Electricity North West Ltd

IFI Annual Report 2008/09

1 About this Report

This report sets out the details of our IFI funded activities for 2008/2009. It begins with a brief description of our business and the challenges we face and then goes on to describe our view of IFI and the role of research and development in the electricity distribution industry. We then illustrate the benefits we have gained from IFI by describing a short résumé of a number of our project successes and the collaborations we have established with partner organisations. We conclude with describing an overview of the current IFI year and our aspirations for the coming year with our statutory report of project descriptions and year end figures.

Our current projects for 08/09 and their associated remit are listed below;

Project Title	Business Area	Partners and Collaborators
STP M5	Connection of DG	UK DNOs
Distribution Transformer with OLTC	Connection of DG	Areva Technology Centre
LineTracker Trial	Connection of DG	EdF
Line Tracker Development	Connection of DG	Nortech, Gridsense
Superconducting Fault Current Limiter	Connection of DG	SP Power Systems, CE Electric UK, Applied Super Conductors Ltd
LineTracker/iHost Development	Connection of DG	Nortech, Gridsense
Flex Net	Connection of DG	EoN, National Grid, EDF Energy, Scottish Power, SSE, ABB, GE, Rolls-Royce, OFGEM, Greenpeace, CE Electric. Georgia Tech, MIT
Wide Area Data Gathering	Connection of DG	Amperion, The Joule Centre
Fault Master Developments	LV persistent fault rectification	Kelvatek (formerly Kelman), EdF
TP22 Development	LV persistent fault rectification	Kehui (UK) Ltd, SP
Delta V Developments and Trial	LV persistent fault rectification	Kelvatek (formerly Kelman)
Modular/Master Slave Rezap	LV persistent fault rectification	Kelvatek (formerly Kelman)
FuseRestore	LV persistent fault rectification	Kelvatek (formerly Kelman)
STP M3	Quality of Supply	UK DNOs
Fault Level Monitor	Quality of Supply	ENA Member companies
Expansion Planning V2	Quality of Supply	Vertex Data Science Ltd, EATL,
LV Sure	Quality of Supply	SP Power Systems, EdF, SSE
Pole Mounted Fault/Load monitor	Quality of Supply	Central Networks
Vegetation Management	Quality of Supply	Other DNOs, ADAS
Radiometric Arc Fault Location	Quality of Supply	SP Power Systems, SSE, CN
LV Sure St 2	Quality of Supply	SP Power Systems, SSE

Transient Resonance Study	Quality of Supply	United Utilities Electricity Services
STP M2	Asset Management	UK DNOs
STP M4	Asset Management	UK DNOs
CBRM	Asset Management	None
Criticality Assessment	Asset Management	None
SuperGen V	Asset Management	UK Universities and DNOs
Functional Spec for ROCOF relays	Asset Management	ENA Member companies
Vista	Asset Management	Other DNOs and other utility companies, Leeds University
ESR Network	Asset Management	Universities, DNOs, Generators, Industrial Companies
Chromatic Analysis of Insulating Oil	Asset Management	MHA Ltd, University of Liverpool, The Joule Centre
EATL Forums	Asset Management	Other DNOs
CBRM Cables	Asset Management	None
UltraTEV Alarm	Asset Management	All DNOs
Alternative Oil Stage 2	Asset Management	AREVA T&D, EDF Energy, Electricity North West, M&I Materials, National Grid, Scottish Power and TJh2b

2 About Us

ENW, owner of a regulated electricity distribution network, separated from United Utilities almost 18 months ago, following a sale to Commonwealth Bank of Australia, [Citicorp Nominees Pty Limited as custodian for CFS Managed Property Limited as responsible entity for the CFS Global Diversified Infrastructure Fund, Citicorp Nominees Pty Limited as custodian for Colonial First State Investments Limited as responsible entity for the Colonial First State Wholesale Infrastructure Income Fund] and IIF Int'l NWEN UK Cayman Limited which is controlled by IIF Int'l Holding GP Ltd, a constituent of the JPMorgan Infrastructure Investments Fund. Consequently Electricity North West Limited became the new name of the Licensed Distribution Network Operator for the north west of England.

Whilst the assets are now owned by ENW, our network is operated and maintained on our behalf by our partner organisation United Utilities Electricity Services (UUES) who provide a range of operational activities through our Asset Services Agreement.

We are continuing to develop our internal and external relationships under our new identity and as our company matures we see an exciting future ahead for research and development and believe that it will be a major contribution to our goal to be the leading UK energy delivery business. We are committed to achieving the highest standards of safety in all our activities and value professionalism, respect, integrity and teamwork as the core of our company values whilst taking every opportunity to demonstrate our enterprising and innovative approach.

ENW is unique when compared to other electricity companies in the UK in a number of ways. For example, we do not employ any front line operational staff, we do not sell electricity, we only hold one licence and 100% of our staff are all co-located in one building in Warrington. We firmly believe that these differences are in fact our strengths and will provide us with a great platform from which to face the research and development challenges ahead.

3 About IFI

It is clear that we are at the beginning of a great change in the use of electricity distribution networks in the UK to accommodate higher levels of renewable energy sources at all voltage levels. Clear signals are now being given that there is an acceptance that market driven forces will not deliver the scale of shift away from fossil fuel energy to renewable energy sources that are required to enable the UK to meet its binding targets for emission reductions. ENW's role as a distribution network operator in facilitating this shift lies between the changing demands of customers for more flexibility in how and when they purchase electricity and the changing role of generators as the mix of generation types changes. Our commitment is to facilitate this shift in the use of our network by using IFI and other means to continue to invent new solutions and provide whatever type of network and service our stakeholders require.

After almost five years of IFI the previous years of continual decline in research and development in our industry has been turned round and we acknowledge Ofgem's very positive role in the inception and continuing support for IFI. However, the level of spending on research and development through IFI and the other leveraged funding we can achieve through various collaborations still falls well short of the UK average for similar industries. The recently published Department for Innovation, Universities and Skills (now the Department for Business, Innovation and Skills from June 2009) 2008 R&D Scorecard makes interesting reading as a comparison of R&D spending across UK industry and shows that DNOs are still investing comparatively little on R&D by any measure. Whilst this level of spending has certainly had a very positive impact, the level of R&D funding is likely to need to increase significantly if we are to deliver the required change in the use of distribution networks.

4 Benefits and Successes

The revision of ENA ER G85 to version 2 has developed our understanding of the longer term benefits of IFI funded projects. The recognition of the benefits of knowledge transfer for example has allowed us to develop understanding in areas previously unfamiliar. For example, we have invested significantly in trials of conductor mounted sensors to monitor conductor temperature and load and have developed real experience of the advantages and disadvantages of these devices, experience that we previously did not have.

Other notable successes from our IFI projects include;

4.1 Kelvatek - Re-Zap CI/CML/fuse restorer strategy implementation

We have been able to adopt a long term strategy supported by IFI funding to address our worst performing LV circuits. Approximately 60% of all low voltage underground mains faults are intermittent meaning that all that is often required to restore customer supplies is to replace a fuse. However, these types of faults can re-occur a number of times repeatedly disconnecting the same block of customers. This situation is made worse by the fact that their intermittent nature makes the exact position of the fault very difficult to locate and effect a permanent repair.

We are using IFI funding to develop a number of new tools to address each stage of LV fault development. For intermittent LV faults (i.e. a single fuse operation in 6 months) our Fuse Restorer project in collaboration with Kelvatek is developing a device that carries two standard fuses and fits within the space envelop of a standard fuse holder. The device can detect when the fuse has blown and can automatically insert a second fuse into the circuit then send an email or SMS to a nominated contact to inform them of the device operation and location. This piece of equipment has taken a significant amount of development and testing as it is an entirely new device that was conceived in 2006 and as the project is nearing completion we expect to have the initial

field trials before the end of this year. For persistent faults (2 or more fuse operations in 6 months) we are collaborating with Kelvatek to redevelop the Re-Zap Fault Master to include:

- full remote communications with our control room server,
- GPS location tracking,
- automatic re-closing (from the control room),
- mobile phone controller,
- variable trips to lockout and auto reset capability,
- a load profiler,
- a distance-to-fault estimation capability.

For difficult to find faults on single feeders we have invested in further developments of the Kehui (UK) Ltd TP-22 which is able to accurately locate a faulty cable section and can detect the type of fault using advanced time-domain reflectometry algorithms and finally we are about to trial the redeveloped Delta V, again from Kelvatek, that uses plug-in nodes in customers premises' to locate faults on feeders with multiple tee-offs and mixes of different types of cables.

All these devices are being written into our standard policies for dealing with underground LV faults demonstrating how IFI has been used to develop and trial solutions to known issues that, if the projects are successful, eventually find their way into 'business as usual'.

4.2 Applied Super Conductors Ltd - SFCL

This year has been another first for our Superconducting Fault Current Limiter Project. This project began at the most basic concept stage as no such innovation had been attempted previously. There was no template for the design and no previous results or experience of using superconducting technology on electrical distribution networks in the UK. The development cycle began with only original notions and ideas based on a business case built around the potential financial savings from avoiding the costs of electrical network reinforcement. Almost every stage of the project development cycle required innovative solutions to new challenges, both from the SFCL designers and from ENW.

The SFCL has passed the design and verification stage and is now under trial within an 11kV primary substation in Lancashire. The device has been in its superconducting state for several weeks as the design calculations are tested against trial results and is due to be commissioned and energised at 11kV in July 2009.

Applied Superconductors Ltd presented a joint paper at CIRED 2009 describing the SFCL and the many technical challenges that have been overcome and we were pleased to be able to enter the SFCL for the IET North West Innovation Awards in 2009.

The next stage of the development cycle is to redesign the superconducting elements to push the boundaries of what can be achieved with the present ceramic materials (Bismuth, Strontium Calcium Copper Oxide) by increasing the electrical rating for use on circuits with greater levels of renewable energy penetration. Subsequent prototype trials are planned with our project partners, SP Energy Networks and CE Electric UK and great credit should go to Applied Super Conductors Ltd at Blyth for their ability to find innovative solutions to the most difficult technical problems.

4.3 ADAS – Vegetation Management

Our long term Utility Space Degradation project with ADAS has continued. The concept is based on maintaining the minimum clearances (or minimum 'space') around overhead conductors by observing the growth of vegetation into the space and measuring the degradation of the space as vegetation grows in from any direction. The key goals of the project include developing statistically robust models of USD by DNO geographical and bioclimatic zones, developing a spatial/temporal knowledgebase of USD and related environmental drivers for the UK, developing a model for spatial/temporal extrapolation, optimising the amount and frequency of cutting schedules to maintain safe distances and understanding the likely impacts of climate change on vegetation management. The project is well underway with 230 of the 1650 measurement locations based in the ENW licence area, the initial survey and cut has been completed and the sites are now being re-surveyed and the USD measured. We are already beginning to see a clear correlation between individual species growth rates and bioclimatic location and the variation in these growth rates between northern and southern locations. The project still has several more years before completion but we believe that it will provide a very robust method of assessing future growth rates and optimised cutting programs (and the associated financial costs) against a number of global warming scenarios.

4.4 Chromatic Analysis of Insulting Oil – development work with Liverpool University

The management and handling of both new and used insulating oil is subject to new legislation, is becoming more expensive and invariably leads to some type of negative local environmental impact therefore a project was initiated with Liverpool University to apply a long standing and well proven data analysis technique to the testing of mineral insulating oil. The objective of the project was to develop a non-intrusive method of analysing insulating oil without the use of traditional analytical chemistry techniques and without requiring direct contact with the oil.

The Department of Electrical Engineering at Liverpool University have developed an investigation technique based on the 'Chromatic' analysis of materials. The technique uses ordinary white light from any source as a stimulus and analyses the frequency and intensity of reflected light from the visible to near-infrared part of the spectrum to determine any changes in the state of the material. This project is based on using the Chromatic analysis technique to detect small differences in the absorption spectrum of mineral insulating oil that should arise from chemical changes produced by different partial discharge and heating phenomena. This method provides chromatic values for the spectral signature from the processed output of two or three optical photo detectors specifically aligned to discriminate small changes in the optical spectrum. Although the technique is well established in other industries it has not previously been applied to electrical insulating oil.

The project work was based on 10 samples of oil from primary transformers whose condition was known to ENW but not to Liverpool University and the technique successfully ranked the oil samples by condition. Further analysis of the samples after re-calibration of the filtering process revealed a strong indication of the levels of key gasses present leading to the belief that it is entirely possible to analyse insulating oil using the Chromatic technique.

Whilst this project was considered a success, it is clearly only based on a limited sample size and its success needs to be taken in context. We are currently considering a proposal for the next stage of the project which will transport the laboratory based analysis hardware to our oil re-processing plant at Blackburn, Lancashire to enable a Chromatic analysis of the oil sample to be carried out in conjunction with the standard techniques that are currently employed. The aim of this work will be to build up a large database of comparative tests for further analysis and to refine the technique further. The ultimate aim of the project will be to eliminate the need for

analytic chemistry altogether and develop a technique to test oil non-intrusively through clear pipes in the processing plant.

5 Collaborations

Again during this financial year we have had a further opportunity to develop and strengthen our relationships with a number of partner organisations.

We have continued to work with a number of universities through the various SuperGen Project consortia; FlexNet led by Strathclyde University and Amperes led by Manchester University. Both these projects are progressing well and, as SuperGen Amperes nears completion, we are working hard to ensure we develop internal processes to disseminate the work throughout the relevant parts of our organisation. We have also continued our relationship with Leeds University through the VISTA Project and Liverpool University through our oil analysis project. We continue to work closely with the Electricity Supply Research Network who are committed to raising the profile of UK electricity industry research by identifying R&D strategies in key areas and to ensure core competencies are maintained.

We are continuing our approach to develop new project ideas with a number of organisations such as EA Technology at Capenhurst, the Areva Research and Technology Centre at Stafford, Nortech at Pershore, Kelvatek (previously Kelman) in northern Ireland, Applied Super Conductors at Blyth, Kehui (UK) Ltd at Herts., ADAS of Wolverhampton, Gridsense of Australia and The Joule Centre at Manchester University.

6 Overview of 2008/09

The SuperGen projects have been a great success during this financial year and continue to bring the very best UK based academics to our industry. These large collaborations really allow us to leverage our IFI investments in such a way that we can get considerable intellectual input in an efficient manner and thanks are due to the coordinators of these projects and the EPSRC for providing funding. We are currently discussing a greater level of support for SuperGen FlexNet Work Programme 'Customers, Citizens and Loads' which has been researching the social and psychological aspects of large infrastructure projects using a range of social science methodologies, we believe that this kind of research will be key in understanding how smart networks interact with customers.

