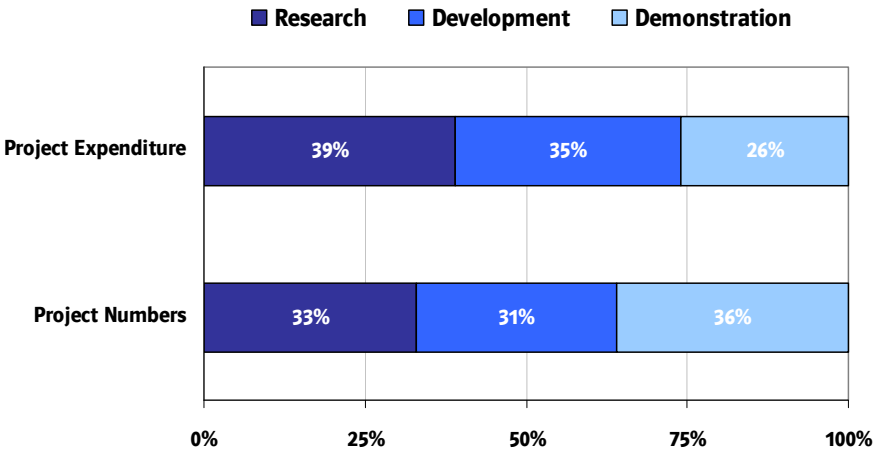
- Understanding Networks
- Supporting Low Carbon
- Asset Management & Condition Monitoring
- Intelligent Networks

Central Networks aims to develop a balanced portfolio of projects across these Key Themes, with projects embracing a range of different technological readiness areas, to provide a sustainable and comprehensive R,D&D programme of work.

At present, the IFI projects undertaken in 2007/08 are spread across the Key Themes as shown:



The portfolio of IFI projects undertaken in 2007/08 was balanced across research, development and demonstration as follows:



3.2 End of Year Report

The table below presents the End of Year Report for DG Incentives, RPZs & IFI.

Regulatory report for DG Incentives, RPZs & IFI
Reporting year 2007/08

Central Networks

Distributed Generation (DG) Incentive		East	West	Total
Total Incentivised DG Capacity	MW	16.1	23.025	39.125
Total Capex for DG	£m	£1	£0.48	£1.48
Use Of System Capex for DG	£m	0	0.03	0.03
Shared Connection Capex for DG	£m	0	0	0
Assets transferred out of DG Capex to Demand Capex	£m	0	0	0
DG Network Unavailability	MWh	0.03	14.6	14.63
DG Network Unavailability Rebate Payment	£m	0	0	0
Operational & Maintenance Costs for DG	£m	£0.06	£0.06	£0.12
Innovation Funding Incentive (IFI)				
IFI Carry Forward	£m	£0.686	£0.694	£1.38
Eligible IFI Expenditure	£m	£1.014	£1.014	£2.03
Eligible IFI Internal Expenditure	£m	£0.149	£0.149	£0.30
increase over previous reporting year	%	82%	82%	82%
Network Revenue by License Region	£m	£287.94	£278.12	£566.06
Number of Eligible Projects		36	36	36
Portfolio NPV of Benefits	£m	£2.1	£2.1	£4.2
Registered Power Zones (RPZ)				
RPZ 1	name	Skegness and Fens CN(e)		
RPZ DG capacity	MW	0		
RPZ starting year	yr	2005/06		
RPZ 2	name			
RPZ DG capacity	MW			
RPZ starting year	yr			

3.3 IFI Project Benefits

The anticipated benefits of each project within Central Networks' R,D&D portfolio clearly show the potential value of the IFI scheme both to Central Networks and to its customers. It should be noted, however, that although quantified financially, not all the projects will result in tangible financial deliverables to Central Networks in terms of direct savings or deferred investments, as the benefits may have been derived from the perceived strategic or risk management value or the project could be designed to avoid future potential costs.

While some of the new technologies and approaches that Central Networks are exploring in these R,D&D projects will eventually result in the real practical benefits described in the individual reports, others will be less successful. A balanced portfolio approach reduces the risks and the G85/2 Residual Risk Rating calculation assists the selection process by quantifying risks in a structured manner. Although some R,D&D projects are unsuccessful and do not deliver the expected benefits, they can be valuable in that they will increase knowledge both in the Collaborating Partners and the R&D Provider.

Transferring research and development projects from demonstration to adoption is essential if benefits are to be delivered to customers and this is often the hardest hurdle for any organisation to achieve. During the year, a number of the listed projects have successfully delivered benefits and a selection of these, are described in more detail on the Central Networks Research and Development web page: http://www.eon-uk.com/distribution/275.aspx.

3.4 Benefit Calculation

The anticipated benefits of each project have been determined using the methodology set down in ENA ER G85/2 - IFI Good Practice Guide. This is a two stage process involving a generic assessment of the project benefits and a specific assessment of the risk associated with the project.

The Generic Assessment scores both the tangible financial benefits and a range of non financial criteria. These are listed below, but are more fully described in the IFI Good Practice Guide.

- NPV of Financial Benefit
- Knowledge Transfer Benefit
- Safety Benefit
- Environmental Benefit
- Network Performance Benefit

Each item in the Generic Assessment Score is weighted in accordance with company strategy and this score can be seen on each of the individual reports.

The Net Present Value (NPV) of Financial Benefit associated with each project is calculated by taking the present value of the estimated benefits, multiplying them by the probability of success and then subtracting the present value costs (including where appropriate the implementation costs). For each project pursued it is expected that the present value costs will be exceeded by the present

value of the benefits that it could deliver to customers. These NPV of Financial Benefit figures can be seen on each of the individual project reports.

The Risk Assessment calculation quantifies the potential risks inherent with each project by scoring risk and mitigation factors. Again these are listed below, but are more fully described in the IFI Good Practice Guide.

Risk

- Innovation Level
- Development Type

Mitigation

- Average Annual Spend per Company
- Leverage (Collaboration Ratio)
- Likelihood of Implementation

No weighting is applied to these scores and subtraction of the value of the Mitigation Ratings from the Risk Ratings produces an overall Residual Risk value for each project. A high negative figure would indicate a low-risk project. The Residual Risk value is then subtracted from the Generic Assessment Score to produce the Overall Project Score. Both the Residual Risk Value and Overall Project Score can be seen on each of the individual project reports.

In line with ENA ER G85/2 GPG, projects falling below the de-minimis level set by the Good Practice Guide (£40k per licensed DNO, £80k for CN) have been grouped to form programmes, with costs and benefits aggregated accordingly. A number of projects within the EA Technology Ltd STP modules, the ENA R&D programme and SuperGen programmes have been reported on in this way.

4. Highlights

4.1 Automation Algorithm

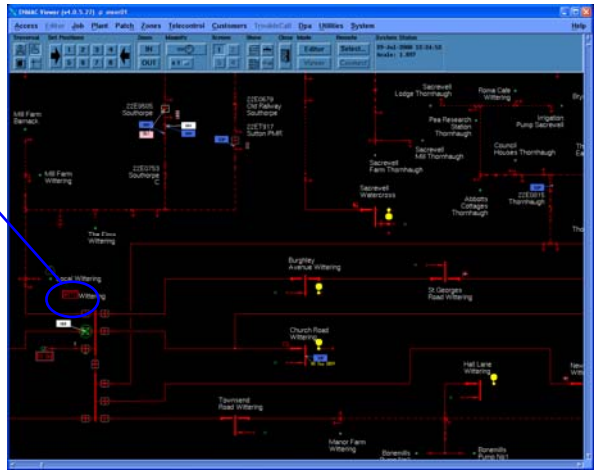
Central Networks is actively working on smarter, innovative, ways to improve network performance for its customers. For over ten years we have been installing remotely controlled (RC) devices on our 11kV distribution network. In the event of a fault occurring, these RC devices allowed control engineers to carry out switching to isolate the fault and restore as many healthy sections of network as possible without having to wait for operational staff to arrive on site.

Further improvements in network performance required supplies to be restored reliably and faster than a human operation would be able to assess the situation. This could only be achieved by automation of the reconfiguration process. Existing automation schemes typically rely on preconfigured logic initiated by a trip operation or loss of voltage. The required logic was specific to each location and intolerant of any network abnormalities. It required reprogramming if any alterations were made to the network. Most schemes were designed to perform checks prior to switching and would abort in the event of any abnormality to prevent mal-operation.

To address the short comings of preconfigured logic automation schemes, Central Networks has developed an algorithmic approach to 11kV automation schemes that seeks to replicate the actions that a control engineer takes when reconfiguring the network in response to a trip event. This results in a single algorithm providing automation for the entire 11kV network, with no locational programming required. The algorithm methodology relies on tracing the network connectivity in real time following an initiation. The tracing can identify all RC devices within the disconnect zone, all the RC devices that interconnect to other healthy networks plus their associated sources. This provides the algorithm with the details of the existing demand and limitations of each alternative circuit, and with this information the algorithm can isolate the faulty section and optimise the restoration switching to ensure that donor circuits are not overloaded.

Image of CN Network Management System Environment containing Automation Algorithm

Sequence Scheme marker at Wittering primary substation



Central Networks believes that the use of this algorithm will deliver better customer service, with improved reliability and lower maintenance requirements than preconfigured automation schemes. During 2008/09 the algorithm will be applied to a section of the 11kV network to demonstrate these benefits.

4.2 RPZ 1 / Dynamic Ratings

Central Networks' Skegness and Fens RPZ has taken a significant step forward during the year with the installation of four Power Donuts on the 132kV network, which will be used to validate the dynamic line rating process.

The Skegness RPZ scheme is designed to facilitate the connection of significant amounts of renewable wind farm generation in the local area by using real time weather data to calculate a dynamic, minute by minute, line rating.

Line ratings are affected by a number of factors, including ambient temperature and wind speed, and reflect the capacity of the line to transmit power. Traditionally a fixed line rating has been calculated for any given section of network. This innovative approach offers a more realistic assessment of ratings at any given time, and takes into account any cooling effects of higher wind speeds. Dynamic ratings thereby allow more power to be exported over the network than would otherwise be possible, improving the economics of wind farm generation connecting to the network in this area and increasing the amount of renewable electricity into the system.

The project's weather stations have been installed and we are gathering data for preliminary analysis. The newly installed donuts are sophisticated measuring devices that relay real time data on a number of measurement parameters to Central Networks' control system. The data from these will be used to validate the calculations based on weather station data, and prove the process.

4.3 Partnerships

Central Networks recognises the value of collaborating with other industry expertise and has developed its partnerships throughout the 2007/08 reporting year resulting in an increase in collaboration with universities, research establishments and industry. In addition DNO collaboration now occurs on almost 60% of projects. We have taken a lead role on a number of key collaborative projects including:

- Met Office EP2 Study - Impacts of Climate Change on the Energy Industry
- TNEI Project - Sensitivity of DNO Networks to Harmonics associated with Significant Underground Cable (starting 2008/09)

4.4 IFI Events

Central Networks has been pleased to host a number of high-level IFI events during the past year.

By bringing a diversity of external organisations together, these events promote collaboration and cooperation between participating DNOs and other external organisations, through the dissemination of knowledge gained from projects underway and by allowing discussion and the identification of future areas of work.

AMPerES 2007 Technical Review Conference
14th Nov 2007, at E.ON's Ratcliffe on Soar P.S. Site
This event showcased a wide range of projects underway within the SUPERGEN AMPerES network.

The conference gave researchers the opportunity to present progress in their work and, critically, provided an open forum for the discussion of ideas with industry. We were pleased to welcome many experts from the Electrical Network Operators and Academia to this event to drive the work forward.

IFI Dissemination Event - Protecting Back-up Battery Systems
13th Nov 2007, at E.ON's Ratcliffe on Soar P.S. Site
This was the first joint dissemination event held for projects undertaken within the IFI framework. Central Networks, EDF Energy and Scottish Power, together with 4energy, presented the technical developments delivered within a range of Passive Battery Air Conditioning projects:

- Pole & Ground Mounted Battery Protection for Rural Automation Sites - Central Networks
- City Centre Substation RTU Battery Protection - EDF Energy
- Urban Substation RTU Battery Protection - Scottish Power

EP2 Work Package 6 Workshop
10th March 2008, at E.ON's Ratcliffe on Soar P.S. Site
Following the EP2 Climate Change Conference, this workshop focused on understanding the issues associated with Urban Heat Island Effects (Work Package 6) and their effect on transformer ratings and other associated equipment (e.g. substation batteries). The event was attended by Network Operators and EATL representatives.

5. Strategy & Portfolio Management

Future networks will be required to operate more flexibly, efficiently and reliably. The projects within our IFI portfolio will improve Central Networks' existing performance and provide us with the ability to meet future challenges. They will also allow us to ensure the successful integration of new technologies into existing networks.

Our R,D&D strategy supports E.ON UK's low carbon leadership and Changing Energy strategy by developing our understanding of and preparation for the possible future network technologies and designs that will facilitate a Low Carbon economy.

5.1 Key Themes

Central Networks' is committed to helping government tackle the threat of climate change. Under the guiding principles of E.ON's Changing Energy initiative, our R,D&D Strategy will contribute to the Government objectives of achieving 20% renewable energy generation by 2020, with a 60% reduction in CO_2 emissions by 2050.

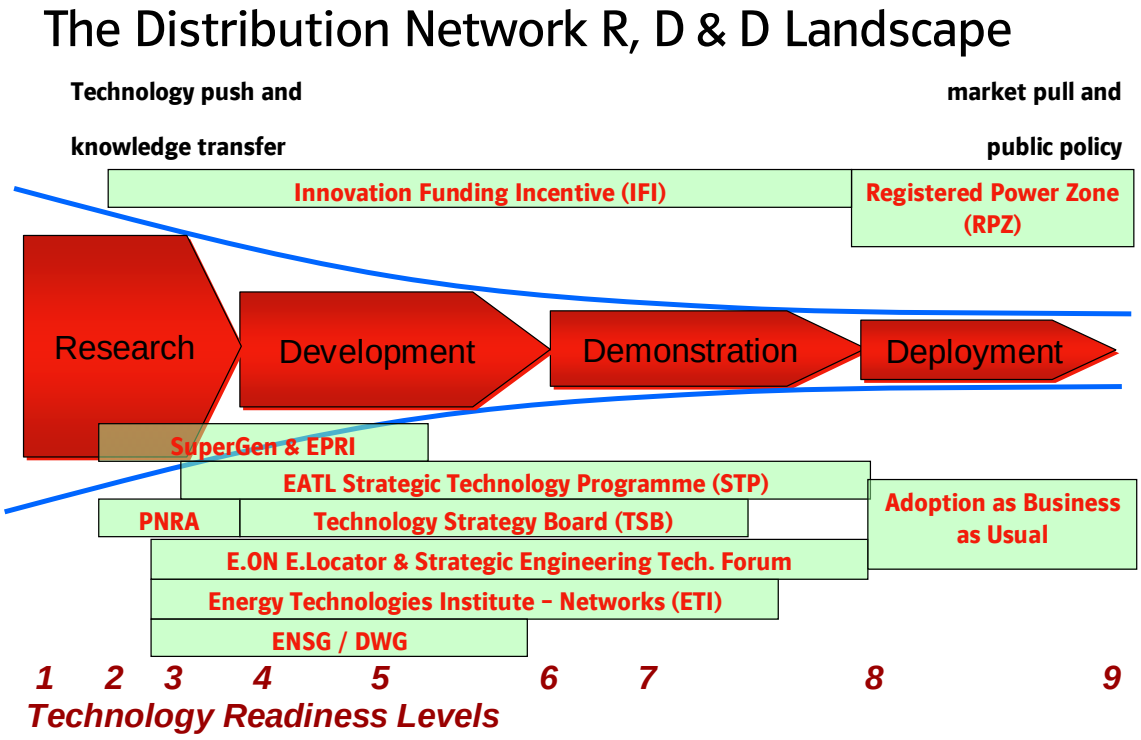
Central Networks' R,D&D Strategy aims to balance four Key Themes:

- **Understanding Networks** - Understanding the capabilities and limitations of existing networks technologies and design across each of Central Networks' strategic objective areas is essential in a changing environment that will challenge the accepted fundamental architecture of traditional networks. Likewise understanding and demonstrating the opportunities from future technologies and designs will enable early adoption of potentially disruptive innovations and ensure their successful integration into existing networks.
- **Supporting Low Carbon** - Supporting E.ON UK's low carbon leadership and Changing Energy strategy by understanding and preparing for the possible future network technologies and designs that will facilitate a Low Carbon economy. Reducing network losses and enabling the economic connection and operation of new types of renewable power sources and distributed generation without reducing network performance or increasing operational risks are the main thrust of this theme.
- **Asset Management Condition Monitoring** - Against a background of an ageing asset base, networks will be required to operate more flexibly, efficiently and reliably. This is expected to result in more complexity in network design and operation and this will have to be balanced by a need to reduce the safety, health and environmental risks. Developing the next generation of asset management tools and techniques will facilitate this objective and maximise the value of Central Networks in the long term, in addition to making our network more environmentally sustainable.
- **Intelligent Networks** - Intelligent Networks are expected to feature prominently in all future network scenarios, whether to support asset management, network performance, active network control, commercial applications, demand side management or network stability. Obtaining, communicating, analysing and processing data are fundamental requirements of future network management. Innovative technologies and arrangements that provide economic and reliable solutions will improve efficiency and enhance customer service.

