# EDF Energy Networks Ltd

# IFI/RPZ Report for the licensed companies:

# EDF Energy Networks (EPN) plc
# EDF Energy Networks (LPN) plc
# EDF Energy Networks (SPN) plc

**October 2004 to March 2005 Inclusive**

## Foreword

Welcome to EDF Energy's first Innovation Funding Incentive report.

At EDF Energy we believe that research and development is a key part of a successful and dynamic electricity networks industry. The relatively straightforward ways of improving efficiency and the quality of our services are behind us. The innovative use of technology will therefore be central to taking our industry forward and improving the customer experience. We are also facing a shortage of skilled power engineers and other key workers. To replace these we need to attract talented young people into our industry and reverse the decline in university courses in power engineering. Innovation can be key to this also, not only through the direct sponsorship of post graduate students, but in creating a dynamic industry that young people are excited about and attracted to.

In establishing the IFI, can I again congratulate Ofgem on a bold and imaginative step. For the first time, the regulatory framework directly promotes innovation, which must be in customers' long term interests. We, and we hope other distribution companies, will respond positively to scheme, by building up a portfolio of high quality, and where appropriate collaborative, innovation projects.

Paul Cuttill
Chief Operating Officer – EDF Energy Networks Branch

# 1. Introduction

During the development of the Distribution Price Control Review (DPCR) that took effect on 1 April 2005, Ofgem proposed two new incentives: the Innovation Funding Incentive (IFI) and Registered Power Zones (RPZ).

## 1.1. Context

As part of the DPCR, Ofgem has introduced the IFI and RPZ incentive mechanisms. They were consulted on as an integral part of the DPCR proposals and were widely supported by a large majority of consultees. As part of this development process Ofgem published a Regulatory Impact Assessment 22 setting out the case for the introduction of the IFI and RPZs.

The primary aim of these two new incentives is to encourage the DNOs to apply innovation in the way they pursue the technical development of their networks. Ofgem recognised that innovation has a different risk/reward balance compared with a DNO's core business. The incentives provided by the IFI and RPZ mechanisms are designed to create a risk/reward balance that is consistent with research, development and innovation.

The two main business drivers for providing these incentives at this time are the growing need to efficiently manage the renewal of network assets and to provide connections for an increasing capacity of distributed generation at all distribution voltage levels. These are significant challenges that will both benefit from innovation.

## 1.2. IFI

The IFI is intended to provide funding for projects focused on the technical development of distribution networks, up to and including 132kV, to deliver value (i.e. financial, supply quality, environmental, safety) to end consumers. IFI projects can embrace any aspect of the distribution system asset management from design through to construction, commissioning, operation, maintenance and decommissioning. The detail of the IFI mechanism is set out in the Special Licence Condition C3, Standard Licence Condition 51 and the Distributed Generation Regulatory Instructions and Guidance (DG RIGs). They can be summarised as follows:

> A Distribution Network Operator (DNO) is allowed to spend up to 0.5% of its Combined Distribution Network Revenue on eligible IFI projects. The DNO is allowed to recover from customers a significant proportion of its IFI expenditure. This proportion is set at 90% in 2005/6 reducing in equal steps to 70% in 2009/10.
>
> Ofgem do not approve IFI projects but DNOs have to openly report their IFI activities on an annual basis. Ofgem reserves the right to audit IFI activities if this is judged to be necessary in the interests of customers.

## 1.3. RPZ

In contrast to the IFI, RPZs are focused specifically on the connection of generation to distribution systems. The estimates made by DNOs as part of the DPCR process indicated that some 10GW of generation could be connected in the next five years. This generation could connect at every distribution voltage level bringing new system design and operating challenges.

RPZs are therefore intended to encourage DNOs to develop and demonstrate new, more cost effective ways of connecting and operating generation that will deliver specific benefits to new distributed generators and broader benefits to consumers generally. The detail of the RPZ mechanism is set out in the Special Licence Condition D2, Standard Licence Condition 51 and the DG RIGs.

The RPZ mechanism is capped in two ways. For the first two years DNOs can only apply for two RPZ registrations per year; this will be reviewed in 2007. Also, in any year, a DNO's additional revenue from RPZ schemes cannot exceed £0.5M.

