Innovation Funding Incentive Reports

Scottish Hydro-Electric Power Distribution

Southern Electric Power Distribution

for period 1 April 2005 to 31 March 2006

Contents

1. Executive Summary

Scottish-Hydro Electric Power Distribution (SHEPD) and Southern Electric Power Distribution (SEPD) have continued the IFI projects started in the initial six month period and have initiated a diverse mix of new projects to increase IFI activity significantly during this reporting period. New working relationships have been established with several external parties to complement existing working arrangements.

The scope of activities ranges from development projects focussed on solving specific problem areas such as the difficulties of locating intermittent underground cable faults to large national collaborations such as Supergen 5 with multiple work packages.

2. Introduction

As part of the April 2005 Distribution Price Control Review (DPCR), Ofgem (the regulatory body for the energy industry) introduced an Innovation Funding Incentive (IFI). The primary aim of this incentive is to encourage the distribution network operators (DNOs) to apply innovation in the way they pursue the technical development of their networks. A Good Practice Guide (Engineering Recommendation G85) has been produced by the DNOs that is available free of charge via the Energy Networks Association's (ENA) website: www.energynetworks.org.

The IFI is intended to provide funding for research and development (R&D) projects focused on the technical development of distribution networks to deliver value (i.e. financial, supply quality, environmental, safety) to end consumers. IFI projects can embrace any aspect of distribution system asset management from design through to construction, commissioning, operation, maintenance and decommissioning. A DNO is allowed to spend up to 0.5% of its Combined Distribution Network Revenue on eligible IFI projects.

Open reporting (i.e. available in the public domain) of IFI projects is required by Ofgem; this is intended to stimulate good management and promote sharing of innovation good practice.

In line with this, we will publish our IFI reports on the Scottish and Southern Energy website: www.scottish-southern.co.uk.

To enhance their accessibility, they will also be available within the "IFI and RPZ" area of work on Ofgem's website: www.ofgem.gov.uk

Scottish and Southern Energy (SSE) and its energy network subsidiary SSE Power Distribution (SSEPD) welcomes this initiative as a positive measure to further improve customer service, enhance safety, address environmental issues and reduce costs.

3. Scope

This document contains the reports for the two electricity distribution licensees within SSEPD :

Scottish Hydro-Electric Power Distribution Ltd (SHEPD)
and
Southern Electric Power Distribution plc (SEPD).

It details activities in the period from 1 April 2005 to 31 March 2006. Activities in the period from 1 October 2004 to 31 March 2005 are treated as 2005/6 activities under the DPCR so the costs are consolidated into the 2005/6 regulatory report but these activities are not detailed in this report as they have previously been reported.

Separate summary reports have been provided for each licence area with one set of detailed individual project reports as projects are generally developed for the benefit of both licence areas, reflecting our strategy of running both companies using one common best practice. The reports have been produced in accordance with the Distributed Generation Regulatory Instructions and Guidance (RIGs) issued by Ofgem and ENA Engineering Recommendation G85.

In addition to reporting on activities in 2005/06 we have included information on current projects and intended developments.

4. Overview of IFI Activity

2005/06
There has been a significant increase in IFI activity in 2005/06 compared with the initial six months of the incentive. Useful consultations have taken place during the period with Ofgem which have developed our understanding of the IFI mechanism. Projects begun in the previous reporting period have been developed and supplemented by new projects with diverse projects ranging from larger individual projects to projects covering multiple activities and several ‘de minimis’ (under £40k) projects. Some of the identified constraints on increasing IFI activity have been progressed. However, uncertainty regarding continuity of the incentive into the next DPCR will become an increasingly important consideration.

The appointment in 2005 of a full-time R&D Programme Manager as the focal point for IFI activity across Power Systems demonstrates SSEPD’s commitment to R&D in this area.

Our programme of projects in 2005/06 is made up of a combination of projects which have originated as a result of collaborative work with external organisations such as EATL and the ENA and projects which have originated internally from our own analysis of areas of work which could benefit from an innovative approach such as faster sectionalising of overhead line faults by deploying portable fault passage indicators coupled with newly available GSM communications technology.

4. Overview of IFI Activity (contd.)

In the SHEPD area, considerable amounts of renewable generation, mainly wind farms, are in the process of being connected to our network. However, network constraints have become apparent in many geographic areas which currently limit the amount of generation we can connect until extensive transmission reinforcements are completed. We believe active management systems and other methodologies can be developed to allow more generation to be connected. SSEPD are progressing research to reduce the impact of these constraints. Earlier work has been developed as an ongoing IFI project during 2005/2006 and this has resulted in Ofgem registering our application for the Orkney network as SSEPD's first Registered Power Zone - see separate RPZ annual report for details. This work continues in 2006/07 and involves Strathclyde University who are an acknowledged UK leader in the field of electrical and electronic engineering with particular involvement in active networks.

We are currently investigating other engineering approaches to facilitate the connection of DG including voltage regulation using power electronics and small scale reactive compensation. It is also expected that useful development and demonstration projects will result from work in various forums such as Supergen 5, ENA, and EA Technology Limited (EATL).

SSEPD has continued its existing partnership with EATL. This research and development company has worked with the DNOs for a number of years and produced significant and successful initiatives which have contributed to improvements in all areas of DNO activity. SSEPD subscribes to, and plays an active role in, each of the four EATL Strategic Technology Platform (STP) modules: overhead lines; underground cables; substation plant; and distributed generation. This partnership will continue in 2006/07.

Present Work and Future Developments

One current example of broadening R&D horizons is the evaluation and appraisal of the work of the American Electric Power Research Institute (EPRI). This is being undertaken by EATL for the participating DNOs and an overall review of the range of EPRI activities will move forward to a more focussed investigation of a range of activities of relevance to UK DNOs.

We have developed our involvement with the energy networks industry trade organisation, the ENA, as it represents the consolidated views of the industry at various important UK and European forums and also provides an opportunity for DNOs to meet, discuss and move forward engineering issues. The R&D Working Group within the ENA has provided a useful collaborative working framework for IFI activities across the DNOs. SSEPD currently chairs the R&D Working Group and participates in the Distributed Work Group – Network Design for a Low Carbon Economy. SSEPD intends to continue to participate in these groups and it is hoped that the current re-organisation of ENA activities will not lessen the value of this pivotal organisation.

4. Overview of IFI Activity (contd.)

Following Engineering and Physical Sciences Research Council (EPSRC) approval in February 2006 of a programme of work proposed by a consortium of universities, SSEPD has engaged with SUPERGEN 5 – Asset Management and Performance of Energy Systems. SUPERGEN is EPSRC's flagship initiative in Sustainable Power Generation and Supply. This collaboration between industry and universities is structured to enable interaction both between academics and also between academic and industrial participants. SUPERGEN 5 has attracted strong industrial participation from the DNOs and it is expected that the work packages within this collaboration will lead to demonstration projects which will meet the criteria to qualify for eligibility as IFI projects so that the research activity can be developed to deliver benefits to end users.

SSEPD is also currently a member of the Electricity Supply Research (ESR) Network. The ESR acts as a knowledge transfer link between industry and academia for research activities. The aims of the ESR are to raise the profile of UK electricity supply research, to identify R&D strategies in key areas, to secure funding, to create synergy among UK research groups and to ensure core competencies are maintained.

5. Financial Summary

As R&D activities are operated from a common perspective across both licence areas the costs and benefits have been taken as applying across both licence areas in proportion to the size of each area as determined by Combined Distribution Network Revenue (CDNR). In round terms, this leads to 30% being allocated to SHEPD and 70% to SEPD.

Qualifying expenditure for the reporting period of 1 April 2005 to 31 March 2006 has been £322,000 for SHEPD and £751,000 for SEPD, of which £51,000 and £119,000 relates respectively to internal costs.

Financial information on the IFI projects relevant to the reporting year 1 April 2005 to 31 March 2006 are contained in the individual reports for SHEPD and SEPD set out in the following sections.

As noted above, the costs of IFI activities reported for the period 1 October 2004 to 31 March 2005 are consolidated into the regulatory returns for the 2005/06 financial period

Adoption costs have not been included at this stage but will be evaluated and taken into consideration as individual projects progress and application to the business can be more accurately assessed.

6. Conclusion

SSEPD has increased R&D activity significantly in the reporting period with new working relationships being established with various external parties to supplement existing arrangements.

Some of these new collaborations are expected to lead to further innovations which will be developed as spin off projects.

It is hoped that the current uncertainty over the continuity of the IFI mechanism into the next DPCR period will be satisfactorily resolved. It is the intention of SSEPD to develop our R&D activity and that future activities will range from increasing our engagement at national level with multi-party collaborations and forums to specific projects targeted at areas which could benefit from an innovative approach.

Section 7

Scottish Hydro-Electric

Power Distribution

IFI Report

for period

1 April 2005 – 31 March 2006

Scottish Hydro-Electric IFI Report

Summary report of IFI project activities:– April 2005 – March 2006

Number of active IFI projects.	25
NPV of costs and anticipated benefits from committed IFI projects.	NPV Costs = £ 322,000 (Internal £51,000 ; External £ 271,000 Anticipated Benefits = £ 798,000 .
Summary of other benefits anticipated from active IFI Projects.	Various customer, safety and environmental benefits will also accrue which are as yet not fully quantified.
Total expenditure to date on IFI projects.	£ 431,000
Benefits actually achieved from IFI projects to date.	Not Applicable as yet.