5.2 Landscape

Our programme will include projects from all aspects of the Research, Development and Demonstration landscape, embracing projects of technology readiness levels (TRL) from TR2 to TR8. As projects are developed they progress through the technology readiness timeline until they reach the stage where they can be adopted as Business as Usual. Central Networks R,D&D programme will deliberately endeavour to maintain a mix of projects with different TRL, both in quantity and financial commitment.

The picture below represents the Distribution Network Research, Development and Demonstration Landscape mapped across the technology readiness timeline. Included are the TRL limitations of the IFI and RPZ mechanisms and the principle delivery channels have also been positioned to show their areas of activity. Central Networks intends to continue to engage with all of these delivery channels.

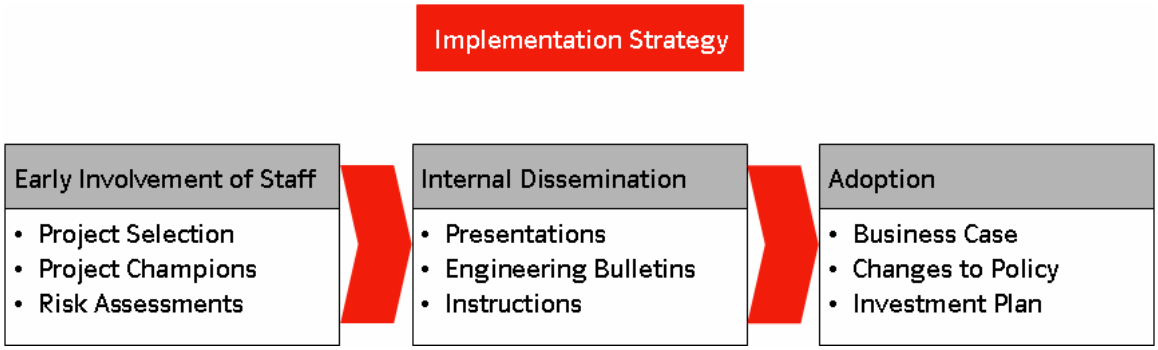


One of the delivery channels included is the Energy Technologies Institute - Networks Theme. The Energy Technologies Institute (ETI) is a 50:50 public-private partnership supported by some of the worlds leading energy companies (including E.ON UK). When fully operational the ETI aims to inject some £100m per year into UK-based energy research to deliver a step change in funding, strategic direction and outcomes of UK energy science and technology.

Within the ETI framework is a Networks Theme, which has the objective of developing sustainable energy infrastructure and supply technologies. Central Networks has been helping to shape the initial research agenda of this theme by identifying critical areas and as the ETI networks theme projects develop, Central Networks involvement is anticipated to increase. Currently no individual projects identified in this report are part of the ETI Networks Theme programme.

5.3 Adoption

The critical aspect for all successful R&D projects is the transfer from demonstration to adoption. This is essential for IFI scheme objectives if benefits are to be delivered to customers. Central Networks has developed its Implementation Strategy as represented in the diagram below.



The diverse portfolio of Central Networks' R,D&D projects includes new technologies and approaches that will eventually result in real practical benefits, along with other projects that contribute to our increasing knowledge base.

6. Project Partners

Central Networks' portfolio of IFI projects balances collaborative and independent projects seeking to minimise the cost of R,D&D whilst ensuring ideas can be taken forward in a timely manner.

The encouragement by Ofgem of collaboration within the IFI incentive brings with it additional benefits beyond the immediate project outcomes.

> Industrial collaborations not only provide new opportunities for established companies, but critically also provide support for young, or Venture Capital funded, businesses pioneering the development of energy efficient technologies. Successful IFI projects offer opportunities to develop and trial beneficial innovative technology with the aim of bringing new products to market.
>
> The engagement and dialogue key to the success of collaborations with the academia research base gives university researchers and students an industrial perspective valuable to future research opportunities, in addition to allowing the open exchange of ideas between sectors.
>
> Through bodies such as the Engineering Education Scheme, companies may also make links with schools to introduce the next generation to the opportunities available within industry and instil a sense of an environment for innovation.

The map below presents a selection of key project partners with whom we have been pleased to work during 2007/08. Brief descriptions of the industry & research establishments are also provided on the subsequent two pages.

1 ADAS - is the UK's largest independent provider of environmental consultancy, rural development services and policy advice. With expertise across the environmental sector, ADAS provide consultancy and contracting services to a diverse range of organisations in the private and public sectors, throughout the UK and internationally.

2 BGS - founded in 1835, the British Geological Survey (BGS) is the world's oldest national geological survey and the UK's premier centre for earth science information and expertise. With a client base drawn from the public and private sectors both in the UK and internationally, they provide expert services and impartial advice in all areas of geoscience.

3 EA Technology Ltd - originally formed as the Research & Development centre for the UK electricity industry in the 1960s, it was transformed following electricity privatisation in the 1990s. The company became fully independent in 1997 with a management and employee buy-out and is now directly owned by its staff.

EA Technology is a Power Asset Management Company with a world-class reputation for delivering innovative business solutions to companies, which supply, distribute and use energy. The company operates the internationally acclaimed Strategic Technology Programme (STP), of which all UK DNOs are members.

4 E.ON Engineering - is part of the E.ON group and leads the group's Research and Development activities. E.ON Engineering (formally Power Technology) is also an international consultancy to the power industry with core capabilities that span the range of interests appropriate to a vertically integrated energy company.

E.ON Engineering prides itself for utilising excellence in scientific research and practical experience to deliver complex engineering solutions that provide real customer value. Focussed on innovation, energy technologies and engineering, it provides technical services and products as diverse as risk-based asset management of technical assets and advanced technology development for a sustainable low carbon future.

5 EPRI - the Electric Power Research Institute (EPRI) conducts multi-disciplinary research and development to meet challenges in electricity generation, delivery and use. Based in the United States, international participation in its technology, operations and environmental programs includes companies from a further 40 countries.

6 Met Office - is one of the world's leading providers of environmental and weather related services. The Met Office's solutions and services meet the needs of many communities of interest…from the general public, government and schools, through broadcasters and on-line media, to civil aviation and almost every other industry sector in UK and around the world.

7 TNEI - launched in 1992, TNEI is an independent company specialising in a range of energy services. Their Power Systems and Associated Technologies group specialises in power systems modelling and analysis and works with distribution network operators, project and technology developers, and the public sector.

8 4Energy (4e) - is a technology start-up company which designs, develops and manufactures innovative and environmentally friendly climate control devices for industrial and utility applications.

9 AREVA T&D - is a world leader in the transmission and distribution of energy. AREVA T&D provides a complete range of innovative products, systems and services across the whole energy value chain from generation to power consumption.

10 Arup - Arup Energy provides multidisciplinary services focused on energy sector companies engaged in upstream activities from exploration to transmission and distribution, with energy projects developed and delivered across the globe.

11 Fundamentals Ltd - specialise in the design, development and manufacture of measurement and control equipment for transmission and distribution power systems.

12 GE Energy - provide products and services for all areas of the energy industry. GE has a comprehensive transmission and distribution portfolio with products and services that enable grid intelligence systems and processes.

13 Ice Clean Engineering - offers a revolutionary, non-abrasive & non-toxic, cleaning process as an alternative to traditional methods of cleaning industrial equipment.

14 Infoterra - a leading provider of geo-information products and services delivers reliable geospacial knowledge to customers; from satellite and aerial data acquisition to analysis, from developing software to hosting information.

15 KOREC - is one of Trimble's largest distributors worldwide, supplying advanced GPS equipment and solutions to the construction, surveying and GIS mapping industries.

16 Nortech - provide a range of telemetry products and central host software solutions for data collection systems. They design and supply remote site monitoring solutions and other specialist technology to electricity utilities, telecom network providers and others with geographically spread networks and assets.

17 Rolls Royce - is a world-leading provider of power systems and services, operating in the global aerospace, marine & energy markets. Rolls Royce Energy supplies a wide range of power systems, with solutions encompassing generation technologies, control systems, energy delivery & systems integration and manufacturing design.

18 Strategy & Solutions - are involved with earthing system design and assessment, providing measurement, design, policy support, research & development and training services.

19 Sterling Power - is a power engineering group composed of a number of individual companies who provide a unique range of services within the utility sector. The group has been established by personnel with a wealth of experience in the utility market.

20 USi - provides engineering services and advanced technology products for the electric power delivery industry, including the design, manufacture and installation of custom engineered electrical and electronic equipment and systems.

21 Willow Technologies - is a specialist supplier of electrical and electronic devices focused on the niche markets of sensing, switching and specialist resistors.

Other Partners - Central Networks has collaboration agreements with a number of other Academic, Industrial and Research Partners. Where possible this information is given in the individual reports, but in some cases Central Networks is bound by mutual confidentiality agreements not to disclose this.

7. Expenditure from IFI Projects

In the year ending March 2008, Central Networks implemented its planned increase in both the number of and expenditure on IFI projects. The internal support structures have been strengthened in order to successfully manage this increased portfolio of R,D&D projects.

The table below details the expenditure during the April 2007 - March 2008 IFI reporting period.

Project Title	External	Internal	Total
EA Technology - STP Overhead Module 2 & Forum	£46,255	£4,480	£50,735
EA Technology - STP Cable Module 3 & Forum	£55,976	£4,357	£60,333
EA Technology - STP Plant/Protection Module 4 & Forum	£43,302	£8,202	£51,504
EA Technology - STP Networks for Dist. Energy Module 5	£52,775	£9,436	£62,211
EA Technology - Protective Coatings Forum	£6,240	£1,264	£7,504
EA Technology - Partial Discharge Project & Forum	£131,234	£8,625	£139,858
ENA R&D Group Programme	£4,850	£6,607	£11,457
Power Technology - Advanced Distribution Automation	£33,048	£1,346	£34,394
Power Technology - Intelligent Universal Transformer	£24,058	£1,256	£25,315
Dynamic Ratings Project	£45,181	£67,538	£112,719
Energy Storage for Distribution Systems	£10,706	£1,633	£12,339
Optimising System Design for Performance and Losses	£166,081	£7,946	£174,027
Maintaining Critical Domestic Load during Power Outages	£135,834	£2,874	£138,708
Networks to Improve Power Quality	£59,254	£2,703	£61,957
Magnetic Fault Current Limiter	£11,937	£1,572	£13,509
Understanding Networks with High Penetrations of DG	£28,438	£4,384	£32,822
Effect of Electric Vehicles on Distribution Networks	£16,221	£1,404	£17,625
SuperGen V (AMPerES)	£100,000	£8,516	£108,516
Ice Cleaning of Distribution Plant	£1,900	£4,733	£6,633
Passive Battery Conditioning for Rural R/C Devices	£36,761	£7,782	£44,543
Non Invasive Overhead Line Inspection Techniques	£600	£1,703	£2,303
Non Invasive Testing of Tower Foundations	£93,075	£9,625	£102,700
Substation Communication Development	£3,365	£3,156	£6,521
Impact of Climate Change and Weather Analysis	£43,900	£8,506	£52,406
EA Technology ACTIV Project	£38,556	£7,768	£46,324
Control System Automation Algorithm	£0	£65,946	£65,946

Earthing Information System	£225,000	£4,380	£229,380
SuperGen FlexNet	£25,200	£2,286	£27,486
Distribution Working Group - Update of R&D Register	£9,659	£2,524	£12,183
S/stn Cooling	£17,854	£4,660	£22,513
Pole Mounted Fault/Load Monitor	£68,260	£6,861	£75,121
Vegetation Management	£136,103	£5,857	£141,960
Aerial Mapping	£37,650	£5,252	£42,902
Flooding	£9,000	£3,521	£12,521
Vermin Deterrent	£2,523	£3,499	£6,022
GPS Recording of Underground Equipment	£9,291	£4,859	£14,150
Total	£1,730,086	£297,060	£2,027,146

The expenditure on IFI projects is equally divided between the two Licensed Distribution Companies that are owned by Central Networks.

Internal expenditure varied considerably between projects, but the total internal expenditure was 14.7% of the total cost.

8. Future Intentions

8.1 Future Projects for 2008/09

In line with our R,D&D Strategy, we will continue to develop a balanced portfolio of projects engaging in multi-collaborative and bilateral innovative projects with universities, research establishments and industry.

In addition to the projects taken forward as planned from the 2007/08 reporting year, a series of new projects will be commenced in the 2008/09 reporting year. These include the following major new R,D&D projects, which are now underway:

- Radio-metric Arc Detection Demonstration
- Heat Island Study of Birmingham
- Anticipating Faults from Disturbance Records

8.2 Power Networks Research Academy

Central Networks are pleased to confirm their support for this new initiative, which will start in 2008.

The Power Networks Research Academy (PNRA) has been established through a strategic partnership agreement between the Engineering and Physical Sciences Research Council (EPSRC), electricity network operators, related manufacturers and consultants that will fund and support PhD researchers undertaking power network related research projects at UK Universities. The PNRA is designed to encourage research excellence within the field of electrical power engineering, to strengthen the teaching capability of the selected universities and address the serious shortfall in science and engineering academic expertise in the UK.

Central Networks, in collaboration with E.ON Engineering and Manchester University, have developed a pioneering research and development project which involves significant innovation and technology transfer. This project will be included in the first cohort of PNRA research projects and is described in more detailed below. The project will commence in September 2008.

Application of Artificial Immune System Algorithm to Distribution Networks

Algorithms developed for Artificial Immune Systems (AIS) will be modified and applied to complex physical electricity distribution networks to identify their "unhealthy" areas. AIS is an area not previously explored and therefore this project will advance scientific knowledge as well as providing a strategic benefit for the UK's electricity distribution networks by impacting on the design, operation and maintenance of these networks. The use of AIS algorithms has the potential to reduce network costs, improve network performance and in addition to ultimately deliver significant benefit to customers by improving their quality of supply. The project therefore has the potential to contribute both directly and indirectly to the economic competitiveness of the country.