The Strategic Technology Programme hosted by EA Technology at Capenhurst has again delivered work on a range of industry issues that benefit all DNOs. The work on live line jumper cutting has quantified the acceptable levels of inductive and reactive loads that can be safely interrupted and the implications for field operatives and also provided some quite spectacular high speed photos of the arcs that can develop. CRATER (cable rating software) has continued its development and has become a standard method for developing cable ratings. The work on issues of national importance such as oil filled cables has continued to deliver valuable results. Research has been carried out into battery management and transformer failures that has again supported DNOs across the whole of the UK and provided a valuable platform for collaboration.

We have also continued to develop our working relationships with the other UK DNOs in the area of research and development. Whilst each company has unique issues as a legacy of the different historical network development philosophies there are many common areas where we can assist each other and the ENA has provided an open and transparent forum with its R&D Working Group. Our expenditure on IFI projects in 2008/2009 was within a few percentage of

our maximum allowance for the year. We know that we can still beneficially increase our investment on IFI/R&D Projects

7 Outlook for 2009/10

We are planning to build on previous success in the coming year and have a number of projects that are due to be completed and implemented. The various developments already described from Kelvatek to support our LV Fault mitigation strategy will be rolled out to assist us in restoring supplies to customers as quickly as possible, especially for known worst served areas. Our on-load tap changer for distribution transformers will be installed this year and will offer our planning engineers an alternative option for LV circuits with high levels of renewable energy penetration. Our SFCL trial should be completed within this financial year and really will be a world first for IFI and innovation on UK distribution networks.

In addition to the delivery of IFI projects we are also committed to continuing to support national initiatives carried out on behalf of our industry by the ENA and developing our partnership with our asset service provider, United Utilities Electricity Services (UUES) without whose support many of our IFI projects could not be completed.

We expect to use the coming year to re-appraise our research and development strategy as the national picture regarding smart meters and smart grids becomes clearer. We are currently focussed on a number of areas including enhanced customer service, the development of smart grids or active networks, environmental impact and climate change, connection of distributed energy systems, management of the ageing asset base and future proofing but it could be expected that the emphasis may change following the expected announcements regarding a number of key issues.

8 Summary

In summary we would again like to re-iterate that IFI has made a substantial and tangible improvement to our industry. It has encouraged us to develop our internal objectives and strategy in relation to research and development and enabled us to think about R&D as a primary business activity that can be used to develop solutions to real and material issues that we face.

In a wider sense, it is believed that the role of distribution networks may change considerably in the future and fundamental aspects of this migration will only be achieved through co-ordinated R&D activities. The types of network applications that may be required are still being defined but we can be confident that the changes that may come will be heavily dependent on the adoption of new technologies and new thinking. Whatever the objectives set by our stakeholders, if the appropriate regulatory and commercial incentives are combined with the right level of investment then we firmly believe that we can deliver the type of network that may be required in the future.

9 Projects Completed in 2008/2009

	Outcome	Financial Benefits	Operational Benefits	Industry benefits
Alternative Oils for Transformers	ENW withdrew from the project following a strategic review of our IFI project objectives in 2008	ENW withdrew from this project due to the low prospect of any tangible benefits being delivered to our network	ENW has no 275kV assets therefore this project would not have delivered any operational benefits	This project will enable our industry to begin to adopt alternative oils at higher voltages in a measured and methodical manner
Lightning Protection	This project delivered a new national standard on lightning protection ETR 134. The recommendations provide non-prescriptive guidance on how to assess the level of risk posed by lightning to equipment on our network. This ETR replaces ACE report 55 which has now been withdrawn	Lightning related faults make up a proportion of CI's and CML's. Although hard to demonstrate specific incidences of revised designs mitigating faults from lightning leading to financial savings, even one avoided incident per year would result in financial benefits	The previous lightning protection standards were inadequate and did not take account of new technology developments. This project has provided valuable guidance to ensure OHL designs, particularly those with OHL/cable interfaces, are as resilient as they can be	Our industry has benefited by ensuring OHL design has the most up to date technologies and methodologies in respect of design for lightning protection
Earthing	This project successfully demonstrated that the transfer potential under fault conditions between HV and LV electrode systems is much lower that was previously thought	Earthing design has not changed for some time and this project may offer the opportunity to reduce electrode design thereby reducing cost	Operational benefits are delivered by more appropriate earthing design and an enhanced knowledge of the effects of earth potential rise under fault conditions	Industry benefits are delivered from a better understanding of the potential for exposure to earth fault conditions for our employees and members of the public

	Outcome	Financial Benefits	Operational Benefits	Industry benefits
LV Voltage Regulator	This project led to the mitigation of specific customer complains	Measurable financial benefits can be claimed following the successful execution of this project when a number of customer issues regarding voltage levels were encountered. It is estimated that costs of £10,000 were avoided in OHL re-conductoring and transformer re-location	Operational benefits are gained from being able to use the voltage regulator as a temporary mitigation whilst the bigger picture (in terms of network re-enforcement) is considered	Industry benefits are gained from being able to respond to customer issues regarding low voltage levels in a very timely manner. This allows us to demonstrate or commitment to our customers in a very direct way
Resilience and Investment Model	This project has successfully delivered a software modelling tool that allows us to investigate different investment options and their effects on network resilience	This project has delivered avoided costs of unnecessary re-enforcement where the software model has shown that the original line designs are adequate	The benefits from this project are derived from developing an understanding of the resilience of OHL designs based on a clear, robust and repeatable methodology	The Resilience Model makes use of detailed overhead line data collected either from site or from 'as built' records to effectively 'reverse engineer' the original line design and determine its likely performance under varying weather condition
EP2 Climate Change	This project provided valuable insights into the potential effects of climate change on electricity distribution networks	This project produced no short term measurable financial benefits although the costs of climate change could be considerable if this work was not completed	The Met Office were able (with industry support) to examine many areas of our operational activities and suggest the likely impact of climate change based on various scenarios over the next few decades	This project allowed our industry to fully engage with challenges posed by climate change to ensure that we can actively contribute to the on-going national debate on climate change mitigation

10 Financial Report

Distribution Network Revenue	£282.2M
IFI Allowance	£1,411,000
Unused IFI Carry Forward to 09/10	£4,838
Number of Active IFI Projects	34
Summary of benefits anticipated from IFI projects – Σ of Project NPV	£7,612,015
External expenditure on IFI projects in 08/09	£1,113,924
Internal expenditure on IFI projects in 08/09	£292,238
Total expenditure 08/09 on IFI projects	£1,406,162
Estimated benefits actually achieved from IFI projects to date [estimated cost benefit plus other benefits outlined in the project benefit assessment]	£667,756

Table 1 – 08/09 Summary Report on IFI Activities

11 Project Reports

Project Title	**Strategic Technology Programme Overhead Network Module**				
Description of project	A DNO research and development collaboration hosted by EA Technology				
Expenditure for financial year	Internal £2,864 External £43,000 Total £45,864		Expenditure in previous (IFI) financial years	Internal £6,263 External £121,946 Total £128,209	
Project Cost (Collaborative + external + [DNO])			Projected 09/10 costs	Internal £1,500 External £45,629 Total £46,500	
Technological area and / or issue addressed by project	The Module 2 programme for budget year 2008/9 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. Completed Projects (March 09):- S2126_4 Monitoring conductor temperature at fixed current – at Cashlie and Queensferry S2132_2 Validation of ice accretion models using Deadwater Fell S2136_3 Continued involvement with European Project COST 727 S2138_2 Investigation of live-line jumper-cutting limitations S2143_2 Develop in-situ degradation monitor for aluminium OHL conductors – Stage 2: Feasibility study S2146_2 Torsion tests on composite insulators - Stage 2: Effect of torsion on tension insulators S2149_2 High durability OHL fittings - Stage 2: Costing for testing prototype high durability fitting S2150_1 Evaluation of TDR for assessment of tower foundations S2152_1 Evaluate performance of Czech Ice meter at Deadwater Fell S2153_1 Suitability of hand-held PD detector for condition assessment of pole-top equipment S2154_1 Experimental investigation of novel conductors – Stage 1: Icing S2156_1 Build Three Prototype Field Pole Leakage Current Detectors S2159_1 LV shrouding - review of current practices and standards Projects Still In Progress (March 09):- S2110_4 Extend OHRAT to include User Defined Covered Conductor S2136_4 and 4A European Project COST 727: Measuring and forecasting atmospheric icing on structures, including Czech ice meter trial; S2143_3 Develop in-situ degradation monitor for Al OHL conductors - Stage 3 Instrument Development; S2147_2 Increasing vibration limit of CCs to 20%UTS using multiple std or single Hi-mass SVDs S2151_2 Alternatives to wood poles - Stage 2: Erection and fitting trials on concrete poles S2154_2 Experimental investigation of novel conductors at Deadwater Fell – Stage 2: Vibration; S2157_1 Novel conductors for 132kV wood pole lines;				
Type(s) of innovation involved	Incremental	Project Benefits Rating	Project Residual Risk	Overall Project Score	

		15	9	24
Expected Benefits of Project	Projects in this module will significantly increase the safety and reliability of the network. In certain cases the asset life may also be extended. 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: • Cost effective and early identification of damaged insulators and discharging components, which if not addressed may result in faults; • Reduce levels of premature failure of assets and so avoid risk of injury or loss of life or damage to property as a result of falling overhead lines; • 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; • Co-operation between European countries in the development of forecasting methods of atmospheric icing and for the exchange of forecasting tools; • Comparison of new covered conductor with known performance of older types • Extend the service life of towers and reduce potential levels of tower failures; • Review alternatives to wood poles; • Reduce lifetime costs by the appropriate use of alternative materials; • Give Members a better understanding of novel conductors for new-build or re-conductoring 132kV wood pole lines that gives lower capital cost, minimum visual impact, environmental acceptance than other methods of improving power transfer.			
Expected Timescale to adoption	Range 2-5 years - dependent on project		Duration of benefit once achieved	Range 2-10 years - dependent on project
Probability of Success	Range 10-50% - dependent on project		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£64,624
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. However, STP has delivered a number of notable innovations since its inception.			
Project Progress to March 09	Most projects or project stages started in the module during 09/10 have been completed, but some projects span more than one year.			
Collaborative Partners	Other DNO's			
R&D Providers	EA Technology			

Project Title	**Strategic Technology Programme: Cables Module**			
Description of project	A DNO research and development collaboration hosted by EA Technology			
Expenditure for financial year	Internal £1,723 External £53,681 Total £55,404		Expenditure in previous (IFI) financial years	Internal £11,141 External £129,089 Total £140,230

<table>
<tr><td>Project Cost (Collaborative + external + [DNO])</td><td></td><td>Projected 09/10 costs:</td><td>Internal £1,500
External £55,000
Total £56,500</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="3">The STP cable network programme for budget year 2008/9 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.

Completed Projects (March 09):-

S3132_12 and 15: CRATER Near Real time Determination and functionality development
S3148_4 Requirements for earthing and bonding of single core MV power cables: feasibility of earthing and bonding of single core MV cable systems
S3151_1 Understanding and controlling thermo-mechanical forces in cables systems: Study to assess work carried out on thermo-mechanical forces in cable systems
S3152_1 Separable connectors and cable compartments in 11 kV switchgear
S3153_1 and 2: Economics and environmental impacts of distribution cable losses: Model development including CO2 burden calculation
S3168_1 and 2: Comparing future designs of HV and EHV polymeric cables: Review of current specifications and designs and study to determine the interaction between resin and semi-conducting layers
S3169_1: Further studies on the retraction of insulation and over-sheath of cables
S3171_1: Jointing on to wet cables

Projects Still In Progress (March 09):-

S3132_16: CRATER annotation
S3144_2: Comparison of processes for the treatment of redundant fluid filled cables: Comparative field trials
S3151_2 and 3 Understanding and controlling thermo-mechanical forces in cables systems: Modelling of thermo-mechanical forces in cable systems
S3155_1 Trial testing of triplexed cable in plastic ducts
S3157_1 Partial discharge testing of MV cable systems to provide asset risk management data
S3164_1: Develop fluid filled cable design tool
S3165_1: Performance ageing tests on polymeric terminations
S3166_1 and 2: Performance of cold- and heat-applied accessories under resin: Assessing interaction between resin and semi-conducting layer</td></tr>
<tr><td>Type(s) of innovation involved</td><td>Incremental</td><td>Project Benefits Rating
13</td><td>Project Residual Risk
8</td><td>Overall Project Score
21</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="3">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 following benefits, including:
• offset future increases in CAPEX and OPEX;
• CI/CML savings per connected customer;
• Reliable, safe and easy to use method of detecting excess moisture in paper insulation of cables;
• Reduce excavation required in locating leaks from fluid-filled cables, reduce the times and costs of leak location, and also reducing outage times;
• Reduce cable purchase costs;
• Reduce design costs.
• Increased safety of staff and public by reducing the number of accidents / incidents.</td></tr>
</table>

Expected Timescale to adoption	Range 1-3 years - dependent on project	Duration of benefit once achieved	Range 2-10 years - dependent on project
Probability of Success	Range 15-50% - dependent on project	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£87,318
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. However, STP has delivered a number of notable innovations since its inception.		
Project Progress to March 09	Most projects or project stages started in the module during 09/10 have been completed, but some projects span more than one year.		
Collaborative Partners	Other DNO's		
R&D Providers	EA Technology		

Project Title	**Strategic Technology Programme: Substations Module**		
Description of project	A DNO research and development collaboration hosted by EA Technology		
Expenditure for financial year	Internal £11,598 External £39,223 Total £50,821	Expenditure in previous (IFI) financial years	Internal £16,197 External £115,053 Total £131,250
Project Cost (Collaborative + external + [DNO])		Projected 09/10 costs:	Internal £1,500 External £40,400 Total £41,500
Technological area and / or issue addressed by project	The aim of the 09/10 Substation Programme was 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 majority of projects have not only resulted in essential knowledge transfer, they have enabled skills to be developed between STP 4 Members and European partners. Key examples of this were the participation in the AM Forum, (S4185_4), reviewing how transformers are connected within Europe (S4221 _2) each of which has contributed significantly to developing better understanding of electrical plant, improving safety implications, utilisation, performance and life cycle. Some of these projects have resulted in the creation of further supplementary projects for 2009/2010. Completed Projects (March 09):- S4164_5: Tap changer monitor stage 5 S4178_2: Impedance Testing of Substation Batteries S4181_3: Ongoing Programme Of Transformer Post Mortems S4209_2: Post Maintenance Testing: Project Workshop Jan 09 S4222_2: Alternatives to ENATS 35-1 Transformers: Extension 315KVA Ground Mounted Transformers S4233_1: 145kV Earthing switch Asset Management Manual S4235_1: Researching New Techniques for Optimising Plant Maintenance Policies S4237_1: Battery Cabinet Temperature Control S4238_1: Module 4 Information Dissemination		

