Innovation Funding Incentive Reports

Scottish Hydro-Electric Power Distribution

Southern Electric Power Distribution

for period 1 October 2004 to 31 March 2005

Contents

1. Introduction

As part of the recent Distribution Price Control Review (DPCR), Ofgem introduced its 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 website, www.energynetworks.org.

The IFI is intended to provide funding for 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/SSEGroup/PowerSystemsDocuments].
To enhance their accessibility, they will also be available on the Ofgem website at http://www.ofgem.gov.uk/ofgem/work/index.jsp?section=/areasofwork/ifirpz).

These reports cover activities in the period from 1 October 2004 to 31 March 2005. Under the terms of the DPCR these activities are treated as 2005/6 activities. They will therefore be consolidated into the 2005/6 reports that will be published in the summer of 2006.

Scottish and Southern Energy Power Distribution welcomes this initiative as a positive measure to further improve customer service, enhance safety, address environmental issues and reduce costs.

2. Scope

This document contains the reports for the two electricity distribution licensees within the SSE Group.

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

Qualifying expenditure for the period of this report has been £109,080 for SHEPD and £106,305 for SEPD, of which £28,980 and £26,205 relates to internal costs. The breakdown of this expenditure across individual projects is set out in the SHEPD and SEPD reports in sections 3 and 4 respectively of this document.

Both reports are similar reflecting our strategy of running both companies using one common best practice. However, the SHEPD area is seeing a higher level of distributed generation activity and is consequently more active in developing innovative solutions in this field.

All of the projects in the tables are ‘deminimis’ (under £40k) reflecting the relatively early stage of the IFI. We intend to expand our activities in this area during 2005/2006 looking at larger projects in a number of diverse areas.

The majority of these initial proposals are centred on our existing partnership with EA Technology (EATL). This research and development company has worked with the DNOs for a number of years and produced significant and successful initiatives that have contributed to improvements in all areas of DNO activity. Our four primary work areas (overhead lines; underground cables; substation plant; and distributed generation) are covered by EATL modules. We are reviewing our involvement with EATL and are currently looking at areas where we can expand our activities both jointly with other DNOs and in our own right. Appendix 1 details the projects that we are currently working on with EATL.

We have included a proposal for IFI activity within the energy networks industry trade organisation – the Energy Networks Association (ENA). The ENA 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. An R&D Working Group has been established within the ENA to consider possible collaborative working in this important area and it is anticipated a number of new initiatives will emerge in the near future.

SSE have an established R&D link with Strathclyde University who are an acknowledged UK leader in the field of electrical and electronic engineering. They have already contributed valuable input into our work in both asset risk management and distributed generation assisting us during the recent DPCR and helping us to develop active management systems for distributed generation on our networks.

Underground cable laying is a key part of our network development and we are actively looking at ways of reducing the cost of installation.

In the SHEPD area, we are seeing considerable amounts of renewable generation requiring to be connected to our network. On Orkney there are a number of network constraints that currently limit the amount of generation we can connect. However, we believe an active management system can be developed that will reduce the constraints and allow more generation to connect. This work is in its early stages and we anticipate that development will continue during 2005/2006.

Section 3

Scottish Hydro-Electric Power Distribution

IFI Report

for period

October 1 2004 – March 31 2005

3. Scottish Hydro-Electric IFI Report October 2004 – March 2005

Summary report of IFI project activities:– October 2004 – March 2005

Number of active IFI projects.	10
NPV of costs and anticipated benefits from committed IFI projects.	NPV Costs = £109,080 (Internal £28,980 ; External £80,100) Anticipated benefits = £223,528 N.B. All projects in this report are currently at a financial value that is less than the Ofgem 'de-minimis' level (<£40,000). We have chosen to use a simple cost benefit approach that combines likelihood of a programmes success with actual cost and anticipated average benefit to get a figure for net benefit. We acknowledge this may be over simplistic and, in conjunction with all the DNOs, have agreed with Ofgem that we review financial benefit calculations for 'de-minimis' projects over the next six months.
Summary of other benefits anticipated from active IFI Projects.	Various customer and environmental benefits will also accrue which are as yet not fully quantified.
Total expenditure to date on IFI projects.	£109,080
Benefits actually achieved from IFI projects to date.	Not Applicable as yet.

Individual IFI Project report :– October 2004 – March 2005

Description of project	EA Technology – Overhead Line Module and Forum. Research and development into all aspects of Distribution overhead lines. Modules are supported by all, or the majority of, UK DNOs and cover R&D into areas that will – reduce operating costs or capital investment; manage environmental impact of associated activities; improve safety; and/or give a positive benefit to customer service.		
Expenditure for financial year	Internal - £ 3,800 External - £9,400 Total Cost – £13,200 **(A)**	Expenditure in previous financial years	N/A
Technological area and / or issue addressed by project	Aspects of overhead line design, specification and rating.		
Type(s) of innovation involved	All innovation types involved (incremental, significant, technological substitution and radical)		
Expected Benefits of Project **(B)**	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.		
Expected Timescale to adoption	See attached summary of projects.	Duration of benefit once achieved	See attached summary of projects.
Estimated Success probability (at start of project)	Success probability is expected to be 20% overall on the whole programme of projects. **(C)**		
PV of Project Costs	£13,200 **(A)**	PV of Project Benefits **BxCxA** = 8x0.2x13,200 = 21,120	Net Project Benefit PV of benefits – PV of costs. i.e **BxCxA – A** = 8x0.2x13,200-13,200 = £7,920
Commentary on project progress and potential for achieving expected benefits	Projects currently on target.		