8.3 Identification of Future Work Areas

Clearly the identification of new projects is key to the continued success of the IFI and RPZ initiatives, and to the future of distribution networks. During the forthcoming year we will undertake a range of activities in developing our portfolio of projects, including:

- Internal Workshops - to obtain expert views on potential future projects which address the issues faced by distribution networks of the future and deliver benefits to our customers and the environment
- Gap Analysis - to identify areas that can be strengthened within our R,D&D portfolio which fit within the IFI criteria and align with our objectives and E.ON's Changing Energy initiative, and to review developments within the future networks landscape to identify new potential threats and opportunities that merit research
- Work with Collaborative Partners - to explore ideas resulting from the dialogue and exchange of knowledge and experience with external groups

The R,D&D projects identified will address the issues which face the Distribution Network of the future and will enable us to achieve our aspiration of Changing Energy for the better to make a difference for our customers and the environment.

9. Individual Project Reports for Period April 2007 - March 2008

The following pages contain the Individual Project Reports for IFI projects undertaken by Central Networks during the 2007/08 regulatory year.

<table>
<tr><td>Project Title</td><td colspan="3">EA Technology - Strategic Technology Programme
EATL STP Overhead Line Module 2 and Forum</td></tr>
<tr><td>Description of project</td><td colspan="3">Research and development into all aspects of Distribution Overhead Lines</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 4,480
External £ 46,255
Total £ 50,735</td><td>Expenditure in previous (IFI) financial years</td><td>Total £ 86,778</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 360,837</td><td>Projected 2008 - 09 costs for Central Networks</td><td>Internal £ 5,000
External £ 47,000
Total £ 52,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="3">The STP overhead network programme for budget year 2007/8 aimed to reduce costs and improve performance of overhead networks by increasing understanding of issues that have a negative impact on costs and performance. The programme is expected to also have a positive impact on safety and environmental performance. The projects all address real problems that have been identified by the module steering group members as significant and which require technical investigation and development. The currently active projects within the programme include:

S2126_3 - Completion of long-term monitoring of conductor temperature by obtaining and analysing 12 months trial data.
S2126_4 - Monitoring overhead line conductor temperature at two trial sites at constant current.
S2136_3 - Continued participation in European Project COST 727: Measuring and forecasting atmospheric icing on structures.
S2140_2 - Field trials of techniques for checking the foundations of newly installed poles.
S2143_2 - Feasibility study to detect in-situ degradation of aluminum overhead line conductors.
S2146_2 - Undertake torsion testing to evaluate possible limits for composite tension insulators.
S2148_1 - Re-appraisal of ACE104 methodology.
S2150_1 - Evaluation of TDR for assessment of tower foundations using actual field data.
S2151_1 - Investigate alternatives to wood poles.
S2152_1 - Evaluate performance of ice recording solution at severe weather test site.
S2154_1 - Experimental investigation of ice loading of novel conductors.
S2155_1 - Comparative performance of available pole-top shrouds.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Technical Substitution</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>14</td><td>-2</td><td>16</td></tr>
</table>

<table>
<tr><td>Expected Benefits of Project</td><td colspan="3">Due to the age profile of system equipment it is inevitable that, unless significant new technology is used to extend asset life, CAPEX and possibly OPEX will need to increase significantly to maintain the present level of network reliability and safety.

If these projects are technically successful and the findings and recommendations from the projects are implemented, then the projects will potentially enable each DNO member of the programme to gain benefits including:
• Avoid redesign, reconstruction or refurbishment of overhead lines where this is driven by a perceived need to increase ratings or strengthen lines, and is required to conform with existing standards but which may be unnecessary
• Reduce levels of premature failure of assets
• Provide more cost effective and early identification of damaged insulators and discharging components, which if not addressed would result in faults
• Confidently extend the service life of towers and reduce potential levels of tower failures
• Reduce lifetime costs by the appropriate use of alternative materials.</td></tr>
<tr><td>Expected Timescale to adoption</td><td>Range 2009 - 2014
Dependent upon project</td><td>Duration of benefit once achieved</td><td>Range 3-7 years
Dependent on project</td></tr>
<tr><td>Probability of Success</td><td>Range 2 - 50%
Dependent on project (ave. 11%)</td><td>Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£ 77,562</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="3">A number of these projects are at early stage and the project cost may not always reflect the likely full costs of implementation. These will be identified providing the outcome of the early stage is positive. STP has delivered a number of notable innovations since its inception.</td></tr>
</table>

Project Progress at March 2008	Module projects have been completed including: Overhead conductor temperatures at steady rated current have been monitored at two locations, one near sea level and one high up in the Scottish Highlands. The data has yet to be analysed. Experimental investigation of live-line jumper cutting was carried out to determine under what conditions load carrying conductors could be cut. Several projects associated with icing of conductors were carried out at the severe weather site on Deadwater Fell. This included ice and creep measurements on novel conductor designs and the testing of ice meters. A study of alternatives to wood poles for HV OH lines indicated that there were potentially significant benefits to be gained from using concrete poles in certain situations. A test rig has been designed to investigate the practical problems of erecting and working on lines mounted on concrete poles.
Collaborative Partners	CE Electric, EDF Energy, Electricity North West, Northern Ireland Electricity, Scottish & Southern Energy, Scottish Power and Western Power
R&D Provider	EA Technology Ltd

<table>
<tr><td>Project Title</td><td colspan="4">EA Technology - Strategic Technology Programme
EATL STP Cable Module 3 and Forum</td></tr>
<tr><td>Description of project</td><td colspan="4">Research and development into all aspects of Distribution Cables and underground equipment</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 4,357
External £ 55,976
Total £ 60,333</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ 86,368</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 382,416</td><td colspan="2">Projected 2008 - 09 costs for Central Networks</td><td>Internal £ 5,000
External £ 57,000
Total £ 62,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">The STP cable network programme for budget year 2007/8 aimed at identifying and developing opportunities to reduce the costs of owning cable networks. The reduction of whole life cost through greater reliability and improved performance of cables and associated accessories comes under the remit of Module 3. Where appropriate, Module 3 worked with other Modules to achieve common goals. The currently active projects within the programme include:

S3132_10 - Further development in cable ratings to address gas compression cables.
S3132_12 - Further development in cable ratings
S3140_3 - Develop best practice for the installation of Ducted Cable systems.
S3144_2 & 3 - Comparison of processes for the treatment of redundant fluid filled cables.
S3151_1, 2 & 3 - Understanding and controlling thermo-mechanical forces in cable systems.
S4152 - Separable connectors and cable compartments in 11kV switchgear.
S3159_1 - Investigation of current ratings of triplexed cable in plastic ducts.
S3157_1 - PD testing of MV cable systems to provide asset risk management data.
S3163_1 - On-going testing of sensors for cable fluids.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>12</td><td>-3</td><td>15</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">The management and rectification of underground cable faults is always a challenge and if the projects are technically successful and the findings and recommendations are implemented the projects will potentially enable a CI/CML savings per connected customer. Further developments on the management of aged cables and fluid filled cables will have a measurable environmental and financial benefit.</td></tr>
</table>

Expected Timescale to adoption	Range 2009 - 2011 Dependent on project	Duration of benefit once achieved	Range 3-7 years Dependent on project
Probability of Success	Range 2 - 50% Dependent on project (ave. 22%)	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£ 74,128
Potential for achieving expected benefits	A number of STP Projects are at an early stage and the project cost may not always reflect the likely full costs of implementation. These will be identified providing the outcome of the early stage is positive. STP has delivered a number of notable innovations since its inception.		
Project Progress at March 2008	Module projects have been completed including: The calculation of current ratings of crossing cables, gas compression cables and dynamic ratings almost finishes the creation of a comprehensive suite of cable rating tools for network designers and cable engineers. A tool for comparing the merits of cross-bonding and solid bonding of MV polymeric cable systems, including outputs of annualized energy losses, as well as current ratings, circulating currents and elementary section length. Work is ongoing to assess the mechanical and thermal integrity of plastic ducts. Initial difficulties in obtaining suitable sites for oil removal trials have been resolved and trials to compare the effectiveness of three different processes for the treatment of oil filled cables at end-of-life have been arranged. Progress is being made in determining the most effective system (on-line and off-line) for Partial Discharge (PD) testing of MV cable systems.		
Collaborative Partners	CE Electric, EDF Energy, Electricity North West, Scottish & Southern Energy, Scottish Power and Western Power		
R&D Provider	EA Technology Ltd		

Project Title	EA Technology - Strategic Technology Programme **EATL STP Plant and Protection Module 4 and Forum**		
Description of project	Research and development into all aspects of Distribution Plant and Protection equipment		
Expenditure for financial year	Internal £ 8,202 External £ 43,302 Total **£ 51,504**	Expenditure in previous (IFI) financial years	Total **£ 94,081**
Total Project Costs (Collaborative + external + Central Networks)	**£ 326,068**	Projected 2008 - 09 costs for Central Networks	Internal £ 8,500 External £ 45,000 Total **£ 53,000**
Technological area and / or issue addressed by project	Issues with the age profile of substation assets within the UK electricity distribution system are well known. Also, both regulatory and shareholder pressures preclude substantial investments of the large scale that was seen in the 1950's to 1970's. The challenge is to constantly review and innovate new solutions to monitor and define asset condition thereby allowing risks to be clearly defined and sound investment decisions to be taken The programme of projects which were approved for funding from the STP substations module budget and were undertaken in 2007/08 encompass both developing new innovative asset management processes and practices and developing innovative diagnostic techniques. The aim is to develop already well established themes such as life extension of aged assets within legal and heath and safety constraints, examination of new technologies, developing an understanding of, and innovative solutions for, the impact on substation assets of increasing levels of distributed generation on networks and condition monitoring techniques. The currently active projects within the programme include: S4164_4 - On load tap changer monitor - develop and install trial systems S4176_3 - Assessment and inspection of substation earthing systems S4181_2 - Transformer Post Mortems S4185_2 - AM Forum membership S4212_1 - Dissemination Seminar to ensure wider appreciation of STP module outputs S4219_1 - Management of substation batteries S4220_1 - Management of 145kV Disconnectors S4221_1 - Investigate Out of Phase Switching S4222_1 - Explore Alternatives to ENATS 35-1 Transformers S4223_1 - Review of Underground Substation design S4225_1 - Assessment of BS148 and IEC60296 Insulating Oils S4228_1 - Investigate Alternative Measuring Techniques for Insulation Materials S4234_1 - Exploration of Ferroresonance Issues		

<table>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>12</td><td>-3</td><td>15</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">Due to the age profile of the current system assets it is inevitable that unless significant new technology is used to extend asset life, CAPEX and possibly OPEX will need to increase significantly to maintain the present level of network reliability and safety.

If the projects are technically successful and the findings and recommendations from the projects are implemented, then the projects will potentially enable each DNO member of the programme to gain the benefits including:
• Offset future increases in CAPEX and OPEX
• Increased safety of staff and public by reducing the number of accidents/incidents
• Improved environmental control from both preventing disruptive failures of oil-filled equipment to reduce land contamination and avoiding unnecessary scrapping of serviceable components will alleviate environmental impact.</td></tr>
<tr><td>Expected Timescale to adoption</td><td>Range 2009 - 2010
Dependent on project</td><td>Duration of benefit once achieved</td><td colspan="2">Range 1-5 years
Dependent on project</td></tr>
<tr><td>Probability of Success</td><td>Range 15 - 50%
Dependent on project (ave. 30%)</td><td>Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td colspan="2">£ 49,404</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">A number of STP Projects are at an early stage and the project cost may not always reflect the likely full costs of implementation. These will be identified providing the outcome of the early stage is positive. STP has delivered a number of notable innovations since its inception.</td></tr>
<tr><td>Project Progress at March 2008</td><td colspan="4">Module projects have been completed including:

The On-Load Tap Changer Monitor and programme of Transformer Post Mortems, which will improve the ability to identify and predict end of life. The projects results provide a clearer understanding of the degradation and failure processes associated with transformers and identify how these could be detected with condition based monitoring.</td></tr>
<tr><td>Collaborative Partners</td><td colspan="4">CE Electric, EDF Energy, Electricity North West, ESB Networks, Scottish & Southern Energy, Scottish Power and Western Power</td></tr>
<tr><td>R&D Provider</td><td colspan="4">EA Technology Ltd</td></tr>
</table>

Project Title	EA Technology - Strategic Technology Programme **EATL STP Networks for Distributed Energy Resources Module 5**		
Description of project	Research and development into all aspects of Network design and management to enable an increased connection of distribution energy.		
Expenditure for financial year	Internal £ 9,436 External £ 52,775 Total **£ 62,211**	Expenditure in previous (IFI) financial years	Total **£ 88,650**
Total Project Costs (Collaborative + external + Central Networks)	**£ 444,830**	Projected 2008 - 2009 costs for Central Networks	Internal £ 10,000 External £ 54,000 Total **£ 64,000**
Technological area and / or issue addressed by project	The projects undertaken through budget year 2007/8 were aimed at enabling cost effective connections and ensuring techniques are in place to plan, operate and manage networks with significant amounts of generation. Most projects also had positive impacts on safety and environmental performance. The projects all addressed real problems that had been identified by the module steering group members as significant and which required technical investigation and development. Fifteen new project stages were approved during the year. These projects were aimed at: S5147_4 - Monitoring of Micro-generator Clusters S5147_5 - Analysis of Micro-generator Cluster monitoring results S5147_7 - Reporting of Micro-generator Monitoring S5149_5 - Explore Active Voltage Control S5142_4 - Generator Data and Structure for DG Connection Applications S5151_4 - Network Risk Modelling S5152_3/4 - Latest developments in the connection of distributed generation S5157_3 - Evaluate the Performance of Small Scale Reactive Power Compensators S5161_2 - Standard risk assessment approach to DNO protection S5167_1 - Assessment of enhanced ratings for overhead lines connecting windfarms S5170_1 - Explore low cost design options for connecting DG to overhead line networks S5171_1 - Investigate the use of inverter connected DG to alleviate fault level contribution S5172_1 - Optimum power factor to support a low carbon economy S5173_1 - Alternative techniques for temperature connected demands S5174_1 - Assessment of the potential for DSM from small customers S5176_1 - Assessing the impact of high penetrations of micro-generation on cable networks S5182_1 - Treatment of distribution network losses S5185_1 - Assessment of the potential for DSM from larger customers S5186_1/2 - Investigate effects on network of proposed ban on		

<table>
<tr><td></td><td colspan="4">incandescent light bulbs</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>15</td><td>-2</td><td>17</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">With national energy policy driving significant increases in generation connection to distribution networks the members need a range of innovative solutions to connection and network operation issues that are cost effective and which maintain the present level of network reliability and safety.