<table>
<tr><td></td><td colspan="4">S4239_1: Research and Testing of Electrical Contact Cleaning Products
S4241_1: Study of Circuit Breaker Timing Measurements and Methods
S4244_1: Review of methods to dissipate pressure in Substations during equipment failure

Projects Still In Progress (March 09):-

S4164_5: Tap changer monitor stage 5
S4178_2: Impedance Testing of Substation Batteries
S4185_4: European AM Forum Membership 09/10
S4221_2: Out Of Phase Modelling Report
S4224_1: X/R Extrapolation of 12kV Vacuum circuit Breakers
S4226_1: Environmental Corrosion, Specification, Testing of Plant and Equipment
S4230_1: Optimisation of Operational Support and Response for Electrical Plant and Equipment
S4236_1: Aquagen recombination system
S4245_1: Switchgear – Effect of Low Power Factor Switching. (Joint Investigation with STP5: S5181_1)</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>14</td><td>9</td><td>23</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">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 following benefits, including:

Offset future increases in CAPEX and OPEX;
CI/CML savings per connected customer;
Preventing disruptive failures of oil-filled equipment tap changers, earth switches increasing safety and avoid unnecessary scrapping of serviceable components will alleviate environmental impact.
Liaison with European Utilities to share new technology and failure modes;
Increased safety of staff and public by reducing the number of accidents / incidents.</td></tr>
<tr><td>Expected Timescale to adoption</td><td colspan="2">Range 1-5 years - dependent on project</td><td>Duration of benefit once achieved</td><td>Range 2-8 years - dependent on project</td></tr>
<tr><td>Probability of Success</td><td colspan="2">Range 10-100% - dependent on project</td><td>Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£67,777</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. However, STP has delivered a number of notable innovations since its inception.</td></tr>
<tr><td>Project Progress to March 09</td><td colspan="4">Most projects or project stages started in the module during 09/10 have been completed, but some projects span more than one year.</td></tr>
<tr><td>Collaborative Partners</td><td colspan="4">Other DNO's</td></tr>
<tr><td>R&D Providers</td><td colspan="4">EA Technology</td></tr>
</table>

<table>
<tr><td>Project Title</td><td colspan="5">Strategic Technology Programme Networks for Distributed Energy Resources</td></tr>
<tr><td>Description of project</td><td colspan="5">A DNO research and development collaboration hosted by EA Technology</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £1,723
External £52,775
Total £54,498</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td colspan="2">Internal £5,792
External £128,210
Total £134,002</td></tr>
<tr><td>Project Cost (Collaborative + external + [DNO])</td><td></td><td colspan="2">Projected 09/10 costs</td><td colspan="2">Internal £1,500
External £54,000
Total £55.500</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="5">During the budget year 09/10, Module 5 has consolidated the work programme by clustering much of the work around a number of key issues of relevance in the planning, design and operation of networks for distributed energy resources; namely, fault level management, network losses, load related investment, circuit ratings, power quality and microgrids. Most of the projects aim to increase network performance and reduce risk whilst having a positive impact on DNO's' environmental performance.

Completed Projects (March 09):-

S5169_1 Route plan to transform networks from passive to active networks
S5161_2 Standard Risk Assessment Approach to DNO protection requirements
S5183_1 Communications for active network management
S5187_1 Module 5 participation in ENARD Annex II DG System Integration
S5188_1 and 2 Latest developments in issues associated with low carbon network designs
S5189_1 Techniques for assessing harmonic distortion from generation plant
S5193_1 Fault level management
S5194_1 Load related investment - Feasibility study
S5195_1 Network Losses - Feasibility study
S5197_1 and 2 Power Quality Issues - voltage dips and swells
S5198_1 Microgrids - Feasibility study
S5200_1 LV Fuse Reach
S5201_1 Distribution Network Losses – Loss Reduction Initiatives

Projects Still In Progress (March 09):-

S5147_8 Microgenerator clusters - Stage 8 - extension of monitoring / analysis
S5151_5 Network Risk Modelling - Stage 5
S5181_1 Effect of low power factor switching
S5190_1 Whispergen output characteristic monitoring
S5204_1 Monitoring and impact of domestic heat pumps
S5205_1 Fault level management - Feasibility Study.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental</td><td>Project Benefits Rating</td><td colspan="2">Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>9</td><td colspan="2">10</td><td>19</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="5">Projects within this module have been cost effective and help improve reliability and safety of generation connection in distribution networks in line with government policy.

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:</td></tr>
</table>

	Contributing to the achievement of Government white paper aims of introduction of significant numbers of micro-CHP units to the UK homes by 2010 and greater numbers beyond then; Paving the way for more actively controlled networks in support of a move to a lower carbon economy; Enhancing the knowledge and awareness of overseas best practice in DG system integration, which can be applied, as appropriate in the UK; Reduction in the cost of connections for developers seeking to connect load and distributed generation; Understanding of the potential to use the j connection modelling tool to simplify / reduce the cost of providing indicative connection costs; Developing a more consistent, knowledgeable and auditable application of LV fuse reach across the network, hence a more reliable network reducing CML/CI; Being better placed to assess the possibilities for real reductions in losses on DNO networks to reduce GB GHG emissions; Understanding how to accommodate energy saving technologies such as heat pumps into distribution network design.		
Expected Timescale to adoption	Range 1-7 years - dependent on project	Duration of benefit once achieved	Range 1-15 years - dependent on project
Probability of Success	Range 5-60% - dependent on project	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£89,367
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. However, STP has delivered a number of notable innovations since it's' inception.		
Project Progress to March 09	Most projects or project stages started in the module during 09/10 have been completed, but some projects span more than one year.		
Collaborative Partners	Other DNO's		
R&D Providers	EA Technology		

Project Title	**Condition Based Risk Management**			
Description of project	Implementation of the Condition Based Risk Management Methodology			
Expenditure for financial year	Internal £446 External £39,352 Total £39,798		Expenditure in previous (IFI) financial years	Internal £25,991 External £161,551 Total £187,542
Project Cost (Collaborative + external + [DNO])			Projected 09/10 costs	Internal £0 External £0 Total £0
Technological area and / or issue addressed by project	Condition Based Risk Management (CBRM) is a methodology that uses all available knowledge, experience and information relating to physical assets in order to define the present condition of the asset and then estimate future performance on the basis of ongoing degradation			
Type(s) of innovation involved	Radical	Project Benefits Rating	Project Residual Risk	Overall Project Score

		13	1	14
Expected Benefits of Project	Financial - Better targeting of Asset Replacement, methodology to justify reduction in Capex whilst maintaining KPI's at their historic level. Supply Quality, Environmental and Safety - Removal of assets most likely to fail			
Expected Timescale to adoption	3 years	Duration of benefit once achieved	5 years	
Probability of Success	50%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£98,102	
Potential for achieving expected benefits	Condition Based Risk Management is aimed at developing a process to link an enhanced understand of the physical condition of electrical plant and it's projected ageing profile to investment decisions on plant replacement. Work during the period 07/08 has progressed the overall understanding of the company asset base to allow ranking of specific asset groups resulted in the following asset group having CBRM methodologies developed: Towers; Switchgear, Transformers, Wood poles and LV Switchgear. Further work has been completed on determining probabilities of failure for all plant types as well as degradation rates to enable the data to be aged and hence determine capital investment needs beyond the usual 5 year planning timescales.			
Project Progress to March 09	Project is complete and signed off and work has progressed to use the various tools that have been produced to assist in the delivery of our DPCR5 submission. Ofgem have stated that Health Indices are to be used as an output measure for DNO's and ENW are extremely well placed to use our CBRM tools developed under IFI to deliver substantial savings on our capital investment plans			
Collaborative Partners	None			
R&D Providers	EA Technology			

Project Title	**CBRM Criticality Assessment**			
Description of project	Assisting with the implementation of the Condition Based Risk Management Methodology by better understanding the criticality of various parts of the network			
Expenditure for financial year	Internal £0 External £73,231 Total £73,231	Expenditure in previous (IFI) financial years	Internal £30,710 External £275,019 Total £305,729	
Project Cost (Collaborative + external + [DNO])		Projected 09/10 costs for ENW	Internal £4,000 External £0 Total £4,000	
Technological area and / or issue addressed by project	The key elements of this approach are Investment, Maintenance, Operation and Service and their effect on Company Risk and Profit. Criticality assessment helps to identify the optimum intervention strategy for an asset, a combination of investment in new assets, maintenance and operation to deliver the desired level of service for the business.			
Type(s) of innovation involved	Incremental	Project Benefits Rating	Project Residual Risk	Overall Project Score
		12	3	15

Expected Benefits of Project	Financial - Better targeting of Asset Replacement which may result in reduced network investment Supply Quality, Environmental, Operational and Safety - Removal of assets most likely to fail		
Expected Timescale to adoption	3 years	Duration of benefit once achieved	5 years
Probability of Success	50%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£97,198
Potential for achieving expected benefits	Work on establishing asset criticality criteria and scoring factors has been completed and the scoring spreadsheets have been populated with network and asset information to enable risk scores for assets to be produced. The first batch of work concentrated on transmission assets followed by establishing criteria for distribution assets. The results of the project has successfully supported and enhanced the results from the CBRM Project		
Project Progress to March 09	This project and the previous project 'CBRM' have become indistinguishable and they both provided a mechanism to produce part of our DPCR5 submission. The project is complete and signed off and work has progressed to use the various tools that have been produced to assist in the delivery of our DPCR5 submission. Ofgem have stated that Health Indices are to be used as an output measure for DNO's and ENW are extremely well placed to use our CBRM tools developed under IFI to deliver substantial savings on our capital investment plans		
Collaborative Partners	None		
R&D Providers	EA Technology		

Project Title	**Reference Networks - Phase 2**			
Description of project	The project used the GROND tool to develop pricing methodologies to aid with planning and technical developments			
Expenditure for financial year	Internal £250 External £0 Total £250		Expenditure in previous (IFI) financial years	Internal £2,509 External £42,260 Total £44,769
Project Cost (Collaborative + external + [DNO])			Projected 09/10 costs for ENW	Internal £0 External £0 Total £0
Technological area and / or issue addressed by project	Phase II of the project will produce a practical software tool to create optimum disaggregation groups and analyse existing networks and proposed performance improvement strategy			
Type(s) of innovation involved	Incremental	Project Benefits Rating	Project Residual Risk	Overall Project Score
		9	9	18

Expected Benefits of Project	Ensuring that capital expenditure on improving the performance of the network will be optimised both in respect of the type of improvement work to be considered and in applying the improvements to circuits where the greatest benefit can be obtained. Providing a standardised method for comparing the performance of different types of circuit, both internally within ENW and externally between DNO's.		
Expected Timescale to adoption	3 years	Duration of benefit once achieved	5 years
Probability of Success	75%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£199,216
Potential for achieving expected benefits	The final report and software were delivered in 2007 and the project was extended through the joining of an additional DNO. Analysis of real data and the development of comparative analysis are complete		
Project Progress to March 09	The project is complete and the software tool is being used as part of a number of Quality of Supply and Planning initiatives.		
Collaborative Partners	Vertex		
R&D Providers	Vertex		

Project Title	**Distribution Transformer with On-Load Tap Changer**			
Description of project	This project is aiming to develop an On-Load Tap Changer for the low voltage side of a standard distribution transformer. This is to aid with voltage level issues when faced with a high level of DG penetration.			
Expenditure for financial year	Internal £3,916 External £58,000 Total £61,916		Expenditure in previous (IFI) financial years	Internal £3,334 External £231,572 Total £234,906
Project Cost (Collaborative + external + [DNO])			Projected 09/10 costs for ENW	Internal £5,000 External £16,000 Total £21,000
Technological area and / or issue addressed by project	Increased penetration of DG on the LV network, particularly domestic combined heat and power (DCHP) units, is expected to have a significant and adverse effect on voltage regulation. This is a concern especially when a large number of DCHP units are installed in existing properties within a small geographical area on an existing LV feeder. If the feeder was designed to normal planning standards it may suffer from voltage excursions at time of peak generation			
Type(s) of innovation involved	Significant	Project Benefits Rating	Project Residual Risk	Overall Project Score
		9	6	15

Expected Benefits of Project	If successful the distribution transformer with on-load tap-changer facility would provide a simple solution to the problem and minimise the disruption to customer supplies. This solution would also negate the requirement to install new distribution substations and associated cable, therefore reducing costs and the environmental impact. In addition to this specific project it is envisaged that this device would have a number of applications on the LV network		
Expected Timescale to adoption	3 years	Duration of benefit once achieved	5 years
Probability of Success	50%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£99,905
Potential for achieving expected benefits	Design phase completed and 80% of prototype components have been delivered including the transformer and tap changer tank. The low quantity requirements of the project have meant long delivery times for certain components resulting in a slippage of the project. This project uses a number of truly innovative designs and combines the most reliable aspects of standard switching devices with a novel use of power electronics.		
Project Progress to March 09	This project has fallen well behind schedule simply due to the size of the technical challenges that have been faced by the project team. A particular issue arose during final testing regarding an unacceptably large temperature rise within the inductors used to enable commutation of the switching circuit. Further analysis revealed the self-inductance of the inductors was marginally too high causing excessive heat build up under load. This led to a need to re-design the inductors using alternative low-self inductance materials which then resulted in space constraints within the housing. The level of innovation applied to this design is truly remarkable and it is no surprise that unforeseen problems have been encountered as the design and testing progresses. The team at Areva have demonstrated exceptional project management skills and ENW have full confidence that the project will be completed and the OLTC commissioned during 2009.		
Collaborative Partners	None		
R&D Providers	Areva Technology Centre		

Project Title	**SuperGen V – Amperes**		
Description of project	The project comprises a collaboration of UK universities and DNO's aiming to carry out fundamental research into asset management specifically for distribution networks		
Expenditure for financial year	Internal £3,322 External £25,000 Total £28,322	Expenditure in previous (IFI) financial years	Internal £6,273 External £77,801 Total £84,074
Project Cost (Collaborative + external + [DNO])		Projected 09/10 costs for ENW	Internal £1,000 External £25,000 Total £26,000

<table>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">The EPSRC (Engineering and Physical Sciences Research Council) 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 and SUPERGEN has active collaboration with UK industry funded by IFI and has created a real cross-interest community. The Universities involved in the £2.8M project are;

Manchester University: the management hub for this activity
Southampton University; the finance hub
Edinburgh University
Liverpool University
Strathclyde University
Queens University, Belfast