Individual IFI Project report :– October 2004 – March 2005

Description of project	EA Technology – Underground Cable Module and Forum. Research and development into all aspects of Distribution underground cables. Modules are supported by all, or the majority of, UK DNOs and cover R&D into areas that will – reduce operating costs or capital investment; manage environmental impact of associated activities; improve safety; and/or give a positive benefit to customer service.		
Expenditure for financial year	Internal - £ 3,800 External - £9,400 Total Cost - £13,200 **(A)**	Expenditure in previous financial years	N/A
Technological area and / or issue addressed by project	Aspects of underground cable design, specification and rating.		
Type(s) of innovation involved	All innovation types involved (incremental, significant, technological substitution and radical)		
Expected Benefits of Project **(B)**	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.		
Expected Timescale to adoption	See attached summary of projects.	Duration of benefit once achieved	See attached summary of projects.
Estimated Success probability (at start of project)	Success probability is expected to be 20% overall on the whole programme of projects. **(C)**		
PV of Project Costs	£13,200 **(A)**	PV of Project Benefits **BxCxA** = 8x0.2x13,200 = 21,120	Net Project Benefit PV of benefits – PV of costs. i.e **BxCxA – A** = 8x0.2x13,200-13,200 = £7,920
Commentary on project progress and potential for achieving expected benefits	Projects currently on target.		

Individual IFI Project report :– October 2004 – March 2005

Description of project	EA Technology – Plant Module and Forum. Research and development into all aspects of Distribution Plant and Equipment. Modules are supported by all, or the majority of, UK DNOs and cover R&D into areas that will – reduce operating costs or capital investment; manage environmental impact of associated activities; improve safety; and/or give a positive benefit to customer service.		
Expenditure for financial year	Internal - £ 3,800 External - £9,400 Total Cost - £13,200 **(A)**	Expenditure in previous financial years	N/A
Technological area and / or issue addressed by project	Aspects of Plant design, specification and rating.		
Type(s) of innovation involved	All innovation types involved (incremental, significant, technological substitution and radical)		
Expected Benefits of Project **(B)**	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.		
Expected Timescale to adoption	See attached summary of projects.	Duration of benefit once achieved	See attached summary of projects.
Estimated Success probability (at start of project)	Success probability is expected to be 20% overall on the whole programme of projects. **(C)**		
PV of Project Costs	£13,200 **(A)**	PV of Project Benefits **BxCxA** = 8x0.2x13,200 = 21,120	Net Project Benefit PV of benefits – PV of costs. i.e **BxCxA – A** = 8x0.2x13,200-13,200 = £7,920
Commentary on project progress and potential for achieving expected benefits	Projects currently on target.		

Individual IFI Project report :– October 2004 – March 2005

Description of project	EA Technology – Distributed Generation Module and Forum. Research and development into all aspects of Distributed Generation. Modules are supported by all, or the majority of, UK DNOs and cover R&D into areas that will – reduce operating costs or capital investment; manage environmental impact of associated activities; improve safety; give a positive benefit to customer service; and/or help create network conditions that can accommodate a greater amount of distributed generation connected.		
Expenditure for financial year	Internal - £ 3,800 External - £9,400 Total Cost - £13,200 **(A)**	Expenditure in previous financial years	N/A
Technological area and / or issue addressed by project	Aspects of Distributed Generation design, specification and capacity.		
Type(s) of innovation involved	All innovation types involved (incremental, significant, technological substitution and radical)		
Expected Benefits of Project **(B)**	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.		
Expected Timescale to adoption	See attached summary of projects.	Duration of benefit once achieved	See attached summary of projects.
Estimated Success probability (at start of project)	Success probability is expected to be 20% overall on the whole programme of projects. **(C)**		
PV of Project Costs	£13,200 **(A)**	PV of Project Benefits **BxCxA** = 8x0.2x13,200 = 21,120	Net Project Benefit PV of benefits – PV of costs. i.e **BxCxA – A** = 8x0.2x13,200-13,200 = £7,920
Commentary on project progress and potential for achieving expected benefits	Projects currently on target.		

Individual IFI Project report :– October 2004 – March 2005

Description of project	EA Technology – Partial Discharge Group and Forum. Research and development into all aspects of partial discharge in distribution equipment. Modules are supported by all, or the majority of, UK DNOs and cover R&D into areas that will – reduce operating costs or capital investment; manage environmental impact of associated activities; and/or improve safety.		
Expenditure for financial year	Internal - £ 1,530 External - £1,500 Total Cost – £3030 **(A)**	Expenditure in previous financial years	N/A
Technological area and / or issue addressed by project	Aspects of partial discharge to reduce fault rates and possibly environmental impact.		
Type(s) of innovation involved	All innovation types involved (incremental, significant, technological substitution and radical)		
Expected Benefits of Project **(B)**	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.		
Expected Timescale to adoption	Ongoing and starting from now.	Duration of benefit once achieved	In perpetuity.
Estimated Success probability (at start of project)	Success probability is expected to be 20% overall on the whole programme of projects. **(C)**		
PV of Project Costs	£3,030 **(A)**	PV of Project Benefits **BxCxA** = 8x0.2x3,030 = 4,848	Net Project Benefit PV of benefits – PV of costs. i.e **BxCxA – A** = 8x0.2x3,030-3,030 = £1,818
Commentary on project progress and potential for achieving expected benefits	Projects currently on target.		