If the findings and recommendations from the projects are implemented, then the projects will potentially enable each DNO member of the programme to gain benefits including:
• Reducing the probability of voltage supply limit excursions resulting from increased distributed generation.
• Improving quality of supply and reducing risk of component failure (by understanding the effect and optimising use of impedance in the system).
• A better understanding of the risk presented by the distribution assets when considered as a network rather than discrete components.
• Greater use of distributed generators to meet current DNO obligations (by assessing, from a DNO perspective, the implications of pending Distribution Code provisions relating to distributed generation).
• Reducing the amount of reinforcement needed (by use of dynamic ratings to allow network components to be used to their full capability) - the use of dynamic circuit ratings is a vital step in the move towards active management of networks.</td></tr>
<tr><td>Expected Timescale to adoption</td><td>Range 2009 - 2013
Dependent on project</td><td colspan="2">Duration of benefit once achieved</td><td>Range 1-10 years
Dependent on project</td></tr>
<tr><td>Probability of Success</td><td>Range 10 - 30%
Dependent on project (ave. 15%)</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£ 70,226</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">A number of STP Projects are at an early stage and the project cost may not always reflect the likely full costs of implementation. These will be identified providing the outcome of the early stage is positive. STP has delivered a number of notable innovations since its inception.</td></tr>
</table>

Project Progress at March 2008	During 2007/08, Northern Ireland Electricity joined the Module. Module projects have been completed including: Completion of twelve months monitoring of the micro-generator cluster in Manchester, a network with a high penetration of micro-generation where the houses are new build (i.e. well insulated with a relatively low heating requirement). Laboratory tests on compact fluorescent light bulbs were undertaken to examine the network effects of the proposed ban on incandescent bulbs and a follow-on stage was approved to monitor whole house performance under typical mixed loads with measurements concentrating on the harmonic effects.
Collaborative Partners	CE Electric, EDF Energy, Electricity North West, ESB Networks, Manx Electricity Authority, Northern Ireland Electricity, Scottish & Southern Energy and Scottish Power
R&D Provider	EA Technology Ltd

<table>
<tr><td>Project Title</td><td colspan="4">EA Technology - Protective Coatings Forum</td></tr>
<tr><td>Description of project</td><td colspan="4">Research and development into all aspects of protective coatings on distribution equipment</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 1,264
External £ 6,240
Total £ 7,504</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ 13,928</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 44,944</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 1,500
External £ 7,000
Total £ 8,500</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">The projects undertaken through budget year 2007/08 addressed real problems that had been identified by the forum members as significant and which required technical investigation and development. Projects were aimed at providing:
Cost effective protective coatings for distribution equipment either by reducing operating costs or capital investment.
Reduction of the environmental impact of associated activities to comply with CEPE (Guide to VOC Reduction in Protective Coatings) in preparation for EC National Emissions Ceiling Directive.
Improvements in safety and application.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental/ Technological Substitution</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>12</td><td>-6</td><td>18</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">Development of a Volatile Organic Compound (VOC) compliant paint system that performs at least as well as the currently used solvent based systems on towers and other structures. This will ensure a smooth transition to environmentally friendly paint systems in accordance with the anticipated legislation.</td></tr>
<tr><td>Expected Timescale to adoption</td><td>2010 - 2012
Dependent on adoption of legislation</td><td colspan="2">Duration of benefit once achieved</td><td>3 - 10 Years</td></tr>
<tr><td>Probability of Success</td><td>50%</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£ 25,533</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">The project costs are at an early stage and the project costs not always reflect the likely full costs of implementation. These will be identified providing the outcome of the projects is positive.</td></tr>
</table>

Project Progress at March 2008	• Quality assessment and evaluation continues on a number of different Volatile Organic Compounds (VOC) compliant paint systems (e.g. Water Based and Epoxy systems). This work includes laboratory prohesion tests on samples and post application on-site monitoring of treated structures. Field inspections and tests have also been carried out on modified MIO and vinyl systems. • Initial testing of Algae Removal biocides to ensure these are not detrimental to the adhesion of existing protective coatings. • Electrical testing of contaminated polymeric insulators has started.
Collaborative Partners	CE Electric, EDF Energy, Electricity North West, National Grid, Scottish & Southern Energy and Scottish Power
R&D Provider	EA Technology Ltd

<table>
<tr><td>Project Title</td><td colspan="4">EA Technology - Partial Discharge Project</td></tr>
<tr><td>Description of project</td><td colspan="4">Research and development into all aspects of partial discharge in distribution equipment.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 8,625
External £131,234
Total £139,858</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ 16,256</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 515,146</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 9,000
External £ 29,000
Total £ 38,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">The projects undertaken in 2007/08 addressed real problems that had been identified by the group members as significant and which required technical investigation and development. Projects were aimed at providing:
• Improved management of Assets through better understanding of Partial Discharge through targeted investigative, research and development work.
• Reduced fault rates by early detection of insipient faults.
• Improvements in Safety.
• Demonstration of a cost effective permanent partial discharge condition monitoring system using Transient Earth Voltage and Ultrasonic detection.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Technical Substitution/ Incremental</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>15</td><td>-7</td><td>22</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">Partial discharge is becoming an essential technique when assessing failure probabilities in both an aging population of traditional distribution assets and certain new equipment, which has been found to have less tolerant insulation mechanisms.
Early detection of faults allows controlled remedial action and provides:
• Financial benefits derived from the reduction in fault repairs
• Improved network performance and operator safety
• Improved quality of supply for customers</td></tr>
<tr><td>Expected Timescale to adoption</td><td>2010</td><td colspan="2">Duration of benefit once achieved</td><td>10 Years</td></tr>
<tr><td>Probability of Success</td><td>75%</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£ 46,829</td></tr>
</table>

Potential for achieving expected benefits	The demonstration installations have already been successful with investigations at the two sites, where significant partial discharge was detected, directly leading to remedial action to rectify deterioration, which if left unchecked would have caused permanent damage to the switchgear. Further refinement is necessary, but all indications are that this project will deliver the expected benefits.
Project Progress at March 2008	• Eleven remotely monitored Partial Discharge Detection systems have been installed at selected Central Networks Substations where switchgear with a history of partial discharge activity were located. Initial indications suggested significant partial discharge was occurring at two of these sites. • Several PD demonstration installations have had secondary NOx, humidity and temperature sensors fitted to identify if any of the detected partial discharge events can be correlated to environmental events. • Tests on several types of equipment are continuing, to determine partial discharge profiles of Long Term Degradation of Switchgear. • Web access has been provided to the developing Partial Discharge Database, which contains significant information on a large population of historic results. A one page bulletin has been produced, which describes in more detail the Central Networks PD demonstration. This can be viewed on the Central Networks Research and Development web page: http://www.eon-uk.com/distribution/275.aspx
Collaborative Partners	AWE, CE Electric, CLP Hong Kong, EDF Energy, Energy North West, ESB Networks, Guernsey Electricity, Manx Electricity Authority, MoD, Northern Ireland Electricity, Scottish and Southern Energy, Scottish Power, Singapore Power and Western Power
R&D Provider	EA Technology Ltd

<table>
<tr><td>Project Title</td><td colspan="4">ENA R&D Programme</td></tr>
<tr><td>Description of project</td><td colspan="4">Three projects initiated by the Energy Networks Association (ENA) R&D Working Group. The ENA represents all UK Network Operators.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 6,607
External £ 4,850
Total £ 11,457</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ 16,618</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 350,000</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 7,000
External £ 40,000
Total £ 47,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">The projects undertaken through 2007/08 address real problems that had been identified by the ENA Working Group as significant and which required technical investigation and development.
• SG12 Fault Level monitor - Develop a device that will connect to the network, and establish the network source impedance from small-scale disturbances / perturbations resulting from transformer tap changer operation, etc. This impedance can accurately be correlated to a true network fault level for that location, providing near real-time information to network control and planning engineers alike.
• SG14 Earthing Project – Improve the existing modelling of distribution earthing systems by assessing the impact of lower voltage earth electrodes on higher voltage 'hot zones' and measuring the resistance of actual distribution substation earth systems.
• Vacuum Bottle Project - Although today there have been few failures, existing Network Operators have large populations of vacuum interrupters and some of these are approaching the manufacturer's declared guaranteed life expectancy (20 years).</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental / Significant</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>12</td><td>-5</td><td>17</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">Fault Current Monitor - The developed unit will allow the DNOs to accurately assess fault infeed levels and design distribution networks appropriately. The particular benefits of this project are seen to be:
• Provide a real-time and consistent estimation of fault level
• Accurately take into account all connected network elements (e.g. Motors)
• Facilitate the connection of distributed generation by providing a standardised methodology for the assessment of network fault levels
• Enable an ongoing assessment of the effects of connected distributed generation to be made
• Provide reassurance to generator developers that decisions to upgrade networks are not subjective but based on objective</td></tr>
</table>

	measurement. Earthing Project - The project will determine the effects of LV earth systems on the potential touch and step voltages around adjacent HV systems. The results of this should determine the means to provide cost effective, safe earthing systems without the need for extensive separations between HV and LV electrodes. Vacuum Bottle Project - Feasibility, development and demonstration of possible field test equipment that can determine the residual life of existing vacuum bottles.		
Expected Timescale to adoption	2012	Duration of benefit once achieved	10 Years
Probability of Success	25%-75% Dependent upon project	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£ 200,000
Potential for achieving expected benefits	• Fault Level Monitor - The proposed testing within a defined third party test network has not been pursued at this time since although this might provide further data supporting the instrument's capabilities it would not answer the question as to why the differences exist between the apparent capability of the existing instrument and the performance of the algorithms implemented in Matlab. Proposals are being prepared for consideration to carry out further work to resolve questions about the apparent differences in performance of the existing Fault Level Monitor and the Fault Level Monitor Algorithms implemented in Matlab. • Earthing Project - The results from tests and simulations can be used to propose a recommended procedure for measuring transfer potential between HV and LV systems, suitable for inclusion in a DNO policy document. • Vacuum Bottle Project – Project is in initial stage.		

Project Progress at March 2008	Fault Current Monitor • Performance of Fault Level Monitor tested against the known parameters of the University of Strathclyde's microgrid. • Fault Level Monitor Algorithm validation using a network model in Matlab/Simulink to provide sampled data, showed that power factor and load disturbance conditions (which were most likely to be experienced in a real power system) were not within the required accuracy band. • Comparison of measurements made on a real network with the Fault Level Monitor exhibited a closer agreement with the results expected. Earthing Project - Report delivered • Measurements and calculations on a test electrode system found that the transfer potential to a distributed LV electrode is much lower than previously thought. • Investigations at two live substations in WPD area with isolated LV networks completed. Computer model developed to represent the actual sites and post-installation analysis including interpretation of results and recommendations for use in DNOs policy documents presented. Vacuum Bottles - Initial Testing • Several vacuum bottles recovered from service in Central Networks have been tested to identify their residual life.
Collaborative Partners	CE Electric, EDF Energy, Electricity North West, National Grid, Northern Ireland Electricity, Scottish & Southern Energy, Scottish Power and Western Power
R&D Provider	Strathclyde University, EA Technology, Strategy & Solutions, Sterling Power

<table>
<tr><td>Project Title</td><td colspan="3">Electric Power Research Institute - Advanced Distribution Automation</td></tr>
<tr><td>Description of project</td><td colspan="3">EPRI Program 124.005
Research into an Integrated Sensor and Monitoring System for Advanced Distribution Automation</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 1,346
External £ 33,048
Total £ 34,394</td><td>Expenditure in previous (IFI) financial years</td><td>Total £ 53,406</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 5,700,000</td><td>Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 2,000
External £ 34,500
Total £ 36,500</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="3">The distribution system of the future will be based on Advanced Distribution Automation that includes two key aspects:
• Enabling new system configurations, such as looped feeders, islandable circuits and bi-directional power flows. Such capabilities will make a system more flexible, more able to operate reliably and able to recover from or reduce the impact from outages.
• Integration and strategic use of new intelligent electric devices (IEDs) to enable the use of flexible electrical architecture to produce not only new system configurations, but also to provide a means for expanding customer service options.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Technical Substitution / Significant</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>10</td><td>-3</td><td>13</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="3">The first generation of integrated sensor and monitoring systems for Advanced Distribution Automation will increase:
• Distribution Reliability by providing continuous monitoring of vital system operating parameters to allow strategic operation of the distribution system.
• Network Utilisation of existing infrastructure by allowing closer control of voltage profiles and maximising energy throughput.
• Flexibility of the network by optimising system performance under changing conditions caused by outages or demand / supply changes.</td></tr>
<tr><td>Expected Timescale to adoption</td><td>2015</td><td>Duration of benefit once achieved</td><td>10 Years</td></tr>
<tr><td>Probability of Success</td><td>25%</td><td>Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£ 78,108</td></tr>
</table>

Potential for achieving expected benefits	The project costs are identified early stage costs. They do not reflect the likely full costs of implementation.
Project Progress at March 2008	• The requirements definition and design has been updated and both the technology and software refined. • Partnerships are being sought with project hosts to implement and test advanced monitoring system concepts. This involves consortia arrangements.
Collaborative Partners	E.ON Engineering
R&D Provider	Electric Power Research Institute

<table>
<tr><td>Project Title</td><td colspan="4">Electric Power Research Institute - Intelligent Universal Transformer</td></tr>
<tr><td>Description of project</td><td colspan="4">EPRI Program 124.006
Research into a Solid State replacement for conventional power transformers.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 1,256
External £ 24,058
Total £ 25,315</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ 49,797</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 6,500,000</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 1,500
External £ 25,500
Total £ 27,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">The Intelligent Universal transformer is an advanced power electronic design that can replace conventional copper and iron transformers. It has the increased functionality necessary for operating on future distribution networks.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Technological Substitution / Significant</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>11</td><td>-2</td><td>13</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">Intelligent Universal Transformers will provide operating benefits and increased functionality over conventional transformers:
• Increased Utilisation of existing infrastructure by regulating voltage, power factor and frequency.
• Active power quality functionality will eliminate dips, and harmonic distortion.
• Increased customer service options such as DC (or high frequency), three phase power from a single phase line. Remote condition monitoring and control may also provide the option for passive DSM.
• Reduced environmental and safety issues as it will contain no hazardous or harmful dielectrics.</td></tr>
<tr><td>Expected Timescale to adoption</td><td>2015</td><td colspan="2">Duration of benefit once achieved</td><td>25 Years</td></tr>
<tr><td>Probability of Success</td><td>25%</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£ 31,385</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">The project costs are identified early stage costs. They do not reflect the likely full costs of implementation</td></tr>
</table>

Project Progress at March 2008	• Market analysis by Davies Consulting is near completion • Exploratory meetings with prospective developers have identified several technical issues and development risks that need to be resolved at the research stage (these include energy efficiency, maximum fault current, communication inter-operability and climate range) • DOE and DARPA have indicated their interest in this project.
Collaborative Partners	E.ON Engineering
R&D Provider	Electric Power Research Institute

<table>
<tr><td>Project Title</td><td colspan="4">Dynamic Ratings</td></tr>
<tr><td>Description of project</td><td colspan="4">Central Networks has developed the first RPZ in the UK. This involves the application of an active rating to a 132kV overhead line based on real time measurements of ambient temperature and wind speed.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 67,538
External £ 45,181
Total £112,719</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ 82,136</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 345,000</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 29,000
External £ 56,000
Total £ 85,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">Active ratings calculations based on CIGRE 207 equations are carried out at our control centre as part of the RPZ load management scheme that will curtail generation in the event of the line rating becoming exceeded. In addition there are two innovative areas, which required further research and are being funded via the IFI mechanism:
• Risk assessments identified the requirement for a local autonomous overload protection scheme, which calculates the line rating from local parameters in the event of a loss of communications. This would enable a higher current rating to be maintained while preventing the line thermal rating becoming exceeded.
• As verification of the assumptions made in the derived ratings, sensors will be attached temporarily to the conductors at various critical positions on the overhead line.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental / Technological Substitution</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>15</td><td>-3</td><td>18</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">The project will:
• Develop and demonstrate an overload protection system which is compatible with a central controlled active rating load management scheme.
• Verify the derived rating of the overhead line by comparing with measured real time conductor data.</td></tr>
<tr><td>Expected Timescale to adoption</td><td>2009</td><td colspan="2">Duration of benefit once achieved</td><td>20 Years</td></tr>
<tr><td>Probability of Success</td><td>75%</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£ 214,376</td></tr>
</table>

Potential for achieving expected benefits	Once all equipment has been installed, a period of intensive monitoring will carried out to verify the original assumptions and identify if any further issues will need to be resolved.
Project Progress at March 2008	• Overcurrent relays have been tested, installed and commissioned at Skegness. Data loggers which can be remotely interrogated have been installed to monitor the Weather Station and Relay outputs. • Four Power Donut sensors, for measuring temperature and current on the 132kV overhead line, have been installed at strategic locations together with ambient temperature sensors. A one page bulletin has been produced, which describes in more detail this project. This can be viewed on the Central Networks Research and Development web page: http://www.eon-uk.com/distribution/275.aspx
Collaborative Partners	AREVA and USi
R&D Provider	AREVA and E.ON Engineering

<table>
<tr><td>Project Title</td><td colspan="4">Energy Storage for Distribution Systems</td></tr>
<tr><td>Description of project</td><td colspan="4">Energy Storage is a key enabling technology for the development of innovative solutions to manage and control the electrical networks of the future. A staged research and development programme will lead to the manufacture of a prototype 1MW redox flow battery with a capacity of several MWh, which will be connected to the distribution system and operated for a period of up to 24 months.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 1,633
External £ 10,706
Total £ 12,339</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ 66,858</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ N/a</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ Nil
External £ Nil
Total £ Nil</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">The object of this project is to investigate the role of energy storage in intelligent network and power outage management by the research and development of a large scale flow battery and demonstrate its application to the distribution network.