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">Tech Transfer/ 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">The consortium expects to deliver a suite of intelligent diagnostic tools for plant, integrated network planning and asset management, improved and reduced environmental impact plant and models and recommendations for network operation and management</td></tr>
<tr><td>Expected Timescale to adoption</td><td colspan="2">12 years</td><td>Duration of benefit once achieved</td><td>20 years</td></tr>
<tr><td>Probability of Success</td><td colspan="2">25%</td><td>Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£18,373</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">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 effective the 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 version 2</td></tr>
</table>

Project Progress to March 09	The project has already produced valuable outputs and has been fundamental to the continuing development of the UK R&D 'people' network and the industry and academic community
Collaborative Partners	Universities and DNO's
R&D Providers	Universities

Project Title	**Electricity Supply Fault Level Instrument**				
Description of project	This project was co-ordinated by the ENA and aimed to develop an on-line instrument that can successfully measure/estimate the fault level on a distribution network with repeatability and reliability. The instrument is to be based on the EA Technology Extended Supply Monitor				
Expenditure for financial year	Internal £1,040 External £693 Total £1,732		Expenditure in previous (IFI) financial years	Internal £1,175 External £6,066 Total £7,841	
Project Cost (Collaborative + external + [DNO])			Projected 09/10 costs for ENW	Internal £0 External £0 Total £0	
Technological area and / or issue addressed by project	The device will connect to the network and establish the network source impedance from small-scale disturbances or perturbations resulting from transformer tap changer operations. This impedance can accurately be correlated to a true network fault level for that location, providing near real-time information to planning engineers. This tool would also facilitate the connection of distributed generation by establishing if the proposal would exceed the fault level rating of the feeder or line				
Type(s) of innovation involved	Significant	Project Benefits Rating	Project Residual Risk	Overall Project Score	
		8	5	13	
Expected Benefits of Project	The developed unit will allow the DNO's to accurately assess fault in-feed 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 measurement.				
Expected Timescale to adoption	3 years		Duration of benefit once achieved	10 years	
Probability of Success	75%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£25,394	

Potential for achieving expected benefits	To progress to stage 2 of the project as originally defined the results obtained from stage 1 had to support a statement that it was technically feasible to develop a Fault Level Measuring Instrument capable of deriving answers within ±5% of the actual Source and Motor In-feed values. Following the work carried out it is not possible to make such a statement. The Algorithm Validation work has cast some doubt over the achievability of that goal. The good agreement of the existing Fault Level Monitor with expected values does however offer some signs that the results obtained in the algorithm validation phase are not unequivocal. The proposed testing of the existing Fault Level Monitor 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. As the results of Stage 1 do not support an unequivocal statement that it is technically feasible to develop a Fault Level monitor with the required degree of accuracy this project will conclude at Stage 1.
Project Progress to March 09	The final report has been received and this project is now closed. ENW did not have enough confidence in the next stage proposals to continue to fund this project although recognise that if a working and reliable fault level monitor could be developed it would be of great benefit to the industry.
Collaborative Partners	ENA Member companies
R&D Providers	University of Strathclyde, EA Technology

Project Title	**Line Tracker Trial**			
Description of project	The project aimed to trial a device that can provide load and temperature data from the OHL network. The data is collected remotely and received in the network control room to assist with network management.			
Expenditure for financial year	Internal £2,837 External £32 Total £2,868		Expenditure in previous (IFI) financial years	Internal £680 External £31,610 Total £32,290
Project Cost (Collaborative + external + [DNO])			Projected 09/10 costs for ENW	Internal £2,000 External £0 Total £0
Technological area and / or issue addressed by project	The Line Tracker is a fault and load monitor device that is attached to the OHL and monitors current, line and ambient temperature data that is downloaded by GPRS to any PC. The aim is to trial the Line Tracker on the OHL network to enable real load data to be monitored in areas where there is currently little visibility of the load at any point in time. The Line Tracker is one of a number of devices commercially available for this purpose but this particular device was selected based on a specific criteria, the aim of the project is not to test the device but more to collect and process data that can be used for a range of purposes including reinforcement assessment, HV unbalance, operation and grading of overhead protection devices, assessment of the operation of HV voltage stabilisers and intermittent, transient and permanent faults. There is real interest in the effect of wind cooling on OHL ratings to develop dynamic rating capabilities but the basic requirement is to be able to observe the load and ambient parameters at any instant in time. A Live Line installation procedure has been developed and a trial installation/removal of the Line Tracker by a single line team has been carried out.			
Type(s) of innovation involved	Substitution	Project Benefits Rating	Project Residual Risk	Overall Project Score

		11	6	17
Expected Benefits of Project	Financial – Deferred or part reinforcement resulting in saving of £30,000pa Security of Supply - Confirmation of outage circuit loading where circuit ratings are near capacity in an outage. Reduce stressing of the network in an outage. Checking unbalance on the OHL network which may be overloaded in normal running or outage. Better response to intermittent, transient and permanent faults. Confirming correct operation of GVR/protection and grading. Line Tracker senses voltage on or off and load/fault current between 5-25,000 Amps			
Expected Timescale to adoption	3 years		Duration of benefit once achieved	10 years
Probability of Success	75%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£83,256
Potential for achieving expected benefits	A great deal of work has been necessary to identify the functionality required from the device and then co-ordinating modifications to the communications and data handling aspects. It is envisaged that the eventual configuration that is being developed will allow data streams to be directly passed to control room staff from specific points on the network once the Line Tracker is installed.			
Project Progress to March 09	This project has been delayed once more by power supply and communications issues and the units have been returned to Australia for a complete re-build. We are now expecting installation during summer 2009.			
Collaborative Partners	EdF			
R&D Providers	Nortech Gridsense			

Project Title	**Line Tracker Development**		
Description of project	This project implemented a technical solution to allow the Line tracker data to be received directly to the network control room via the iHost Platform.		
Expenditure for financial year	Internal £9,891 External £0 Total £9,891	Expenditure in previous (IFI) financial years	Internal £9,891 External £92,431 Total £102,322
Project Cost (Collaborative + external + [DNO])		Projected 09/10 costs for ENW	Internal £3,000 External £0 Total £0
Technological area and / or issue addressed by project	The key aims are to add conductor and ambient temperature up to 132kV voltage and accommodate larger conductor applications. Present conductor ratings based on the load current and typical ambient temperature in winter, spring/autumn and summer are defined in ENA Engineering Recommendation P27 which was based on experimental work carried out some years ago. Actual temperature measurements and profiles would assist in determining maximum conductor loading for specific overhead lines and defer or reduce investment in load related cases. The objective is to develop Line Tracker to assist in determining dynamic conductor ratings.		

Type(s) of innovation involved	Incremental	Project Benefits Rating	Project Residual Risk	Overall Project Score
		11	6	17

Expected Benefits of Project	Financial – Deferring capital investments in reinforcing overloaded circuits at 11/33/132kV. Allow the maximum load flow through conductors by recording a profile of temperatures and load currents Security of Supply - Assist the connection of Distributed Generation		
Expected Timescale to adoption	3 years	Duration of benefit once achieved	10 years
Probability of Success	75%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£668,482
Potential for achieving expected benefits	Fifteen prototypes of Line Tracker LT50's have been delivered and Gridsense have provided on-site training and uploading of firmware upgrades to resolve protocols between Line Tracker and the control room iHost platform. A great deal of work has been necessary to identify the functionality required from the device and then co-ordinating modifications to the communications and data handling aspects. It is envisaged that the eventual configuration that is being developed will allow data streams to be directly passed to control room staff from specific points on the network once the Line Tracker is installed		
Project Progress to March 09	This project has been delayed once more by power supply and communications issues and the units have been returned to Australia for a complete re-build. Nortech have installed the required iHost upgrade to allow communication directly to the DCMS and a DNP 3.0 link is being installed between the iHost and the DCMS to facilitate easier data transfer.		
Collaborative Partners	None		
R&D Providers	Nortech Gridsense		

Project Title	**Vista - Mapping Underground Assets**		
Description of project	This project is a collaboration of partners with an interest in street excavations. The ultimate aim is to provide tools to visualise underground assets by the use of GIS/GPS techniques before excavations are started		
Expenditure for financial year	Internal £1,402 External £0 Total £1,402	Expenditure in previous (IFI) financial years	Internal £1,180 External £2,520 Total £3,700
Project Cost (Collaborative + external + [DNO])		Projected 09/10 costs for ENW	Internal £0 External £0 Total £0
Technological area and / or issue addressed by project	UKWIR successfully bid for DEBERR funding and is project managing the £2.4 million VISTA project. It is investigating the use of global navigation satellite technology linked to existing asset records to produce 3-D images of utilities' underground assets. The project is supported by £0.9 million of DEBERR funding with over 20 collaborators covering a wide range of utilities in the UK. The project is being carried out by the Universities of Leeds and Nottingham		

Type(s) of innovation involved	Radica	Project Benefits Rating	Project Residual Risk	Overall Project Score
		14	8	22

Expected Benefits of Project	Utilities open up 4 million holes in UK streets each year at an estimated cost of £1bn with indirect costs of £4bn. With 750,000 km of water mains and sewers, there are large potential savings to be made by UKWIR members and other utilities in rapidly and accurately locating assets without inflicting third party damage. The recently introduced Traffic Management Act has placed even further pressure on utilities to reduce street excavations		
Expected Timescale to adoption	3 years	Duration of benefit once achieved	10 years
Probability of Success	75%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£202,570
Potential for achieving expected benefits	The following milestones have all been delivered:- Initial exploitation and communication plan Agree location for preliminary trials Agree methodology for field trials Completion of data model and ontological specification Document protocols for field trials Identify locations for further field trials Report on preliminary field trials GIS data management GIS discrepancy resolution GPRS evaluation Techniques to deal with GPRS 'black-spots'		
Project Progress to March 09	This project is competed with the launch event in June 2009		
Collaborative Partners	Other DNO's and other utility companies		
R&D Providers	UK Universities		

Project Title	**Re-Zap Fault Master Developments**		
Description of project	The Kelvatek (formerly Kelman) Re-Zap Fault Master has proved to be a very useful tool in assisting with the rapid location and restoration of LV faults. This project aimed to make several major developments to the Re-Zap in collaboration with Kelvatek (formerly Kelman).		
Expenditure for financial year	Internal £1,931 External £51,278 Total £53,209	Expenditure in previous (IFI) financial years	Internal £5,051 External £180,886 Total £185,937
Project Cost (Collaborative + external + [DNO])		Projected 09/10 costs for ENW	Internal £2,000 External £3,000 Total £5,000

<table>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">The re-zap has been used for the last 10 years as a tool to locate intermittent LV faults and has been very successful. Kelvatek (formerly Kelman) were engaged as a collaborative partner to develop a new re-zap with an agreed functionality and a number of additional potential beneficial features.

The aims of this project;
• Controlled trial and development of the re-zap Fault Master on LV Transient Faults
• Develop Firmware/software interface to DCMS/CI/CML's data base
• Develop additional features i.e. Mobile phone control, Auto-reset

Objectives;
• Develop accuracy and effectiveness of distance to fault location function
• Assess effectiveness of Fault Thumping mode
• Assess/develop effectiveness of location tracking mode Develop/assess effectiveness and compatibility when used with other fault location devices produced by Kelvatek (formerly Kelman) and others
• Develop remote/auto resetting and re-closing fault Master. Both remote via re zap control software and mobile phone
• Modular re zap for outdoor substations

The aim is to continue to develop our LV fault restoration strategy using the latest innovations</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Technical Substitution/Radical</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="4">Financial - Should reduce the number of joint holes required during fault location.
Quality of Supply - A reduction in joint holes would save 1.5 hrs/hole, assuming an average of 30 customers/fault, 45 CML/fault, 11250 CML/annum. If the re zap could be reset remotely or Auto-reset this would reduce the number of CI and CML's except in situation in which the fault condition changes to a permanent fault. In this case the re zap may be re-closed remotely under certain criteria
Safety - Reducing excavations and live jointing reduce the risk
Environment - Reduction in joint holes saves environmental impact on landfill</td></tr>
<tr><td>Expected Timescale to adoption</td><td colspan="2">3 years</td><td>Duration of benefit once achieved</td><td>10 years</td></tr>
<tr><td>Probability of Success</td><td colspan="2">50%</td><td>Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£147,863</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">The following developments have been completed and are now on trial;

Mobile Phone Controller
Trips to Lockout and Auto Reset capability
Load Profiler

Single Ended Location to Fault software is still under development but good results have been obtained from testing at a test facility where live faults were replicated</td></tr>
</table>

Project Progress to March 09	This project is almost completed with only the final single ended fault locations algorithms to be uploaded to the units. We are currently undergoing extended field trials with the re-developed re-zap to appraise their new features and we are working with Kelvatek (formerly Kelman) to provide communications links from the re-zap directly to our fault restoration dispatch teams in our control room.
Collaborative Partners	Kelvatek (formerly Kelman)
R&D Providers	Kelvatek (formerly Kelman)

Project Title	**Superconducting Fault Current Limiter (SFCL)**				
Description of project	This project aimed to assist with the development of a Super Conducting Fault Current Limiter for use on the 11kV network. It will be the first such trial in the UK and only the second in Europe. ENW are proud to be able to host this trial on our network				
Expenditure for financial year	Internal £90,773 External £116,250 Total £207,023		Expenditure in previous (IFI) financial years	Internal £1,273 External £53,139 Total £54,412	
Project Cost (Collaborative + external + [DNO])			Projected 09/10 costs for ENW	Internal £10,000 External £133,000 Total £143,000	
Technological area and / or issue addressed by project	Development in the area of fault current limiting devices has been carried out by a number of leading manufacturers and research establishments for several years in order to offer an alternative to network reconfiguration/asset replacement in tackling rising fault levels. ASL are intending to design and construct a prototype super-conducting fault-current limiter (SFCL) and undertake trials in the UK. The SFCL is perceived to be a lower risk device, utilising a non-linear 'high-temperature' super-conducting ceramic rather than any electronic, electromechanical, mechanical or explosive components. When the material is operated at below its critical temperature it loses all electrical resistance, thereby allowing load current to flow with negligible losses. Either the increased current density caused by fault current, or the loss of cooling medium (liquid nitrogen) causes the temperature of the super-conducting material to rise and it reverts to a normal resistive state. This added resistance has the effect of clamping the fault current to lower/acceptable limits. Being a solid state device, the SFCL has been proven to operate in a few milliseconds, after which the impedance remains high until the fault is cleared by conventional means (protection operated circuit breakers, fuses, etc.). The SFCLs operation is sufficiently fast to ensure that the first peak of the fault current is limited. The subsequent limited current can be set to suit a specific application. It will in many cases be convenient to choose this level such that existing protection arrangements do not need to be adjusted. ASL is developing SFCLs using super-conducting material from specialist manufacturer Nexans Super-Conductors GmbH (NSC) who supplied the material for the successful 10MVA, 10kV, 600A CURL10 trial in RWE's network in Germany in 2004. In co-ordination with ASL difficulties like high investment costs and losses have been resolved by substantially reducing the internal thermal losses in the super-conducting material and by redesigning the super-conducting components so that a much smaller quantity of the super-conducting material is required. These latest developments will form the basis of the trial installations in the UK. The project will be carried out in a consortium comprising SP Power Systems, ENW, CE Electric UK and ASL. This proposal is for the design, development and trial of 12kV devices, suitable for use in each of the DNO partner networks				
Type(s) of innovation involved	Radical	Project Benefits Rating	Project Residual Risk	Overall Project Score	