Individual IFI Project report :– October 2004 – March 2005

Description of project	EA Technology – Equipment coatings Forum. Research and development into all aspects of coatings on distribution equipment. Modules are supported by all, or the majority of, UK DNOs and cover R&D into areas that will – reduce operating costs or capital investment; manage environmental impact of associated activities; and/or improve safety.		
Expenditure for financial year	Internal - £ 1,000 External - £1,250 Total cost – £2,250 **(A)**	Expenditure in previous financial years	N/A
Technological area and / or issue addressed by project	Aspects of coatings for distribution equipment to promote longevity, reduce faults and improve environmental impact.		
Type(s) of innovation involved	All innovation types involved (incremental, significant, technological substitution and radical)		
Expected Benefits of Project **(B)**	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.		
Expected Timescale to adoption	Ongoing and starting from now.	Duration of benefit once achieved	In perpetuity.
Estimated Success probability (at start of project)	Success probability is expected to be 20% overall on the whole programme of projects. **(C)**		
PV of Project Costs	£2,250 **(A)**	PV of Project Benefits **BxCxA** = 8x0.2x2,250 = 3,600	Net Project Benefit PV of benefits – PV of costs. i.e **BxCxA – A** = 8x0.2x2,250-2,250 = £1,350
Commentary on project progress and potential for achieving expected benefits	Projects currently on target.		

Individual IFI Project report :– October 2004 – March 2005

Description of project	Support of various project work at Energy Networks Association in relation to Approvals and Standards Group, Operational Support Group, Distributed Generation Steering Group and R&D Working Group. The ENA is the trade body of the UK DNOs and provides a forum for the companies to discuss issues of mutual interest, including R&D. It is envisaged IFI projects will be developed and sponsored within the ENA during 2005/2006 and include areas such as substation earthing and overhead line lightning protection.		
Expenditure for financial year	Internal - £ 2,000 Total Cost - £2,000 **(A)**	Expenditure in previous financial years	N/A
Technological area and / or issue addressed by project	Aspects of design, specification, rating, safety and environmental impacts of distribution equipment.		
Type(s) of innovation involved	All innovation types involved (incremental, significant, technological substitution and radical)		
Expected Benefits of Project **(B)**	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.		
Expected Timescale to adoption	Ongoing and starting from now.	Duration of benefit once achieved	In perpetuity.
Estimated Success probability (at start of project)	Success probability is expected to be 20% overall on the whole programme of projects. **(C)**		
PV of Project Costs	£2,000 **(A)**	PV of Project Benefits **BxCxA** = 8x0.2x2,000 = 3,200	Net Project Benefit PV of benefits – PV of costs. i.e **BxCxA – A** = 8x0.2x2,000-2,000 = £1,200
Commentary on project progress and potential for achieving expected benefits	Projects currently on target.		

Individual IFI Project report :– October 2004 – March 2005

Description of project	Sponsored endowment with Strathclyde University for applied research and development of Distributed Generation and Asset Risk Management issues. This funding provides close links with a noted academic organisation and will promote rapid transfer of new technology and ideas into existing business areas.		
Expenditure for financial year	Internal - £ 1,475 External - £9,750 Total £11,225 **(A)**	Expenditure in previous financial years	N/A
Technological area and / or issue addressed by project	Increased and more controlled out put 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 **(B)**	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.		
Expected Timescale to adoption	Next 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. **(C)**		
PV of Project Costs	£11,225 **(A)**	PV of Project Benefits **BxCxA** = 8x0.2x11,225 = 17,960	Net Project Benefit PV of benefits – PV of costs. i.e **BxCxA – A** = 8x0.2x11,225-11,225 = £6,735
Commentary on project progress and potential for achieving expected benefits	Projects currently on target.		

Individual IFI Project report :– October 2004 – March 2005

Description of project	Development of Renewable Generation active management for Orkney. This project is looking to connect a greater amount of distributed generation on Orkney by use of novel techniques. It has the potential to become a Registered Power Zone after some further development.		
Expenditure for financial year	Internal - £ 2,775 Total Cost – £2,775 **(A)**	Expenditure in previous financial years	N/A
Technological area and / or issue addressed by project	Increased capacity of Distribution Generation allowed to connect to Orkney network (still under development).		
Type(s) of innovation involved	All innovation types involved (incremental, significant, technological substitution and radical)		
Expected Benefits of Project **(B)**	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.		
Expected Timescale to adoption	Next 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. **(C)**		
PV of Project Costs	£2,775 **(A)**	PV of Project Benefits **BxCxA** = 8x0.2x2,775 = 4,440	Net Project Benefit PV of benefits – PV of costs. i.e **BxCxA – A** = 8x0.2x2,775-2,775 = £1,665
Commentary on project progress and potential for achieving expected benefits	Project currently on target.		