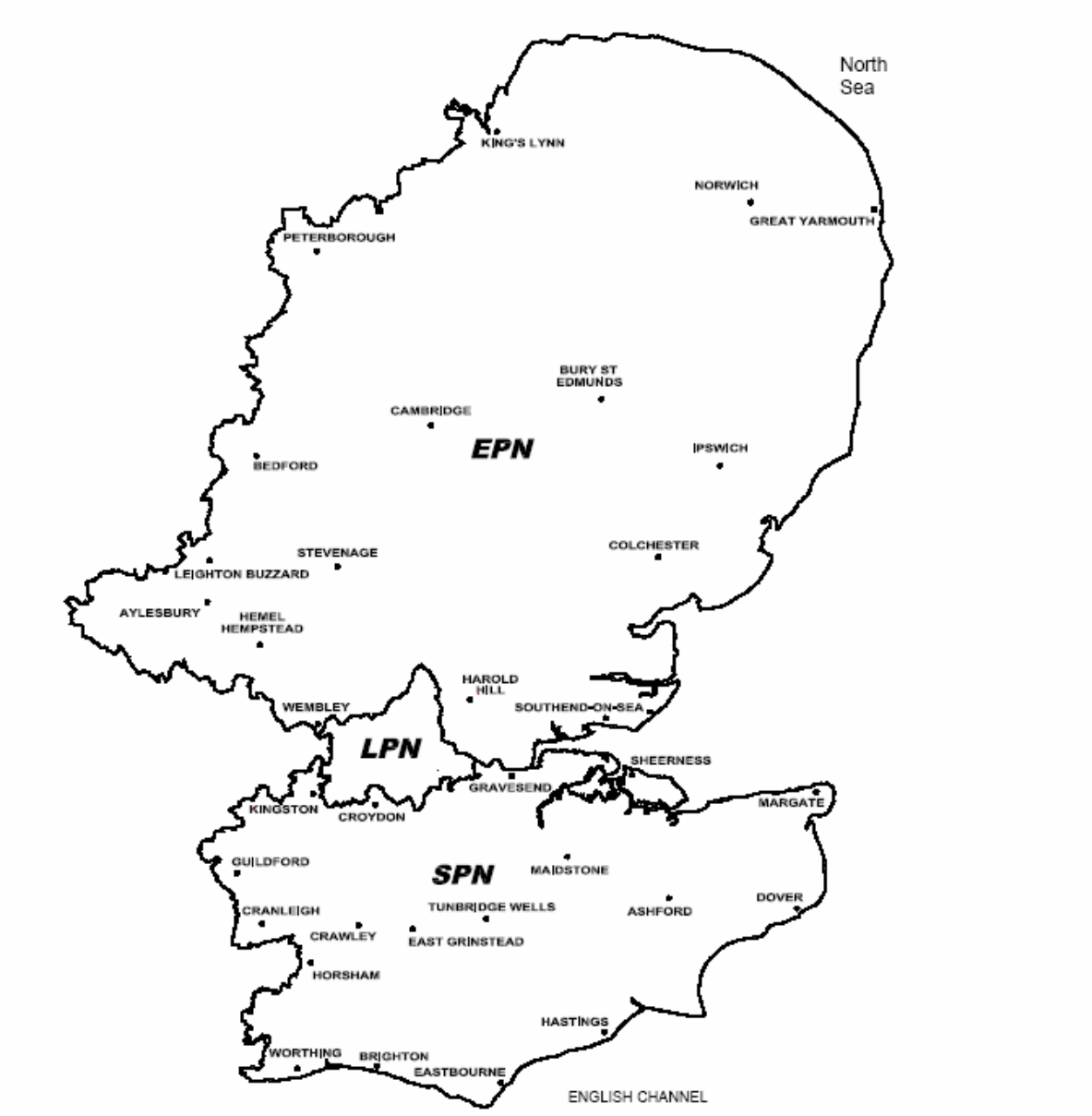
This report contains a summary of EDF Energy's IFI activities for the period October 2004 to March 2005 inclusive. No RPZs were registered by EDF Energy during the period covered by this report.

## 1.4. EDF Energy Structure

EDF Energy owns and operates the distribution networks serving the East of England, London and the South of England through the following licensed companies:

- EDF Energy Networks (EPN) plc for East of England, referred to as EPN in the rest of this report
- EDF Energy Networks (LPN) plc for London, referred to as LPN in the rest of this report
- EDF Energy Networks (SPN) plc for the South of England, referred to as SPN in the rest of this report.

These are shown in the map below.



Research and Development activities are conducted by EDF Energy Networks for the benefit of our customers on behalf of the three licensed network operators named above. Where the benefits of a project are achievable in a particular network then the costs are be assigned to that network. However, with the exception of overhead line projects all projects have been divided equally across each network. As a consequence we are submitting one combined report for the three licensees with benefits assigned to the license area(s) to which they apply.

EDF Energy has, prior to the start of the IFI, been involved with research and development projects with many universities. Stages of some existing projects and programmes are delivering benefits. Subsequent stages of these programmes have now been entered into this IFI framework. It is our strategic intent to establish a balanced portfolio of projects which means that we have initially focussed on scoping some longer term major projects.

As can be seen from the individual project reports, the longer term major projects have high internal expenditure. There is a significant amount of effort required to set up project collaborations and agreements. It is expected that the proportion of internal costs to total costs will reduce as each project progresses and that this proportion will track towards the 15% limit of total IFI expenditure.

## 1.5. Project Partners

EA Technology Ltd is our R&D provider for the Strategic Technology Programme (STP) modules.

The University of Manchester, HV Solutions Ltd and IPEC are partners in our HV condition monitoring programme. Recent results of work were presented at the CIRED 2005 conference held in Turin in June 2005.

Partners for other projects have not been disclosed as EDF Energy is bound by mutual confidentiality agreements. Once papers have been published in the public domain they will be reported in our future IFI/RPZ reports.

# 2 Summary of IFI Project Activities

## 2.1. Number of active IFI projects

There are 6 EDF Energy led IFI projects and participation in 4 EA Technology Ltd (EATL) STP modules.

## 2.2. NPV of costs and anticipated benefits from committed IFI projects

The Programme NPV of committed EDF Energy led IFI projects could be £5,562k. The Project NPV of each project in the IFI Programme is calculated by taking the present value of the estimated benefits multiplying them by the probability of success and then subtracting the present costs. A discount rate of 6.9% has been used.

Each STP module falls below the de-minimis level set in the Good Practice Guide of £40k. It is recognised that as each project has variable benefits and different start / completion timeframes it is not possible to give a specific figure for the benefits achieved against a given financial year. The financial project benefits are expected to be approximately 6 times the cost of successful projects. The benefits will be across a range of areas including construction, maintenance, refurbishment and operation.

## 2.3. Summary of other benefits anticipated from active IFI projects

Other benefits which are anticipated from active IFI projects include:

- an improvement in the security of supply and quality of service received by our customers;
- a reduction in the cost of DG connections; and
- environmental and safety benefits in the avoidance of construction work.