		11	4	15
Expected Benefits of Project	Successful trials will result in the development of commercially available devices that are capable of clamping fault levels to within network design limits. This can bring a number of benefits: Financial - If proven cost effective, SFCLs could be strategically deployed onto the network in areas either with existing high fault level issues, or experiencing a high degree of distributed generation connection activity (e.g. Urban Combined Heat and Power (CHP) generation systems). This could provide a method of deferring the replacement of switchboards or reconfiguration of networks whilst ensuring fault levels are maintained within acceptable limits. Quality of Supply - There may be operational benefits in certain areas, associated with minimising the often-complicated switching requirements needed to ensure equipment operates within its fault rating during network outages. This could reduce the risk of incurring CI and CML's arising from either network switching or operating parts of the network temporarily on a single circuit. An improvement in staff safety may also be delivered. SFCLs may, subject to resolution of protection issues, allow radial circuits to be interconnected, with associated improvements to customer supply quality (both CI/CML and flicker/harmonics). This could facilitate a radical change in the way networks are designed and operated. Environmental - If network fault currents are restricted equipment will not be subjected to increased wear or stress, potentially prolonging the asset life.			
Expected Timescale to adoption	3 years	Duration of benefit once achieved	20 years	
Probability of Success	75%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£840,000	
Potential for achieving expected benefits	Bamber Bridge, Preston has been identified as the first trial site and a full specification of the SFCL has been prepared based on a detailed study of the local network impedances. Modelling of the SFCLs interaction with the network has been undertaken and no particular problems are apparent. Superconducting elements have been designed and tested and shown to provide the necessary performance. Design of the SFCL, its enclosure and associated equipment is in progress. Applied Superconductor Ltd experienced a setback in mid 2006 when a major offer of finance from a private investor was withdrawn. The company has since secured the financial support required to ensure that the three planned pilots can be completed and the project re-commenced from the beginning of June 2007			
Project Progress to March 09	The initial prototype has been built and installed at Bamber Bridge substation and has been superconducting since March 09. The final cable work is being completed in June 09 with an expected commissioning date of early July 09. Design and procurement work on the next two prototypes is also well underway.			
Collaborative Partners	SP Power Systems, CE Electric UK			
R&D Providers	Applied Super Conductors Ltd			

Project Title	**IHost developments**

<table>
<tr><td>Description of project</td><td colspan="5">This project is supporting a number of other projects and is aiming to provide an interface between the Line Tracker, Re-Zaps, TP-22 devices and the Control Room Management System. It is recognised that to extend the 'Active' part of our network greater visibility is needed at the lower voltage levels, IHost provides a means to achieve this</td></tr>
<tr><td>Expenditure for financial year</td><td colspan="2">Internal £8,552
External £17,280
Total £25,832</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Internal £4,733
External £40,486
Total £45,219</td></tr>
<tr><td>Project Cost (Collaborative + external + [DNO])</td><td colspan="2"></td><td colspan="2">Projected 09/10 costs for ENW</td><td>Internal £2,000
External £0
Total £2,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="5">There are two existing projects relating to Line Tracker and its development to include measurement of conductors and ambient temperatures, higher voltage and conductor applications. Line Tracker data can be downloaded locally via wireless link to a laptop and remote communications and event notification can be established via GSM/GPRS communications. Data is to be held in a database for historic review (for Network Planning) and interfaced with CRMS for real-time load and event notification (faults and system operation). It is not thought that Line Tracker would be deployed on a wide-scale basis but at critical network points at all high voltage levels due to generation, faults and conductor rating limitations for both normal and abnormal running. The aims of the project include Integration of the Line Tracker with iHost data collection, storage and notification and the objectives include Identifying critical network points at all high voltage levels, developing communication between Line Tracker and iHost and developing iHost, Gridsense Software and CMRS interfaces</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 colspan="2">Overall Project Score</td></tr>
<tr><td>9</td><td>9</td><td colspan="2">18</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="5">Financial - Reduce the capital investment of reinforcing overloaded circuits at 11/33kV/132kV
Quality of Supply - less risk under abnormal running
Environmental - Allows for reduced connection costs</td></tr>
<tr><td>Expected Timescale to adoption</td><td colspan="2">3 years</td><td colspan="2">Duration of benefit once achieved</td><td>10 years</td></tr>
<tr><td>Probability of Success</td><td colspan="2">75%</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£695,982</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="5">This project has faced the challenging task of integrating various essentially non-compatible systems to provide a seamless interface for the control room operators. A decision has been taken to use the iHost platform to develop a number of applications as it allows a virtual link with the control room management system but does not impact on its normal operation. When successful the platform will provide access to load and fault data instantaneously</td></tr>
<tr><td>Project Progress to March 09</td><td colspan="5">This project is largely completed with only testing and implementation remaining, it has led to a larger project proposal to integrate all our iHost servers within our control room firewall to provide instant communications with all our remote devices</td></tr>
<tr><td>Collaborative Partners</td><td colspan="5">Nortech</td></tr>
</table>

R&D Providers	Nortech

Project Title	**TP-22 LV Fault Locator**		
Description of project	The Kehui TP-22 is used to locate the most elusive intermittent faults on the ENW LV network, this project collaborated with Kehui to introduce a number of further functional developments and also Nortech to enable the TP-22 data to be viewed over the iHost Platform		
Expenditure for financial year	Internal £1,240 External £2,098 Total £3,338	Expenditure in previous (IFI) financial years	Internal £4,733 External £47,206 Total £51,939
Project Cost (Collaborative + external + [DNO])		Projected 09/10 costs for ENW	Internal £0 External £0 Total £0
Technological area and / or issue addressed by project	TP-22 units, and their predecessors the T-P20 and T-P21, have been used to locate many intermittent faults on the LV network, some of which had existed for many months and been impossible to locate with previously available fault location instruments. All of these fault locations were carried out by a small number of 'specialists' using the remote interrogation features of the T-P2X Master Station software. As the number of instruments in service increases it is becoming more difficult to ensure that the status of units and the integrity of the communication channels are checked regularly. If this is not done systematically it is possible for valuable 'fault events' to be over-written or for problems with a unit, or its communication channel, to go undetected until an interrogation is attempted after a fault has occurred. When first introduced the TP-20 operated purely as a 'triggered' TDR device with a limited range of functions. The TP-22 now includes the 'Travelling Wave' (TRS) mode of operation whilst still providing 'triggered' TDR, but with a wider range of functions. Alone, or in combination with TV-22, the TP-22 forms a 3 phase Voltage Gradient System (VGS) with remote control and interrogation. Depending on the situation, the 3 modes of operation can often be used simultaneously, or sequentially, to improve the chances of achieving a successful fault location or to resolve an ambiguous result on a multi-branched cable. As awareness of the usefulness of the TP-22 has grown there has been an increase in the number of non-specialist users requiring a simplified means of control and interrogation, preferably with a degree of automatic analysis and validation of the acquired data. Against the above background it is now appropriate to re-evaluate how the full potential of the T-P22 and TV-22 units can be realised through the development of a new Master Station software package which will reduce the need for manually initiated interrogation by 'specialist' operators. A number of T-P22 would be purchased to trial the developed firmware and software. The main features of the proposed development package are; • Regular automatic Logging and polling of specified units • Configuration tool to provide investigation into possible methods of automatic fault location using estimation of 'impedance to fault' from voltage measurements • Conversion of 'impedance to fault' into 'distance to fault' based on Cable parameters and source transformer rating • Estimation of 'distance to fault' using TRS data • Estimation of 'distance to fault' using TDR data • Create 'automatic fault location' log giving results of successful locations		

Type(s) of innovation involved	Incremental	Project Benefits Rating	Project Residual Risk	Overall Project Score
		10	10	20

Expected Benefits of Project	Financial - Reduction of LV joint holes and LV Cable joints would reduce the costs of an LV fault. Quality of Supply - A reduction in joint holes and joints would save an assumed 1.5 hrs/hole on 50% of faults on 30% of the LV Feeder Network that has an average of five transient faults before a permanent fault develops. Transient fault reductions would save an assumed number of customers off supply Safety - Reducing excavations and live jointing would reduce risks Environment - Reduction is jointing holes reduces environmental impact		
Expected Timescale to adoption	3 years	Duration of benefit once achieved	5 years
Probability of Success	50%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£92,946
Potential for achieving expected benefits	The Kehui LV Fault Locator has been integrated with iHost and final coding and successful testing was completed last year. The trial period revealed compatibility issues with the Kehui GPRS modem and iHost but with the full support of both Kehui and Nortech the issues have been resolved. The improved functionality is being used in a variety of ways and is proving to offer a real enhancement and improved response times for fault location in even the most difficult circumstances		
Project Progress to March 09	Training of field staff and appraisal of results is still on-going. A proposal has been created to integrate the TP22 analysis software into iHost so information about the nature of the fault can be seen by control room fault restoration dispatch teams		
Collaborative Partners	EdF		
R&D Providers	Kehui (UK) Ltd		

Project Title	**Delta V Developments and Trials**			
Description of project	The Delta V system has been used as an event recorder to locate difficult to find intermittent faults on underground LV feeder systems. Inherent weakness in the origin design made it difficult to use event thought it was a very useful device, this project collaborated with Kelvatek (formerly Kelman) to improve the functionality			
Expenditure for financial year	Internal £1,634 External £0 Total £1,634		Expenditure in previous (IFI) financial years	Internal £2,212 External £62,410 Total £64,622
Project Cost (Collaborative + external + [DNO])			Projected 09/10 costs for ENW	Internal £1,000 External £0 Total £1,000
Technological area and / or issue addressed by project	Delta V is a portable system for the accurate location of intermittent and permanent faults on complex low voltage (LV) power distribution networks. The system uses a number of small transient recorders (nodes) to record the voltage drop across the network under fault conditions and a handset to gather and analyse the fault data. The fault location is calculated using a refined version of the ´transgradient´ method and the known cable topography			
Type(s) of innovation involved	Incremental	Project Benefits Rating	Project Residual Risk	Overall Project Score

		10	8	18
Expected Benefits of Project	Financial - The Delta V will reduce the number of jointing test positions and reduce the average fault cost of a LV fault. Quality of Supply - A reduction in jointing holes would save 1.5 hrs /hole. Assuming average of 30 customers/fault. Safety - Reducing excavations and live jointing Environment - Reduction is jointing holes reduces environmental impact			
Expected Timescale to adoption	3 years		Duration of benefit once achieved	10 years
Probability of Success	75%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£104,683
Potential for achieving expected benefits	Functional developments carried out include: • New handset hardware with larger screen, more powerful processor, larger and more useable volatile memory, larger non-volatile memory for code and data. • Rewrite of handset software from previous handset to new handset. • Design and implementation of radio-based communications between handset, nodes and case to allow short-range data transfer from inaccessible installations. • Revision of data-structures and analysis code to permit more flexible use of data capture hardware including Rezap FM. • Revision of case to improve appearance, manufacturability, durability and to enable automatic calibration and testing of nodes. • Revision of node hardware to eliminate problems of battery failure • increase the number of records stored to 64 and to enable radio communications with the handset			
Project Progress to March 09	The Delta V is still under trial and is being assessed against the original project benefits claims			
Collaborative Partners	None			
R&D Providers	Kelvatek (formerly Kelman)			

Project Title	**Modular Rezap Fault Master**			
Description of project	The Re-Zap has proved a real success in the restoration of supplies following transient faults but its size combined with the move to smaller outdoor LV Feeder Pillars means that it will fit into only a limited number of locations. This project collaborated with Kelvatek (formerly Kelman) to redesign the Re-Zap to fit into all of our current and legacy design LV Feeder Pillars			
Expenditure for financial year	Internal £2,634 External £39,500 Total £42,134		Expenditure in previous (IFI) financial years	Internal £2,212 External £28,587 Total £30,799

<table>
<tr><td>Project Cost (Collaborative + external + [DNO])</td><td colspan="2"></td><td>Projected 09/10 costs for ENW</td><td>Internal £2,000
External £3,000
Total £90,137</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">Kelvatek (formerly Kelman) Ltd has developed a new version of the re-zap with additional beneficial features which is being trialled under separate IFI Projects. Further developments are proposed to split the electronic control/power supply and the vacuum bottle with one controller being able to control up to three separate vacuum bottles. This will allow Re-zaps to be installed in all outdoor LV cabinets and Pillars.