Regulatory report for Innovation Funding Incentive Reporting Year 2005/06

	2004/2005	2005/2006	Consolidated Total
IFI carry forward	**n/a**	**0**	**0**
Eligible IFI Expenditure (£m)	**0.109**	**0.322**	**0.431**
Eligible IFI Internal Expenditure (£m)	**0.030**	**0.051**	**0.08**
Combined Distribution Network Revenue (£m)	**n/a**	**144.9**	**n/a**

Section 8

Southern Electric Power Distribution

IFI Report

for period

1 April 2005 – 31 March 2006

Southern Electric Power Distribution IFI Report

Summary report of IFI project activities:– April 2005 – March 2006

Number of active IFI projects.	25
NPV of costs and anticipated benefits from committed IFI projects.	NPV Costs = £ 751,000 (Internal £ 119,000 ; External £ 632,000 Anticipated Benefits = £ 1,862,000
Summary of other benefits anticipated from active IFI Projects.	Various customer, safety and environmental benefits will also accrue which are as yet not fully quantified.
Total expenditure to date on IFI projects.	£ 857,000
Benefits actually achieved from IFI projects to date.	Not Applicable as yet.

Regulatory report for Innovation Funding Incentive Reporting Year 2005/06

	2004/2005	2005/2006	Consolidated Total
IFI carry forward	**n/a**	**0**	**0**
Eligible IFI Expenditure (£m)	**0.106**	**0.751**	**0.857**
Eligible IFI Internal Expenditure (£m)	**0.026**	**0.119**	**0.145**
Combined Distribution Network Revenue (£m)	**n/a**	**364.5**	**n/a**

Section 9

Scottish Hydro Electric Power Distribution

Southern Electric Power Distribution

Individual IFI Project Reports

for period

1 April 2005 – 31 March 2006

Individual IFI Project report :– April 2005 – March 2006

Description of project	Strategic Technology Programme Overhead Network Module
Expenditure for financial year	External = £36,000 Internal = £4,000 Total = £40,000
Technological area and / or issue addressed by project	The STP overhead network programme for budget year 2005/6 aimed to reduce costs and improve performance of overhead networks by increasing understanding of issues that have a negative impact on costs and performance. The programme is expected to also have a positive impact on safety and environmental performance. The projects all address real problems that have been identified by the module steering group members as significant and which require technical investigation and development. The projects within the programme aimed to: • S2120_2 - Improve detection of defective surge arresters in-situ with selection and evaluation of the most promising solutions. • S2126_2 - Undertake long-term monitoring of conductor temperature by obtaining and analysing 12 months trial data. • S2132 - Validate current and proposed new ice accretion models • S2133 - Investigate the use of sacrificial anodes for protecting tower foundations to defer or remove the need for full foundation refurbishment. • S2134_1 - Determine the susceptibility of currently used surge arresters to the principal modes of failure • S2135 - Evaluate the life expectancy of copper conductors. • S2136 - Participate in European Project COST 727: Measuring and forecasting atmospheric icing on structures. • S2138_1 - Investigate live-line jumper-cutting limitations Stage 2 is to define a realistic experimental programme. • S2139 - Begin to evaluate a new corona discharge camera system. • S2140 - Explore possible means of checking the foundations of newly installed poles

<table>
<tr><td>Type(s) of innovation involved</td><td colspan="3">Technical Substitution / Radical</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="3">Due to the age profile of system equipment it is inevitable that, unless significant new technology is used to extend asset life, CAPEX and possibly OPEX will need to increase significantly to maintain the present level of network reliability and safety.
If these projects are technically successful and the findings and recommendations from the projects are implemented, then the projects will potentially enable each DNO member of the programme to gain benefits including:
avoid redesign, reconstruction or refurbishment of overhead lines where this is driven by a perceived need to increase ratings or strengthen lines, and is required to conform with existing standards but which may be unnecessary;
reduce levels of premature failure of assets;
provide more cost effective and early identification of damaged insulators and discharging components, which if not addressed would result in faults;
confidently extend the service life of towers and reduce potential levels of tower failures;
reduce lifetime costs by the appropriate use of alternative materials.</td></tr>
<tr><td>Expected Timescale to adoption</td><td>Range 1-7 years - dependent on project</td><td>Duration of benefit once achieved</td><td>Range 2-10 years - dependent on project</td></tr>
<tr><td>Estimated Success probability (at start of project)</td><td colspan="3">Range 5-20% - dependent on project</td></tr>
<tr><td>PV of Project Costs</td><td>£40,000
(nb. This is identified early stage cost. It does not reflect the likely full costs of implementation. These will be identified providing the outcome of the early stage is positive.)</td><td>PV of Project Benefits</td><td>£54,600</td></tr>
</table>

Commentary on project progress and potential for achieving expected benefits	Some projects within the programme are at an early stage, whilst others are complete. Issues have been identified relating to both operational and capital expenditure which, if successfully addressed, would enable the expected benefits to be achieved. *S2120_2 - Improve detection of defective surge arresters with selection and evaluation of the most promising solutions.* Laboratory tests have determined the most effective techniques and these have been presented to members with recommendations for further action. *S2126_2 - Undertake long-term monitoring of conductor temperature by obtaining and analysing 12 months trial data.* The trial is continuing with the expectation that the results will indicate it should be possible to re-rate (up-rate) some overhead line circuits in certain circumstances. *S2132 - Validate current ice accretion models.* The data currently being collected will be used to revise national overhead line design standards *S2133 - Investigate the use of sacrificial anodes for protecting tower foundations to defer or remove the need for full foundation refurbishment.* A practical reference document has been produced to assist in the application and specification of such devices *S2134_1 - Determine the susceptibility of currently used surge arresters to the principal modes of failure.* The findings provide a review of the capabilities of a range of surge arresters, allowing informed and more cost effective specification of these devices. *S2135 - Life expectancy of copper conductors.* The results of initial laboratory testing of samples of varying age provided from UK distribution networks will be available shortly. They should allow an initial assessment of the overall condition of copper based conductors to be made. *S2136 - Measuring and forecasting atmospheric icing on structures.* This is part of a much larger European collaborative project aiming to provide more accurate mapping of ice prone areas. This in turn will allow the most appropriate structure to be constructed. *S2138_1 - Investigate live-line jumper-cutting limitations.* Controlled testing regime has been specified and this should lead to improved working practices being adopted. *S2139 Begin to evaluate a new corona discharge camera system.* This project is at a very early stage. *S2140 Explore possible means of checking the foundations of newly installed poles.* An initial review of worldwide practice and commercially available techniques has begun.

	2005/06 Total Expenditure	**2005/06 Internal Expenditure**
SHEPD	£12,000	£1200
SEPD	£28,000	£2800

Individual IFI Project report :– April 2005 – March 2006

Description of project	Strategic Technology Programme Cable Networks Module
Expenditure for financial year 2005/06	External = £36,000 Internal = £4,000 Total = £40,000
Technological area and / or issue addressed by project	The STP cable network programme for budget year 2005/6 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. Eight new projects were approved during the year (shown in bold below). The projects undertaken within the programme during 2005-06 (include some approved in previous years) aimed to: • S3100_2 – Define better functional requirements for link boxes. • S3108_2 – Produce software for assessing earthing practice on PME systems. • S3115 – Determine the corrosion resistance of aluminium foil cables. • S3120 – Assess novel flame retardant coatings for cables in basements. • S3121 - Produce a cable fluid sniffer Stage 1(b) Feasibility study. • S3123 – Produce a guide and specify functional requirements for the selection of cable ducts. • **S3125 - Assess new degreasing products for MV and LV cables.** • **S3126 - Explore issues associated with the use of polyurethane and development of alternative jointing resins.** • S3131 – Produce a summary of CIGRE issues relating to HV cables.

	• S3113_2 - Addition of duct bank modelling functionality within CRATER cable rating software. • S3113_3 - Addition of paper cable modelling within CRATER cable rating product. • S3132_1 - Addition of HV polymeric cable modelling functionality within CRATER cable rating software. • S3132_2 - Addition of LV cable modelling functionality within CRATER cable rating software. • S3132_3 - Addition of cyclic and emergency rating modelling functionality within CRATER cable rating software. • **S3132_4 - Addition of limited time rating of mixed circuit modelling functionality within CRATER cable rating software.** • **S3132_5 - CRATER cable rating software, overview report.** • **S3132_6 - Addition of single core MV paper cable modeling functionality within CRATER cable rating software.** • **S3132_7 - Addition of cable crossing modelling functionality within CRATER cable rating software.** • **S3140_1 – produce a spreadsheet tool for pulling-in of cables into ducts.** • **S3144_1 – Evaluate the Hydragel process for the treatment of redundant fluid filled cables.**		
Type(s) of innovation involved	Technical Substitution / Radical		
Expected Benefits of Project	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; • savings of the order of 0.25 CML per connected customer; • increased safety of staff and public by reducing the number of accidents / incidents.		
Expected Timescale to adoption	Range 1-5 years - dependent on project	Duration of benefit once achieved	Range 2-10 years - dependent on project

Estimated Success probability (at start of project)	Range 2-30% - dependent on project		
PV of Project Costs	£40,000 (nb. This is identified early stage cost. It does not reflect the likely full costs of implementation. These will be identified providing the outcome of the early stage is positive.)	PV of Project Benefits	£66,000
Commentary on project progress and potential for achieving expected benefits	Some projects within the programme are at an early stage, whilst others are complete. Issues have been identified relating to both operational and capital expenditure which, if successfully addressed, would enable the expected benefits to be achieved. • *S3100_2 – Define better functional requirements for link boxes.* A document that defines functional requirements for LV link boxes has been produced for member companies. Previously such a document did not exist. • *S3108_2 – Software for earthing practice on PME systems.* An assessment tool has been produced for earthing practice on PME systems which evaluates the compliance with regulations and practices, carries out a check of LV cable circuit design. • *S3115 – Corrosion resistance of aluminium foil cables.* Tests have shown that corrosion of the laminated aluminium foil sheath is likely if the outer sheath of the cable is damaged leading to moisture penetration to the cable core. • *S3120 – Flame retardant coatings for cables in basements.* Findings recommended the use of a system consisting of a water-based intumescent coating and an associated water resistant topcoat. This should give valuable long-term fire protection to PE cables in basements and substations.		