## 2.4. Total expenditure to date on IFI projects

Total expenditure to date on EDF Energy led IFI projects is £309k. The programme to develop major collaborative projects to secure additional funding through the DTI Technology Programme, could result in significant expenditure for many years. Other ongoing IFI compliant projects haven't accrued any costs during this six month period.

## 2.5. Benefits actually achieved from IFI projects to date

EDF Energy has taken the opportunity to start the IFI projects early. During this period partners have been sought, agreements reached and research activities are about to commence. Therefore apart from the obvious benefit of engaging with the Ofgem, DTI and universities it is too early to fully assess other benefits.

## 2.6. Tabular Summary

| | EPN | LPN | SPN |
|---|---|---|---|
| IFI carry forward (£k) | 0k | 0k | 0k |
| Eligible IFI expenditure | £106.9k | £95.1k | £106.9k |
| Eligible IFI internal expenditure | £22.3k | £21.1k | £22.3k |
| Combined distribution network revenue (£m) | £317.3m | £242.6m | £173.1m |

# 3 IFI Programme Reports

## 3.1. Strategic Technology Programme

- STP: Overhead Network Module 2
- STP: Cable Network Module 3
- STP: Substations Module 4
- STP: Distributed Generation Module 5

## 3.2. Individual IFI Project Reports

- HV cable condition monitoring
- LV cable programme
- Overhead line condition monitoring
- The use of Perfluorocarbon Tracers (PFT) leak location techniques
- Evaluation of the characteristics of alternative oils for retro-filling power transformers and for use in new transformers
- Development of major collaborative projects

### 3.3. STP: Module 2 - Overhead Networks

| | |
|---|---|
| Expenditure for financial year | Internal – £1,078<br>External - £21.3k Total EDF Energy costs<br>Total Cost - £22.4k |
| Expenditure in previous (IFI) financial years | £0 |
| Technological area and / or issue addressed by project | The STP overhead network programme aims to reduce costs and improve performance of overhead networks by increasing understanding of issues that have a negative impact on costs and performance. The projects in this module are selected by the participating members. Each project has its own benefits and completion timescales.<br><br>Details of the STP projects are in section 4 |
| Type(s) of innovation involved | All innovative types involved (Incremental, significant, Technological Substitution / Radical) |
| Expected Benefits of Project | As each project has variable benefits and different start / completion timeframes it is not possible to give a specific figure for the benefits achieved against a given financial year.<br><br>The financial project benefits are expected to be approximately 6 times the cost of successful projects. The benefits will be across a range of areas including construction, maintenance, refurbishment and operation. |
| Expected Timescale to adoption | 5 years |
| Duration of benefit once achieved | 20 years |
| Probability of Success | The overall probability of success is expected to be 25% on the whole programme of projects. |
| Project NPV (Present Benefits x Probability of Success) – Present Costs | £35.8k |
| Commentary on project progress and potential for achieving expected benefits | All projects are currently on target. |

## 3.4. STP: Module 3 - Cable Network

| | |
|---|---|
| Expenditure for financial year | Internal – £ 775<br>External - £21.3k Total EDF Energy costs<br>Total Cost - £22.1k |
| Expenditure in previous (IFI) financial years | £0 |
| Technological area and / or issue addressed by project | The STP cable network programme aims to reduce costs and improve performance of underground cable networks by increasing understanding of issues that have a negative impact on costs and performance. The projects in this module are selected by the participating members. Each project has its own benefits and completion timescales.<br><br>Details of the STP projects are in section 4 |
| Type(s) of innovation involved | All innovative types involved (Incremental, significant, Technological Substitution / Radical) |
| Expected Benefits of Project | As each project has variable benefits and different start / completion timeframes it is not possible to give a specific figure for the benefits achieved against a given financial year.<br><br>The financial project benefits are expected to be approximately 6 times the cost of successful projects. The benefits will be across a range of areas including construction, maintenance, refurbishment and operation. |
| Expected Timescale to adoption | 5 years |
| Duration of benefit once achieved | 20 years |
| Project NPV (Present Benefits x Probability of Success) – Present Costs | The overall probability of success is expected to be 25% on the whole programme of projects. |
| Commentary on project progress and potential for achieving expected benefits | £35.3k |

## 3.5. STP: Module 4 - Substations

| | |
|---|---|
| Expenditure for financial year | Internal – £707<br>External - £21.3k Total EDF Energy costs<br>Total Cost - £22.0k |
| Expenditure in previous (IFI) financial years | £0 |
| Technological area and / or issue addressed by project | The STP substation programme aims to reduce costs and improve performance of substation equipment by increasing understanding of issues that have a negative impact on costs and performance. The projects in this module are selected by the participating members. Each project has its own benefits and completion timescales.<br><br>Details of the STP projects are in section 4 |
| Type(s) of innovation involved | All innovative types involved (Incremental, significant, Technological Substitution / Radical) |
| Expected Benefits of Project | As each project has variable benefits and different start / completion timeframes it is not possible to give a specific figure for the benefits achieved against a given financial year.<br><br>The financial project benefits are expected to be approximately 6 times the cost of successful projects. The benefits will be across a range of areas including construction, maintenance, refurbishment and operation. |
| Expected Timescale to adoption | 5 years |
| Duration of benefit once achieved | 20 years |
| Project NPV (Present Benefits x Probability of Success) – Present Costs | The overall probability of success is expected to be 25% on the whole programme of projects. |
| Commentary on project progress and potential for achieving expected benefits | £35.2k |