Aims:-
1. Develop and trial a Modular Rezap for outdoor substation (for LV Transient Faults)
2. Develop One Controller for 3 Modular Re-zaps

Objectives:-
1. Compact waterproof (IP rated) case
2. Same features are existing Rezap
3. Specifically design leads
4. Trial a number of Modular Rezap

The initial consideration is to understand the available envelope (that would fit into all our LV Pillar designs) and then to research and specify the proposed Modular REZAP by carrying out a feasibility phase</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>11</td><td>9</td><td>20</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">Financial - Potentially the Modular Re-zap could reduce the number of jointing test positions and reduce the average fault cost of an LV fault.
Quality of Supply -If the Re-zap could be reset remotely this would reduce the number of CI and CML's except in situation in which the fault condition changes to a permanent fault. The Re-zap can be used to turn intermittent faults into permanent faults thereby allowing a proper repair to be made and improving the quality of supply for the longer term
Safety - Reducing excavations and live jointing reduce risk
Environment - Reduction is jointing holes saves environmental impact on landfill</td></tr>
<tr><td>Expected Timescale to adoption</td><td colspan="2">3 years</td><td>Duration of benefit once achieved</td><td>10 years</td></tr>
<tr><td>Probability of Success</td><td colspan="2">75%</td><td>Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£56,323</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">The project has successfully developed a prototype in the required envelope which proved to be an extremely challenging task. We are confidentially expecting the modular re-zap to extend the benefits of the standard re-zap as part of our overall supply restoration strategy</td></tr>
<tr><td>Project Progress to March 09</td><td colspan="4">This project has been delayed for a number of reasons including the sale of Kelman, the developers, to GE. A revised project management regime has been agreed with Kelvatek and we are aiming to receive delivery of the first prototype later this year.</td></tr>
</table>

Collaborative Partners	EdF
R&D Providers	Kelvatek (formerly Kelman)

Project Title	**ESR Network**				
Description of project	The Electricity Supply Network is a self-funded academic and industry network used purely for ensuring the proper visibility is given to academic research amongst potentially interested industrial companies and DNO's				
Expenditure for financial year	Internal £1,040 External £3,000 Total £4,040		Expenditure in previous (IFI) financial years	Internal £1,446 External £4,500 Total £5,946	
Project Cost (Collaborative + external + [DNO])			Projected 09/10 costs for ENW	Internal £500 External £3,000 Total £3,500	
Technological area and / or issue addressed by project	The ESR Network was established in August 2000 with support from EPSRC and the major companies of the UK electricity supply industry, together with manufacturers of electrical and generating plant. The Network currently has fourteen industrial members and 49 academic members. It has a number of purposes, among which is to provide industrial members with an overview of current research, with an opportunity to become involved where appropriate, and to give academic members a chance to strengthen their links with the power industry				
Type(s) of innovation involved	Radical	Project Benefits Rating	Project Residual Risk	Overall Project Score	
		7	8	15	
Expected Benefits of Project	Monitoring / data exchange of all EPSRC funded projects submitted in 'responsive mode' • Monitoring / data exchange of other UK/EU research initiatives • Network of academic contacts • Network of industrial contacts				
Expected Timescale to adoption	7 years		Duration of benefit once achieved	20 years	
Probability of Success	25%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£1,056	
Potential for achieving expected benefits	A number of very informative and stimulating research strategy papers have been published including a matrix of UK current research activities against a number of strategic issues. The ESR is a very low cost activity but more than delivers a number of tangible and intangible benefits				
Project Progress to March 09	A number of meetings have been held through the year				
Collaborative Partners	Universities, DNO's, Generators, Industrial Companies				

R&D Providers	ESR Network

Project Title	**FuseRestore**				
Description of project	This project is aiming to develop a novel method of automatically restoring supplies following the operation of a fuse on an LV Feeder Pillar				
Expenditure for financial year	Internal £3,114 External £35,559 Total £38,673		Expenditure in previous (IFI) financial years	Internal £2,978 External £43,293 Total £46,271	
Project Cost (Collaborative + external + [DNO])			Projected 09/10 costs for ENW	Internal £2,000 External £45,000 Total £47,000	
Technological area and / or issue addressed by project	Just as with HV feeders LV feeders have rogue circuits which result in repeated faults even after a fault has been repaired therefore it is proposed to develop a device that can automatically replace a fuse that has operated. The 'FuseRestore' would be able to hold two fuses, one in circuit and the second to restore customers after 30 seconds should the first fuse operate. The units would have communication via GPRS to the iHost platform via the Kelvatek (formerly Kelman) server in N Ireland and would be able to record any events where it has been caused to operate. This would allow for regular scheduling via the LV fault Management system for fuse replacement during normal working hours. It is envisaged that the FuseRestore could be fitted to any LV Feeder Pillar at any location. Aims Development of the FuseRestore to replace a standard Fuse Objectives 1. Develop 3 FuseRestore devices as proof of concept 2. Carry out extensive testing 3. Develop proto-type units 4. Trial on the network				
Type(s) of innovation involved	Radical	Project Benefits Rating	Project Residual Risk	Overall Project Score	
		11	8	17	
Expected Benefits of Project	Financial – The figures for number of fuse operations and the locations of many 'rouge' LV feeders are well known. If the FuseRestore was fitted to every circuit after the initial fuse operation we could potentially eliminate all subsequent fuse operations by being able to maintain the supply on the second fuse whilst the primary fuse is replaced. A successful deployment programme could have a significantly positive effect on our targets for the reduction in CML's and CI's which currently result in additional payments in IIP. 240 Installation would potential save 20% in CML's and CI's as only approximately 80% of intermittent faults will restore with one fuse replacement. Safety – The FuseRestore will provide much more control over fault restoration and enable fuse replacement to be carried out in a scheduled manner rather than under the pressure of an outage. This should provide more time and a more planned approach for field staff				

Expected Timescale to adoption	2 years	Duration of benefit once achieved	1 years
Probability of Success	50%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£14,107
Potential for achieving expected benefits	Many iterations of design were considered for the Fuse Restore. It is now nearing the end of the design phase. A prototype switching mechanism is being manufactured for heat tests in the workshop.		
Project Progress to March 09	This is another very challenging project. The basic prototype designs have been tested to destruction and revealed a number of issues that required a re-design of the basic switching mechanism. Further work has been required on safety interlocks and visual indications to allow field engineers to see the state of the Fuse Restorer after it has operated. A revised project management regime has been agreed and cost overruns are being discussed with Kelvatek and even though the project is over budget and over time, the potential of this device is such that ENW will continue to support the development until completion		
Collaborative Partners	None		
R&D Providers	Kelvatek (formerly Kelman)		

Project Title	**Expansion Planning**		
Description of project	This project is aiming to develop a new software module that will sit alongside the existing IPSA software suite and use the existing IPSA network model of the grid and primary distribution network		
Expenditure for financial year	Internal £53,708 External £220,879 Total £274,586	Expenditure in previous (IFI) financial years	Internal £36,127 External £14,453 Total £50,580
Project Cost (Collaborative + external + [DNO])		Projected 09/10 costs for ENW	Internal £2,000 External £14,000 Total £16,000

<table>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">To ensure timely delivery of the load related capital investment programme, for G and P networks, it is essential to develop a forecast of network reinforcement needs. The forecast should look ahead 20 years and be reviewed annually to produce a rolling programme. Certainty of the programme of work and its associated cost will allow ENW to plan its resource requirement and negotiate its revenue stream with Ofgem on the basis of a justified Price Control submission. It is proposed to specify and develop with our partners, TNEI Services, an expansion planning tool. The new software module will sit alongside the existing IPSA software suite and using the existing IPSA network model of the G and P distribution network will apply DC load flow techniques, with a set of reinforcement rules to create an investment profile for the given time horizon.

Aims - To develop an Expansion Planning software tool capable of analysing the G and P network for multiple load conditions and outage scenarios. The tool shall check the network for compliance with thermal and voltage limits, fault level limits and Licence Standard ERP2/6. The output of the tool will be a record of non-compliance issues over the 20 year planning horizon. It is a further requirement of the Expansion Planning software tool that it interfaces with another IPSA related development software package which calculates nodal marginal prices for DUoS charging.

Objectives
1. To specify and develop a DC load flow module for network analysis;
2. To specify and develop an expansion planning module;
3. Implement and trial the software for the creation of a forecast investment plan for a defined time horizon</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>11</td><td>3</td><td>14</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">Financial - Although a systematic review of the network is not currently undertaken by ENW there is a clear business need to do so. It is anticipated that because there will be a greater knowledge of the status of the network it will be possible to develop engineering solutions that will utilise available Capex more efficiently. Whilst it is difficult to accurately quantify the savings it is reasonable to anticipate a 0.5% saving (available for reinvestment) over the whole load related capital programme. Based on the XD4 load related capital programme this would deliver a £250k over the five-year period, which equates to a £50k saving per annum anticipated for each year of the 20-year programme.
Supply Quality - The Expansion Planning tool will enable United Utilities to plan and deliver an efficient and co-ordinated distribution network that will positively impact on the Supply Quality (CI and CML) delivered to customers. There is a further option to include a reliability element to the network analysis part of the tool; however the decisions whether to include this will be delayed until the other elements have been proven.
Quality of Supply - The expansion-planning tool will assist with the efficient and co-ordinated development of the distribution network. Although the output is a first order approximation of the development of the EHV distribution network, in some cases it may provide the reinforcement solution.
An output of the load related investment profile is a set of 'time to reinforcement' values for the congested elements of the EHV distribution network. These values are to be used as inputs into the creation of network prices within the Structure of Charges project to signal, through use of system charges, to existing and potential users the future cost of utilising these network assets.</td></tr>
<tr><td>Expected Timescale to adoption</td><td colspan="2">3 years</td><td>Duration of benefit once achieved</td><td>5 years</td></tr>
</table>

Probability of Success	50%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£74,000
Potential for achieving expected benefits	The main objective of the Expansion Planning Initiative is the analysis, design, development and testing of a new software tool to analyse network bottlenecks and non-compliance with the P2/6 planning standard. The tool will undertake complex analyses and calculations, taking into account a range of factors and data, to study the effects of forecast demand and generation for the company's distribution network over the next 20 years. The initial focus of the work was to investigate, analyse, design and document the initial specifications for the computational engine, and the algorithms within it, all of which form the foundation of the software tool. The computational engine specification was completed after many revision cycles between the designer and the relevant engineering specialists in ENW		
Project Progress to March 09	The project is continuing and a number of milestones have been reached. The project is expected to conclude in 2009		
Collaborative Partners	None		
R&D Providers	Vertex Data Science Ltd, EATL,		

Project Title	**LV Sure**			
Description of project	This project aims to develop an automatic LV feeder fault restoration system			
Expenditure for financial year	Internal £1,040 External £31,000 Total £31,040		Expenditure in previous (IFI) financial years	Internal £2,212 External £3,125 Total £5,337
Project Cost (Collaborative + external + [DNO])			Projected 09/10 costs for ENW	Internal £0 External £0 Total £0
Technological area and / or issue addressed by project	A great deal of benefits have been realised from the many automation schemes that have been installed on the OHL network over a number of years. If the same philosophy could be applied to underground circuits it could deliver a number of benefits and offer faster customer restoration times			
Type(s) of innovation involved	Incremental	Project Benefits Rating	Project Residual Risk	Overall Project Score
		7	1	8

Expected Benefits of Project	Quality of Supply - The benefits delivered by low voltage automation are those that improve the operational performance of the low voltage electricity distribution network by a reduced number of customer interruptions (CIs). Although when deployed on a radial network actual customer interruptions will still occur, the system will reconfigure the local network and restore many customers before expiry of the 3-minute transient time limit. By automatically restoring many customers within a short period of time, only those customers within the faulted zone will remain off supply. Follow-up manual fault restoration resources can then be directed to the faulted zone for a permanent repair to be effected Quality of Supply - Fault location on low voltage networks is a time consuming activity. The system provides a means of fault localisation by isolating the faulted section, allowing fault teams to eliminate health sections of the network from their investigations		
Expected Timescale to adoption	7 years	Duration of benefit once achieved	20 years
Probability of Success	25%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£10,348
Potential for achieving expected benefits	Work carried out to date suggests that there may be opportunities to reduce the number of CIs and CMLs associated with transient faults by deploying this system. The preferred strategy would appear to be retrofitting 'rogue' LV circuits which have the highest number of recorded transient fault incidents.		
Project Progress to March 09	The project is completed and led to the proposal for LV Sure Stage 2		
Collaborative Partners	SP Power Systems, EdF, SSE		
R&D Providers	EATL		

Project Title	**Pole Mounted Fault/Load monitor**		
Description of project	The aim of this project was to develop and trial a reliable non-contact Fault/load remote monitor up to 33kV		
Expenditure for financial year	Internal £4,431 External £0 Total £4,431	Expenditure in previous (IFI) financial years	Internal £0 External £17,732 Total £17,732
Project Cost (Collaborative + external + [DNO])		Projected 09/10 costs for ENW	Internal £1,500 External £0 Total £1,500

<table>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">This is another project with links to other IFI funded research and development. Fault Passage Indicators 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 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 and is installed 3 metres below 11kV conductors on the wooden 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

Objectives
• Trial the device
• Develop load monitoring algorithms
• Evaluate the potential replacement for power outage devices (PODs) on OHL networks
• Feed real-time fault/load data into CRMS
• 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</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>10</td><td>11</td><td>21</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">Financial - From a reduction in CML and CI's
Quality of supply - On-line load monitoring to assist in network management , 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, gathering of historical load data for planning or network development and faster restoration</td></tr>
<tr><td>Expected Timescale to adoption</td><td colspan="2">3 years</td><td>Duration of benefit once achieved</td><td>10 years</td></tr>
<tr><td>Probability of Success</td><td colspan="2">75%</td><td>Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£198,887</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">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</td></tr>
<tr><td>Project Progress to March 09</td><td colspan="4">A number of devices have been installed and are communicating well with the iHost server. They are being assessed through this year and the project will conclude in 2010</td></tr>
<tr><td>Collaborative Partners</td><td colspan="4">Central Networks</td></tr>
<tr><td>R&D Providers</td><td colspan="4">Nortech</td></tr>
</table>

Project Title	**Vegetation Management**			
Description of project	This project proposes to monitor vegetation growth at approximately 2000 sites across the UK network and develop a software model which will take into account factors such as tree species, bioclimatic area, and the effect of climate variation to estimate the speed of vegetation growth at different geographical sites			
Expenditure for financial year	Internal £1,931 External £41,000 Total £42,931		Expenditure in previous (IFI) financial years	Internal £0 External £131,000 Total £131,000
Project Cost (Collaborative + external + [DNO])			Projected 09/10 costs for ENW	Internal £1,000 External £37,000 Total £28,000
Technological area and / or issue addressed by project	Rate of vegetation growth and the impact on the OHL network			
Type(s) of innovation involved	Significant	Project Benefits Rating	Project Residual Risk	Overall Project Score
		11	4	15
Expected Benefits of Project	Financial - The software tool will enable an ability to predict whether areas are high growth or low growth and hence allow two-fold savings. In high-growth areas, proactive cutting can be carried out, thereby reducing the number of outages (by cutting before the vegetation enters the live zone) and cost. Simultaneously, cutting cycles in low growth areas will be extended, resulting in fewer spans being cut each year. The scale and cost of tree cutting each tear means that even a small percentage reduction in costs will be a substantial sum			
Expected Timescale to adoption	3 years		Duration of benefit once achieved	10 years
Probability of Success	50%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£122,615
Potential for achieving expected benefits	This project has a high probability of success as it is using well proven scientific methods combined with the ability to manipulate large amounts of data to better define vegetation management strategies			
Project Progress to March 09	The first year's measurements have bee recorded and the initial cutting programs have been developed and are being implemented. Following the first year cut the sites will be re-surveyed and growth measurements taken.			
Collaborative Partners	Other DNO's			
R&D Providers	ADAS			

Project Title	**Radiometric Fault Location**
Description of project	This project aims to develop a radiometric arc fault locator demonstrator

Expenditure for financial year	Internal £1,040 External £16,820 Total £17,860		Expenditure in previous (IFI) financial years	Internal £0 External £3,220 Total £0
Project Cost (Collaborative + external + [DNO])			Projected 09/10 costs for ENW	Internal £500 External £8,000 Total £8,500
Technological area and / or issue addressed by project	Radiometric Arc Fault Location (RAFL), is a methodology to fault locate the position of arcing faults on overhead lines., this project will develop a method to use (RAFL) on OH distribution circuits			
Type(s) of innovation involved	Incremental	Project Benefits Rating	Project Residual Risk	Overall Project Score
		9	9	18
Expected Benefits of Project	It has been estimated that a typical DNO network could have average of 120 lightning related faults per annum affecting approximately 43000 customers giving an around 350 customers affected per fault. A faster location methodology would allow a reduction in these affected customers.			
Expected Timescale to adoption	7 years		Duration of benefit once achieved	10 years
Probability of Success	25%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£891
Potential for achieving expected benefits	The significant challenges to be faced in this project are: • Development of sub-µs timing function to measure the impulse time-of-arrival • Development of autonomous monitoring software • Development of GSM/GPRS function for remotely accessing station data Interpretation of the results It is expected that all these major challenges can be overcome and the project will deliver a successful outcome			
Project Progress to March 09	All of the aerials have been installed and most of the timing and communications issues have been resolved allowing measurements to be taken. The current phase is concerned with matching radiometric events with fault records to establish if what is being recorded by the system is from physical faults rather than other potential sources of interference.			
Collaborative Partners	Other DNO's			
R&D Providers	University of Strathclyde			

Project Title	**LV Sure Stage 2**
Description of project	This project was attempting to take forward the project work from the initial feasibility study to prototype development

Expenditure for financial year	Internal £1,040 External £41,242 Total £42,282	Expenditure in previous (IFI) financial years	Internal £0 External £0 Total £0
Project Cost (Collaborative + external + [DNO])		Projected 09/10 costs for ENW	Internal £0 External £0 Total £0
Technological area and / or issue addressed by project	LV Sure stage 1 was completed in 2008 and the output was a feasibility study into the development of a proposed LV Automation System primarily designed for the urban underground LV Network. The proposed system was based on the installation of an 'Intelligent Link Unit' at the LV Distribution Board and an 'Electronic Fuse Unit' installed at the link box that would be used to automatically disconnect faulted sections from feeder circuits and restore supplies to those customers unaffected by the faulted cable section.		