	• *S3121 - Cable fluid sniffer Stage 1(b) Feasibility study.* Laboratory familiarisation has been carried out and field trials are being undertaken. • *S3123 – Guide and functional requirements for the selection of cable ducts.* A report giving some advice on the use of plastic ducts in heavily loaded circuits has been produced. • *S3125 - Degreasing products for MV and LV cables.* The project defined a suitable wet-wipe that will ensure satisfactory cleaning of LV, MV and HV cables without adversely affecting their performance. • *S3126 - Explore issues associated with the use of polyurethane and development of alternative jointing resins.* The project concluded that under current legislation, and provided employers comply with the requirements of the COSHH Regulations, the continued use of polyurethane resin systems is acceptable. Alternative systems are available, but currently more expensive than polyurethane resins. • *S3131 – Summary of CIGRE issues relating to HV cables.* An extensive report (140 pages) provides a comprehensive picture of work carried out by Cigré over the past 5 years, as well that currently underway and some that is planned. This places the work of the Module in an international context. • *S3113_2 - Addition of duct bank modelling functionality within CRATER cable rating software.* The spreadsheet produced is a valuable tool for cable engineers. It ensures correct rating of cables installed in non-standard ducts and conditions. • *S3113_3 - Addition of paper cable modelling functionality within CRATER cable rating software.* A user-friendly spreadsheet tool for the cable engineer was created to determine sustained, cyclic and distribution current ratings for MV paper cable ratings, using approved methods of calculation. • *S3132_1 - Addition of HV polymeric cable modelling functionality within CRATER cable rating software.* A user-friendly spreadsheet tool for the cable engineer was created to determine sustained, cyclic and distribution current ratings for HV polymeric cable ratings, using approved methods of

	calculation. • *S3132_2 - Addition of LV cable modelling functionality within CRATER cable rating software.* A user-friendly spreadsheet tool for the cable engineer was created to determine sustained, cyclic and distribution current ratings for LV cable ratings, using approved methods of calculation. • *S3132_3 - Addition of cyclic and emergency rating modelling functionality within CRATER cable rating software.* A user-friendly spreadsheet tool for the cable engineer was created to determine cyclic and emergency current ratings for most practical mixed circuit problems. • *S3132_4 – Addition of limited time rating of mixed circuit modelling functionality within CRATER cable rating software.* The basic functionality is now incorporated into CRATER and operation with grouped circuits is being developed. • *S3132_5 - CRATER cable rating software, overview report.* The report, which is in preparation, will cover a range of practical applications for CRATER. The intention is that the report will form a handy reference to be used in conjunction with the basic operating manuals. • *S3132_6 - Addition of single core MV paper cable modeling functionality within CRATER cable rating software.* Preliminary scoping work has been carried out and a questionnaire sent out to ascertain user requirements. • *S3132_7 - Addition of cable crossing modelling functionality within CRATER cable rating software.* The method for calculating ratings of cable crossings has been established and development work is on-going. • *S3140_1 – produce a spreadsheet tool for pulling-in of cables into ducts.* Proprietary software is being evaluated for this project, which is at an early stage. • *S3144_1 – Evaluate the Hydragel process for the treatment of redundant fluid filled cables.* Information has been collected on the two available processes and further information is being gathered from members.

	2005/06 Total Expenditure	2005/06 Internal Expenditure
SHEPD	£12,000	£1200
SEPD	£28,000	£2800

Individual IFI Project report :– April 2005 – March 2006

Description of project	Strategic Technology Programme Substation Module
Expenditure for financial year 2005-06	External = £36,000 Internal = £4,000 Total = £40,000
Technological area and / or issue addressed by project	Issues with the age profile of substation assets within the UK electricity distribution system are well known. Also, both regulatory and shareholder pressures preclude substantial investments of the large scale that was seen in the 1950's to 1970's. The challenge is to constantly review and innovate new solutions to monitor and define asset condition thereby allowing risks to be clearly defined and sound investment decisions to be taken The programme of projects which were approved for funding from the STP substations module budget and were undertaken in 2005/06 encompass both developing new innovative asset management processes and practices and developing innovative diagnostic techniques. The aim is to develop already well established themes such as life extension of aged assets within legal and heath and safety constraints, examination of new technologies, developing an understanding of, and innovative solutions for, the impact on substation assets of increasing levels of distributed generation on networks and condition monitoring techniques. Eighteen new projects were approved during the year (shown in bold below). The projects undertaken within the programme during 2005-06 (include some approved in previous years) aimed to: <u>In progress Projects</u> • S0499 - Extend the TASA tap-changer diagnostic Trial. • S4107_2 – Field test on a sample of switchgear. the headspace gas testing technique to indicate the condition of oil filled switchgear • **S4180 – Develop an indicator to detect discharge**

	activity in substations. • **S4172 – Follow-up of S0455 paint preparation for tanks to determine the longer term performance of the technique.** • **S4173 – Enhance the Transformer thermal rating assessment system.** • **S4178 – Testing and management of substation standby batteries.** • **S4181 – Ongoing programme of transformer post mortems to provide better correlation between condition assessment tests, true condition and remaining life.** • **S4182 – Develop a better understanding of frequency response analysis of transformers.** • **S4186 – Study of PM cast resin VTs.** • **S4188_1 – Assess replacement insulator grease.** • **S4189_1 – Examine substation noise.** • **S4190_1 - Review of pad mounted substations.** • **S4193_1 - Develop a common approach to risk and reliability.** <u>Completed Projects</u> • S0497 – Transformer post mortems to assist estimation of remaining life from non-invasive tests**.** • **S4130_4 – Assess wipes for HV oil filled equipment.** • S4149 - Assess the quality, performance and longevity of recent substation equipment. • S4155 - Investigate ester based insulating oils. • S4162 – Extend the range of non-intrusive PD for > 90kV switchgear. • S4164 – Feasibility study into on-line tapchanger monitoring. • S4167 – Improve CBRM by use of better understanding of degradation processes. • **S4172 – Scoping studies on transformer refurbishment, fault passage indicators, out of phase switching and fire legislation for substations.** • **S4174 - Compare a range of power system protection software.** • **S4175 – Assess circuit breaker cleaning techniques**

	and materials. • **S4176 – Compare available earth testing instruments.** • **S4179 - Explore in-situ testing of vacuum interrupters.** • **S4187_1 – Hold a risk modelling workshop.**		
Type(s) of innovation involved	Incremental / Significant / Technological Substitution / Radical		
Expected Benefits of Project	Due to the age profile of the current system assets it is inevitable that unless significant new technology is used to extend asset life, CAPEX and possibly OPEX will need to increase significantly to maintain the present level of network reliability and safety. If the projects are technically successful and the findings and recommendations from the projects are implemented, then the projects will potentially enable each DNO member of the programme to gain the benefits including: • Offset future increases in CAPEX and OPEX • Increased safety of staff and public by reducing the number of accidents/incidents; • Both preventing disruptive failures of oil-filled equipment to reduce land contamination and avoiding unnecessary scrapping of serviceable components will alleviate environmental impact.		
Expected Timescale to adoption	1-5 years - dependent on project	Duration of benefit once achieved	2-7 years - dependent on project
Estimated Success probability (at start of project)	1-20% - dependent on project		
PV of Project Costs	£40,000 (nb. This is identified early stage cost. It does not reflect the likely full costs of implementation. These will be identified providing	PV of Project Benefits	£71,000

	the outcome of the early stage is positive.)		
Commentary on project progress and potential for achieving expected benefits	Some projects within the programme are at an early stage, whilst others are complete. Issues have been identified relating to both operational and capital expenditure which, if successfully addressed, would enable the expected benefits to be achieved. <u>In progress Projects</u> • S0499 - Extend the TASA tap-changer diagnostic Trial. The original trial had a low sample population and this work aims to increase the sample size. If earlier results are confirmed then the technique offers the potential for non-invasive condition assessment of tapchangers, with consequent improvements in network performance due to avoided failures and reduced OPEX from better targeted maintenance. • S4107_2 - Headspace gas testing of oil filled switchgear. Working closely with members, the project aims to collect headspace gas samples from units within the field and resolve any GCMS issues. If correlation is successful then the project offers the prospect of targeted maintenance and reduction of invasive inspections. • S4180 – Develop an indicator to detect discharge activity in substations. Results suggest the device in its present form cannot reliable detect/indicator discharge activity in many substation environments. This development will not be pursued within STP, but related trials of an electronic NO_x detector are being undertaken by the Discharge User Group. • *S4172 – Follow-up of S0455 Surface preparation of tanks.* The performance of the paint systems are being reviewed as a follow-up to earlier work. • *S4173 – Transformer thermal rating system.* This project is to re-develop the current Transformer Thermal Rating software to enable members to assess BSP Transformer safe loading limits. • *S4178 – Testing and management of substation standby batteries.* The project aims to assess the effectiveness of Battery Impedance testing methods to replace traditional discharge testing.		