## 3.6. STP: Module 5: Distributed Generation

| | |
|---|---|
| Expenditure for financial year | Internal – £592<br>External - £21.3k Total EDF Energy costs<br>Total Cost - £21.9k |
| Expenditure in previous (IFI) financial years | £0 |
| Technological area and / or issue addressed by project | The STP distributed generation programme aims to reduce costs and improve network performance by increasing understanding of issues that have a negative impact on costs and performance. The projects in this module are selected by the participating members. Each project has its own benefits and completion timescales.<br><br>Details of the STP projects are in section 4 |
| Type(s) of innovation involved | All innovative types involved (Incremental, significant, Technological Substitution / Radical) |
| Expected Benefits of Project | As each project has variable benefits and different start / completion timeframes it is not possible to give a specific figure for the benefits achieved against a given financial year.<br><br>The financial project benefits are expected to be approximately 6 times the cost of successful projects. The benefits will be across a range of areas including construction, maintenance, refurbishment and operation. |
| Expected Timescale to adoption | 5 years |
| Duration of benefit once achieved | 20 years |
| Project NPV (Present Benefits x Probability of Success) – Present Costs | The overall probability of success is expected to be 25% on the whole programme of projects. |
| Commentary on project progress and potential for achieving expected benefits | £35.0k |

## 3.7. HV condition monitoring project

| | |
|---|---|
| Expenditure for financial year | Internal – £7.3k<br>External - £96.0k Total EDF Energy costs<br>Total Cost - £103.2k |
| Expenditure in previous (IFI) financial years | £0 |
| Technological area and / or issue addressed by project | EDF Energy has identified opportunities from monitoring HV underground cable condition. The issues being investigated by the project are:<br>• On-line fault detection and location;<br>• Pre-emptive fault repairs;<br>• Cable replacement & maintenance strategy;<br>• Quality of supply improvement; and |
| Type(s) of innovation involved | Radical |
| Expected Benefits of Project | Benefits are expected to include:<br>• Ability to target the replacement of cable; and<br>• Ability to identify faults before they occur, carry out a repair and reduce the number of customer interruptions |
| Expected Timescale to adoption | 2 years |
| Duration of benefit once achieved | 20 years |
| Estimated Success probability (at start of project) | 75% |
| Project NPV (Present Benefits x Probability of Success) – Present Costs | £201.8k |
| Commentary on project progress and potential for achieving expected benefits | Stages completed:<br>• Development of On-line mapping equipment;<br>• Small scale field trials;<br>• Development of IT infrastructure (Servers, analysis website); and<br>• Creation of international working group: “On-line Partial discharge consortium”.<br>Stages in progress:<br>• Development of low cost monitoring equipment for use in smaller substation;<br>• Development/improvement of knowledge rules; and<br>• Development of deployment strategy.<br><br>A paper “Comparison of Off-Line and On-Line Partial Discharge MV Cable Mapping Techniques” was presented at CIRED 2005.<br><br>Early indications show that there is a potential for achieving benefits in pre-empting faults before they manifest themselves in the form of a customer interruptions. |

## 3.8. Development of techniques to locate intermittent faults on LV underground cables

| | |
|---|---|
| Expenditure for financial year | Internal – £12.8k<br>External - £43.7k Total EDF Energy costs<br>Total Cost - £56.5k |
| Expenditure in previous (IFI) financial years | £0 |
| Technological area and / or issue addressed by project | EDF Energy has identified opportunities from intermittent fault detection location on LV underground cables using the following techniques:<br>• Time reflection to determine fault location;<br>• Transient impedance Fault location; and<br>• Travelling wave fault location. |
| Type(s) of innovation involved | Radical |
| Expected Benefits of Project | Benefits are expected to include:<br>• Reduction in number of site visits to replace fuses<br>• Reduction in repeated customer interruptions due to intermittent faults being re-energised;<br>• Reduction in customers minutes lost; and<br>• Reduction in worst served customers. |
| Expected Timescale to adoption | 2 years |
| Duration of benefit once achieved | 20 years |
| Estimated Success probability (at start of project) | 75% |
| Project NPV (Present Benefits x Probability of Success) – Present Costs | £1.2M |
| Commentary on project progress and potential for achieving expected benefits | Stages completed:<br>• Theory development; and<br>• Experimental testing.<br><br>Stages in progress:<br>• Field trialing leading to large scale trials.<br><br>Early indications show that there is a potential for achieving benefits in intermittent fault location which could bring about reductions in customer interruptions.<br><br>A paper “Low Voltage Fault Detection and Localisation Using the TOPAS 1000 Disturbance Recorder” was presented at CIRED 2005. |

## 3.9. Development of overhead line condition monitoring techniques

| | |
|---|---|
| Expenditure for financial year | External costs £0<br>Internal costs £1.2k Total EDF Energy costs<br>Total costs £1.2k |
| Expenditure in previous (IFI) financial years | £0 |
| Technological area and / or issue addressed by project | A feasibility study to devise a more convenient monitoring system that will allow detection and location of faulty insulators and surge arresters and tree flashovers, and help avoid faults on the system. |
| Type(s) of innovation involved | Radical innovation |
| Expected Benefits of Project | Benefits are expected to include:<br>• a better understanding of basic phenomena governing insulator and surge arresters failures as well as tree flashover<br>• the feasibility of a new approach to location and/or remote monitoring of overhead line condition failures as well as tree proximity. |
| Expected Timescale to adoption | 7 years |
| Duration of benefit once achieved | 20 years |
| Estimated Success probability (at start of project) | 25% |
| Project NPV (Present Benefits x Probability of Success) – Present Costs | £1M |
| Commentary on project progress and potential for achieving expected benefits | An initial assessment to determine whether monitoring of overhead lines can be developed using similar techniques to that of underground cable partial discharge monitoring.<br><br>The next stage will involve the development of experimental equipment to monitor the characteristics of failing insulators and surge arresters. |