Type(s) of innovation involved	Research (Applied analytical knowledge development)	Project Benefits Rating	Project Residual Risk	Overall Project Score
		16	1	17

Expected Benefits of Project	Financial: The financial benefits are calculated from figures developed from the feasibility stage and are based on identifying the worst performing circuits that are suitable for retro-fitting with the system. It has been calculated by EATL that the NPV figure is £140,692, based on a 10% probability of success. The 'Financial Benefit' IFI score is 4 (Significant - £100k-£1M per annum reduction in costs) Quality of Supply: If the system was installed on the worst performing circuits with an assumed 5 transient interruptions per year then it would lead to a substantial improvement in circuit performance. The 'Network Performance Benefit' IFI score is 4 (Significant - Leads to sustainable improvement in Regulatory performance targets) Safety: Improvements in safety will occur through the automatic restoration of faulted sections removing the requirement for manually replacing fuses in circuits that may still have faults present. The 'Safety' IFI score is 2 (Minor - Leads to the reduction of a single potential major injury / LTA over 1yr)		
Expected Timescale to adoption	3 years	Duration of benefit once achieved	10 years
Probability of Success	50%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£12,685
Potential for achieving expected benefits	This project was to be delivered in a number of stages from initial electrical and mechanical design through prototype development and testing. ENW took the view after the initial detailed specification development that the proposed designs were not feasible within the agreed project budget therefore took the decision to withdraw from the project after the initial stage was complete		
Project Progress to March 09	The project is concluded and no further work is proposed		
Collaborative Partners	SP Power Systems, SSE		
R&D Providers	EA Technology		

Project Title	**FlexNet**

<table>
<tr><td>Description of project</td><td colspan="4">The EPSRC (Engineering and Science Research Council), operated by DEBERR is the primary funding agency for Engineering and Science in UK University's and one of the initiatives currently funded under the scheme is the SuperGen Project (Sustainable Power Generation and Supply). The project began in 2004 and consisted of collaboration between a number of UK universities and DNO's and other stake holders. FlexNet is the second stage of one of the original SuperGen V projects, FutureNet and has been influenced by two factors in particular; Work under FutureNet on scenario assessments and modelling produced the broadest discussion within the consortium and the widest engagement amongst stakeholders leading to the recognition that there are many perfectly plausible scenarios for the mix, locations and scales of generation technologies and network technologies and prevailing views of what generation may emerge can change remarkably quickly and leave narrowly based research initiatives stranded</td></tr>
<tr><td>Expenditure for financial year</td><td colspan="2">Internal £1,931
External £10,000
Total £11,931</td><td>Expenditure in previous (IFI) financial years</td><td>Internal £0
External £0
Total £0</td></tr>
<tr><td>Project Cost (Collaborative + external + [DNO])</td><td colspan="2"></td><td>Projected 09/10 costs for ENW</td><td>Internal £500
External £10,000
Total £10,500</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">FlexNet is divided into six work streams with associated projects; shape and size of future electricity networks, markets and investment, power system electronics, smart flexible controls, customers, citizens and loads and validation and showcase</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Research (Applied analytical knowledge development)</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>15</td><td>5</td><td>20</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">Financial - No specific financial reductions will result from supporting the Flexnet programme however, as with it's predecessor, AMPerES, participation is highly leveraged with both industrial, academic, DNO and EPSRC support. It is estimated that research into the various work streams should result in tools and techniques that can ultimately be applied to the management of the network. It is believed that a reduction of £25,000 will result in 10 years time and last for 10 further years leading to a Medium NPV of £78,590. Other Benefits - No specific benefits are defined in the areas of Supply Quality, Environmental, Safety or Operation but the work of FlexNet is intended to address issues that impact each of these areas.</td></tr>
<tr><td>Expected Timescale to adoption</td><td colspan="2">10 years</td><td>Duration of benefit once achieved</td><td>10 years</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>£78,590</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">The project is proceeding well with regular reporting and a well defined and accountable management structure and executive steering committee. The challenge for DNO's is to transfer the work of SuperGen to our normal business activities</td></tr>
<tr><td>Project Progress to March 09</td><td colspan="4">The project is progressing according to plan with strong leadership.</td></tr>
<tr><td>Collaborative Partners</td><td colspan="4">EoN, National Grid, EDF Energy, Scottish Power, SSE, ABB, GE, Rolls-Royce, OFGEM, Greenpeace, CE Electric. Georgia Tech, MIT</td></tr>
</table>

R&D Providers	University of Bath, University of Birmingham, University of Cambridge, University of Edinburgh, Imperial College London, University of Manchester, University of Strathclyde

Project Title	**Chromatic Analysis of Insulating Oil**		
Description of project	This project is a collaboration with Liverpool University's 'Centre for Intelligent Monitoring Systems' who have developed an analysis technique based on the 'Chromatic' analysis of various materials. The technique uses ordinary white light from any source as a stimulus and analyses the frequency and intensity of reflected light from the visible to near-infrared part of the spectrum to determine any changes in the state of the material. This project is based on using this technique to analyse mineral insulating oil with the objective of providing an alternative non-intrusive optical method for oil analysis. This project is supported by the Joule Centre at Manchester University and the NWDA		
Expenditure for financial year	Internal £1,837 External £20,000 Total £21,837	Expenditure in previous (IFI) financial years	Internal £0 External £0 Total £0
Project Cost (Collaborative + external + [DNO])		Projected 09/10 costs for ENW	Internal £0 External £0 Total £0
Technological area and / or issue addressed by project	The project aims are to establish if small changes in the optical signal of the oil caused by increased attenuation that would be indicative of chemical degradation by whatever mechanism can be detected, establish if any changes in the optical signal can be related to known degradation mechanisms and to establish if this can this be done through the oil-level site glass.		

Type(s) of innovation involved		Project Benefits Rating	Project Residual Risk	Overall Project Score
	Development (Small scale trials / prototypes)	15	5	20

Expected Benefits of Project	Financial: The financial benefits of the initial stage of this project will be low due to the nature of the laboratory based work. However, if a system could be successfully developed it could lead to a substantial reduction in the cost of oil sampling and the associated transport, storage and handling costs. It would provide a fast non-intrusive analysis technique that could be used to contribute to a CBRM ranking score. The project NPV was calculated to be £33,115 although again, it should be stated that this project is only at an early laboratory stage. The 'Financial Benefit' IFI score is 3 (Medium - £10k-£100k per annum reduction in costs). Quality of Supply: The project will provide an enhanced ability to more readily measure and quantify ageing assets. The 'Network Performance Benefit' IFI score is 2 (Minor - Contributes to improvement in performance). Safety: The safety benefits of this project, if successful, should be measurable. The issues surrounding older transformers and the difficulties of operating oil drain valves to take samples often lead to the removal of the transformer lid to recover the sample or even prohibit the taking of oil sample in many instances. The benefits of oil analysis trending are well established and if it could be carried out non-intrusively and therefore more safely then benefits should be delivered. The 'Safety' IFI score is 2 (Minor Lead to the reduction of a single potential major injury / LTA over 1yr). Environmental: Any measures that can be taken to reduce oil sampling and handling will deliver Environmental Benefits. Oil sampling, if carried out according to recommended standards, always produces an amount of waste oil and contaminated PPE to be disposed of and even if bespoke sampling kits are used, there is generally a level of local spill to be managed. The legislation regarding the storage and

	handling of mineral oil are slowly becoming more onerous and the requirement to find an alternative to physical oil sampling is clear. The 'Environmental' IFI score is 3 (Medium - Environmental benefits to a measurable population of affected sites (e.g. 20%-40% locations)		
Expected Timescale to adoption	4 years	Duration of benefit once achieved	10 years
Probability of Success	100%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£33,115
Potential for achieving expected benefits	This project was early stage research but based on very well established techniques that have been proven to deliver benefits in other industries for a number of years. The practice of oil sampling has changed little over many years based on the benefits of the recognition of various oil and paper decomposition products however the methods of removing an oil samples for testing is practically unchanged since the initial design of transformers. The ultimate aim of this project is to assess if oil can be analysed non-intrusively so removing the need to take a physical sample. The project aims are to establish if small changes in the optical signal of the oil caused by increased attenuation that would be indicative of chemical degradation by whatever mechanism can be detected, establish if any changes in the optical signal can be related to known degradation mechanisms and to establish if this can this be done through the oil-level site glass. The project work is completed and the final report is about to be delivered. The limited laboratory trial was a complete success with ten samples supplied being readily ranked and partly analysed for key gas content by the application of various filtering techniques.		
Project Progress to March 09	The current project is completed with a proposal received from Liverpool University for a further stage of extended field trial in conjunction with our oil reprocessing plant, CORD.		
Collaborative Partners	MHA Ltd, University of Liverpool, The Joule Centre		
R&D Providers	University of Liverpool		

Project Title	**Wide Area Data Gathering**		
Description of project	The aim of this project is to develop an 11kV communications test network using Power Line Carrier to explore the potential for a wide area active data gathering system to support real time control of the potentially constantly changing operational parameters of the distribution network. The University of Manchester have developed a range of network control algorithms, for example using state estimation techniques based on wide area measurement to optimise transformer OLTC settings. The data generated from the trials will be used to verify existing network models to allow both an operational and economic analysis.		
Expenditure for financial year	Internal £2,228 External £75,000 Total £77,228	Expenditure in previous (IFI) financial years	Internal £0 External £0 Total £0
Project Cost (Collaborative + external + [DNO])		Projected 09/10 costs for ENW	Internal £3,000 External £0 Total £3,000

Technological area and / or issue addressed by project	The overall objective of project is to gather data from the 11kV and 415V distribution networks using power line communications technology to support the future implementation of active distribution network systems and Distributed Energy Systems. The project will use a PLC system to identify the key aspects regarding the design and implementation of a prototype PLC system specifically designed for use on an electricity distribution network and then analyse the resulting data against a range of criteria. The project will be divided into three stages; prototyping and installation: optimisation and data gathering and analysis. It is believed that even though GSM based communications are widespread PLC techniques may well offer competitive solutions in some circumstances and merit continued support and development.			
Type(s) of innovation involved	Development (Small scale trials / prototypes)	Project Benefits Rating	Project Residual Risk	Overall Project Score
		14	1	15
Expected Benefits of Project	Financial - The project NPV is £168,135 assuming a 50% probability of success and that the benefits last for 10 years. The 'NPV of Financial Benefit' IFI score is 4 (Significant - £100k-£1M). Quality of Supply - If the system was installed at a selected location and provided wide area monitoring it could lead to a to a improvement in circuit performance by improved management and control. The 'Network Performance Benefit' IFI score is 2 (Minor - Contributes to improvement in performance). Safety - Safety benefits will result from a better ability to more accurately identify any potentially overloaded or redundant substations. Currently the only basis for action is reference to the MDI readings therefore any more accurate information regarding circuit loadings would assist the management of the Distribution System. The 'Safety' IFI score is 3 (Medium - Mitigation of major incident or prevention of multiple minor incidents)			
Expected Timescale to adoption	3 years		Duration of benefit once achieved	10 years
Probability of Success	50%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£84,068
Potential for achieving expected benefits	The project is expected to deliver an extremely high bandwidth, free to use optimised communications system. It is intended to use the system to gather wide area information to support a range of further initiatives.			
Project Progress to March 09	The PLC equipment has been specified and purchased and the circuit for initial trial installation has been identified. The current task is to develop internal procedures and train line teams for installation with expected completion in Autumn 2009			
Collaborative Partners	Amperion, The Joule Centre			
R&D Providers	University of Manchester			