The demonstration will involve installation and operation of physical plant to identify the implications of connecting large electrical storage capacity to a network and the contribution it can make to:
• Supply reliability
• Connection of large amounts of generation with intermittent output
• Control of networks with large fluctuating demands
• A range of other network services

This will be the first application of large-scale energy storage to the electricity distribution system in the UK, which will require innovation in control technology and operational strategy to understand and exploit the benefits of storage in intelligent networks.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Significant / Radical</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>13</td><td>-2</td><td>15</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">The project addresses the need to develop and apply energy storage at a scale of significant size in order to promote confidence in the technology. The work will tease out practical interface and operational issues.

This redox flow battery has a theoretically high power transfer density which will make it suitable for maintaining supplies during short duration outages, so portable units could be used to provide standby support at substations during maintenance and construction activities, allowing sufficient time for restoration by switching or connection of</td></tr>
</table>

	portable generation. Static units could be used to smooth generation profiles to defer reinforcement requirements / prevent generation being curtailed. They could also be used to improve distribution network power quality.		
Expected Timescale to adoption	2014	Duration of benefit once achieved	15 Years
Probability of Success	25%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£ 165,102
Potential for achieving expected benefits	This project has been cancelled, but the potential exists with other battery technologies and this will be investigated.		
Project Progress at March 2008	Project partners withdrew from the collaboration agreement in November 2007, because they were unable to develop the technology sufficiently within the target deliverable dates.		
Collaborative Partners	DTI, Plurion and E.ON Engineering		
R&D Provider	Plurion and E.ON Engineering		

<table>
<tr><td>Project Title</td><td colspan="3">Optimising System Design for Improved Performance and Reduced Losses</td></tr>
<tr><td>Description of project</td><td colspan="3">The project aims to provide Central Networks with an optimising tool, which will consider both performance and system losses of alternative networks, under different degrees of distributed generation penetration, as well as to provide the parameters necessary to identify the financial impacts associated with each alternative.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 7,946
External £166,081
Total £174,027</td><td>Expenditure in previous (IFI) financial years</td><td>Total £ 84,820</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 315,000</td><td>Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 7,500
External £ 45,000
Total £ 53,500</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="3">There is a need for more quantitative analysis of the life cycle costs of network investment. Whereas buying cheaper network components may result in short term savings, Distribution Network operators need to consider how to achieve both improved performance and reduced losses in the network and to consider these in a network environment that contains distributed generation.

We already have developed performance tools, which can be used to develop both strategic and tactical plans, but there is no clear understanding of where losses occur in the distribution system. It is important not to develop these tools in isolation, but recognise that optimal network solutions are required.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental / Significant</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>14</td><td>2</td><td>12</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="3">The primary aims of this project are to:
(i) deliver better customer service
(ii) reduce system losses
(iii) lower long term operational costs

The optimising tool will be used to facilitate the following:
• Identification of optimum improvement strategies that could include fundamental changes to circuit topology as well as incremental improvements to design.
• Generate optimum network designs that are flexible enough to accommodate different levels of Distributed Generation penetration.
• Influence future asset replacement decisions to maximise the effectiveness and efficiency of the network design and allow the development of design guidelines.
• Provide a mechanism to influence future regulation by providing an</td></tr>
</table>

	objective mechanism for understanding the performance and efficiency drivers of different network designs.		
Expected Timescale to adoption	2012	Duration of benefit once achieved	20 Years
Probability of Success	50%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£ 187,159
Potential for achieving expected benefits	Progress has been good, with this research creating interest in other areas and edited highlights presented at the ESR Networks Panel in February. It has been found necessary to include additional verification work, but the probability of success has also increased, resulting in the NPV almost doubling when recalculated. The second phase of modelling is scheduled to complete in May 2009.		
Project Progress at March 2008	The following modelling components have been completed: • Enhancement of analysis tool capability and usability including techniques for assessing the impact of DG on networks. • Development of generic distribution network models for the Central Networks distribution system. • Quantifying the impact of specified design strategies on network performances and performing sensitivity studies on key assumptions. In parallel with this modelling work, detailed analysis of losses on the existing Central Networks' distribution system topologies, using actual network component data and load profiles measured at the different grid supply points has also been completed at all voltage levels. This has given a valuable insight into the proportion of losses occurring in different parts of the network and will allow the network models to be calibrated.		
Collaborative Partners	Imperial College London and E.ON Engineering		
R&D Providers	Imperial College London, CREST Loughborough, Clarkson Database Services, Mathematical & Computer Modelling and E.ON Engineering		

<table>
<tr><td>Project Title</td><td colspan="4">Maintaining Critical Domestic Loads During Power Outages</td></tr>
<tr><td>Description of project</td><td colspan="4">Distribution Network Operators have an obligation to maintain supplies to customers</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 2,874
External £135,834
Total £138,708</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ 27,665</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£178,000</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 1,500
External £10,000
Total £11,500</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">During a power outage, electrical power is lost to both critical and non-critical appliances. Power outages during the summer can be inconvenient and annoying, but are rarely life-threatening. Power outages during cold weather can however have serious impacts for customers. Even central heating systems powered by other fuel sources fail, due to their reliance on mains power for control circuits and circulation pumps.

The aim of this project is to develop a demonstration of the micro-CHP unit operating as an island generator, supporting the critical domestic housing load and heating requirements.

A future stage of passively or remotely controlling the micro-CHP as a domestic Demand Side Management scheme could be used as a tool for better network management and allow the potential deferment of capital works, but benefits from this particular area have not been considered.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental / Technological Substitution</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>11</td><td>1</td><td>10</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">Micro-CHP can already provide a carbon efficient method of heating, but the use of micro-CHP units that generate power to support critical domestic housing load requirements during power outages, in addition to providing heating requirements, is an innovation which takes this technology one stage further and can provide significant customer benefits.

This technology could be especially useful for maintaining the critical domestic loads of vulnerable customers.</td></tr>
<tr><td>Expected Timescale to adoption</td><td>2015</td><td colspan="2">Duration of benefit once achieved</td><td>20 Years</td></tr>
<tr><td>Probability of Success</td><td>25%</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£ 58,705</td></tr>
</table>

Potential for achieving expected benefits	Volatility in gas prices and the erosion of the differential between gas and electric prices could affect the economics of this application. The project has however been progressing and is still expected to deliver some benefits, especially as developed technology is likely to be transferable.
Project Progress at March 2008	• Critical component models have been developed and initial simulations performed to verify these models against actual micro-CHP output. Critical parameters have been modified to understand the sensitivity. • Load / generation balancing algorithms have been developed and simulated. The results of this work have been published as an ICSEng paper.
Collaborative Partners	None
R&D Provider	University of Twente Enschede and E.ON Engineering

<table>
<tr><td>Project Title</td><td colspan="4">Networks to Improve Power Quality</td></tr>
<tr><td>Description of project</td><td colspan="4">Power quality and reliability continue to grow in importance with deregulation of the electric power industry. Computer technology, automated processes and sensitive electronic equipment are in widespread use across all sectors and there is a requirement on DNOs to provide a high quality of supply and service to its customers.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 2,703
External £ 59,254
Total £ 61,957</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ 63,975</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£157,000</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 3,000
External £ 28,000
Total £ 31,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">Short duration interruptions and voltage sags are the most frequent cause of loss of revenue to commercial and industrial customers as they can result in frequent mal-operation of equipment.
The disruption of an industrial process, due to a supply interruption or voltage sag, can result in very substantial costs to the operation ranging up to millions of pounds attributed to a single disruption of the process, whereas the costs to commercial customers (e.g. banks, data centres, customer service centres, etc.) can be just as high if not higher.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental / Significant</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>9</td><td>-3</td><td>12</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">Mesh distribution networks can reduce the number of short duration interruptions, but can also increase the potential for voltage sags. Understanding the feasibility of modifying existing networks and how any undesirable consequences for customers can be mitigated or eliminated is therefore an important element in improving distribution network design.
The two key areas of research in this project are:
• Investigation of the performance benefits, economics and the technical restrictions of modifying existing radial networks into mesh distribution networks with the aim of reducing short duration customer outages.
• Investigation into the potential and available alternatives for a distribution company to provide a cost effective, enhanced electricity supply, which will limit the effects of voltage sags on the network to either individual or clustered groups of customers.</td></tr>
<tr><td>Expected Timescale to adoption</td><td>2012</td><td colspan="2">Duration of benefit once achieved</td><td>20 Years</td></tr>
</table>

Probability of Success	25%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£ 66,113
Potential for achieving expected benefits	This project is on track and is expected to deliver the intended benefits.		
Project Progress at March 2008	• The cost of power quality events to customers and network operators is being calculated through a combination of customer surveys, DNO cost data and mathematical modelling. • Mathematical models of representative customer plant have been developed and a methodology for assessing potential financial loss for customers has been established. • Work on the probability of individual items of plant failing in response to different events and the likely impact of that failure on a process inferred. • Sensitive equipment, typical disturbance patterns and available devices to measure power quality improvement have been identified. • Two papers have been produced for the IEEE Transaction on Power Delivery and this project is feeding into CIGRE Joint Working Group C4.107 'Economics of Power Quality'.		
Collaborative Partners	None		
R&D Provider	Manchester University and E.ON Engineering		

<table>
<tr><td>Project Title</td><td colspan="4">Fault Current Limiter</td></tr>
<tr><td>Description of project</td><td colspan="4">Development and demonstration project</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 1,572
External £ 11,937
Total £ 13,509</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ 11,280</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£319,000</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 21,250
External £ 75,000
Total £ 96,250</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">Distribution networks have to manage ever increasing load demand and penetration of distributed generation, while having to maintain high security and reliability standards set out by the regulator. There are increasingly situations where fault current levels exceed the ratings of existing switchgear and transient current ratings of other equipment such as cables, lines and transformers. This overstressing can cause disruptive failure of switchgear under fault conditions.

The traditional method to overcome this problem is to replace relevant assets with higher rated components. Another approach is to install a fault current limiter, this has the effect of reducing the current during a fault and should have minimal voltage drop during normal operation. There have been recent developments in fault current limiters by various suppliers. AREVA T&D have been looking at two ways to limit system fault current:
1. A fault current limiter using novel super-conducting materials
2. A fault current limiter using permanent magnets

Whereas the technical and economical viability of using super-conducting materials is presently still questionable, the magnetic fault current limiter is expected to be more promising as it employs permanent magnetic material that is easier to handle. This project seeks to evaluate how magnetic fault current limiters can facilitate fault level management in a distribution network.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Technological Substitution / Significant</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>13</td><td>0</td><td>13</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">This project will investigate the exploitation options of a magnetic fault current limiter as being developed by AREVA T&D and will provide the following important information:
• Demonstrate whether magnetic fault current limiters are a viable technology for fault level management.
• How to specify a fault current limiter</td></tr>
</table>

Expected Timescale to adoption	2013	Duration of benefit once achieved	20 Years
Probability of Success	25%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£182,874
Potential for achieving expected benefits	Technical and resource problems have delayed this project but alternative Fault Current Limiter options are being considered.		
Project Progress at March 2008	• AREVA T&D have been modelling the hysteresis behaviour of the magnetic materials and identified a number of issues that need to be resolved before they can progress the development work. • There have also been resource constraints, but these are expected to be resolved soon. • Central Networks have been considering alternative Fault Current Limiter options: Evaluation of a Fault Coupling Device (FCD), which employs conventional L/C components with solid state switching devices to mitigate voltage dips and decouple faults. Initial work at LV has demonstrated the principle is sound, so a feasibility study for an 11kV FDC design is being considered. Development with another industrial partner.		
Collaborative Partners	AREVA T&D		
R&D Provider	AREVA T&D, University of Palermo and E.ON Engineering		

<table>
<tr><td>Project Title</td><td colspan="3">Understanding Networks with High Penetrations of Distributed Generation</td></tr>
<tr><td>Description of project</td><td colspan="3">Development of a distribution network model onto which different types and penetrations of Distributed Generation can be incorporated to understand the effects which could be encountered on real networks.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 4,384
External £ 28,438
Total £ 32,822</td><td>Expenditure in previous (IFI) financial years</td><td>Total £ 14,920</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 91,500</td><td>Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 5,500
External £ 38,000
Total £ 43,500</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="3">New and existing developments are being promoted with the aim of achieving zero carbon communities. This challenges traditional distribution network design in a number of ways:
• There is a requirement to absorb large penetrations of micro generation on to the LV network. (This requirement may extend to several substations where major redevelopment is being proposed.)
• Other low carbon conservation measures applied in the same areas means that local generation could exceed demand at certain periods of the day.
Central Networks would like to support such Low Carbon initiatives by modifying network design to both minimise network losses while maximising the amount of generation that can be accommodated without infringing fault level or statutory voltage limitations.
A proposed major urban redevelopment has given Central Networks the opportunity to demonstrate the benefits of an innovative approach to network design and this network is to be modelled in a number of configurations. The project will include an 11kV connected wind turbine and various forms of 'green' micro generation connected in individual domestic premises and public buildings. This micro generation will be distributed across the LV networks of approximately a dozen substations on two existing 11kV feeders. Actual load and voltage profiles will also be monitored at substation level both before and after redevelopment to obtain information for future network design and verify the model's outputs.
This network modelling will also be compared with the theoretical study on the Loughborough network being carried out by Loughborough University, Centre for Renewable Energy Systems Technology (CREST) using their Unbalanced Load-Flow Software. Central Networks is providing network data and monitoring actual load and voltage profiles to support this work.</td></tr>
</table>

<table>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>15</td><td>-1</td><td>16</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">• Identification of changes required to conventional network design to maximise the penetration of micro generation
• Understanding the effect of increasing generation output from a cluster of micro generation on the distribution network. In particular thermal rating, voltage rise and fault level.
• Ability to ensure that any modified design also reduces network losses.</td></tr>
<tr><td>Expected Timescale to adoption</td><td>2013</td><td>Duration of benefit once achieved</td><td colspan="2">5 Years</td></tr>
<tr><td>Probability of Success</td><td>75%</td><td>Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td colspan="2">£ 11,183</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">Early results have already provided a greater understanding of the effect of clusters of micro-generation on distribution networks. Measurements will not now be taken on the proposed redevelopment site, but instead the inclusion of real power quality data from a new 'Eco Development' site will provide further useful information.</td></tr>
<tr><td>Project Progress at March 2008</td><td colspan="4">• A computer programme was developed to identify substations with high proportions of similar dwelling types from GIS and OS data.
• High resolution power quality meters have been installed at four locations to measure real and reactive power demands of the representative circuits at 1 minute intervals.
• Load profiles are being synthesised using a combination of occupancy, activity and solar luminance and this is being validated against real measured data.
• Network modelling of a typical urban HV / LV network to calculate the potential fault contribution and voltage rises on the LV network for different penetrations of micro-generation.</td></tr>
<tr><td>Collaborative Partners</td><td colspan="4">None</td></tr>
<tr><td>R&D Provider</td><td colspan="4">Centre for Renewable Energy Systems technology (CREST) Loughborough University and E.ON Engineering</td></tr>
</table>

<table>
<tr><td>Project Title</td><td colspan="4">Effect of Electric Vehicles on Distribution Networks</td></tr>
<tr><td>Description of project</td><td colspan="4">Investigate the impact of charging electric vehicles on conventionally designed distribution networks.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 1,404
External £ 16,221
Total £ 17,625</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ 5,525</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 90,000</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 3,000
External £ 30,000
Total £ 33,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">The project is looking at the potential impact of Electric Vehicles on the existing UK Distribution Grid systems and considers how the energy in the car battery might be returned to the grid at times of peak load or for system support. ″Vehicle-to-Grid in the UK (V2GUK)″.