## 3.10. The use of Perfluorocarbon Tracers (PFT) leak location techniques

| | | |
|---|---|---|
| Expenditure for financial year | External costs £0k<br>Internal costs £16.0k<br>Total costs £16.0k | £220k was paid up front in March 2004 for the costs of developing the detector unit during the current year.<br><br>Total EDF Energy costs |
| Expenditure in previous (IFI) financial years | £0 | |
| Technological area and / or issue addressed by project | PFT tracer technology to determine cable leak location and reduce the number of excavations required. | |
| Type(s) of innovation involved | Radical | |
| Expected Benefits of Project | Benefits are expected to include:<br>• Faster and more accurate oil leak locations;<br>• Operational cost savings with fewer and smaller excavations; and<br>• Commercial partnership with a large overseas utility company for future development of the unit. | |
| Expected Timescale to adoption | 2 years | |
| Duration of benefit once achieved | 20 years | |
| Estimated Success probability (at start of project) | 50% | |
| Project NPV (Present Benefits x Probability of Success) – Present Costs | £5M | |
| Commentary on project progress and potential for achieving expected benefits | Initial Development work associated with the READ detection unit has been completed.<br><br>Future stages to conduct acceptance testing of Beta READ detection unit resulting in the delivery of an acceptable instrument that can be successfully deployed to locate leaks involving fewer excavations. | |

## 3.11. Evaluation of the characteristics of alternative oils for retro-filling power transformers and for use in new transformers

| | |
|---|---|
| Expenditure for financial year | External costs £8.9k<br>Internal costs £1.6k Total EDF Energy costs<br>Total costs £10.5k |
| Expenditure in previous (IFI) financial years | £0 |
| Technological area and / or issue addressed by project | Evaluation of the characteristics of alternative oils for retro-filling power transformers and for use in new transformers |
| Type(s) of innovation involved | Technological substitution |
| Expected Benefits of Project | The benefits of using alternative oils in transformers are based around two main points:<br>• safety/environment; and<br>• lifetime ageing performance. |
| Expected Timescale to adoption | 7 years |
| Duration of benefit once achieved | 20 years |
| Estimated Success probability (at start of project) | 50% |
| Project NPV (Present Benefits x Probability of Success) – Present Costs | £14.2k |
| Commentary on project progress and potential for achieving expected benefits | A range of alternative oils and a mineral oil have been tested to compare electrical characteristics for new and aged oils with cellulose materials found in transformers.<br><br>Finite element analysis models are being developed to represent the internal structure of power transformers. |

## 3.12. Development of Major Collaborative Projects

| | |
|---|---|
| Expenditure for financial year | External costs £9.6k<br>Internal costs £23.6k Total EDF Energy costs<br>Total costs £33.2k |
| Expenditure in previous (IFI) financial years | £0 |
| Technological area and / or issue addressed by project | The scoping and development of three major collaborative projects. The results of these projects will integrate but not overlap to develop a holistic approach to the integration of the following:<br>• Distributed Generation and demand side management using the concept of a large-scale virtual power plant to facilitate the connection of DG to the network;<br>• Develop a controller that will monitor electricity networks, isolate faults quickly and allow distributed generation to remain connected and operating; and<br>• Determine the utilisation of advanced network storage, enhanced electrical plant cooling and dynamic control techniques to release the unused capacity of electricity networks. |
| Type(s) of innovation involved | Radical innovation |
| Expected Benefits of Project | Benefits are expected to include:<br>• Maximisation of the contribution of DG to the electricity network;<br>• Reduction in carbon emissions and help towards the UK governments climate change targets;<br>• Reduction in network losses by having the source of generation close to the load;<br>• Improvement in quality and security of supply;<br>• Improvement in network resilience; and<br>• Reducing the current market failures to increase network capacity for DG. |
| Expected Timescale to adoption | 7 years |
| Duration of benefit once achieved | 20 years |
| Estimated Success probability (at start of project) | 75% |
| Project NPV (Present Benefits x Probability of Success) – Present Costs | These projects are expected to deliver benefits in the order of millions of pounds. |
| Commentary on project progress and potential for achieving expected benefits | Development and submission of Project applications to reduce the risk of failure of securing additional EU and government funding has been completed. |

# 4 List of EATL STP Projects 2004-2005

## 4.1. Module 2 – Overhead Networks

| Project No | Project Title | Project Objective | Commitment Date | Completion Date | Budget | Partners |
|---|---|---|---|---|---|---|
| S2114_2 | Lightning risk contour map - Stage 2: Prototype risk map | A map showing how the risk from lightning damage varies from place to place will help companies target lightning protection measures to reduce operational expenditure. | May 2004 | Oct 2004 | £11,200 | Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF |
| S2118 | Module co-ordination | Administration | Apr 2004 | Mar 2004 | £18,800 | Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF |
| S2119 | Effect of lightning on insulated earth wires. | There will be quantifiable benefits in network performance as well as improvement in operator health and safety through re-evaluation of cable design based on this study of lightning effects. | Aug 2004 | Feb 2005 | £12,100 | Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF |
| S2120 | Detection of defective surge arresters | Network performance will be improved by reducing over-voltage transients to customers, reducing equipment failure due to over-voltage stress, identification of under performing network protection and early detection of incipient faults in surge arresters. | May 2004 | Oct 2004 | £16,325 | Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF |

| Project No | Project Title | Project Objective | Commitment Date | Completion Date | Budget | Partners |
|---|---|---|---|---|---|---|
| S2121 | Tracking tests on new and old covered conductor samples from Finland and Sweden | Covered conductor networks will experience improved performance, particularly in coastal or polluted areas, through the re-specification of these conductors. | Apr 2004 | Oct 2004 | £23,780 | Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF |
| S2122 | Arc gaps for long-rod polymeric 132kV insulators on wood pole and tower lines - Stage 1: Arc Gaps and Grading rings – Use of existing data | Improved network performance and operational cost reduction will stem from this best practice definition of long rod insulator specification. | Jul 2004 | Feb 2005 | £11,580 | Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF |
| S2123 | Continued involvement with Cigre WG11 | By determining and distributing best practice across the industry through cost effective identification of world-wide best practice, all aspects of customer benefits should be positively impacted. | May 2004 | Apr 2005 | £17,070 | Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF |
| S2124 | Vibration tests on new covered conductor types | Premature replacement of new conductor types should be reduced and conversely in service failure of these conductors should be reduced, resulting in operational cost reduction and improved network performance. | Apr 2004 | Oct 2004 | £11,575 | Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF |
| S2125 | Monitoring Cigré 2004/5 | By determining and distributing best practice across the industry through cost effective identification of world-wide best practice, all aspects of customer benefits should be positively impacted. | Aug 2004 | Apr 2005 | £9,250 | Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF |

| Project No | Project Title | Project Objective | Commitment Date | Completion Date | Budget | Partners |
|---|---|---|---|---|---|---|
| S2126 | Long-term monitoring of conductor temperature at fixed current to confirm/reassess validity of using Leatherhead 1976 data as basis of distribution ratings | Up-rating of distribution network conductors could substantially reduce the cost of replacing these items by deferring temporarily or permanently the need for replacement. | Apr 2004 | May 2005 | £27,300 | Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF |
| S2127 | Attend 2nd Wrap seminar and report | Positive environmental benefits will stem from the improvement in disposal practices of treated utility poles. | Apr 2004 | May 2005 | £1,360 | Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF |
| S2112 | Call-out for leakage currents on suspect poles – 10% additional funding | | Nov 2003 | Sep 2004 | £980 | Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF |

## 4.2. Module 3 – Cable Networks

| Project No | Project Title | Project Objective | Commitment Date | Completion Date | Budget | Partners |
|---|---|---|---|---|---|---|
| S0352 | Module 3 administration | Provide an efficient administration for the module, including the following services as set out in the STP agreement:-<br>• Provide support to the steering group<br>• Prepare proposals for new projects against the objectives set by the steering group<br>• Ensure as far as reasonably possible that projects are delivered to the required time, budget, and quality standards<br>• Ensure accurate and timely communication with the participants<br>• Make recommendations for protection or exploitation of the IPR arising from the Module Programme and Outputs | Apr 2004 | Mar 2005 | £13,000 | Mod 3 DNOs: EDF, CN, CE, S&S, UU, WPD |
| S3100_2 | Specification for link boxes. Stage 2: Final specification | Through correct specification of link box characteristics, to increase reliability and thereby reduce operating costs. | Apr 2004 | Oct 2004 | £8,000 | Mod 3 DNOs: EDF, CN, CE, S&S, UU, WPD |

| Project No | Project Title | Project Objective | Commitment Date | Completion Date | Budget | Partners |
|---|---|---|---|---|---|---|
| S3113 | Current rating tools for cables | Through the development of user friendly software for the calculation of cable ratings, to ensure best engineering design practice and to reduce the cost of purchase of cables by more accurately matching cable specification to functional requirement.<br>Stage 1: Extend the functionality of the existing CRATER cable rating software to include user defined input of load curve.<br>Stage 2: Create a tool to calculate ratings of cables in banks of ducts | Apr 2004 | Nov 2004 | £38,000 | Mod 3 DNOs: EDF, CN, CE, S&S, UU, WPD |
| S3115 | Corrosion resistance of aluminium foil cables | To improve reliability and to reduce operating costs by reducing life-reducing corrosion in 132 kV foil laminate cables. | May 2004 | Jan 2005 | £21,000 | Mod 3 DNOs: EDF, CN, CE, S&S, UU, WPD |
| S3116 | Mechanical properties of corrugated ducting | To introduce best engineering practice and to reduce operating costs by better understanding and hence correct selection of cable duct. | Apr 2004 | Dec 2004 | £20,000 | Mod 3 DNOs: EDF, CN, CE, S&S, UU, WPD |
| S3120 | Burn-back of cables in ducts, basements and ducts | To improve network performance, to reduce the impact of cable failure and to reduce health and safety risks from serious fires, by testing coating systems which can prevent the propagation of fire along PE sheathed cable. | Apr 2004 | Dec 2004 | £26,670 | Mod 3 DNOs: EDF, CN, CE, S&S, UU, WPD |

## 4.3. Module 4 – Substations

| Project No | Project Title | Project Objective | Commitment Date | Completion Date | Budget | Partners |
|---|---|---|---|---|---|---|
| S0425 | Module Co-ordination 04/05 | To provide support to the steering group and its sub-groups to enable them to function as efficiently as possible. | Apr 2004 | Mar 2005 | £21,630 | Mod 4 DNOs: CN, CE, UU, S&S, SP, EDF, WPD |
| S0499_3 | Extension of TASA Trial | To improve network performance as a result of reduced failure of on-load tap changers by ensuring that the TASA Technique is rigorously tested to give confidence in its approach and methodology to enable a condition based maintenance strategy to be implemented for on load tap changers. | May 2004 | May 2005 | £35,920 | Mod 4 DNOs: CN, CE, UU, S&S, SP, EDF, WPD |
| S4127_7 | Scoping Study: Identify relevant Electro-technical forums to monitor | To further Module 4's understanding of other, mainly European, organisations activities in line with Objective 5 of STP's Substation Module core scope and objectives. | May 2004 | Jun 2004 | £1,000 | Mod 4 DNOs: CN, CE, UU, S&S, SP, EDF, WPD |
| S4127_8 | Scoping Study: Seminar to discuss S0485 Safety | To reach a consensus opinion amongst member companies regarding the safety implications for the design and operation of substation plant in the UK in light of the on-going "Europeanisation" of substation plant design. | Jul 2004 | Jul 2004 | £1,000 | Mod 4 DNOs: CN, CE, UU, S&S, SP, EDF, WPD |
| S4130_2 | Dry Wipe Assessment | To rank the performance of wipe products depending on their suitability for cleaning the tanks of HV oil filled equipment during maintenance. | Apr 2004 | Aug 2004 | £11,200 | Mod 4 DNOs: CN, CE, UU, S&S, SP, EDF, WPD |