	• *S4181 – On-going programme of transformer post mortems.* Further work in this area to build on the good results obtained in an earlier project, where a good correlation between non-invasive tests and internal examinations had been shown • *S4182 – Understanding frequency response analysis.* Frequency Response Analysis is a potentially useful condition assessment technique that can be significant in identifying and defining end of life for grid and primary transformers. Initial tests have produced some good results. • *S4186 – Study of PM cast resin VTs.* Members are completing an issues questionnaire and testing regimes are being developed. • *S4188_1 – Assess replacement insulator grease.* The project is to compare the performance of Insojell Grease with its proposed replacement, Dow Corning 3099 HVIC by performing a number of pre-specified accelerated aging tests. • *S4189_1 – Examine substation noise.* The project is investigating and clarifying the issues surrounding substation noise and develop a common, agreed framework to enable members to assess noise issues and take appropriate actions. • *S4190_1 - Review of pad mounted substations.* The project will provide an overview of members experience and identify any issues that may be arising through changing legislation. • *S4193_1 - Develop a common approach to risk and reliability.* The objective of this initial stage of work is to quantify the information requirements and determine its availability. An outline of the approach to be adopted has been produced and is currently being refined. <u>Completed Projects</u> • *S0497 – Transformer post mortems to assist estimation of remaining life from non-invasive tests.* A good correlation between non-invasive tests and internal examinations has been shown. This will assist in interpreting on-going non-invasive testing of other transformers. • *S4130_4 – Assess wipes for HV oil filled equipment.* Final

	development and testing of a new 3rd party high performance wipe, which was specially developed to the specification, which was developed in early stages of the project, was undertaken. This is now a product available for members • *S4149 - Assess the quality, performance and longevity of recent substation equipment.* An analysis of failure rates and reliability of modern substation equipment was undertaken and has highlighted a number of issues which warrant further investigation. • *S4155 - Investigate ester based insulating oils.* The project concluded that both natural and synthetic ester oils offer advantages over mineral oil in terms of biodegradability and electrical performance although oxidation stability and viscosity are poor. • *S4162 – Extend the range of non-intrusive PD for use on > 90kV switchgear.* The work identified the population of equipment suitable for PD testing, concluding that some types would benefit from such testing. • *S4164 – Feasibility study into on-line tap-changer monitoring.* The project concluded that it is possible to consistently characterise the operation of such devices using acoustic emissions techniques. • *S4167 – Improve CBRM by use of better understanding of degradation processes.* Mathematical models of asset ageing have been refined and calibrated in order to improve the accuracy of CBRM results. • *S4172 – Scoping studies on transformer refurbishment, fault passage indicators, out of phase switching and fire legislation for substations.* A series of short projects that allowed specific issues to be examined before deciding if a larger project in that area is appropriate. • *S4174 - Compare a range of power system protection software.* The available power system protection software was ranked in terms of its functionality, cost and ease of use. This will be used to assist members in making informed decisions. • *S4175 – Assess circuit breaker cleaning techniques and materials.* This project assessed different techniques and materials for cleaning circuit breaker contacts. A number

	of materials have been recommended together with a working practice. • *S4176 – Compare available earth testing instruments.* The project examined the operation of a number of simple clamp-on instruments and compared their effectiveness. The results showed that several instruments were quite inaccurate and could give misleading results. • *S4179 - Explore testing of vacuum interrupters.* The project investigated current and alternative methods of testing vacuum interrupters. It concluded that routine loss of vacuum testing would provide little benefit. It would be more appropriate to determine "at risk" interrupters and inspect these more frequently. • *S4187_1 – Hold a risk modelling workshop.* A workshop for members and experts to discuss risk quantification was held.

	2005/06 Total Expenditure	**2005/06 Internal Expenditure**
SHEPD	£12,000	£1200
SEPD	£28,000	£2800

Individual IFI Project report :– April 2005 – March 2006

Description of project	Strategic Technology Programme Distributed Generation Module
Expenditure for financial year 2005/6	External = £36,000 Internal = £4,000 Total = £40,000
Technological area and / or issue addressed by project	The projects undertaken through budget year 2005/6 were aimed at enabling cost effective connections and ensuring techniques are in place to plan, operate and manage networks with significant amounts of generation. Most projects also had positive impacts on safety and environmental performance. The projects all addressed real problems that had been identified by the module steering group members as significant and which required technical investigation and development. Fourteen new project stages were approved during the year (shown in bold below). The projects undertaken within the programme during 2005-06 (include some approved in previous years) aimed to: <u>Projects in Progress</u> • S5138 – Review of Industry Codes • **S5147_3 – Monitor Microgenerator Clusters** • **S5149_4 – Explore Active Voltage Control** • **S5150_2 – Review G59/1 and G75 Protection and identify improvements** • **S5151_3 – Model Network Risk** • **S5142 – Define Generator Data and Structure for DG Connection Applications** • **S5154_1 – Develop a Voltage Control Policy Assessment Tool on the IPSA Platform** • **S5155_1 – Explore Lower Cost Connection Solutions for Distributed Generation** • **S5157_1 – Evaluate the Performance of Small Scale Reactive Power Compensators** <u>Completed Project Stages</u> • S5144 – Workshop on Regulatory and Economic Issues • S5145 – Dynamic Circuit Ratings

	• S5147_1 - Microgeneration Clusters • S5149_1 - Active Voltage Control • S5150 Stage 1 – G59 and G75 Protection • S5151_1– Network Risk Modelling • **S5133 – Tapchangers Reverse Power Capabilities** • **S5143 – Produce a Draft Code of Practice on Stability** • **S5149 Stages 2 & 3 - Active Voltage Control** • **S5151 Stage 2 – Network Risk Modelling** • **S5152_1 – Examine the Latest Developments in the Connection of Distributed Generation**
Type(s) of innovation involved	Incremental / Significant / Technological Substitution
Expected Benefits of Project	With government policy driving significant increases in generation connection to distribution networks the members need a range of innovative solutions to connection and network operation issues that are cost effective and which maintain the present level of network reliability and safety. If the findings and recommendations from the projects are implemented, then the projects will potentially enable each DNO member of the programme to gain benefits including: • Reducing the probability of voltage supply limit excursions resulting from increased distributed generation (eaVCAT interface to IPSA software tool); • Improving quality of supply and reducing risk of component failure (by understanding the effect and optimising use of impedance in the system); • A better understanding of the risk presented by the distribution assets when considered as a network rather than discrete components.; • Greater use of distributed generators to meet current DNO obligations (by assessing, from a DNO perspective, the implications of pending Distribution Code provisions relating to distributed generation); Reducing the amount of reinforcement needed (by use of dynamic ratings to allow network components to be used to their full capability) - the use of dynamic circuit ratings is a vital step in the move towards active management of networks.

Expected Timescale to adoption	1-5 years - dependent on project	Duration of benefit once achieved	1-5 years - dependent on project
Estimated Success probability (at start of project)	5-25% - dependent on project		
PV of Project Costs	£40,000 (nb. This is identified early stage cost. It does not reflect the likely full costs of implementation. These will be identified providing the outcome of the early stage is positive.)	PV of Project Benefits	£63,000
Commentary on project progress and potential for achieving expected benefits	Some projects within the programme are at an early stage, whilst others are complete. Issues have been identified relating to both operational and capital expenditure which, if successfully addressed, would enable the expected benefits to be achieved. • *S5147_3 – Microgenerator Clusters.* Installation of monitoring points is currently underway and a new substation is being commissioned. Monitoring will commence upon completion of installation and commissioning. • *S5149_4 – Explore Active Voltage Control.* Modelling of typical radial and interconnected networks in preparation for flexing key parameters to examine limits of active voltage control. • *S5150_2 – G59/1 and G75 Protection.* An initial review is complete and further work is pending results from allied university project. • *S5151_3 – Model Network Risk.* Following establishment of user requirements and review of available risk models and approaches is being undertaken. • *S5142 – Define generator Data and Structure for DG Connection Applications.* The generator data has been		

	identified and a data structure agreed. Rationalisation of this data should now be considered. • *S5154_1 – Develop a voltage Control Policy Assessment Tool on the IPSA Platform.* The interface between the existing eaVCAT software and the widely used IPSA power system analysis software has been developed and is currently being tested. • *S5155_1 – Explore Lower Cost Connection Solutions for Distributed Generation.* This project is at the information gathering stage, but intends to identify lower cost solutions. • *S5157_1 – Performance of Small Scale Reactive Power Compensators.* Four devices have been identified and detailed information is being collated. User requirements are being sought from members. <u>Completed Project Stages</u> • *S5144 – Workshop on Regulatory and Economic Issues.* A workshop to ensure the regulatory and economic environment is fully understood to assist selection of most appropriate technical developments. • *S5145 – Dynamic Circuit Ratings.* A report has been produced which summarises international work to date, evaluates available technologies and examines how these could be applied to UK distribution networks. • *S5147_1 – Monitor Microgeneration Clusters.* The Project Initiation Document has been prepared and approved. • *S5149_1 – Explore Active Voltage Control.* The Project Initiation Document has been prepared and approved. • *S5150 Stage 1 – G59 and G75 Protection.* The Project Initiation Document has been prepared and approved. • *S5151_1– Model Network Risk.* The Project Initiation Document has been prepared and approved. • *S5133 – Tapchangers Reverse Power Capabilities.* It was concluded that under certain conditions there is an increased probability of internal flashover for single compartment tap-changers with single transition resistors. Steps should be taken to increase the maintenance frequency or de-rate the tap-changer to negate these affects.

	• *S5143 – Draft Code of Practice on Stability.* The draft code of practice can be used to develop policy within each member company. It will facilitate the connection of distributed generation by providing a guideline on stability issues. • *S5149 Stages 2 & 3 - Active Voltage Control.* An overview of current control practices and how distributed generation impacts on them has been produced and a workshop held to explore the specific issues. This provides a firm basis for in depth studies of how active voltage control can be implemented and its advantages and disadvantages in different situations. • *S5151 Stage 2 – Model Network Risk.* The user requirements of a network risk model have been defined, documented and agreed and will be used to direct subsequent stages of the project. • *S5152 – Latest Developments in the Connection of Distributed Generation.* Regular updates on new developments have been provided to members to help inform and influence the research programme.