Individual IFI Project report :– October 2004 – March 2005

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 - £ 5,000 External - £30,000 Total £35,000	Expenditure in previous financial years	N/A
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 considered substantial with reductions in cable laying costs of at least 10%. Environmental and safety benefits are more difficult to quantify and are being assessed on an ongoing basis.		
Expected Timescale to adoption	Next three years.	Duration of benefit once achieved	Lifetime of asset.
Estimated Success probability (at start of project)	Success probability is thought to be 50%.		
PV of Project Costs	£35,000	PV of Project Benefits Estimated to be approx. 8x costs x success prob. = £140,000	Net Project Benefit PV of benefits – PV of costs. £140,000- £35,000 = £105,000
Commentary on project progress and potential for achieving expected benefits	Project currently on target.		

Section 4

Southern Electric Power Distribution

IFI Report

for period

October 1 2004 – March 31 2005

4. Southern Electric Power Distribution IFI Report October 2004 – March 2006

Summary report of IFI project activities:– October 2004 – March 2005

Number of active IFI projects.	9
NPV of costs and anticipated benefits from committed IFI projects.	NPV Costs = £106,305 (Internal £26,205 ; External £80,100) Anticipated benefits = £219,088 N.B. All projects in this report are currently at a financial value that is less than the Ofgem 'de-minimis' level (<£40,000). We have chosen to use a simple cost benefit approach that combines likelihood of a programmes success with actual cost and anticipated average benefit to get a figure for net benefit. We acknowledge this may be over simplistic and, in conjunction with all the DNOs, have agreed with Ofgem that we review financial benefit calculations for 'de-minimis' projects over the next six months.
Summary of other benefits anticipated from active IFI Projects.	Various customer and environmental benefits will also accrue which are as yet not fully quantified.
Total expenditure to date on IFI projects.	£106,305
Benefits actually achieved from IFI projects to date.	Not Applicable as yet.

Individual IFI Project report :– October 2004 – March 2005

Description of project	EA Technology – Overhead Line Module and Forum. Research and development into all aspects of Distribution overhead lines. Modules are supported by all, or the majority of, UK DNOs and cover R&D into areas that will – reduce operating costs or capital investment; manage environmental impact of associated activities; improve safety; and/or give a positive benefit to customer service.		
Expenditure for financial year	Internal - £ 3,800 External - £9,400 Total Cost – £13,200 **(A)**	Expenditure in previous financial years	N/A
Technological area and / or issue addressed by project	Aspects of overhead line design, specification and rating.		
Type(s) of innovation involved	All innovation types involved (incremental, significant, technological substitution and radical)		
Expected Benefits of Project **(B)**	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.		
Expected Timescale to adoption	See attached summary of projects.	Duration of benefit once achieved	See attached summary of projects.
Estimated Success probability (at start of project)	Success probability is expected to be 20% overall on the whole programme of projects. **(C)**		
PV of Project Costs	£13,200 **(A)**	PV of Project Benefits **BxCxA** = 8x0.2x13,200 = 21,120	Net Project Benefit PV of benefits – PV of costs. i.e **BxCxA – A** = 8x0.2x13,200-13,200 = £7,920
Commentary on project progress and potential for achieving expected benefits	Projects currently on target.		

Individual IFI Project report :– October 2004 – March 2005

Description of project	EA Technology – Underground Cable Module and Forum. Research and development into all aspects of Distribution underground cables. Modules are supported by all, or the majority of, UK DNOs and cover R&D into areas that will – reduce operating costs or capital investment; manage environmental impact of associated activities; improve safety; and/or give a positive benefit to customer service.		
Expenditure for financial year	Internal - £ 3,800 External - £9,400 Total Cost - £13,200 **(A)**	Expenditure in previous financial years	N/A
Technological area and / or issue addressed by project	Aspects of underground cable design, specification and rating.		
Type(s) of innovation involved	All innovation types involved (incremental, significant, technological substitution and radical)		
Expected Benefits of Project **(B)**	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.		
Expected Timescale to adoption	See attached summary of projects.	Duration of benefit once achieved	See attached summary of projects.
Estimated Success probability (at start of project)	Success probability is expected to be 20% overall on the whole programme of projects. **(C)**		
PV of Project Costs	£13,200 **(A)**	PV of Project Benefits **BxCxA** = 8x0.2x13,200 = 21,120	Net Project Benefit PV of benefits – PV of costs. i.e **BxCxA – A** = 8x0.2x13,200-13,200 = £7,920
Commentary on project progress and potential for achieving expected benefits	Projects currently on target.		

Individual IFI Project report :– October 2004 – March 2005

Description of project	EA Technology – Plant Module and Forum. Research and development into all aspects of Distribution Plant and Equipment. Modules are supported by all, or the majority of, UK DNOs and cover R&D into areas that will – reduce operating costs or capital investment; manage environmental impact of associated activities; improve safety; and/or give a positive benefit to customer service.		
Expenditure for financial year	Internal - £ 3,800 External - £9,400 Total Cost - £13,200 **(A)**	Expenditure in previous financial years	N/A
Technological area and / or issue addressed by project	Aspects of Plant design, specification and rating.		
Type(s) of innovation involved	All innovation types involved (incremental, significant, technological substitution and radical)		
Expected Benefits of Project **(B)**	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.		
Expected Timescale to adoption	See attached summary of projects.	Duration of benefit once achieved	See attached summary of projects.
Estimated Success probability (at start of project)	Success probability is expected to be 20% overall on the whole programme of projects. **(C)**		
PV of Project Costs	£13,200 **(A)**	PV of Project Benefits **BxCxA** = 8x0.2x13,200 = 21,120	Net Project Benefit PV of benefits – PV of costs. i.e **BxCxA – A** = 8x0.2x13,200-13,200 = £7,920
Commentary on project progress and potential for achieving expected benefits	Projects currently on target.		