It aims to understand the requirements and limitations of the energy demands of a network-connected vehicle fleet when connected to a real distribution network.

Develop a system-level network management strategy to level the demand loading and maximise efficiency, and a local management strategy to control individual vehicle network connections, along with further strategies implemented on board the vehicles.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Technological Substitution / Radical</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>14</td><td>-1</td><td>15</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">The proposed research will provide knowledge to overcome the barriers in the use of network-connected vehicles by the development of models to represent operating conditions.

Identify real world demand requirements on distribution networks from charging / storage / discharging cycling as determined by actual vehicle operation and the capabilities of the distribution network load.</td></tr>
<tr><td>Expected Timescale to adoption</td><td>2013</td><td colspan="2">Duration of benefit once achieved</td><td>10 Years</td></tr>
<tr><td>Probability of Success</td><td>25%</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£ 35,159</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">Progress after initial delays has been good.</td></tr>
</table>

Project Progress at March 2008	• Development of an analysis tool, which uses electric vehicle data to generate typical Electric Vehicle load profiles. These profiles may be superimposed on a network load profile to measure the degree of impact. • The analysis tool will also interface with Distribution companies Power System Analysis Programs to allow technical implications to be assessed. • Initial views to be shared at 'Low Carbon Transport for Cities ' conference in May 2008.
Collaborative Partners	Warwick University, ARUP and E.ON Engineering
R&D Provider	Warwick University and E.ON Engineering

<table>
<tr><td>Project Title</td><td colspan="4">SuperGen V AMPerES
Asset Management and Performance of Energy Systems</td></tr>
<tr><td>Description of project</td><td colspan="4">This is a four year major multi party collaborative project. The research programme is split into 6 work packages & 25 activities. Most of the research will be carried out by the universities. A Central Networks representative has been identified for each work package so that research can be steered toward delivering benefits to the DNOs.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 8,516
External £100,000
Total £108,516</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ 29,830</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£2,800,000</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 5,000
External £ Nil
Total £ 5,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">The Engineering and Physical Sciences Research Council (EPSRC) is the major research funding agency for Universities in the UK. One of the EPSRC initiatives is funding work in the area of Sustainable Power Generation and Supply and a call was put out in 2004 to a group of universities to address the issues facing the UK energy infrastructure. The SUPERGEN consortium was formed which addresses a range of issues through a number of targeted work programmes. SUPERGEN and has active collaboration with UK industry funded by IFI and has created a real cross-interest community.
In essence there are 5 main activities:
• improving knowledge of plant ageing
• developing condition monitoring techniques
• developing plant with reduced environmental impact
• developing new protection and control techniques
• enhanced network performance and planning tools</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Radical</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>11</td><td>-4</td><td>15</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">The expected aims of the project are:
• To deliver a suite of intelligent diagnostic tools for plant
• To provide platform technologies for integrated network planning and asset management
• To progress plans to develop and implement improved and reduced environmental impact networks
• To develop models and recommendations for network operation and management</td></tr>
</table>

Expected Timescale to adoption	2013	Duration of benefit once achieved	20 Years
Probability of Success	25%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£ 150,000
Potential for achieving expected benefits	Asset management is core to the business. The appropriate use of the emerging opportunities for condition monitoring is key to optimising performance, both financially and in quality of supply. Some of the technologies being developed in this programme are likely to be utilised, however much more important is the broader window this work gives to the global research community. Through demonstration sites the true value of condition monitoring will be identified, enabling appropriate business decisions on adoption of technologies.		
Project Progress at March 2008	The project is now fully resourced at all the universities (PhD and RAs). The Consortium Agreement was signed in November 2006 and this led to the establishment of a Steering Group and an Executive Management group to provide engagement and the effective participation of all parties. Reports produced by the SuperGen Consortia include: • Loss of mains detection and amelioration on networks • Loss of mains detection by differential ROCOF Protection using internet protocol. • Interim report on protection and control of distribution networks with synchronous islands. • Reducing the Environmental Impact of Electrical Plant - Annual report • First report on use of high temperature conductors on distribution networks. • Final report on high temperature low sag conductors. • Report on ICSD 2007 • Report on literature on non-power frequency ageing in dielectrics • Condition monitoring -State of the Art report vs 2 27 technical publications have been submitted or published in the last year.		
	A number of demonstrator projects are presently being implemented in both transmission and distribution substations across the UK. These will be used to prove data acquisition technology. The resulting data will be used to develop interpretation tools. The demonstrator projects include: • Monitoring of two 275/132kV National Grid transformers. • Monitoring of six substations in Scottish Power. • Processing of Partial discharge data from EDF Energy substations. Further information can be obtained from: www.supergen-amperes.org		

Collaborative Partners	National Grid, Scottish Power, Scottish and Southern, Western Power Distribution, EDF Energy Networks, Electricity North West, CE Electric, NIE and Advantica
R&D Provider	Universities of Edinburgh, Liverpool, Manchester, Queens (Belfast), Southampton and Strathclyde

<table>
<tr><td>Project Title</td><td colspan="4">Ice Cleaning of Distribution Plant</td></tr>
<tr><td>Description of project</td><td colspan="4">Demonstration of a non abrasive, non solvent cleaning process which uses blasted solid CO_2 pellets to clean severely contaminated plant and equipment.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 4,733
External £ 1,900
Total £ 6,633</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ 17,157</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 23,790</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ Nil
External £ Nil
Total £ Nil</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">Central Networks has several sites adjacent to industrial process plants, where significant quantities of airborne contamination settles on equipment. This contamination can cause flashovers when deposited on exposed insulators and can significantly reduce thermal efficiency of transformer radiators if deposits are allowed to accumulate.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental / Technological Substitution</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>7</td><td>-3</td><td>10</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">Cost effective alternative to traditional methods of removing contamination with the advantages of:
No abrasive or solvent damage to equipment or plant
Non toxic cleaning material reduces handling and storage requirements
No post cleaning residue to be removed
Ice pellets vaporise after impact leaving no waste products except the dislodged contamination</td></tr>
<tr><td>Expected Timescale to adoption</td><td>2009</td><td colspan="2">Duration of benefit once achieved</td><td>6 Years</td></tr>
<tr><td>Probability of Success</td><td>75%</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£ 5,896</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">A trial demonstration, which involved cleaning a severely contaminated transformer bank at a site adjacent to a cement works has confirmed that the process is as effective as traditional techniques and the expected benefits can be delivered.</td></tr>
<tr><td>Project Progress at March 2008</td><td colspan="4">Demonstration complete.</td></tr>
<tr><td>Collaborative Partners</td><td colspan="4">None</td></tr>
<tr><td>R&D Provider</td><td colspan="4">Ice Clean Engineering</td></tr>
</table>

<table>
<tr><td>Project Title</td><td colspan="4">Passive Battery Conditioning for Rural Remote Control Devices</td></tr>
<tr><td>Description of project</td><td colspan="4">Development and demonstration of a passive battery conditioning unit. These units will be retrofitted into existing control boxes associated with remotely controlled pole mounted equipment to extend the life of the standby batteries by maintaining the battery temperature between suitably defined limits.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 7,782
External £ 36,761
Total £ 44,543</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ 33,670</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 84,000</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 5,500
External £ Nil
Total £ 5,500</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">Central Networks has approximately 4000 remotely controlled pole mounted devices installed on its network. These devices are an essential part of our automation strategy and are required to operate when the power system is de-energised. To enable this, each device has a float charged lead acid standby battery located within the device's associated control box.

The life of these batteries is being considerably reduced by thermal effects within these exposed control boxes and necessitates an intensive battery replacement programme to avoid a loss of performance and protection capabilities on the network.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental / Technological Substitution</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>9</td><td>-3</td><td>12</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">This project aims to design and produce a passive battery conditioning unit that can be retro-fitted within the most prevalent type of existing control boxes and maintain the battery temperature between suitably defined limits such that extended battery life results.

The benefits are:
• Reduced operational costs associated with battery change programme and disposal of scrap batteries.
• Assurance of required performance and protection capabilities on network.

Reduced environmental impact, as batteries will not need such frequent replacement.</td></tr>
<tr><td>Expected Timescale to adoption</td><td>2013</td><td colspan="2">Duration of benefit once achieved</td><td>20Years</td></tr>
</table>

Probability of Success	50%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£ 58,832
Potential for achieving expected benefits	Initial testing indicated that battery temperatures could be maintained between predetermined limits, which should extend battery life with consequential cost, reliability and environmental benefits.		
Project Progress at March 2008	Remote monitoring of field sites is ongoing. An ENA R&D project to quantify the amount of battery life extension is being considered. A one page bulletin has been produced, which describes in more detail this project. This can be viewed on the Central Networks Research and Development web page: http://www.eon-uk.com/distribution/275.aspx		
Collaborative Partners	None		
R&D Provider	4Energy		

<table>
<tr><td>Project Title</td><td colspan="4">Non Invasive Overhead Line Inspection Techniques</td></tr>
<tr><td>Description of project</td><td colspan="4">Demonstrate and evaluate a series of innovative tools and equipment that are robust, relatively easy to carry and can be used to inspect and measure potential defects on pole top equipment without climbing the pole.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 1,703
External £ 600
Total £ 2,303</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ 7,674</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 17,000</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 3,000
External £ 2,700
Total £ 5,700</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">Regular inspections are carried out on the Overhead Line assets, in the form of helicopter or ground foot patrols. Both these types of inspections have their limitations as they do not allow very close visual inspection or detailed measurements to be taken at the pole top.
Climbing inspections are occasionally carried out where such activity is possible, but this normally requires an outage and incurs safety risks from working at height.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental / Technological Substitution</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>9</td><td>-5</td><td>14</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">The expected benefits of this condition assessment tool are:
• Independence from outage requirements and their time constraints
• Measurements provide improved information from sites which allows consistent investment decision making process for overhead lines
• Negates need for climbing thereby reduces safety risks to staff</td></tr>
<tr><td>Expected Timescale to adoption</td><td>2011</td><td colspan="2">Duration of benefit once achieved</td><td>10 Years</td></tr>
<tr><td>Probability of Success</td><td>25%</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£ 7,580</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">The costs are identified early stage costs. They do not reflect the likely full costs of implementation. These will be identified providing the outcome of the early stage is positive.</td></tr>
</table>

Project Progress at March 2008	Two different pieces of equipment were field trialled after completion of risk assessments: • Remotely operated video with wireless link for detailed visual inspection of 11kV and LV pole top equipment • Tester for remotely measuring the resistance of energised overhead joints in situ. Modifications to equipment have been completed after evaluation and assessment of initial trials Further demonstration of innovative inspection and measurement tools has continued with field staff.
Collaborative Partners	None
R&D Provider	Eastgood (HK) Ltd, Video capture Ltd,

<table>
<tr><td>Project Title</td><td colspan="4">Non Intrusive Testing of Tower Foundations</td></tr>
<tr><td>Description of project</td><td colspan="4">Demonstration to compare and evaluate various Non Destructive Testing techniques.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 9,625
External £ 93,075
Total £102,700</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ 117,805</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 222,000</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 1,500
External £ Nil
Total £ 1,500</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">Central Networks owns and maintains over 9,500 steel towers supporting overhead lines at voltages from 33kV to 132kV. Some of these towers were erected over 70 years ago and a variety of different foundations were used in their construction.

The traditional method of examining tower foundation condition is to excavate around individual tower legs to allow detailed visual inspection. This is a time consuming procedure, which also temporarily derates the tower's structural capabilities because it disturbs the consolidated backfill around the frustum block foundation. In addition crop and land damage compensation adds further to the high costs of the excavation associated with these inspections.

Advances in non-destructive inspection techniques for civil engineering can be applied to Overhead Line Tower foundations to determinate the condition and depth of buried foundations without the need for excavation. This project aims to evaluate and compare the following civil engineering non-destructive testing (NDT) techniques:

• Transient Dynamic Response Method (TDR) also known as Sonic Echo
• Linear Polarisation Resistance (LPR) using a Below Ground Corrosion meter (BGCMap)
• Pulse Velocity (Ultrasound) Measurements
• Ground Penetrating Radar (GPR)</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental / Technological Substitution</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>11</td><td>-1</td><td>12</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">• Evaluation of the usability of each of the various NDT methods in different environments

• Comparison between the results of the various NDT methods on overhead line tower circuits of different construction types

• Introduction of NDT should reduce both the costs and time taken in the future inspections of overhead line tower foundations.</td></tr>
</table>

Expected Timescale to adoption	2010	Duration of benefit once achieved	20 Years
Probability of Success	50%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£ 143,900
Potential for achieving expected benefits	Some of the techniques trialled have potential for inclusion in Central Networks on-going maintenance strategy and will provide benefits.		
Project Progress at March 2008	Completion of all Line Inspections and comparison and evaluation of the results started		
Collaborative Partners	None		
R&D Provider	Sterling Power Group Ltd		

<table>
<tr><td>Project Title</td><td colspan="4">Substation Communication Development</td></tr>
<tr><td>Description of project</td><td colspan="4">Demonstration of future communication options for Control, System Protection, Data Acquisition and Communication to distributed intelligent electronic devices at operational sites.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 3,156
External £ 3,365
Total £ 6,521</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £100,603</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 120,000</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 3,000
External £ 3,500
Total £ 6,500</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">An extensive communications infrastructure has been developed over time to provide critical operational communications and as a result these use a wide range of different technologies with provision from a variety of sources.