| Project No | Project Title | Project Objective | Commitment Date | Completion Date | Budget | Partners |
|---|---|---|---|---|---|---|
| S4145 | Environmental Aspects of Substation Operation | To present a summary of worldwide techniques and solutions currently employed to reduce the environmental impact of existing and planned substations. | Apr 2004 | Aug 2004 | £7,100 | Mod 4 DNOs: CN, CE, UU, S&S, SP, EDF, WPD |
| S4146 | Impact of Distributed Generation | To present a high level perspective of the fundamental issues and implications of connecting Distributed Generation to the distribution network focused at the 11kV level and take into account those factors, issues and implications for substation plant. | Jun 2004 | Aug 2004 | £13,000 | Mod 4 DNOs: CN, CE, UU, S&S, SP, EDF, WPD |
| S4147 | On-line oil regeneration | To review available online oil regeneration processes for oil filled equipment in the context of reducing cost of maintenance, thereby improving network performance through increased reliability and extending life. | Jun 2004 | Dec 2004 | £22,500 | Mod 4 DNOs: CN, CE, UU, S&S, SP, EDF, WPD |
| S4149 | Reliability of existing and newly installed plant | To provide an objective assessment of the extent and severity of the issues regarding the performance of newly installed plant which in some instances is not performing as well as older, more established plant. | Jun 2004 | Dec 2004 | £21,500 | Mod 4 DNOs: CN, CE, UU, S&S, SP, EDF, WPD |
| S4150 | Arc Suppression Coil Systems | To produce a concise report which clearly reviews the recent development in ASCS and the issues that need to be considered when applying this technology to UK distribution networks rated up to 36kV. | May 2004 | Jun 2004 | £7,680 | Mod 4 DNOs: CN, CE, UU, S&S, SP, EDF, WPD |

| Project No | Project Title | Project Objective | Commitment Date | Completion Date | Budget | Partners |
|---|---|---|---|---|---|---|
| S4155 | Investigation of Ester Based Insulating Oils | To understand where and when vegetable based oils would be more advantageous than mineral based oils and where on the system would most advantage be gained from its use . | Jul 2004 | Sep 2004 | £13,289 | Mod 4 DNOs: CN, CE, UU, S&S, SP, EDF, WPD |
| S4156 | Current Cigre Substation Work Group | To provide up-to-date information on work applicable to the UK DNO's from world-wide sources. | May 2004 | Aug 2004 | £10,790 | Mod 4 DNOs: CN, CE, UU, S&S, SP, EDF, WPD |
| S4157 | Review of last 10 years of Cigre Substation work | To provide a source of new ideas for UK use as well as providing information on world-wide progress and experience of substations. | May 2004 | Aug 2004 | £11,620 | Mod 4 DNOs: CN, CE, UU, S&S, SP, EDF, WPD |

## 4.4. Module 5 – Distributed Generation

| Project No | Project Title | Project Objective | Commitment Date | Completion Date | Budget | Partners |
|---|---|---|---|---|---|---|
| S0581_4 | Voltage control policy assessment tool | Developing effective policies for applying voltage control technologies is key in enabling distributed generation Developers and Customers to connect increasing numbers of small generators. This project is developing a tool for DNOs to assess new approaches and find the best that allows maximum connections at lowest cost to developer, customer & DNO. | Apr 2004 | May 2004 | £7,500 | Mod 5 DNOs: CN, EDF, CE, SP, UU |
| S0581_5 | Voltage control policy assessment tool (workshop) | See previous for project objective. This workshop tested whether the tool functioned as required and gave DNO staff the opportunity to gain knowledge of how to use it. | Jun 2004 | Jul 2004 | £5,635 | Mod 5 DNOs: CN, EDF, CE, SP, UU |
| S0594_3 | Rapid response to regulatory consultation documents | To ensure that knowledge gained from STP projects is effectively provided into the consultation processes. Thereby ensuring that the impact of regulatory developments on innovative technology solutions in development is known and can be accounted for to the long term benefit of network customers. | Apr 2004 | Mar 2005 | £11,500 | Mod 5 DNOs: CN, EDF, CE, SP, UU |
| S5100_2 | Enhancing protection & control systems to maximise network benefits … | Future network performance will be enhanced by defining best practice management of protection and control systems, as will the ability to manage the risks associated with DG connection. | Mar 2004 | May 2004 | £9,900 | Mod 5 DNOs: CN, EDF, CE, SP, UU |