Individual IFI Project report :– October 2004 – March 2005

Description of project	EA Technology – Distributed Generation Module and Forum. Research and development into all aspects of Distributed Generation. Modules are supported by all, or the majority of, UK DNOs and cover R&D into areas that will – reduce operating costs or capital investment; manage environmental impact of associated activities; improve safety; give a positive benefit to customer service; and/or help create network conditions that can accommodate a greater amount of distributed generation connected.		
Expenditure for financial year	Internal - £ 3,800 External - £9,400 Total Cost - £13,200 **(A)**	Expenditure in previous financial years	N/A
Technological area and / or issue addressed by project	Aspects of Distributed Generation design, specification and capacity.		
Type(s) of innovation involved	All innovation types involved (incremental, significant, technological substitution and radical)		
Expected Benefits of Project **(B)**	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.		
Expected Timescale to adoption	See attached summary of projects.	Duration of benefit once achieved	See attached summary of projects.
Estimated Success probability (at start of project)	Success probability is expected to be 20% overall on the whole programme of projects. **(C)**		
PV of Project Costs	£13,200 **(A)**	PV of Project Benefits **BxCxA** = 8x0.2x13,200 = 21,120	Net Project Benefit PV of benefits – PV of costs. i.e **BxCxA – A** = 8x0.2x13,200-13,200 = £7,920
Commentary on project progress and potential for achieving expected benefits	Projects currently on target.		

Individual IFI Project report :– October 2004 – March 2005

Description of project	EA Technology – Partial Discharge Group and Forum. Research and development into all aspects of partial discharge in distribution equipment. Modules are supported by all, or the majority of, UK DNOs and cover R&D into areas that will – reduce operating costs or capital investment; manage environmental impact of associated activities; and/or improve safety.		
Expenditure for financial year	Internal - £ 1,530 External - £1,500 Total Cost – £3030 **(A)**	Expenditure in previous financial years	N/A
Technological area and / or issue addressed by project	Aspects of partial discharge to reduce fault rates and possibly environmental impact.		
Type(s) of innovation involved	All innovation types involved (incremental, significant, technological substitution and radical)		
Expected Benefits of Project **(B)**	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.		
Expected Timescale to adoption	Ongoing and starting from now.	Duration of benefit once achieved	In perpetuity.
Estimated Success probability (at start of project)	Success probability is expected to be 20% overall on the whole programme of projects. **(C)**		
PV of Project Costs	£3,030 **(A)**	PV of Project Benefits **BxCxA** = 8x0.2x3,030 = 4,848	Net Project Benefit PV of benefits – PV of costs. i.e **BxCxA – A** = 8x0.2x3,030-3,030 = £1,818
Commentary on project progress and potential for achieving expected benefits	Projects currently on target.		

Individual IFI Project report :– October 2004 – March 2005

Description of project	EA Technology – Equipment coatings Forum. Research and development into all aspects of coatings on distribution equipment. Modules are supported by all, or the majority of, UK DNOs and cover R&D into areas that will – reduce operating costs or capital investment; manage environmental impact of associated activities; and/or improve safety.		
Expenditure for financial year	Internal - £ 1,000 External - £1,250 Total cost – £2,250 **(A)**	Expenditure in previous financial years	N/A
Technological area and / or issue addressed by project	Aspects of coatings for distribution equipment to promote longevity, reduce faults and improve environmental impact.		
Type(s) of innovation involved	All innovation types involved (incremental, significant, technological substitution and radical)		
Expected Benefits of Project **(B)**	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.		
Expected Timescale to adoption	Ongoing and starting from now.	Duration of benefit once achieved	In perpetuity.
Estimated Success probability (at start of project)	Success probability is expected to be 20% overall on the whole programme of projects. **(C)**		
PV of Project Costs	£2,250 **(A)**	PV of Project Benefits **BxCxA** = 8x0.2x2,250 = 3,600	Net Project Benefit PV of benefits – PV of costs. i.e **BxCxA – A** = 8x0.2x2,250-2,250 = £1,350
Commentary on project progress and potential for achieving expected benefits	Projects currently on target.		