	2005/06 Total Expenditure	**2005/06 Internal Expenditure**
SHEPD	£12,000	£1200
SEPD	£28,000	£2800

Individual IFI Project report :– April 2005 – March 2006

Description of project	Partial Discharge User Group
Expenditure for financial year	External = £5,000 Internal = £ 4,000 Total = £9,000
Technological area and / or issue addressed by project	Partial discharge is an electrical discharge or spark that bridges a portion of the insulation between two conducting electrodes. Partial discharge may occur in aged, defective or poor quality insulation and can propagate and develop until the insulation is unable to withstand the electrical stress and flashover and failure occurs. Partial discharge is the primary cause of disruptive failure of HV switchgear. The PD User group is a technical forum where information on partial discharge related failures can be disseminated and the understanding of partial discharge on switchgear can be enhanced through targeted investigative, research and development work. This in turn will enhance the way in which HV assets are managed and maintained and make a positive impact on the safety of operators working within substations. During FY06 the expenditure of the group was focused on the following areas: • **Enhanced data manager** The management of partial discharge data and turning this into information to enable decisions to be made on the need for maintenance and the likelihood of failure is vital to the success of comprehensive deployment of partial discharge test equipment. • **Outdoor testing** The partial discharge techniques are now commonly applied on indoor metalclad distribution switchgear. Little partial discharge testing is undertaken on outdoor open busbar type equipment working at voltages from 33 to132kV. A research project was undertaken during the year to determine the applicability of utilising partial discharge test equipment on

	the open terminal switchgear. • **Profile of the long term degradation of switchgear** A panel of 11kV switchgear common to DNO networks was set up in a test rig and continuously energised at working voltage and monitored for partial discharge activity. The aim of the project was to assess the effect of the environment on partial discharge activity and the profile of discharge through to failure.		
Type(s) of innovation involved	Technical Substitution / Enhanced methods of working		
Expected Benefits of Project	Due to the ageing profile of switchgear and the introduction of air insulated switchgear designs using cast resin insulation, which is less tolerant to the effects of partial discharge activity, unless the condition of switchgear is actively assessed and managed there is a likelihood of increasing failure rates. The expected benefits of the projects undertaken during FY06 are: • Understanding of the potential partial discharge related failure points for all types of switchgear • Enhanced interpretation of the results of routine PD surveys • Better targeting of maintenance teams to switchgear in need of attention • Preservation or reduction of the low failure rate for HV distribution switchgear • Transfer of existing technology and skills to use on an ageing population of bulk oil open terminal switchgear • Understanding the effect of the environment on the levels of PD activity and condition of switchgear • Identifying the profile of degradation for surface tracking on modern cast resin insulation in air insulated chambers		
Expected Timescale to adoption	Range 1 - 3 years - dependent on task	Duration of benefit once achieved	Ongoing benefit
Estimated Success probability (at start of project)	Range 50 - 100% dependent upon projects		

PV of Project Costs	£5,953 (nb. This is cost of running the user group and carrying out the projects. It does not reflect the likely full costs of implementation of any ideas / techniques resulting from the work).	PV of Project Benefits	£12,000 per average DNO Based on the average prevention of 1 failure on an RMU and 1 failure of a switch panel across the DNO members of the year.
Commentary on project progress and potential for achieving expected benefits	Some projects within the programme of work are complete and others are ongoing due to the nature of the work. • **Enhanced data manager** During FY06 the PD User Group invested in the formation of a database of results that enables significant and key information to be quickly drawn from the large population of historical results. The database can now incorporate pictures, drawings, failure records, sound files (for the analysis of heterodyned ultrasonic activity). This greatly enhances the incident reporting facilities which helps engineers to better interpret the results of partial discharge surveys and make an assessment on whether switchgear is in need of immediate attention. Input of additional data will now be the key to realising best use of the functionality. • **Outdoor testing** One of the perceived problems with undertaking PD testing of outdoor open terminal switchgear was in the level of interference within the outdoor substation environment. Frequency response analysis equipment was utilised to identify the spectrum of interference to help assess whether modification to equipment would be appropriate / required to mitigate against interference signals. A large programme of testing was completed and analysis and recommendations on the way forward will be finalised in FY07. • **Profile of the long term degradation of switchgear** The panel of 11kV switchgear has continued to operate throughout the year and significant levels of discharge have been monitored. The switchgear is now close to failure and a great deal of knowledge on the relationship between surface discharge and relative humidity and profile through to failure has been gained. Full reporting is expected to be completed in FY07 dependent upon the time of failure of the switchgear.		

Individual IFI Project report :– April 2005 – March 2006

Partial Discharge User Group (contd.)

	2005/06 Total Expenditure	2005/06 Internal Expenditure
SHEPD	£3,000	£1200
SEPD	£7,000	£2800

Individual IFI Project report :– April 2005 – March 2006

Description of project	Protective Coatings Forum
Expenditure for financial year	External = £6,000 Internal = £ 4,000 Total = £ 10,000
Technological area and / or issue addressed by project	**Effective Protective Coatings for Plant and Overhead Line Towers: Quality Control and Consultancy services** EA Technology has been actively involved in work on surface coatings for overhead line towers and substation plant for a number of years, primarily sponsored by the DNOs and the National Grid. Specifications for tower and plant paint systems have been produced for use by the sponsoring companies. For overhead line towers, most companies currently use two-coat paint systems based on urethane alkyd or modified vinyl resins, manufactured to specifications produced by EA Technology and the National Grid. To ensure satisfactory quality control throughout the industry, a batch certification scheme has been set up and paint samples from manufacturers and painting contracts are checked on a regular basis. As a result, problems relating to paint application have been largely eliminated and the performance of the paint systems has been much improved. Other services provided include troubleshooting, evaluation of various new products and special purpose paint systems, surveys of coatings on new plant and general guidance on surface coatings. In recent years, European legislation has been introduced with the aim of reducing emissions of Volatile Organic Compounds (VOCs), such as the solvents in paint systems, to the atmosphere. The Process Guidance Note PG6/23 (97): Coating of Metal and Plastics, introduced the concept of EPA Compliant Coatings and proposed alternative approaches for surface coatings to reduce VOC emissions. In July 2003, a draft revised version of PG6/23 was issued for consultation, PG6/23A. The main change is the inclusion of requirements specified in EC Directive 1999/13/EC, known generally as the Solvent Emission Directive (SED). The aim of the SED is to reduce emissions of VOCs from specified industrial processes. Full implementation of SED is required by October 2007. This will not immediately affect the use of the solvent based paints currently used for painting towers and plant, because the directive is applicable only to factory applied coatings and does not include coatings applied to outside installations, such as bridges, refineries, towers etc. However, The European Commission and EU Member States have recognised that they need to do even more to improve air quality, and hence two new directives are being prepared. One refers to ozone. The other, the future National Emissions Ceiling Directive will require Member States to reduce their emissions of several air pollutants including VOCs to lower levels from 2010. These directives may well lead Member States to require the Protective Coatings sector to further reduce emissions arising from the use of its products. This suggests that current tower paints may be acceptable until 2010.

	However, the availability of suitable low solvent paint systems as substitutes for the currently used solvent based systems must be seen as a priority for all users of large quantities of paints. In anticipation of the proposed legislation, EA Technology developed an environmentally friendly water based tower paint system as part of the NORUST project, part funded by the Commission of European Communities, in conjunction with a paint manufacturer, a resin manufacturer and an overseas (Spanish) utility company. Field trials were carried out on overhead line towers in six UK DNOs. These were completed in 1998, and one of the tasks of the project is to continue to monitor the field performance of the paint system, with a view to ensuring a smooth transmission to environmentally friendly paint systems as demanded by legislation. Other VOC compliant paint systems, which have been evaluated, through laboratory test programmes and field trials, have included water based and high solids two-pack epoxy coatings. A stated task within the project is to continue to assess VOC compliant paint systems which may be suitable for painting towers and substation plant.		
Type(s) of innovation involved	Development of VOC compliant coatings (in conjunction with manufacturers) Testing and evaluation of new products		
Expected Benefits of Project	It is anticipated that the majority of overhead lines will be needed along existing routes for the foreseeable future. Present lines will remain in service as long as the structures can be maintained economically. Currently, the National Grid owns and operates some 7000 route-km of 400kV and 275kV transmission lines with approximately 28,000 towers. The DNOs operate and maintain the 132kV system which comprises approximately 48,000 towers in total. Current paint systems are expected to last for 10 to 12 years, provided the towers have been previously well maintained and the steelwork is in good condition. Life expectancy of the paint systems on rusty substrates will be lower, possibly 5 years. It is essential that any new VOC compliant paint systems proposed for use on overhead line towers should perform at least as well as the currently used solvent based systems, since they are likely to be more expensive, although material costs account for a relatively small proportion of total contract costs. For a typical DNO, a small improvement in performance would generate financial benefits in the region of £5,000 per annum, together with associated environmental benefits.		
Expected Timescale to adoption	Range 3 - 5 years - dependent on legislation	Duration of benefit once achieved	Ongoing benefit
Estimated Success probability (at start of project)	50% - 100%.		