Some of these technologies are reaching the end of their useful life and at least one of our service providers has announced that they wish to withdraw some of their services by 2011 and replace it with a Next Generation Networks (NGN), which will not support the current specific requirements of the connected equipment.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental / Technological Substitution</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>13</td><td>-2</td><td>15</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">The operational communications network which will be developed as a result of this trial will have the following benefits:

• Backward compatibility with existing systems and legacy equipment / protocols
• Forward compatibility with future systems and new applications
• Reduced construction costs and time than existing systems
• Reduced running costs from infrastructure simplification and the use of remote management software
• Greater reliability from robust architecture and redundancy
• Increased security from encryption of both encapsulated legacy protocols and modern standards
• Ability to connect with distributed Intelligent electronic devices (IEDs)</td></tr>
<tr><td>Expected Timescale to adoption</td><td>2013</td><td colspan="2">Duration of benefit once achieved</td><td>25 Years</td></tr>
</table>

Probability of Success	50%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£ 159,287
Potential for achieving expected benefits	The project costs are identified early stage costs. They do not reflect the full costs of implementation. These will be identified providing the outcome of the early stage is positive.		
Project Progress at March 2008	• Installed equipment continues to be monitored and assessed. • Trial ethanet bridge using border gateway protocol installed between two operation sites.		
Collaborative Partners	None		
R&D Provider	BT and E.ON IS		

<table>
<tr><td>Project Title</td><td colspan="3">Impact of Climate Change on the UK Energy Industry</td></tr>
<tr><td>Description of project</td><td colspan="3">In 2006 the Met Office carried out a scoping study on the impacts of climate change on the UK energy industry. The report was the result of collaboration between E.ON UK, EDF Energy, National Grid and the Met Office Hadley Centre to scope the impacts of climate change on the UK energy industry.

This Phase 2 project was industry funded; it involved 11 UK energy companies and was undertaken by the Met Office. It focussed on the priorities identified by the earlier scoping study.

During the project new tools and methods required to understand the impact of climate change on the energy industry were developed and new data resources designed to address gaps in underpinning information were produced.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 8,506
External £ 43,900
Total £ 52,406</td><td>Expenditure in previous (IFI) financial years</td><td>Total £ 27,952</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 554,000</td><td>Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 2,000
External £ Nil
Total £ 2,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="3">The project has been run as a series of work packages (WP). Those WPs relevant to distribution and transmission are described below:

• WP1 - Modelling Energy Impacts. Models created to assess impacts of climate change on Electricity Demand, Conductor Performance, Transformer Performance, Cables, Overhead Network, and Wind Power.

• WP2 - Guidance for the Energy Industry on the use of the United Kingdom Impacts Programme new scenarios of climate change (UKCIP08). UKCIP08 is planned for released in November 2008.

• WP3 - Climate Models and Wind Projections. Investigating methods of including estimated future wind resource in wind farm viability.

• WP4 - Climate Change and Underground Cable Performance. Modelling future soil conditions to increase understanding of the impacts of climate change on cables.

• WP6 - Climate change and the Urban Heat Island Effect. Producing information on the urban heat island for use when planning infrastructure in cities.

• WP7 - Final reporting and presentation of the results to each company.

• WP8 - Predicted climatologies for the UK: 2008 - 2018</td></tr>
</table>

<table>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Technological Substitution</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>18</td><td>-5</td><td>23</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">The expected benefits of project are:
• For the elements assessed an understanding of the sensitivity to climate change and key meteorological drives of the impacts. This will highlight priorities for adaptation.
• New models for projecting impacts suitable for inclusion in climate models or for application to climate model output.
• Guidance on the application of climate models to energy industry applications which should result in appropriate use of climate information by Networks.
• New information on urban heat islands and climatologies for the next 10 years to assist infrastructure design and planning.</td></tr>
<tr><td>Expected Timescale to adoption</td><td>2011</td><td colspan="2">Duration of benefit once achieved</td><td>20 Years</td></tr>
<tr><td>Probability of Success</td><td>50%</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£ 100,000</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">There is a good chance of achieving the expected benefits. This was a year long project that finished at the end of May on time and to budget and to specification.
Project outputs and reports are now available via the project website.
The project has highlighted some areas of Networks where no change to existing practice is required because of climate change and other areas where adaptation may be beneficial.
The new models that have been developed and used in this project will be a useful legacy.
The new information produced specifically for the energy industry has been demonstrated to have significant benefits over what was available previously.</td></tr>
</table>

Project Progress at March 2008	In March 2008 the status of the project work packages was as follows. • WP1 - Complete • WP2 - 50% Complete • WP3 - Complete • WP4 - 90% Complete • WP6 - 90% Complete • WP7 - 50% Complete • WP8 - 80% Complete Overall the project was 75% complete. An executive summary of the Impact of Climate Change on the UK Electricity Industry can be viewed on the Met Office EP2 website: www.ep2.org.uk
Collaborative Partners	All UK Network operators and most energy supply businesses.
R&D Provider	Met Office

<table>
<tr><td>Project Title</td><td colspan="4">EA Technology ACTIV Project</td></tr>
<tr><td>Description of project</td><td colspan="4">This project investigates active voltage control to increase the efficiency of existing distribution networks and facilitate the connection of more distributed generation. It will undertake demonstrations of the Fundamentals SuperTAPP n+ automatic voltage control (AVC) relay and develop associated modelling criteria for network planners.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 7,768
External £ 38,556
Total £ 46,324</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ Nil</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 300,000</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 48,000
External £ 14,000
Total £ 62,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">To investigate the performance of the Fundamentals SuperTAPP n+ AVC relay to regulate voltage on 33kV and 11kV network feeders with load and generation present.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental / Significant</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>13</td><td>-7</td><td>20</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">The expected benefits of the project are:
• Enabling the connection of distributed generation using a simple solution which requires minimal network modification
• Improving the voltage profile of supply
• Reducing the requirement for network extensions or reinforcement and increasing the capacity for the connection of distributed generation
• Reducing the risk of voltage being outside statutory limits and thus damaging equipment and injuring personnel</td></tr>
<tr><td>Expected Timescale to adoption</td><td>2010</td><td colspan="2">Duration of benefit once achieved</td><td>10 Years</td></tr>
<tr><td>Probability of Success</td><td>75%</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£ 223,000</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">With one trial site installed with promising initial results and a further two identified, there is a high probability that the expected benefits will be achieved.</td></tr>
</table>

Project Progress at March 2008	• The project is currently on schedule and budget. The first relay and monitoring equipment was installed during March in two transformer sites in CE Electric, which has a landfill generator connected on one feeder that is also supplying load • Initial results show that the estimation follows the generator output well for a landfill gas generator with a steady output. It was able to estimate significant changes in output. • Detailed network analysis have been carried out on a 33kV network in Central Networks, which has several wind turbines connected in preparation for a further installation during 2008/09.
Collaborative Partners	CE Electric, EDF Energy and Scottish Power
R&D Provider	EA Technology Ltd, Fundamentals Ltd and E.ON Engineering

<table>
<tr><td>Project Title</td><td colspan="4">Control System Automation Algorithm</td></tr>
<tr><td>Description of project</td><td colspan="4">Development and demonstration of Self Healing Networks by using an automated switching algorithm which can carry out real-time circuit tracing to identify source and alternative supplies.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 65,946
External £ Nil
Total £ 65,946</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ Nil</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 121,000</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 25,000
External £ Nil
Total £ 25,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">Preconfigured automated switching schemes triggered by protection operations, loss of supply or automatic switch operation are generally intolerant of abnormal network running arrangements and are not particularly suitable for distribution networks where regular reconfiguration is necessary for maintenance or repair activities.

Preconfigured automation schemes also need to be individually adapted for individual circuits and therefore require changing if the normal running arrangement is altered for any reason. As this is a regular occurrence on large 11kV distribution networks, it creates a considerable maintenance commitment.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Significant</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>14</td><td>-2</td><td>16</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">• Increased probability of correct restoration operations because the automation algorithm will trace circuit configuration in real time and adapt to any changes. All relevant information on the network held in the control system will be taken into account.
• Improved fault restoration times because algorithm will allow deployment of automation to networks irrespective of abnormal running arrangements or network alterations.
• More efficient data management since no preconfigured schemes are necessary. Operators do not have to switch schemes in/out.
• Improved safety due to ability to carry out real time checks for work activity and temporary plant operational restrictions on circuits.</td></tr>
<tr><td>Expected Timescale to adoption</td><td>2010</td><td colspan="2">Duration of benefit once achieved</td><td>10 Years</td></tr>
<tr><td>Probability of Success</td><td>50%</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£ 533,000</td></tr>
</table>

Potential for achieving expected benefits	Project has progressed to the stage where it can be demonstrated on a real distribution network.
Project Progress at March 2008	• Algorithm pre-requisites, assumptions and requirements defined. • Algorithm developed and built into Network Management System Environment. • Algorithm has been successfully tested on a network simulator • Presentation for CIGRE Smart Grid Conference in May 2008
Collaborative Partners	GE Energy
R&D Provider	Central Networks

<table>
<tr><td>Project Title</td><td colspan="5">Earthing Information System</td></tr>
<tr><td>Description of project</td><td colspan="5">The project will develop a GIS Information System to assist the installation of rural ground earthing systems, by providing a graphical presentation of ground conditions and the likelihood of a suitable earthing resistance being met.

Earthing rural substations can be very labour intensive, with the need to drive earthing rods vertically downwards into the ground to a depth of 12 metres to achieve the necessary 10 ohm resistance. Usually rods are driven by pneumatic tools or by hand and where hard ground restricts the depth of installation an array of rods is installed at shallower depth, or an earthing system is installed some distance from the substation to achieve the required resistance.</td></tr>
<tr><td>Expenditure for financial year</td><td colspan="2">Internal £ 4,380
External £225,000
Total £229,380</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ Nil</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td colspan="2">£465,000</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 10,000
External £ Nil
Total £ 10,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="5">A network-wide information system that will help them to improve planning and costing of new and replacement earthing installations.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Significant</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td colspan="2">Overall Project Score</td></tr>
<tr><td>9</td><td>-4</td><td colspan="2">13</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="5">The expected benefits are:
• Accurate estimation of the cost of installation of rural ground earthing systems
• Advice on the number and technique of installation
• Employee safety</td></tr>
<tr><td>Expected Timescale to adoption</td><td colspan="2">2012</td><td colspan="2">Duration of benefit once achieved</td><td>20 Years</td></tr>
<tr><td>Probability of Success</td><td colspan="2">50%</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£ 110,000</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="5">This collaboration with EDF Energy is proceeding well. Regular meetings have ensured issues are resolved with the minimum of delay.</td></tr>
</table>

Project Progress at March 2008	• Ease of Installation - BGS has collated all available engineering properties for the two test areas to allocate strength values to DIGMAP and a first-pass working layer of engineering properties has been established. Cranfield has mapped the areas with rock close to the surface, as well as soil with either impermeable horizon, excess of gravel in the profile or soils which have been established over gravel indicating areas in which installation will require heavier equipment. • Electrical Resistivity - BGS has collated all available data for the test areas from resistivity sounding databases and Cranfield has collated all relevant soil properties and developed a model to generate worst case scenarios for both soil moisture and soil temperature related changes in soil resistivity. Next steps - The integration of the relevant datasets for both the Ease of Installation and the Electrical Resistivity assessment
Collaborative Partners	EDF Energy
R&D Provider	British Geological Survey and Cranfield University

<table>
<tr><td>Project Title</td><td colspan="4">SuperGen - FlexNet</td></tr>
<tr><td>Description of project</td><td colspan="4">SUPERGEN FlexNet will put in place a substantial body of work that will build on the achievements of SUPERGEN FutureNet and lay out the major steps, technical, economic, market design, public acceptance and others, that will lead to flexible networks, including starting to showcase these so that they can be taken up by the commercial sector, Government and Regulators for practical implementation.</td></tr>
<tr><td>Expenditure for financial year</td><td colspan="2">Internal £ 2,286
External £ 25,200
Total £ 27,486</td><td>Expenditure in previous (IFI) financial years</td><td>Total £ Nil</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td colspan="2">£ 6,900,000</td><td>Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 3,000
External £ 20,000
Total £ 23,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">The Engineering and Physical Sciences Research Council (EPSRC) is the major research funding agency for Universities in the UK. One of the EPSRC initiatives is funding work in the area of Sustainable Power Generation and Supply and a call was put out in 2004 to a group of universities to address the issues facing the UK energy infrastructure. The SUPERGEN FutureNet consortium was formed which addresses a range of issues through a number of targeted work programmes and this was extended in 2007 to become SUPERGEN FlexNet. Some key questions being addressed are:
How can we judge the degree of flexibility needed?
How can flexibility be achieved?
How much flexibility should come from primary plant giving margin and how much from secondary plant giving enhanced controllability?
What constrains or encourages flexibility, what technologies are acceptable and what economic frameworks and public policies provide flexibility at the least overall long term cost?</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Technological Substitution / Significant / Radical</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>11</td><td>-2</td><td>13</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">Each work stream is expected to deliver benefits.
Shape & Size of Future Electricity Networks will build on FutureNet scenarios.
Markets & Investments will investigate economic issues of the electricity market.
Power System Electronics will investigate why capital cost, cost of power losses and concerns over local network integration result in power electronic systems are currently restricted to voltage control.</td></tr>
</table>

	• Smart, Flexible Controls will help network operators understand the benefits of changing network operation philosophy and the requirements for implementation. • Customers, Citizens & Loads will analyse potential contributions that customers and responsive demand can make towards enabling a more flexible energy system, identify barriers to this participation and possible remedies, and analyse place-related factors shaping public acceptance of a more flexible network infrastructure. • Validation & Showcase will provide the basis for testing research outcomes in a representative environment and demonstrate their effectiveness in addressing problems central to the realisation of flexible power networks. • Future Energy Mix will consider possible energy changes in 2050 and examine the impact of these changes on energy transportation networks. • Future LV Networks will investigate losses through auditing and analysing the relative impact of load-profile, sharing, imbalance and sag on losses. • Education, Deliberative Engagement & Public Acceptance of Future Network will inform social issues and engagement.		
Expected Timescale to adoption	2012 onwards	Duration of benefit once achieved	20 Years
Probability of Success	25%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£ 200,000
Potential for achieving expected benefits	Some of the consortium members who produced the results of SUPERGEN I - FutureNet are continuing to participate in FlexNet. It is expected that the quality of work will continue. The input of the industrial partners will be able to enrich the research with their own experiences.		
Project Progress at March 2008	The project started in October 2007 with recruitment of PhD students and research assistants to undertake the research. The project management and steering groups have been established to manage and govern the progress of the project. Some of the work-streams are already producing some useful results. Further information can be obtained from: www.supergen-networks.org.uk/index.htm		
Collaborative Partners	CE Electric, EDF Energy, Electricity North West, EPSRC, National Grid, Rolls-Royce plc, Scottish and Southern Energy and Scottish Power		
R&D Provider	Universities of Bath, Birmingham, Cambridge, Cardiff, Edinburgh, Manchester, Strathclyde, Surrey and Imperial College London		

<table>
<tr><td>Project Title</td><td colspan="4">Distribution Working Group - Update of R&D Register</td></tr>
<tr><td>Description of project</td><td colspan="4">The Distribution Working Group (DWG) is a subgroup of the Electricity Networks Strategy Group which is jointly chaired by BERR and Ofgem. The DWG continues the work of the earlier Distributed Generation Co-ordination Group (DGCG), examining issues to enable the integration of generation onto the distribution network. The DWG manages several work programmes which initiate and manage a series of projects which are normally completely funded by BERR.</td></tr>
<tr><td>Expenditure for financial year</td><td colspan="2">Internal £ 2,524
External £ 9,659
Total £ 12,183</td><td>Expenditure in previous (IFI) financial years</td><td>Total £ Nil</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td colspan="2">£ 12,183</td><td>Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 0
External £ 0
Total £ 0</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">It was agreed with Ofgem that Central Networks (as the chair of DWG Programme P03) should fund the update of the DWG R&D Register and that the costs could be submitted as IFI expenditure.
Presentation and accessibility of the Register would also be improved.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">n/a</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>n/a</td><td>n/a</td><td>n/a</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">An updated and improved presentation will increase accessibility to the register which provides a useful resource for Network Operators and other stakeholders.</td></tr>
<tr><td>Expected Timescale to adoption</td><td colspan="2">2008</td><td>Duration of benefit once achieved</td><td>1 Year</td></tr>
<tr><td>Probability of Success</td><td colspan="2">100%</td><td>Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£ n/a</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">Updated register in complete and can be found at:
http://www.ensg.gov.uk/assets/anm_deployment_register_-_january_2008_-_final.pdf</td></tr>
<tr><td>Project Progress at March 2008</td><td colspan="4">• Existing register entries substantially updated and new entries added including more international projects
• New fields on register to fully provide development/deployment status, type of solution (e.g. DSM, voltage control, etc.), scale and impact being added and populated</td></tr>
<tr><td>Collaborative Partners</td><td colspan="4">n/a</td></tr>
<tr><td>R&D Provider</td><td colspan="4">Strathclyde University</td></tr>
</table>

<table>
<tr><td>Project Title</td><td colspan="4">City Centre Substation Cooling</td></tr>
<tr><td>Description of project</td><td colspan="4">This project will develop passive cooling techniques to apply to existing secondary substations. The cooling solutions will address the issues of reinforcement and the growth of air conditioning and cooling in city centre sites.