Individual IFI Project report :– October 2004 – March 2005

Description of project	Support of various project work at Energy Networks Association in relation to Approvals and Standards Group, Operational Support Group, Distributed Generation Steering Group and R&D Working Group. The ENA is the trade body of the UK DNOs and provides a forum for the companies to discuss issues of mutual interest, including R&D. It is envisaged IFI projects will be developed and sponsored within the ENA during 2005/2006 and include areas such as substation earthing and overhead line lightning protection.		
Expenditure for financial year	Internal - £ 2,000 Total Cost - £2,000 **(A)**	Expenditure in previous financial years	N/A
Technological area and / or issue addressed by project	Aspects of design, specification, rating, safety and environmental impacts of distribution equipment.		
Type(s) of innovation involved	All innovation types involved (incremental, significant, technological substitution and radical)		
Expected Benefits of Project **(B)**	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.		
Expected Timescale to adoption	Ongoing and starting from now.	Duration of benefit once achieved	In perpetuity.
Estimated Success probability (at start of project)	Success probability is expected to be 20% overall on the whole programme of projects. **(C)**		
PV of Project Costs	£2,000 **(A)**	PV of Project Benefits **BxCxA** = 8x0.2x2,000 = 3,200	Net Project Benefit PV of benefits – PV of costs. i.e **BxCxA – A** = 8x0.2x2,000-2,000 = £1,200
Commentary on project progress and potential for achieving expected benefits	Projects currently on target.		

Individual IFI Project report :– October 2004 – March 2005

Description of project	Sponsored endowment with Strathclyde University for applied research and development of Distributed Generation and Asset Risk Management issues. This funding provides close links with a noted academic organisation and will promote rapid transfer of new technology and ideas into existing business areas.		
Expenditure for financial year	Internal - £ 1,475 External - £9,750 Total £11,225 **(A)**	Expenditure in previous financial years	N/A
Technological area and / or issue addressed by project	Increased and more controlled out put 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 **(B)**	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.		
Expected Timescale to adoption	Next 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. **(C)**		
PV of Project Costs	£11,225 **(A)**	PV of Project Benefits **BxCxA** = 8x0.2x11,225 = 17,960	Net Project Benefit PV of benefits – PV of costs. i.e **BxCxA – A** = 8x0.2x11,225-11,225 = £6,735
Commentary on project progress and potential for achieving expected benefits	Projects currently on target.		

Individual IFI Project report :– October 2004 – March 2005

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 - £ 5,000 External - £30,000 Total £35,000	Expenditure in previous financial years	N/A
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 considered substantial with reductions in cable laying costs of at least 10%. Environmental and safety benefits are more difficult to quantify and are being assessed on an ongoing basis.		
Expected Timescale to adoption	Next three years.	Duration of benefit once achieved	Lifetime of asset.
Estimated Success probability (at start of project)	Success probability is thought to be 50%.		
PV of Project Costs	£35,000	PV of Project Benefits Estimated to be approx. 8x costs x success prob. = £140,000	Net Project Benefit PV of benefits – PV of costs. £140,000- £35,000 = £105,000
Commentary on project progress and potential for achieving expected benefits	Project currently on target.		

Appendix 1

EA Technology Project Lists

October 1 2004 – March 31 2005

LIST OF EATL STP PROJECTS 2004-2005

MODULE 2 – OVERHEAD NETWORKS

Project No	Project Title	Project Objective	Commitment Date	Completion Date	Budget	Partners
S2114_2	Lightning risk contour map - Stage 2: Prototype risk map	A map showing how the risk from lightning damage varies from place to place will help companies target lightning protection measures to reduce operational expenditure.	May 2004	Oct 2004	£11,200	Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF
S2118	Module co-ordination	Administration	Apr 2004	Mar 2004	£18,800	Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF
S2119	Effect of lightning on insulated earth wires.	There will be quantifiable benefits in network performance as well as improvement in operator health and safety through re-evaluation of cable design based on this study of lightning effects.	Aug 2004	Feb 2005	£12,100	Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF
S2120	Detection of defective surge arresters	Network performance will be improved by reducing over-voltage transients to customers, reducing equipment failure due to over-voltage stress, identification of under performing network protection and early detection of incipient faults in surge arresters.	May 2004	Oct 2004	£16,325	Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF
S2121	Tracking tests on new and old covered conductor samples from Finland and Sweden	Covered conductor networks will experience improved performance, particularly in coastal or polluted areas, through the respecification of these	Apr 2004	Oct 2004	£23,780	Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF

		conductors.				
S2122	Arc gaps for long-rod polymeric 132kV insulators on wood pole and tower lines - Stage 1: Arc Gaps and Grading rings – Use of existing data	Improved network performance and operational cost reduction will stem from this best practice definition of long rod insulator specification.	Jul 2004	Feb 2005	£11,580	Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF
S2123	Continued involvement with Cigre WG11	By determining and distributing best practice across the industry through cost effective identification of world-wide best practice, all aspects of customer benefits should be positively impacted.	May 2004	Apr 2005	£17,070	Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF
S2124	Vibration tests on new covered conductor types	Premature replacement of new conductor types should be reduced and conversely in service failure of these conductors should be reduced, resulting in operational cost reduction and improved network performance.	Apr 2004	Oct 2004	£11,575	Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF
S2125	Monitoring Cigré 2004/5	By determining and distributing best practice across the industry through cost effective identification of world-wide best practice, all aspects of customer benefits should be positively impacted.	Aug 2004	Apr 2005	£9,250	Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF
S2126	Long-term monitoring of conductor temperature at fixed current to confirm/reassess validity of using Leatherhead 1976 data as basis of distribution	Up-rating of distribution network conductors could substantially reduce the cost of replacing these items by deferring temporarily or permanently the need for replacement.	Apr 2004	May 2005	£27,300	Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF

	ratings					
S2127	Attend 2nd Wrap seminar and report	Positive environmental benefits will stem from the improvement in disposal practices of treated utility poles.	Apr 2004	May 2005	£1,360	Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF
S2112	Call-out for leakage currents on suspect poles – 10% additional funding		Nov 2003	Sep 2004	£980	Mod 2 DNOs: CN, UU, SP, WPD, S&S, EDF