PV of Project Costs	£6,000 per company	PV of Project Benefits	£5,000 per annum. Based on new paint systems performing marginally better than current solvent based systems.
Commentary on project progress and potential for achieving expected benefits	Some high solids two-pack materials, which are VOC compliant, have been identified which have the potential to replace the solvent based systems, and may be applied as a single coat. However, application of these products in the field can present difficulties with mixing, pot-life and H&S. Water-based systems have performed well on galvanised and steel surfaces in good condition, but not as well as solvent based systems on rusty substrates. Composite systems, comprising solvent based primers, with water based top coats, which may comply with SED requirements, offer an alternative solution. The potential for achieving the expected benefits is considered to be fairly high.		

	2005/06 Total Expenditure	**2005/06 Internal Expenditure**
SHEPD	£2700	£1200
SEPD	£6300	£2800

Individual IFI Project report :– April 2005 – March 2006

Description of project	Fault level monitor		
Expenditure for financial year	Internal = £ 3000 External = £ 16,000 Total Cost = £ 19,000		
Technological area and / or issue addressed by project	The objective of this proposal is the development of an instrument that can successfully measure fault level on a distribution network with repeatability and reliability. This instrument, to be known as the Fault Level Monitor (FLM), will be developed to the specification agreed by the ENA's Operations and Systems Group (OSG). The FLM's measurements will be based on normally occurring events, so no customer supply interruption will be required. The technical development risks are reduced as the underlying methodology has been proven with EA Technology's existing Extended Supply Monitor.		
Type(s) of innovation involved	Incremental		
Expected Benefits of Project	The main benefits that a FLM will bring to the Distribution Network Operators (DNOs) are: • it will allow the DNOs to accurately assess fault infeed levels and design distribution networks appropriately; • it will facilitate the connection of distributed generation by providing a standardised and accurate method of assessing network fault levels; • it will enable an ongoing assessment of the effects of distributed generation to be made; • it will help to satisfy generator developers that decisions to upgrade networks are not subjective but based on objective measurement.		
Expected Timescale to adoption	3 years	Duration of benefits once achieved	20 years
Estimated Success probability (at start of project)	75%		
PV of Project Costs	£ 790,556 per company	PV of Project Benefits	£ 322, 347 per company
Commentary on project progress and potential for achieving expected benefits	Phase I of the project requires the collection of data from a small number of major substations, preferably with different load types and profiles. As a matter of expediency, it is expected that these substations will be chosen within the United Utilities and Manweb Distribution Licence areas. Progress to date has been restricted to discussion of the specification of suitable power quality measuring instruments and potential substation sites.		

Individual IFI Project report :– April 2005 – March 2006

Fault Level Monitor (contd.)

	2005/06 Total Expenditure	2005/06 Internal Expenditure
SHEPD	£ 5700	£ 900
SEPD	£ 13300	£ 2100

Individual IFI Project report :– April 2005 – March 2006

Description of project	Lightning Protection		
Expenditure for financial year	Internal = £ 3000 External = £ 0 Total Cost = £ 3000		
Technological area and / or issue addressed by project	Produce a new ETR on lightning protection with a Scope that covers: • background information on the lightning density across the UK and the year to year variation as a result of factors such as sun spot activity • catalogue current practices and procedures – with an explanation of pros and cons • provide a view on international practices / procedures • reference to peripheral issues such as earthing and protection, however the ETR should avoid trying to provide in-depth information on these matters • provide a list of reference documents		
Type(s) of innovation involved	Incremental		
Expected Benefits of Project	• Reduction in Failure/faults due to lightning • Improved risk assessment • Reduction in CML's		
Expected Timescale to adoption	3 Years	Duration of benefit once achieved	10 Years
Estimated Success probability (at start of project)	75%		
PV of Project Costs	£ 324,932 per company	PV of Project Benefits	£ 380,403 per company
Commentary on project progress and potential for achieving expected benefits	Document is close to completion.		

Individual IFI Project report :– April 2005 – March 2006

Lightning Protection (contd.)

	2005/06 Total Expenditure	2005/06 Internal Expenditure
SHEPD	£900	£900
SEPD	£2100	£2100

Individual IFI Project report :– April 2005 – March 2006

Description of project	Functional Specification for ROCOF relays
Expenditure for financial year	Internal = £ 3000 External = £ 0 Total Cost = £ 3000
Technological area and / or issue addressed by project	Studies have been carried out to assess the capabilities of loss of mains relays to withstand system disturbances, whilst this is an important characteristic to maintain generation as systems move increasingly towards active networks the prime consideration in determining a suitable setting must be safety and compliance with regulations. The stability setting requirements to ride through anticipated system disturbances may form the minimum desired setting. Previous work carried out on testing the stability of relays to genuine network disturbances, show that there is a wide variation in the response of relays from different manufacturers to the disturbances. The results also show that relays from the same manufacturers have different responses at different settings. **Issues** It is equally important to understand how sensitive a loss of mains relay is to a genuine loss of mains. • How many cycles are required to detect the condition i.e. how many cycles does the relay need to sample before it can detect a loss of mains? • What percentage change or mismatch of load compared to generator rating is required for the relay to detect a loss of mains? This can vary with construction and size of generator? ENA Members need to have confidence in a loss of mains relay to demonstrate that they meet the Environmental Test Requirements of ENA TS 48– 5 and have a time delay setting from 0-60 seconds. ENA Members require an Engineering Report that captures the issues above and the terms of reference below. From which a new Engineering Recommendation will be written.
Type(s) of innovation involved	Incremental
Expected Benefits of Project	**Use of more effective settings** On completion of the work there will be an improved understanding of loss of mains relays and how they respond to system disturbances and genuine loss of mains, which will enable more effective settings to be applied to relays. More effective settings will reduce the number of spurious trips of generator installations due to system disturbances. Estimating 60 unwanted trips throughout the UK per year due to system disturbances and assuming that more effective settings will reduce these by 50% the number of spurious trips will be reduced by 30 per year. Fewer generation trips will result in fewer disturbances to other connected customers improving quality of supply.

	A matrix of recommended settings and an improved confidence in the quality of loss of mains relays will reduce the time for producing a scheme design. Reducing the cost producing a quote to generators. **More effective Use of Loss of Mains relays** An improved understanding of and confidence in loss of mains relays will result in the more effective use of them as interface protection between DNO and generator replacing the need for inter-tripping in some situations.		
Expected Timescale to adoption	3 Years	Duration of benefit once achieved	10 Years
Estimated Success probability (at start of project)	75%		
PV of Project Costs	£ 21,038 per company	PV of Project Benefits	£ 183,794 per company
Commentary on project progress and potential for achieving expected benefits	Draft final report received by the Protection Assessment Panel in April for review and comment. Initial review of the report shows some very useful findings which are quite different to the approach currently taken for Loss of Mains settings. The final report will form the basis of a change in the way that these settings are applied across the electricity network. It is anticipated that use of these new setting guidelines will enable the majority of the perceived benefits to be achieved.		

	2005/06 Total Expenditure	**2005/06 Internal Expenditure**
SHEPD	£ 900	£ 900
SEPD	£ 2100	£ 2100

Individual IFI Project report :– April 2005 – March 2006

Description of project	Earthing Projects
Expenditure for financial year	Internal = £ 3000 External = £ 0 Total Cost = £ 3000
Technological area and / or issue addressed by project	To develop new techniques to assess the impact of lower voltage earth electrodes on higher voltage 'hot zones', and to measure the resistance of distribution substation earth systems. • The advantage of this work will be that if successful the project will deliver a clear rationale describing the correct location of LV earth electrodes with respect to HV earth electrodes. This will have potential benefits in improving understanding of the safety of the earth installations. ESQRC Regulation 8(2) (b) requires that HV electrodes are installed and used in such a manner so as to prevent danger in the LV network due to a fault in the HV network. Currently the safety of the LV electrode is assured by maintaining a separation between the HV and LV earth electrode such that the LV earth electrode is situated outside the 430V Rise of Earth Potential (ROEP) contour. This is based on longstanding requirements to ensure that the LV electrode has <430V imposed upon it under HV fault conditions. • All designs for earthing systems consider the effects of touch and step potentials under fault conditions. However the quantity of concern is actually the current flowing through a human body when in contact with metalwork subject to this potential and the time the current flows for. An electrode simply sited in soil which has a surface potential cannot be regarded as presenting the same hazard as metalwork with a direct metallic connection to the earth fault current return path. However there exists at this time no methodology for assessing the either the hazard posed by such an earth electrode or the possible effects of the earth when connected to a distributed system on the ROEP contours. • This project will if successful determine these effects and provide a means to provide cost effective safe earthing systems without the need for extensive separations between HV and LV electrodes which in a PME system may be impractical to achieve and maintain.
Type(s) of innovation involved	Incremental

Expected Benefits of Project	This project will determine the effects of LV earth systems on HV systems. The results of this should determine the means to provide cost effective, safe, earthing systems without the need for extensive separations between HV and LV electrodes which in a PME system may be impractical and costly to achieve and maintain.		
Expected Timescale to adoption	3 Years	Duration of benefit once achieved	40 Years
Estimated Success probability (at start of project)	75%		
PV of Project Costs	£ 24,137 per company	PV of Project Benefits	£ 110,534 per company
Commentary on project progress and potential for achieving expected benefits	Initial research work was completed to determine whether there was a need for further work in this area. The outcome of this justified further work being carried out. The earthing consultant has been in discussions with the various DNOs to identify suitable sites for testing to be carried out. Sites have been made available within Central Networks and Western Power and the testing work commenced. It is not yet known whether savings will be achieved until the outcome of the testing work is known.		