Specifically deployment will:
• Lower secondary transformer skin temperatures by 10°C on all sites enabling load ratings to be re-benchmarked
• In conjunction with the battery management ensure that power is available for automatic regeneration when required.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 4,660
External £ 17,854
Total £ 22,513</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ Nil</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£125,000</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 5,500
External £ 45,000
Total £ 50,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">Cooling of secondary transformer without recourse to large forced convection or vapour compression air conditioning systems.

Developing systems that are easy to fit to existing substations with minimal changes for specific site requirements, use less power than a domestic light bulb with little maintenance requirement.

Extend the capability of passive cooling in substations to ensure that the need for moving parts is drastically reduced.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental / Significant</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>10</td><td>-6</td><td>16</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">The expected benefits include:
• Extended life of installed transformer capacity.
• The removal of load rating issues from secondary transformer sites especially during summer months</td></tr>
<tr><td>Expected Timescale to adoption</td><td>2009</td><td colspan="2">Duration of benefit once achieved</td><td>20 Years</td></tr>
<tr><td>Probability of Success</td><td>85%</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£128,340</td></tr>
</table>

Potential for achieving expected benefits	Extensive off line modelling has helped understanding of hot air flows in transformer substations. Quarter scale models have been built to simulate the solutions and extensive design work has been undertaken to ensure that civil building regulations have been adhered to. An immediate improvement on the installed site has been demonstrated as noted below. Collaboration has enabled the experience and best practice from installations on different networks to be input into the Birmingham Wholesale Market version. This work has been undertaken in conjunction with a Carbon Trust sponsored project in the telecommunication sector to provide alternative methods of cooling to traditional solutions.
Project Progress at March 2008	Alpha system installed for 5 months in Birmingham Wholesale Market. The 3MVA Substation is heavily loaded and subjected to non-cyclic refrigeration demand. A reduction of 20°C from between 60°C and 70°C transformer skin temperature has been achieved by the removal of previously installed cooling.
Collaborative Partners	EDF Energy
R&D Provider	4Energy

<table>
<tr><td>Project Title</td><td colspan="4">Pole Mounted Fault/Load Monitor</td></tr>
<tr><td>Description of project</td><td colspan="4">The aim of this project was to develop and trial a reliable non-contact Fault/load remote monitor up to 33kV.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 6,861
External £ 68,260
Total £ 75,121</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ Nil</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 106,500</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 8,000
External £ Nil
Total £ 8,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">Fault Passage Indicators (FPIs) have been used for many years and have evolved from simple blinking light indications to the latest devices that include an array of communications and sensor technology. The Polestar FPI was selected for a trial with the aim of gathering data and developing communications protocols to allow the FPI to communicate with the control room management system.

The Polestar Device is non-contact, installed 3 metres below 11kV conductors on the pole. It detects the presence and magnitude of the magnetic and electrical field in the vicinity of the conductor and uses a GSM/GPRS modem to report alarms, routine events and field capture trends to a central iHost Platform.

The objective of this project is:
• Trial the device and prove the concept.
• Develop load monitoring algorithms
• Evaluate the potential replacement for existing dumb fault passage indicators (FPIs) and power outage devices (PODs) on OHL networks
• Obtain real-time fault/load data to improve fault location response times
• Obtain historical load data for planning network reinforcement or development</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental / Significant</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>12</td><td>-5</td><td>17</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">The expected benefits are:
• Reduction in CMLs and CIs
• Improved quality of supply
o On-line load monitoring assists in network management
o Gathering fault data and outage data can be used with automation schemes in helping to determine which NOP to close and what load would be picked up
o Gathering of historical load data for planning or network</td></tr>
</table>

	development and faster restoration		
Expected Timescale to adoption	2012	Duration of benefit once achieved	10 Years
Probability of Success	75%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£ 151,000
Potential for achieving expected benefits	This project stems from a strategy of developing our infrastructure to allow greater visibility of the network loads in the control room at any instant in time. The Pole Stars can be installed without any outage making them an attractive device. Once the results are calibrated they will provide another means to better manage issues such as DG connections.		
Project Progress at March 2008	Six prototype devices were installed on overhead lines in Central Networks to allow an initial assessment as to their accuracy to be carried out and the software to be calibrated. Traces from a fault which occurred during this assessment period provided useful calibration data and these have been circulated to the collaborative partners. Additional demonstration units have been purchased and are ready for installation.		
Collaborative Partners	Electricity North West and Scottish & Southern Energy		
R&D Provider	Nortech		

<table>
<tr><td>Project Title</td><td colspan="4">Vegetation Management</td></tr>
<tr><td>Description of project</td><td colspan="4">This project proposes to:
• Monitor vegetation growth at 1650 sites across the UK network
• Develop a software model, which will take into account factors such as tree species, bio-climatic area, and the effect of climate change, in order to estimate the speed of vegetation growth at different sites.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 5,857
External £136,103
Total £141,960</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ Nil</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 1,740,000</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 8,000
External £120,000
Total £128,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">Historically vegetation management has been based on a single time based interval across the company, but rate of vegetation growth differs because of locational micro climates and soil conditions.
Nationally the growing season has been increasing due to climate change factors.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental / Significant</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>14</td><td>-4</td><td>18</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">The software tool will enable Central Networks and other DNOs to predict whether areas are high growth or low growth areas, and hence allow two-fold savings:
• In high-growth areas, proactive cutting can be carried out, therefore reducing the number of outages (by cutting before the vegetation enters the live zone) and cost to DNOs.
• Simultaneously, cutting cycles in low growth areas will be extended, resulting in fewer spans being cut each year.</td></tr>
<tr><td>Expected Timescale to adoption</td><td>2011</td><td colspan="2">Duration of benefit once achieved</td><td>20 Years</td></tr>
<tr><td>Probability of Success</td><td>50%</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£400,000</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">The project is progressing in accordance with the project plan and is on course to deliver the initial results at the end of December 2008.</td></tr>
</table>

Project Progress at March 2008	The project is being delivered in line with the project plan: • Sample sites have been set up for Central Networks, EDF energy, National Grid, and Scottish Power. • Consents to use the sites for research for the next four years have been obtained from land owners and the initial measurements have been made.
Collaborative Partners	EDF Energy, Electricity North West, Scottish and Southern Electric, Scottish Power and National Grid.
R&D Provider	ADAS

<table>
<tr><td>Project Title</td><td colspan="4">Aerial Mapping Demonstration</td></tr>
<tr><td>Description of project</td><td colspan="4">A demonstration of how aerial digital photography can be used to enhance existing geospacial systems and confirm existing data positioning.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 5,252
External £ 37,650
Total £ 42,902</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ Nil</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 94,000</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 7,000
External £ 44,000
Total £ 51,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">The introduction of OSMasterMap as a background for existing GIS data has had the unforeseen consequence of certain asset types (in particular overhead distribution poles), which will retain their inaccurate position on the new map base. Software is available to correct these inaccuracies, but there was an uncertainty as to the degree original data was correctly positioned and therefore a risk that any errors could be compounded.

Conventional digital orthophotograph provides a mechanism to accurately position overhead poles and can also provide asset height information. This can therefore be used to identify any errors as well as to provide additional functionality. In addition the latest digital imagery can also provide CIR (False Colour Infrared) and panchromatic imagery. These can be used to develop Digital Surface Models classified by vegetation type and height.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>15</td><td>-1</td><td>16</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">This project will demonstrate the capabilities of aerial digital photography for providing information on overhead assets. In particular the following areas shall be evaluated:
• Understanding potential pole positioning errors.
• Identifying long spans where conductor clashing may be a problem.
• Providing ground clearance information.
• Location of different vegetation types.
• Location of vegetation of different heights.
• Identifying land use type including recreation and potential fishing sites.</td></tr>
</table>

Expected Timescale to adoption	2009	Duration of benefit once achieved	20 Years
Probability of Success	50%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£ 167,000
Potential for achieving expected benefits	Initial progress has been very satisfactory and this project is likely to achieve the expected benefits.		
Project Progress at March 2008	The Central Networks GIS data set for Leicestershire was chosen as the demonstration area. • All EHV and HV Pole and Tower positions and heights were obtained with an accuracy of ±1m. Less than 0.1% of poles could not be located due to tree cover etc. Returned data set was compared with existing recorded pole positions. • All span lengths calculated and those in excess of the basic span identified.		
Collaborative Partners	None		
R&D Provider	Infoterra and Rotla		

<table>
<tr><td>Project Title</td><td colspan="4">Flood Risk Modelling</td></tr>
<tr><td>Description of project</td><td colspan="4">Predicting flooding and calculating flood risk is complex. The Environment Agency provides information on the risk from river flooding (fluvial) and sea breach, but information on floods caused by direct runoff (pluvial) is limited. The extreme precipitation of July 2007 caused at least one pluvial event in the Central Networks region and there is a need to identify the potential risks at critical sites.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 3,521
External £ 9,000
Total £ 12,521</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ Nil</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£97,500</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 5,000
External £ 65,000
Total £ 70,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">Pluvial flooding results from high intensity or prolonged heavy rainfall leading to overland flows and ponding. Flooding can also occur due to exceedence or blockage of watercourses and drainage systems. The risk depends upon a number of factors including topography, amount of impermeable surface within upstream catchments' areas and the drainage capacity within the catchment area.
Using a series of modelling tools on GIS and OS data will allow catchment areas around critical sites to be identified and the quantity of runoff calculated. Existing drainage and watercourse features can then be modelled and restrictions identified where pluvial risks are identified. Information from the DEFRA 'Making Space for Water' programme will be included.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Significant</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>15</td><td>-1</td><td>16</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">The proposed work will help to identify those critical sites at risk from pluvial flooding and enable a strategy that will prevent equipment damage to be developed.</td></tr>
<tr><td>Expected Timescale to adoption</td><td>2011</td><td colspan="2">Duration of benefit once achieved</td><td>25 Years</td></tr>
<tr><td>Probability of Success</td><td>50%</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£ 33,408</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">This project is progressing as planned.</td></tr>
</table>

Project Progress at March 2008	• Initial work has been carried out to identify those sites, which need to be assessed for Pluvial Flood risk. • The project methodology has been development following assessment of available modelling techniques.
Collaborative Partners	None
R&D Provider	ADAS

<table>
<tr><td>Project Title</td><td colspan="4">Vermin Deterrent</td></tr>
<tr><td>Description of project</td><td colspan="4">Research the cause of vermin damage and the efficiency of various means of deterrent.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 3,499
External £ 2,523
Total £ 6,022</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Total £ Nil</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 30,000</td><td colspan="2">Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 2,000
External £ 22,000
Total £ 24,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">The growth in the UK's grey squirrel population has resulted in a perceived increase in supply interruptions caused by vermin contact to overhead line plant and equipment.
This project will identify the type of equipment and locations at risk from grey squirrel damage and what can be done to reduce their attraction. This will include an investigation of the use and effectiveness of humane deterrents.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>7</td><td>-4</td><td>11</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">The aim of this project is:
• Reduction in number of supply interruptions from vermin contact
• Consequential improvement to performance & saving of fault costs
• Demonstration of a proactive approach to environmental protection</td></tr>
<tr><td>Expected Timescale to adoption</td><td>2010</td><td colspan="2">Duration of benefit once achieved</td><td>20 Years</td></tr>
<tr><td>Probability of Success</td><td>50%</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£ 3,656</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">The initial work has identified areas which will be explored in more depth.</td></tr>
<tr><td>Project Progress at March 2008</td><td colspan="4">As part of this project students from Ecclesbourne School supported by ADAS and Central Networks staff carried out a research project as part of their involvement in the EES.
They have investigated the effectiveness of various deterrents (including visual and acoustic) and will report back their findings in April.</td></tr>
<tr><td>Collaborative Partners</td><td colspan="4">Engineering Education Scheme (EES)</td></tr>
<tr><td>R&D Provider</td><td colspan="4">Ecclesbourne School, Derby and ADAS</td></tr>
</table>

<table>
<tr><td>Project Title</td><td colspan="3">GPS Recording of Underground Equipment</td></tr>
<tr><td>Description of project</td><td colspan="3">Demonstrate the viability of GPS equipment to record underground equipment and identify the requirements both for electronic transfer of data and the operator interface.</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £ 4,859
External £ 9,291
Total £ 14,150</td><td>Expenditure in previous (IFI) financial years</td><td>Total £ Nil</td></tr>
<tr><td>Total Project Costs (Collaborative + external + Central Networks)</td><td>£ 19,150</td><td>Projected 2008 - 2009 costs for Central Networks</td><td>Internal £ 5,000
External £ Nil
Total £ 5,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="3">The upgrade to OS MasterMap will enable the accurate capture of asset locations using GPS recorders. A demonstration of this technique using hand held equipment will be carried out to prove the functionality and identify how best to achieve a user-friendly operator interface.

Positioning underground assets such as cables and joint positions is considered to be the most challenging requirement (regarding satellite visibility) and provided the most benefits (buried assets would be the most difficult to locate in the future).

Determining a user-friendly operator interface to the GPS recorder device, such that information transfer can be efficiently carried out, while data entry requirements could be kept simple, but sufficiently comprehensive to fulfil business needs.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Technological Substitution</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>8</td><td>-3</td><td>11</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="3">The accurate location of buried assets will assist future work, by:
• Reducing the time spent finding buried equipment
• Increasing safety when future excavations are being carried out by internal or external parties

Providing a GPS recording device with a user-friendly interface will benefit measurement collection, by:
• Reducing the time spent recording the position of equipment
• Ensuring that the device is used and that the required information is captured</td></tr>
<tr><td>Expected Timescale to adoption</td><td>2011</td><td>Duration of benefit once achieved</td><td>10 Years</td></tr>
<tr><td>Probability of Success</td><td>50%</td><td>Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£ 29,000</td></tr>
</table>

Potential for achieving expected benefits	This project is at an early stage, but is expected to deliver the identified benefits.
Project Progress at March 2008	• GPS receiving equipment has been purchased and is in the process of being trialled. • Requirements for data transfer requirements are being specified. • Operator interface requirements are under consideration.
Collaborative Partners	None
R&D Provider	Korec and Central Networks