MODULE 3 – CABLE NETWORKS

Project No	Project Title	Project Objective	Commitment Date	Completion Date	Budget	Partners
S0352	Module 3 administration	Provide an efficient administration for the module, including the following services as set out in the STP agreement:- ❑ Provide support to the steering group ❑ Prepare proposals for new projects against the objectives set by the steering group ❑ Ensure as far as reasonably possible that projects are delivered to the required time, budget, and quality standards ❑ Ensure accurate and timely communication with the participants ❑ Make recommendations for protection or exploitation of the IPR arising from the Module Programme and Outputs	Apr 2004	Mar 2005	£13,000	Mod 3 DNOs: EDF, CN, CE, S&S, UU, WPD
S3100_2	Specification for link boxes. Stage 2: Final specification	Through correct specification of link box characteristics, to increase reliability and thereby reduce operating costs.	Apr 2004	Oct 2004	£8,000	Mod 3 DNOs: EDF, CN, CE, S&S, UU, WPD
S3113	Current rating tools for cables	Through the development of user friendly software for the calculation of cable ratings, to ensure best engineering design practice and to reduce the cost of	Apr 2004	Nov 2004	£38,000	Mod 3 DNOs: EDF, CN, CE, S&S, UU, WPD

		purchase of cables by more accurately matching cable specification to functional requirement. Stage 1: Extend the functionality of the existing CRATER cable rating software to include user defined input of load curve. Stage 2: Create a tool to calculate ratings of cables in banks of ducts				
S3115	Corrosion resistance of aluminium foil cables	To improve reliability and to reduce operating costs by reducing life-reducing corrosion in 132 kV foil laminate cables.	May 2004	Jan 2005	£21,000	Mod 3 DNOs: EDF, CN, CE, S&S, UU, WPD
S3116	Mechanical properties of corrugated ducting	To introduce best engineering practice and to reduce operating costs by better understanding and hence correct selection of cable duct.	Apr 2004	Dec 2004	£20,000	Mod 3 DNOs: EDF, CN, CE, S&S, UU, WPD
S3120	Burn-back of cables in ducts, basements and ducts	To improve network performance, to reduce the impact of cable failure and to reduce health and safety risks from serious fires, by testing coating systems which can prevent the propagation of fire along PE sheathed cable.	Apr 2004	Dec 2004	£26,670	Mod 3 DNOs: EDF, CN, CE, S&S, UU, WPD

MODULE 4 – SUBSTATIONS

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

		for cleaning the tanks of HV oil filled equipment during maintenance.				S&S, SP, EDF, WPD
S4145	Environmental Aspects of Substation Operation	To present a summary of worldwide techniques and solutions currently employed to reduce the environmental impact of existing and planned substations.	Apr 2004	Aug 2004	£7,100	Mod 4 DNOs: CN, CE, UU, S&S, SP, EDF, WPD
S4146	Impact of Distributed Generation	To present a high level perspective of the fundamental issues and implications of connecting Distributed Generation to the distribution network focused at the 11kV level and take into account those factors, issues and implications for substation plant.	Jun 2004	Aug 2004	£13,000	Mod 4 DNOs: CN, CE, UU, S&S, SP, EDF, WPD
S4147	On-line oil regeneration	To review available online oil regeneration processes for oil filled equipment in the context of reducing cost of maintenance, thereby improving network performance through increased reliability and extending life.	Jun 2004	Dec 2004	£22,500	Mod 4 DNOs: CN, CE, UU, S&S, SP, EDF, WPD
S4149	Reliability of existing and newly installed plant	To provide an objective assessment of the extent and severity of the issues regarding the performance of newly installed plant which in some instances is not performing as well as older, more established plant.	Jun 2004	Dec 2004	£21,500	Mod 4 DNOs: CN, CE, UU, S&S, SP, EDF, WPD
S4150	Arc Suppression Coil Systems	To produce a concise report which clearly reviews the recent development in ASCS and the issues that need to be	May 2004	Jun 2004	£7,680	Mod 4 DNOs: CN, CE, UU, S&S, SP, EDF,

		considered when applying this technology to UK distribution networks rated up to 36kV.				WPD
S4155	Investigation of Ester Based Insulating Oils	To understand where and when vegetable based oils would be more advantageous than mineral based oils and where on the system would most advantage be gained from its use .	Jul 2004	Sep 2004	£13,289	Mod 4 DNOs: CN, CE, UU, S&S, SP, EDF, WPD
S4156	Current Cigre Substation Work Group	To provide up-to-date information on work applicable to the UK DNO's from world-wide sources.	May 2004	Aug 2004	£10,790	Mod 4 DNOs: CN, CE, UU, S&S, SP, EDF, WPD
S4157	Review of last 10 years of Cigre Substation work	To provide a source of new ideas for UK use as well as providing information on world-wide progress and experience of substations.	May 2004	Aug 2004	£11,620	Mod 4 DNOs: CN, CE, UU, S&S, SP, EDF, WPD