	2005/06 Total Expenditure	**2005/06 Internal Expenditure**
SHEPD	£ 900	£ 900
SEPD	£ 2100	£ 2100

Individual IFI Project report :– April 2005 – March 2006

Description of project	Sponsored endowment with Strathclyde University for applied research and development of Distributed Generation and Asset Risk Management issues.		
Expenditure for financial year	Internal - £ 1000 External - £ 39000 Total = £ 40,000		
Technological area and / or issue addressed by project	Increased and more controlled output from Distributed Generation. Improved management of distribution assets.		
Type(s) of innovation involved	All innovation types involved (incremental, significant, technological substitution and radical)		
Expected Benefits of Project	Financial project benefits are expected to be approximately 8 times the cost of successful projects. The benefits will be across a range of areas including construction, maintenance, refurbishment and operation. This funding provides close links with a noted academic organisation and will promote rapid transfer of new technology and ideas into existing business areas.		
Expected Timescale to adoption	Short – three years.	Duration of benefit once achieved	Lifetime of asset.
Estimated Success probability (at start of project)	Success probability is expected to be 20% overall on the whole programme of projects.		
PV of Project Costs	£ 37,418	PV of Project Benefits	£ 39,518
Commentary on project progress and potential for achieving expected benefits	Projects currently on target.		

	2005/06 Total Expenditure	**2005/06 Internal Expenditure**
SHEPD	£12,000	£300
SEPD	£28,000	£700

Individual IFI Project report :– April 2005 – March 2006

Description of project	HUDDIG This project is to trial and evaluate the use of innovative overhead line construction methodologies using a multi purpose mechanical aid.		
Expenditure for financial year	Internal - £ 15,500 External - £ 4,000 Total Cost = £ 19,500		
Technological area and / or issue addressed by project	This project addresses mechanical aids to overhead lineworks and the objectives were stated as considering practicality, reliability, support, safety, productivity and risks associated with overhead line works.		
Type(s) of innovation involved	Incremental and technological substitution		
Expected Benefits of Project	Financial project benefits are expected to be derived from reduced overhead line construction costs. It is expected to make a positive contribution to improving safety performance. Benefits will be : improved safety whilst working at height improved safety by reducing manual handling tasks reduction in overhead line construction costs		
Expected Timescale to adoption	Short - One year	Duration of benefit once achieved	7 years.
Estimated Success probability (at start of project)	Success probability is assessed as 20%		
PV of Project Costs	£ 83,767	PV of Project Benefits	£ 83,980
Commentary on project progress and potential for achieving expected benefits	Project currently on target. Initial reports demonstrate that the Huddig is a flexible machine with considerable rough terrain capability. During construction of the overhead lines it was shown that the MEWP was flexible enough to remove the need for any pole climbing and manual handling tasks were reduced to dressing the poles.		

	2005/06 Total Expenditure	**2005/06 Internal Expenditure**
SHEPD	£ 5900	£ 4600
SEPD	£ 13,600	£ 10,900

Individual IFI Project report : April 2005 – March 2006

Description of project	Development of portable Fault Passage Indicators (FPIs) with GSM communications. This project is to trial and evaluate the combination of proven FPIs with GSM technology to provide a SMS text messaging service.		
Expenditure for financial year	Internal - £ 4,000 External - £ 17,000 Total Cost = £ 21,000		
Technological area and / or issue addressed by project	Overhead line faults and the resultant customer interruptions and CHLs.		
Type(s) of innovation involved	Technological substitution		
Expected Benefits of Project	Financial project benefits are expected to be derived from reduced operational costs resulting from faster location of overhead line faults.		
Expected Timescale to adoption	Short – one to two years.	Duration of benefit once achieved	10 years
Estimated Success probability (at start of project)	Success probability is assessed as 20%		
PV of Project Costs	£ 19,645	PV of Project Benefits	£ 29,703
Commentary on project progress and potential for achieving expected benefits	Project currently on target. Initial evidence gained from application on one intermittent overhead line fault was successful with a faster and accurate location of the faulty section of overhead 11kV network.		

	2005/06 Total Expenditure	**2005/06 Internal Expenditure**
SHEPD	£ 6,300	£ 1200
SEPD	£ 14,700	£ 2,800

Individual IFI Project report : April 2005 – March 2006

Description of project	Development of.Downstream OYT Operation Detector. This project is to take a Fault Passage Indicator which has the ability to communicate via DNP3 protocol and apply it to a location downstream of a fault clearing device.		
Expenditure for financial year	Internal - £ 3000 External - £ 5300 Total Cost – £ 8300		
Technological area and / or issue addressed by project	To identify when fault clearing devices have tripped on transient and permanent faults.		
Type(s) of innovation involved	Technological substitution		
Expected Benefits of Project	Financial project benefits are expected to be derived from reduced operational costs resulting from faster response to overhead line faults which have been cleared by an OYT.		
Expected Timescale to adoption	Short – within next three years.	Duration of benefit once achieved	10 years.
Estimated Success probability (at start of project)	Success probability is assessed as 20%		
PV of Project Costs	£ 7,764	PV of Project Benefits	£ 5,457
Commentary on project progress and potential for achieving expected benefits	Project currently on target. 10 units being deployed for field trials in SHEPD territory.		

	2005/06 Total Expenditure	**2005/06 Internal Expenditure**
SHEPD	£ 2500	£900
SEPD	£ 5800	£ 2100

Individual IFI Project report : April 2005 – March 2006

Description of project	This project is a Communications Network study to evaluate the satellite service to form part of the Private Mobile Radio replacement strategy.		
Expenditure for financial year	Internal - £ 3000 External - £ 48,000 Total Cost – £ 51,000		
Technological area and / or issue addressed by project	Loss of communications during power systems emergencies. The current PMR system is unsupported technology and poor communications with remote field staff contributes to safety concerns in poor weather conditions and delays in restoring supply to customers.		
Type(s) of innovation involved	Technological substitution		
Expected Benefits of Project	Financial project benefits are assessed by comparing the cost of the different potential solutions. The benefits will be across a range of areas including construction, maintenance, refurbishment and operation.		
Expected Timescale to adoption	Short - three years.	Duration of benefit once achieved	Lifetime of asset.
Estimated Success probability (at start of project)	Success probability is assessed as 20%		
PV of Project Costs	£ 69,585	PV of Project Benefits	£ 80,866
Commentary on project progress and potential for achieving expected benefits	Project currently on target.		

	2005/06 Total Expenditure	**2005/06 Internal Expenditure**
SHEPD	£ 15,300	£ 900
SEPD	£ 35, 700	£ 2100

Individual IFI Project report : April 2005 – March 2006

Description of project	This project is to develop a 11kV Pole Mounted Recloser with synchronising equipment		
Expenditure for financial year	Internal - £ 3000 External - £ 7000 Total Cost – £ 10,000		
Technological area and / or issue addressed by project	Increasing use of mobile diesel generation (MDG) has, wherever practical, reduced loss of supply to customers during planned works on the distribution networks. Where supply is being maintained by MDG it is currently not possible to synchronise the islanded network back to the Grid. This project aims to provide continuity of supply to consumers supplied by MDG.		
Type(s) of innovation involved	Incremental		
Expected Benefits of Project	Financial project benefits are assessed as being marginal. The principal benefit will be in improved quality of supply by a reduction in CIs and CMLs.		
Expected Timescale to adoption	Short – next three years.	Duration of benefit once achieved	20 years
Estimated Success probability (at start of project)	Success probability is assessed as 20%		
PV of Project Costs	£ 9,355	PV of Project Benefits	£ 9,478
Commentary on project progress and potential for achieving expected benefits	Project currently on target.		

	2005/06 Total Expenditure	**2005/06 Internal Expenditure**
SHEPD	£ 3000	£ 900
SEPD	£ 7000	£ 2100

Individual IFI Project report : April 2005 – March 2006

Description of project	Field trials with new and novel methods of laying mains cable. These include a 'mole plough' device that cuts the ground and lays in cable from a winch and another device that uses a 'vibrating plough' to cut the ground on a moving vehicle.		
Expenditure for financial year	Internal - £ 20,000 External - £ 120,000 Total £ 140,000		
Technological area and / or issue addressed by project	Proposal addresses the cost, environmental impact and safety of installing mains cables and is expected to benefit each of these areas to a considerable degree.		
Type(s) of innovation involved	Significant and technological substitution.		
Expected Benefits of Project	Financial project benefits are estimated at 4 times the cost of the project due to reductions in cable laying costs. Environmental and safety benefits are more difficult to quantify and are being assessed on an ongoing basis.		
Expected Timescale to adoption	Short - within one year	Duration of benefit once achieved	7 Years
Estimated Success probability (at start of project)	Success probability is thought to be 50%.		
PV of Project Costs	£ 155,251	PV of Project Benefits	£ 236,626
Commentary on project progress and potential for achieving expected benefits	Project currently on target. Experience has now been gained from application of the two different designs of mole plough across a range of differing site conditions.		

	2005/06 Total Expenditure	**2005/06 Internal Expenditure**
SHEPD	£ 42,000	£ 6000
SEPD	£ 98,000	£ 14,000

Individual IFI Project report : April 2005 – March 2006

Description of project	This project is an innovative application of GPS technology with a hand held datalogger		
Expenditure for financial year	Internal - £ 14,300 External - £ 13,000 Total Cost – £ 27,300		
Technological area and / or issue addressed by project	Handling increased amounts of data associated with inspection of the overhead distribution network.		
Type(s) of innovation involved	Technological substitution		
Expected Benefits of Project	Financial project benefits are derived from a 10% increase in efficiency of survey staff.		
Expected Timescale to adoption	Short - one year	Duration of benefit once achieved	10 years.
Estimated Success probability (at start of project)	Success probability is assessed as 20%		
PV of Project Costs	£ 25,538	PV of Project Benefits	£ 26,403
Commentary on project progress and potential for achieving expected benefits	Project currently on target.		