| Project No | Project Title | Project Objective | Commitment Date | Completion Date | Budget | Partners |
|---|---|---|---|---|---|---|
| S5102 | A watching brief on distributed generation | This project assembles the key information published in UK & internationally to ensure that all the projects in STP use best knowledge and do not duplicate work. It benefits DNOs, DG Developers & customers in bringing to their notice best practice. | Apr 2004 | Jan 2005 | £12,500 | Mod 5 DNOs: CN, EDF, CE, SP, UU |
| S5113 | Seminar on Module 5 work – Stability | Knowledge & understanding of stability issues as the amount of DG in distribution networks increases is an increasing concern. This seminar will transfer knowledge from 8 STP projects to DNO design engineers, thereby enabling them to better accommodate connection requests without incurring Supply Quality dis-benefits. | Jun 2004 | Sep 2004 | £7,100 | Mod 5 DNOs: CN, EDF, CE, SP, UU |
| S5119 | Stability assessment policies: generic guidance | A best practice guide for stability assessment policy will communicate the output from previous STP projects on stability and will assist in enhancing network performance and reduce operational costs stemming from instability caused by DG connection. | Mar 2004 | Apr 2004 | £5,000 | Mod 5 DNOs: CN, EDF, CE, SP, UU |

| Project No | Project Title | Project Objective | Commitment Date | Completion Date | Budget | Partners |
|---|---|---|---|---|---|---|
| S5122_2 | Guidance as to LOM protection settings on distribution networks | Having the right setting on generator Loss of Mains protection is vital to ensure customers see the minimum number of loss of supply events. This project gives advice founded upon earlier stage testing of commonly used relays in the UK. Major reductions in numbers of nuisance false trips are expected | Jun 2004 | Aug 2004 | £5,800 | Mod 5 DNOs: CN, EDF, CE, SP, UU |
| S5123_2 | BAM Solution 3.5 - Line voltage regulation | To improve future network performance by developing a guide through improved operational design practices, to communicate effectively innovative options for line voltage regulation. | Jun 2004 | Aug 2004 | £9,250 | Mod 5 DNOs: CN, EDF, CE, SP, UU |
| S5124_2 & 3 | BAM Solution 2.2 - Increase impedance of components S2 | To assess the potential for increasing the impedance of transformers by identifying and enumerating the network benefits and disadvantages. To identify methods to reduce the disadvantages. To design and cost demonstration trials. | Apr 2004<br>Jul 2004 | Jun 2004<br>Sep 2004 | £8,000<br>£9,800 | Mod 5 DNOs: CN, EDF, CE, SP, UU |
| S5125 | BAM Solution 2.1 - Uprate network components | To investigate the engineering, practical and fiscal considerations and constraints associated with the options of holding the 11kV fault level at the design fault level of 250MVA during normal running arrangements and increasing the design fault level. The investigation will consider implications to HV and LV connected customers as well as implications to the DNO system | May 2004 | Jul 2004 | £7,500 | Mod 5 DNOs: CN, EDF, CE, SP, UU |

| Project No | Project Title | Project Objective | Commitment Date | Completion Date | Budget | Partners |
|---|---|---|---|---|---|---|
| S5126 | BAM Solution 2.3 - Converter technology | To obtain outline costs and high-level technical benefits for commercially available converters across a range of generator types. Aim being to assist the process of implementation of TSG Workstream 3 solution 3.5 by DNOs. | Apr 2004 | Jun 2004 | £5,000 | Mod 5 DNOs: CN, EDF, CE, SP, UU |
| S5128 | Module 5 co-ordination | Administration | Apr 2004 | Mar 2005 | £15,000 | Mod 5 DNOs: CN, EDF, CE, SP, UU |
| S5130 | Network risk management | To assist DNOs to form a set of views on issues surrounding network risk including those associated with increasing network utilisation and risks of relying on DG to avoid network reinforcement, ideally, before the draft P2/6 network security standard is published for consultation. | Jun 2004 | Sep 2004 | £13,500 | Mod 5 DNOs: CN, EDF, CE, SP, UU |
| S5132 | Overview of system behaviour with large amounts of windpower | To assist in ensuring supply quality in disturbances on networks with large amounts of windpower, the key aspects of this recent work in Denmark are to be identified for application in UK. | Jun 2004 | Jul 2004 | £3,000 | Mod 5 DNOs: CN, EDF, CE, SP, UU |
| S5133 | Tapchangers - reverse power capabilities | Tap changers are key items in achieving good voltage control with significant amounts of distributed generation. There is no definitive reference document of the equipment out on the networks reverse power capability. The project will give this, enabling the most cost-effective option to be selected. | Jun 2004 | Sep 2004 | £15,000 | Mod 5 DNOs: CN, EDF, CE, SP, UU |

| Project No | Project Title | Project Objective | Commitment Date | Completion Date | Budget | Partners |
|---|---|---|---|---|---|---|
| S5138 | Review of Industry Codes | To identify likely new Distribution Code provisions relating to distributed generation and comment on their implications | Jun 2004 | Jul 2004 | £7,250 | Mod 5 DNOs: CN, EDF, CE, SP, UU |
| S5139 | Potential of RPZ framework | To improve future network performance and reduce network costs by defining specific RPZ scenarios and quantifying the commercial issues, in order to facilitate the identification and establishment of optimum RPZs. | Aug 2004 | Sep 2004 | £4,200 | Mod 5 DNOs: CN, EDF, CE, SP, UU |
| S5140 | Domestic CHP potential | To produce an up to date estimate of rollout for key dCHP products to establish a time plan against which DNOs may have to respond with technical solutions to the supply quality and financial implications. | Jul 2004 | Sep 2004 | £7,000 | Mod 5 DNOs: CN, EDF, CE, SP, UU |
| S5141 | IFI work portfolio | To identify potential project outlines that meet the IFI benefit criteria for customers, generators and DNOs through a brain storm and project formulation workshop. | Jun 2004 | Jul 2004 | £2,500 | Mod 5 DNOs: CN, EDF, CE, SP, UU |