MODULE 5 – DISTRIBUTED GENERATION

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

		systems, as will the ability to manage the risks associated with DG connection.				
S5102	A watching brief on distributed generation	This project assembles the key information published in UK & internationally to ensure that all the projects in STP use best knowledge and do not duplicate work. It benefits DNOs, DG Developers & customers in bringing to their notice best practice.	Apr 2004	Jan 2005	£12,500	Mod 5 DNOs: CN, EDF, CE, SP, UU
S5113	Seminar on Module 5 work – Stability	Knowledge & understanding of stability issues as the amount of DG in distribution networks increases is an increasing concern. This seminar will transfer knowledge from 8 STP projects to DNO design engineers, thereby enabling them to better accommodate connection requests without incurring Supply Quality dis-benefits.	Jun 2004	Sep 2004	£7,100	Mod 5 DNOs: CN, EDF, CE, SP, UU
S5119	Stability assessment policies: generic guidance	A best practice guide for stability assessment policy will communicate the output from previous STP projects on stability and will assist in enhancing network performance and reduce operational costs stemming from instability caused by DG connection.	Mar 2004	Apr 2004	£5,000	Mod 5 DNOs: CN, EDF, CE, SP, UU
S5122_2	Guidance as to LOM protection settings on distribution networks	Having the right setting on generator Loss of Mains protection is vital to ensure customers see the minimum number of loss of supply events. This	Jun 2004	Aug 2004	£5,800	Mod 5 DNOs: CN, EDF, CE, SP, UU

		project gives advice founded upon earlier stage testing of commonly used relays in the UK. Major reductions in numbers of nuisance false trips are expected				
S5123_2	BAM Solution 3.5 - Line voltage regulation	To improve future network performance by developing a guide through improved operational design practices, to communicate effectively innovative options for line voltage regulation.	Jun 2004	Aug 2004	£9,250	Mod 5 DNOs: CN, EDF, CE, SP, UU
S5124_2 & 3	BAM Solution 2.2 - Increase impedance of components S2	To assess the potential for increasing the impedance of transformers by identifying and enumerating the network benefits and disadvantages. To identify methods to reduce the disadvantages. To design and cost demonstration trials.	Apr 2004 Jul 2004	Jun 2004 Sep 2004	£8,000 £9,800	Mod 5 DNOs: CN, EDF, CE, SP, UU
S5125	BAM Solution 2.1 - Uprate network components	To investigate the engineering, practical and fiscal considerations and constraints associated with the options of holding the 11kV fault level at the design fault level of 250MVA during normal running arrangements and increasing the design fault level. The investigation will consider implications to HV and LV connected customers as well as implications to the DNO system	May 2004	Jul 2004	£7,500	Mod 5 DNOs: CN, EDF, CE, SP, UU
S5126	BAM Solution 2.3 - Converter technology	To obtain outline costs and high-level technical benefits for commercially available converters across a range of generator types. Aim being to assist the	Apr 2004	Jun 2004	£5,000	Mod 5 DNOs: CN, EDF, CE, SP, UU

		process of implementation of TSG Workstream 3 solution 3.5 by DNOs.				
S5128	Module 5 co-ordination	Administration	Apr 2004	Mar 2005	£15,000	Mod 5 DNOs: CN, EDF, CE, SP, UU
S5130	Network risk management	To assist DNOs to form a set of views on issues surrounding network risk including those associated with increasing network utilisation and risks of relying on DG to avoid network reinforcement, ideally, before the draft P2/6 network security standard is published for consultation.	Jun 2004	Sep 2004	£13,500	Mod 5 DNOs: CN, EDF, CE, SP, UU
S5132	Overview of system behaviour with large amounts of windpower	To assist in ensuring supply quality in disturbances on networks with large amounts of windpower, the key aspects of this recent work in Denmark are to be identified for application in UK.	Jun 2004	Jul 2004	£3,000	Mod 5 DNOs: CN, EDF, CE, SP, UU
S5133	Tapchangers - reverse power capabilities	Tap changers are key items in achieving good voltage control with significant amounts of distributed generation. There is no definitive reference document of the equipment out on the networks reverse power capability. The project will give this, enabling the most cost-effective option to be selected.	Jun 2004	Sep 2004	£15,000	Mod 5 DNOs: CN, EDF, CE, SP, UU
S5138	Review of Industry Codes	To identify likely new Distribution Code provisions relating to distributed generation and comment on their	Jun 2004	Jul 2004	£7,250	Mod 5 DNOs: CN, EDF, CE, SP, UU

		implications				
S5139	Potential of RPZ framework	To improve future network performance and reduce network costs by defining specific RPZ scenarios and quantifying the commercial issues, in order to facilitate the identification and establishment of optimum RPZs.	Aug 2004	Sep 2004	£4,200	Mod 5 DNOs: CN, EDF, CE, SP, UU
S5140	Domestic CHP potential	To produce an up to date estimate of rollout for key dCHP products to establish a time plan against which DNOs may have to respond with technical solutions to the supply quality and financial implications.	Jul 2004	Sep 2004	£7,000	Mod 5 DNOs: CN, EDF, CE, SP, UU
S5141	IFI work portfolio	To identify potential project outlines that meet the IFI benefit criteria for customers, generators and DNOs through a brain storm and project formulation workshop.	Jun 2004	Jul 2004	£2,500	Mod 5 DNOs: CN, EDF, CE, SP, UU