	2005/06 Total Expenditure	**2005/06 Internal Expenditure**
SHEPD	£ 8200	£ 4300
SEPD	£ 19,100	£ 10,000

Individual IFI Project report : April 2005 – March 2006

Description of project	This project is to develop and evaluate a new approach to 11kV network design.		
Expenditure for financial year	Internal - £ 9500 External - £ 20,900 Total Cost – £ 30,400		
Technological area and / or issue addressed by project	One identifiable reason for the CI/CHLs incurred on the distribution network is the standards applied to network design.		
Type(s) of innovation involved	Incremental/significant		
Expected Benefits of Project	Financial project benefits are assessed as being approximately 8 times the cost. The benefits will result from improved quality of supply to consumers supplied from the 11kV distribution network.		
Expected Timescale to adoption	Medium – within seven years.	Duration of benefit once achieved	40 years
Estimated Success probability (at start of project)	Success probability is assessed as 50%		
PV of Project Costs	£ 37,189	PV of Project Benefits	£ 50,210
Commentary on project progress and potential for achieving expected benefits	Project currently on target.		

	2005/06 Total Expenditure	**2005/06 Internal Expenditure**
SHEPD	£ 9100	£ 2900
SEPD	£ 21,300	£ 6600

Individual IFI Project report : April 2005 – March 2006

Description of project	This project is to develop, trial and evaluate an innovative application of GPS technology to overhead line profiling.		
Expenditure for financial year	Internal - £ 4000 External - £ 85000 Total Cost – £ 89,000		
Technological area and / or issue addressed by project	Cost of overhead line surveying		
Type(s) of innovation involved	Technological substitution		
Expected Benefits of Project	Financial project benefits are expected to be approximately 8 times the cost of successful projects. The benefits will be across a range of areas including construction, maintenance, refurbishment and operation. Replacing the existing “Dumpy” level methodology with the proposed system integrating GPS technology will allow a reduction in cost, increased accuracy and allow a single person to carry out the work of two thereby maximizing the use of the skilled resource.		
Expected Timescale to adoption	Short - within three years.	Duration of benefit once achieved	Lifetime of asset.
Estimated Success probability (at start of project)	Success probability is assessed as 20%		
PV of Project Costs	£ 83,255	PV of Project Benefits	£ 99,011
Commentary on project progress and potential for achieving expected benefits	Project currently on target.		

	2005/06 Total Expenditure	**2005/06 Internal Expenditure**
SHEPD	£ 26,700	£ 1200
SEPD	£ 62,300	£ 2800

Individual IFI Project report : April 2005 – March 2006

Description of project	This project is to extend the trial and evaluate the potential benefits of deploying laptops supported by the Geographic Information System (GIS) to vehicles and strategic substations.		
Expenditure for financial year	Internal - £ 26,200 External - £ 298000 Total Cost – £ 324,200		
Technological area and / or issue addressed by project	Field availability of current and accurate network maps.		
Type(s) of innovation involved	Technological substitution		
Expected Benefits of Project	Financial project benefits are derived from an assessment of how many LV underground mains faults the innovation would be used on successfully and the perceived benefit of its' successful deployment. The benefits will be delivered by a reduction in fault response times, reduced traveling and reduced plant damage on the SEPD network. Improved levels of customer service are expected.		
Expected Timescale to adoption	Short - within three years.	Duration of benefit once achieved	10 years
Estimated Success probability (at start of project)	Success probability is assessed as 60%		
PV of Project Costs	£ 303,277	PV of Project Benefits	£ 324,753
Commentary on project progress and potential for achieving expected benefits	Project currently on target.		

	2005/06 Total Expenditure	**2005/06 Internal Expenditure**
SHEPD	£ 97,300	£ 7900
SEPD	£ 226,900	£ 18,300

Individual IFI Project report : April 2005 – March 2006

Description of project	Development of Renewable Generation active management for Orkney. This project is integral to establishing a Registered Power Zone on Orkney.		
Expenditure for financial year	Internal - £ 11,000 External - £ 0 Total Cost – £ 11,000		
Technological area and / or issue addressed by project	The amount of Distribution Generation allowed to connect to the Orkney distribution network is currently limited by network constraints.		
Type(s) of innovation involved	Radical		
Expected Benefits of Project	Financial project benefits are derived from comparing the cost of the active network solution with the cost of extensive reinforcement. This project will allow connection of further distributed generation on Orkney by use of novel techniques		
Expected Timescale to adoption	Short - within three years.	Duration of benefit once achieved	10 years
Estimated Success probability (at start of project)	Success probability is assessed as 10%		
PV of Project Costs	£ 175,940	PV of Project Benefits	£ 270,322
Commentary on project progress and potential for achieving expected benefits	Project currently on target.		

	2005/06 Total Expenditure	**2005/06 Internal Expenditure**
SHEPD	£ 3,300	£ 3,300
SEPD	£ 7,700	£ 7,700

Individual IFI Project report : April 2005 – March 2006

Description of project	This project is to participate in the development of a pulse-echo cable fault locator in conjunction with Strathclyde University.		
Expenditure for financial year	Internal - £ 3500 External - £ 0 Total Cost – £ 3500		
Technological area and / or issue addressed by project	Cost of locating intermittent underground cable faults on the distribution network		
Type(s) of innovation involved	Technological substitution		
Expected Benefits of Project	Financial project benefits are derived from an assessment of how many LV underground mains faults the innovation would be used on successfully and the perceived benefit of its' successful deployment. The benefits will be delivered by reducing the cost of locating intermittent faults on the LV distribution network. Improved levels of customer service are expected.		
Expected Timescale to adoption	Medium – within seven years.	Duration of benefit once achieved	10 years
Estimated Success probability (at start of project)	Success probability assessed as 20%		
PV of Project Costs	£ 9202	PV of Project Benefits	£ 10,482
Commentary on project progress and potential for achieving expected benefits	Project currently on target. The device has been deployed on a small number of faults with very mixed results – further development is required in conjunction with field trials.		

	2005/06 Total Expenditure	**2005/06 Internal Expenditure**
SHEPD	£ 1000	£ 1000
SEPD	£ 2500	£ 2500

Individual IFI Project report : April 2005 – March 2006

Description of project	This project is to field test and evaluate the Kelman Delta V		
Expenditure for financial year	Internal - £ 3500 External - £ 0 Total Cost – £ 3500		
Technological area and / or issue addressed by project	Cost of locating underground cable faults on the distribution network		
Type(s) of innovation involved	Technological substitution		
Expected Benefits of Project	Financial project benefits are derived from an assessment of how many LV underground mains faults the innovation would be used on successfully and the perceived benefit of its' successful deployment. The benefits will be delivered by reducing the cost of locating intermittent faults on the LV distribution network. Improved levels of customer service are expected.		
Expected Timescale to adoption	Short – two years.	Duration of benefit once achieved	10 years.
Estimated Success probability (at start of project)	Success probability is assessed as 20%		
PV of Project Costs	£ 16,400	PV of Project Benefits	£ 12,805
Commentary on project progress and potential for achieving expected benefits	Project currently on target. Initial trial has been run on several faults with various results. Some issues were identified and resolved satisfactorily. Further small scale trials to be run to assess application.		

	2005/06 Total Expenditure	**2005/06 Internal Expenditure**
SHEPD	£ 1000	£ 1000
SEPD	£ 2500	£ 2500

Individual IFI Project report : April 2005 – March 2006

Description of project	Template 2 : this project is a progression of earlier work to develop, field test and evaluate the innovative application of automation technology to the distribution network		
Expenditure for financial year	Internal - £ 12,500 External - £ 74,800 Total Cost – £ 87,300		
Technological area and / or issue addressed by project	Impact of faults on the HV underground distribution networks		
Type(s) of innovation involved	Technological substitution		
Expected Benefits of Project	Financial project benefits result from reduction in labour costs. The benefits will be delivered by automatically isolating only the faulty section of network following a fault resulting in a reduction in CMLs, faster fault location and a reduction in costs. Improved quality of supply is expected.		
Expected Timescale to adoption	Short - three years.	Duration of benefit once achieved	10 years
Estimated Success probability (at start of project)	Success probability is assessed as 75%		
PV of Project Costs	£ 90,416	PV of Project Benefits	£ 112,575
Commentary on project progress and potential for achieving expected benefits	Project currently on target.		

	2005/06 Total Expenditure	**2005/06 Internal Expenditure**
SHEPD	£ 26,200	£ 3700
SEPD	£ 61,100	£ 8700

Appendix 1 : Summary Listing of IFI Activities

Total Costs of All Projects	Int Cost	Ext Cost	Total Cost
Overhead Line Module	4000	36000	40000
Underground Cable Module	4000	36000	40000
Plant Module	4000	36000	40000
Distributed Gen. Module	4000	36000	40000
Partial Discharge Module	4000	6000	10000
Equipment Coatings Forum	4000	5000	9000
Fault Level Monitor	3000	16000	19000
Lightning Protection	3000	0	3000
ROCOF	3000	0	3000
Earthing	3000	0	3000
Various Projects – Strathclyde Uni	1000	39000	40000
HUDDIG trial phase 1	15500	4000	19500
Portable FPI's with GSM Ph.1	3000	17000	20000
OYT operation detection	3000	5300	8300
comms network study	3000	48000	51000
Synchronising PMR	3000	7000	10000
U/G Cable plough	20000	120000	140000
dataloggers + GPS	14300	13000	27300
11kV network design	9500	20900	30400
survey equipment	4000	85000	89000
Mobile GIS	26200	298000	324200
Orkney Active Management	11000	0	11000
Pulse-echo cable fault locator	3500	0	3500
Kelman Delta V	3500	0	3500
Template 2 automation	12500	74800	87300
TOTAL	**170,000**	**903,000**	**1,073,000**