Project Title	**EATL Forums**

Description of project	In addition to the Strategic Technology Programme (STP), ENW currently attend seven forums and information exchange groups hosted by EA Technology. They are; Protection Engineers Forum, Project - The scope of this forum includes any topic or issue relating to the design, installation, operation and general management of power network protection systems including Protection System hardware, Software, communications, Protection related risk management for power network failure and unauthorised interference and Power network stability Cable Engineers Forum - The scope of this forum is any topic or issue relating to the design, manufacturing, installation, operation and general management of power network cables including Auxiliary and control wiring (including identification); LV, MV, HV and EHV Cables and associated joints/accessories; Earthing aspects of cables; Cable related asset/risk management; Cable rating issues and associated software packages; Failure mode investigation and related incidents of interest to other operators and cable management and related system tools, techniques and technologies. Effective Protective Coatings for Plant and Overhead Line Towers - The scope of this forum includes the provision of quality control services to supporting electricity companies on tower and plant painting, maintenance and monitoring of the batch certification scheme, to carry out laboratory tests on paint samples from field contracts to ensure compliance with specifications To liaise with manufacturers on quality control procedures and on their development work on improved paint systems, To carry out quality assessment checks/troubleshooting in individual electricity companies as required. The project budget includes the provision for one visit to each supporting electricity company, To produce updated specifications for tower and plant paint systems as required, and to maintain a list of approved manufacturers Plant Engineers Forum - The aim of the Forum is to allow DNO's to share knowledge and raise awareness of plant-related issues which affect the industry as a whole, including plant failures and safety and standards issues. Each Forum includes presentations from guest speakers and expert members on topics of interest as well as discussion of the issues raised by Forum members. The scope of the forum includes plant manufacturing and installation issues ,operational issues, plant related safety and standards issues, new developments in plant design and manufacture, failure mode investigation and related incidents of interest to all electricity network operators Network Planning and Design Forum - The scope and purpose of this forum is to enable interested parties in Electricity Distribution Network Planning and Design to explore, develop and understand the approaches which fellow members take to the challenges and issues that face Network Planning Engineers, present, discuss and share experiences and challenges in the planning and design of power networks, raise awareness in the industry of the key issues which face network planners and designers and gain awareness and understanding of new equipment, approaches and philosophies in network design Overhead Line Forum - The scope of the OHL Engineers Forum is to provide an industry platform for discussion and dissemination of information and case histories Partial Discharge User Group - The scope of the PDUG is to provide a forum to discuss partial discharge issues relating to switchgear and other substation plant and equipment. Other activity includes development of a PD Database, testing for other PD phenomena and long term testing of cable terminations			
Expenditure for financial year	Internal £3,071 External £20,793 Total £23,863		Expenditure in previous (IFI) financial years	Internal £0 External £0 Total £0

Project Cost (Collaborative + external + [DNO])			Projected 09/10 costs for ENW	Internal £2,000 External £20,000 Total £22,000
Technological area and / or issue addressed by project	The EATL Forums address a vast range of different issues and are used to develop a common industry view on a wide range of issues of a technical, engineering or safety nature.			
Type(s) of innovation involved	Demonstration (System prototypes or trials)	Project Benefits Rating	Project Residual Risk	Overall Project Score
		14	11	25
Expected Benefits of Project	Financial - No specific financial reductions will result from participating in the Forums however, they have for many years provided an ideal opportunity for information exchange and both formal and informal industry collaboration. Their have been a number of occasions when various EATL forums have been used to alert DNO's to specific issues of concern and many case studies and other valuable outputs have resulted from participation. The Project NPV score has been calculated to be Medium (3) Other - No specific benefits are defined in the areas of Supply Quality, Environmental, Safety or Operation but all of these issues are addressed.			
Expected Timescale to adoption	1 year		Duration of benefit once achieved	10 years
Probability of Success	100%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£39,301
Potential for achieving expected benefits	The EATL Forums have provided a range of benefits across many areas of our business. For example the Protective Coatings Forum has been investigating reducing emissions of Volatile Organic Compounds which can be found in paints and solvents. The Protection Engineers Forum has been investigating protection mal-operation and component defects. The Overhead Line Engineers Forum and Cable Engineers Forum have identified defective materials and /or specifications. The Plant Engineers Forum has reported an issues with some switchgear with inherent quality problems. The PD User Group Forum has used developed PD monitoring techniques that have saved significant amounts of time and money. The Network Planning and Design Engineers Forum has enabled development of planning tools and techniques.			
Project Progress to March 09	Projects are funded on an annual 'rolling' basis and have concluded for the financial year 08/09. ENW intend to continue to support the EATL forums as they offer a very low-cost and effective means of accessing the latest technical developments across the industry			
Collaborative Partners	Other DNO's			
R&D Providers	EATL			

Project Title	**CBRM for Cables**

<table>
<tr><td>Description of project</td><td colspan="4">It is well recognised that ENW's asset base contains a significant population of buried cables and that a number of these cables are at or near to their original design life. The capital value of these assets is considerable and it would be impracticable from both a financial and operation perspective to embark on wholesale replacement simply based on age. Condition Based Risk Management (CBRM) is a methodology that uses all available knowledge, experience and information relating to physical assets in order to define the present condition of the asset and then estimate future performance on the basis of ongoing degradation. The results can then be used to quantify the risks relating to the assets and evaluate the effect (in terms of risk) of different management options.

The project is concerned with developing ENW's ability to model our cable assets by adopting a more detailed methodology of condition assessment and combining this enhanced understanding with the CBRM methodologies already used for above ground assets.</td></tr>
<tr><td>Expenditure for financial year</td><td colspan="2">Internal £446
External £0
Total £41,688</td><td>Expenditure in previous (IFI) financial years</td><td>Internal £0
External £0
Total £0</td></tr>
<tr><td>Project Cost (Collaborative + external + [DNO])</td><td colspan="2"></td><td>Projected 09/10 costs for ENW</td><td>Internal £9,000
External £28,000
Total £37,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">The project aimed to apply specific condition assessment techniques including physical examination of cable samples recovered at the time of faults and improved recording of fault related information including specific location, operational history, cable type/age, cause of fault etc to available cable samples. Such information should enable a better understanding of generic degradation processes and rates and enable the identification of individual cables approaching end of life (EOL).</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Development (Small scale trials / prototypes)</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">Financial: The financial benefits are derived from a more accurate method of identifying cables that are at risk of failure based on condition rather than age. The 'NPV of Financial Benefit' IFI score is 4 (Significant - £100k-£1M)
Quality of Supply: One specific benefit of this project will be to enhance quality of supply by identifying cables at risk of failure. The 'Network Performance Benefit' IFI score is 2 (Minor - Contributes to improvement in performance)
Safety: Safety benefits will result from a better understanding of which cables may fail and cause a potential risk. The 'Safety' IFI score is 3 (Medium - Mitigation of major incident or prevention of multiple minor incidents)
Environmental: Environmental benefits will arise from a more targeted replacement of cables leading to a reduction in the number of cables that are replaced unnecessarily. The 'Environmental' IFI score is 1 (Small but measurable environmental benefits to a single or limited population of affected sites)</td></tr>
<tr><td>Expected Timescale to adoption</td><td colspan="2">3 years</td><td>Duration of benefit once achieved</td><td>10 years</td></tr>
<tr><td>Probability of Success</td><td colspan="2">50%</td><td>Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£79,671</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">This project is intended to initiate a much larger body of work to address the issue of the management of buried assets.</td></tr>
</table>

Project Progress to March 09	The project is progressing according to the project plan
Collaborative Partners	None
R&D Providers	EA Technology

Project Title	**Transient Resonance Study**				
Description of project	It had been noted that during de-energisation of certain grid transformers on the ENW network, unfamiliar audible phenomena was occurring that gave rise to concern about the safety of personnel and the potential effect on asset life. A project was commissioned with the University of Manchester and Physical Acoustics to investigate further.				
Expenditure for financial year	Internal External Total	£3,440 £15,000 £18,440	Expenditure in previous (IFI) financial years	Internal External Total	£0 £0 £0
Project Cost (Collaborative + external + [DNO])			Projected 09/10 costs for ENW	Internal External Total	£1,500 £43,000 £31,500

Technological area and / or issue addressed by project	The stated project deliverables are; • A case study report on three substations switching transients • Analysis of condition monitoring data • Accurate models for the three case studies, and a "generic" model • Report with any recommendations for changes to transformer design and specifications The stated project objectives are; • To ensure the transformers have not suffered any damage and will meet their expected design life of 40 years. • To gain better knowledge to manage the de-energisation of grid transformers. • To consider the findings and to implement any design policy changes regarding cable/transformer configurations.

Type(s) of innovation involved	Research (Applied analytical knowledge development)	Project Benefits Rating	Project Residual Risk	Overall Project Score
		18	3	21

Expected Benefits of Project	Financial Benefits – The project NPV benefit score is calculated to be 3 (Medium - £10k-£100k per annum reduction in costs) Environmental – No immediate benefits will be delivered but if it can be shown by the project that transformers are better protected as a result than eventual benefits will be realised. The 'Environmental' IFI score is 1 (Low - Small but measurable environmental benefits to a single or limited population of affected sites) Safety – It is not known if the phenomena presents an increased risk to operators or plant but at present it cannot be ruled out that a disruptive failure could occur at some time in the future. This is a primary driver of this work. The 'Safety' IFI score is 4 (Significant - Lead to the reduction of a single potential fatality over a 5yr period) Quality of Supply – The 'Network Performance Benefit' IFI score is 3 (Medium - Leads to improvement in performance)

Expected Timescale to adoption	1 years	Duration of benefit once achieved	20 years
Probability of Success	100%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£94,386
Potential for achieving expected benefits	The project has successfully captured data and developed models to analyse the effects on the transformer being switched. It is expected that the data captured will allow us to reach a firm conclusion regarding the potential adverse effects of this phenomena		
Project Progress to March 09	The project is on-going. Recent work was completed as part of the project that used a range of sensors and data recorders to capture and record the audible phenomena at the instant of de-energisation and this data is currently being analysed by University of Manchester with the results due to be presented in July. Further discussion with then take place regarding the impact of this phenomena and the potential impact on safety and asset remnant life.		
Collaborative Partners	United Utilities Electricity Services, Physical Acoustics Laboratory		
R&D Providers	UoM		

Project Title	**Indoor Substation Environments**				
Description of project	The work of the Partial Discharge Users Group has established a demonstrable link between partial discharge activity and substation environment particularly with regard to relative humidity and this phenomenon is particularly detrimental to primary substation equipment that employs polymeric insulation materials. This project employed a semi-permanent partial discharge monitor supplied by EA Technology (EATL) that can monitor and record surface partial discharge (ultrasonic), internal partial discharge (TEV), temperature and relative humidity in three indoor substation locations known to suffer from high levels of humidity.				
Expenditure for financial year	Internal £1,243 External £22,365 Total £23,608		Expenditure in previous (IFI) financial years	Internal £0 External £0 Total £0	
Project Cost (Collaborative + external + [DNO])			Projected 09/10 costs for ENW	Internal £0 External £0 Total £0	
Technological area and / or issue addressed by project	The specific aim of the project is to further research the potential link between environment and partial discharge activity and to trial the cost effectiveness and practicality of remote partial discharge monitoring of substation equipment on the ENW network.				
Type(s) of innovation involved	Development (Small scale trials / prototypes)	Project Benefits Rating	Project Residual Risk	Overall Project Score	
		13	4	17	
Expected Benefits of Project	Financial - It is estimated that targeted monitoring could prevent one disruptive and one non-disruptive failure every other year leading to an NPV value of £42,359 rated at Medium (3) Supply Quality - Deployment of the monitoring system in targeted substations could result in CML and CI reductions based on an avoidance of a non-disruptive failure or				

	a disruptive failure which affects only one switch will result in 500 customers off supply for one hour (approximate based on national averages) or disruptive failure which destroys the whole switchboard will resulting in 2000 customers off supply for two hours (approximate based on national averages). Medium (3) Leads to improvement in performance Safety - Operational safety could be enhanced by targeted condition monitoring of substation equipment. The techniques used will identify any switchgear deterioration by partial discharge activity before it is detectable by standard inspection routines. The safety benefit is Minor (2) Leads to the reduction of a single potential major injury / LTA over 1yr		
Expected Timescale to adoption	1 years	Duration of benefit once achieved	15 years
Probability of Success	100%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£161,173
Potential for achieving expected benefits	The link between accelerated partial discharge development and substation humidity is of concern to the industry. New switchgear being manufactured comes with a recommendation for very low levels of relative humidity that are not easily achievable in the north west of England and the speed of PD development within this equipment at what we would consider normal levels of RH is alarming. The ability of polymeric insulation to withstand PD activity is almost non-existent and once PD activity has taken place the switchgear becomes unserviceable. This project is also part of a programme of civil works to investigate building structures and how humidity develops and moves around within a brick-built substation. The project is expected to provide a suit of measures and recommendations that can be used to protect the substantial population of switchgear with polymeric insulation		
Project Progress to March 09	All the monitoring equipment is installed and the project is on-going.		
Collaborative Partners	All DNO's through the Partial Discharge User Group at EA Technology		
R&D Providers	EA Technology		

Project Title	**Alternative Oils for Transformers Stage 2**		
Description of project	Mineral oil is widely used across a range of substation equipment and its performance is well understood and documented. Although standard mineral oil is used in a range of applications it would be advantageous to have alternative options for non-standard applications where mineral oil may not be the first choice. Although alternative oils have been available for a number of years it is necessary to build up a level of knowledge of their behaviour to gain confidence that they do perform as expected.		
Expenditure for financial year	Internal £1,743 External £23,333 Total £25,076	Expenditure in previous (IFI) financial years	Internal £0 External £0 Total £0
Project Cost (Collaborative + external + [DNO])		Projected 09/10 costs for ENW	Internal £0 External £0 Total £0
Technological area and / or issue addressed by project	The use of mineral oil for insulation in transformers and switchgear is becoming more onerous over time, efforts need to be made to find reliable and sustainable alternatives.		

Type(s) of innovation involved	Research (Applied analytical knowledge development)	Project Benefits Rating	Project Residual Risk	Overall Project Score
		15	7	22
Expected Benefits of Project	Financial: Financial benefits of using alternative transformer fluids are derived from the following; Claimed to be biodegradable, Reduced mineral oil handling, Reduction of risk of environmental contamination from spills, Reduction in bunding and oil leak/spill surveillance measures, Lifetime ageing performance, Retro-fill for wet transformers, Higher flashpoints of alternative fluids. The 'NPV of Financial Benefit' IFI score is 3 (Medium - £100k-£1M) Safety - Safety benefits will be derived from the lower flammability, higher electrical breakdown strength and higher flash point of natural ester oils. The 'Safety' IFI score is 2 (Minor) Environmental - Both natural and synthetic esters have been tested to demonstrate their biodegradability against a number of international standards, their use in targeted applications would bring obvious environmental benefits. If the research confirmed their long term viability they would offer a valuable potential solution for sensitive locations. The 'Environmental' IFI score is 2 (Minor - Environmental benefits to a small population of affected sites (e.g. 5%-20% locations)			
Expected Timescale to adoption	5 years		Duration of benefit once achieved	20 years
Probability of Success	50%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£67,710
Potential for achieving expected benefits	The widespread use of alternative natural ester oils in high voltage equipment can only be expected to take place after a great deal of research and comparative testing.			
Project Progress to March 09	After a strategic review of all our projects during the financial year is was concluded that ENW could no longer support this project after the 07/08 financial year. This was primarily due to the lack of 400 and 275kV assets on our network resulting in it being unlikely that ENW could receive any benefit from the work at those voltage levels. We are proposing a new project focused on natural ester oils for distribution transformers which we feel will potential by more applicable to our network.			
Collaborative Partners	AREVA T&D, EDF Energy, Electricity North West, M&I Materials, National Grid, Scottish Power and TJh2b			
R&D Providers	University of Manchester			

