United Utilities IFI report

Introduction & Background

Context

As part of the recent Distribution Price Control Review (DPCR), Ofgem introduced two incentive mechanisms: the Innovation Funding Incentive (IFI) and Registered Power Zone (RPZ). The introduction of these incentives was widely supported.

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

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

Innovation Funding Incentive (IFI)

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

They can be summarised as follow:

A DNO is allowed to spend up to 0.5% of its Combined Distribution Network Revenue on eligible IFI projects. This GPG provides guidance on the characteristics of such projects. The DNO is allowed to recover from customers a significant proportion of its IFI expenditure. This proportion is set at 90% in 2005/6 reducing in equal steps to 70% in 2009/10.

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

Registered Power Zone (RPZ)

In contrast to the IFI, RPZs are focused specifically on the connection of generation to distribution systems. The estimates made by DNOs as part of the DPCR process indicated that some 10GW of generation could be connected in the next five years.

This generation could connect at every distribution voltage level bringing new system design and operating challenges.

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

The RPZ mechanism is an extension of the Distributed Generation (DG) Incentive that is also being introduced as part of DPCR4. The DG incentive allows DNOs to recover their generation connection costs by a combination of pass through (80%) and incentive per kW connected (£1.5/kW). This approach is expected to deliver a higher return to a DNO for generation connection schemes than other network investments.

If a DNO employs genuine innovation in the way that it connects generation it can seek to register the connection scheme with Ofgem as an RPZ. Ofgem will decide, using published criteria, whether the scheme qualifies as an RPZ. If it does, the incentive element of the DG Incentive is increased for the first five years of operation by £3/kW.

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

This report is also available on United Utilities website at www.uuplc.co.uk

IFI 2004/05 Summary

Project	04/05		Total Project Expenditure (Xd4)	NPV of Project	Estimated Adoption Costs (Xd4/Xd5)
	Int.	Ext.			
STP Module 2 Overhead	2	17.25	123	266.6	1230
STP Module 3 Cables	2	17.25	123	266.6	1230
STP Module 4 Substations	2	17.25	123	266.6	1230
STP Module 5 Dist Gen	2	17.25	123	266.6	1230
CBRM	5	10	180	196.2	1800
Criticality	2	7.5	180	194	1800
Alternative Oils for T/F's	1.5	8.9	31.2	16.3	312
GROND Assessment of HV Networks	1	9.3	20.6	353	206
Losses Methodology	20		20	202	200
Cost Effective Dist. Network Pricing Methodology		37.5	37.5	-	375
Reference Network - Phase 2	1	15	64	265	640
Total Expenditure Int/Ext	38.5	157.2			
Total Expenditure	195.7		1025.3	2292.9	10253

Summary Report of IFI project Activities

Number of active IFI projects.	11
NPV of costs and anticipated benefits from committed IFI Projects.	£2,292,900
Summary of other benefits anticipated from active IFI Projects.	Improvements in network performance by reducing the CML and CI. Effective network investment Increased safety of staff and the public. Introduction of Best Engineering practices
Total expenditure to date on IFI Projects.	£195,700
Benefits actually achieved from IFI Projects to date.	None

Regulatory report for DG incentives, RPZs and IFI
Reporting year 2005/06

United Utilities Plc

Distributed generation (DG) incentive

total incentivised DG capacity (MW)	
total capex for DG (£m)	
use of system capex for DG (£m)	
shared connection capex for DG (£m)	
assests transferred out of DG capex to demand capex (£m)	
DG network unavailability rebate payment (£m)	
operational & mainenance costs for DG (£m)	

Innovation Funding Incentive

IFI carry forward (£m)	0
eligible IFI expenditure (£m)	0.196
eligible IFI internal expenditure (£m)	0.039
combined distribution network revenue (£m)	279.5

RegisteredPower Zones

RPZ Zone	
RPZ DG capacity (MW)	
RPZ starting year	

Individual IFI Project Report

Description of project	Strategic Technology Programme Overhead Network Module		
Expenditure for financial year	£19,250	Expenditure in previous financial years	
Technological area and / or issue addressed by project	The STP overhead network programme for budget year 2004/5 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 programme of work aims to: • 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.		
Type(s) of innovation involved	Technical Substitution / Radical		
Expected Benefits of Project	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: • substantial offset of future increases in CAPEX and OPEX of the order of £288,000 / DNO / year • savings of the order of 0.93 CMLs per connected customer / year, increased resilience in storm conditions; • increased safety of staff and public through increased ground clearances.		
Expected Timescale to adoption	7 years	Duration of benefit once achieved	10 years

Estimated Success probability (at start of project)	25%				
PV of Project Costs	£106,920	PV of Project Benefits	£373,577	NPV of Project	£266,657
Commentary on project progress and potential for achieving expected benefits	Projects making good progress and are currently on target.				

Individual IFI Project Report

Description of project	Strategic Technology Programme Cable Module				
Expenditure for financial year	£19,250		Expenditure in previous financial years		
Technological area and / or issue addressed by project	The aim of this module is to reduce costs and improve the performance of cable networks by increasing understanding of issues that have a negative impact on costs and performance. Most projects also have positive impacts 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 programme of work aims to: • Reduce the cost of reinforcement of the network • Reduce the risk of failure from over-rated cables • Provide faster, more efficient location of intermittent LV faults • Reduce the number of faults due to loss of earth continuity • Improve techniques and equipment to monitor and assess the condition of cables • Provide better jointing compounds				
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 at least the following benefits, including offset future increases in CAPEX and OPEX of the order of (assessment is based only on those projects that currently have fully enumerated benefits): • average savings of £288k **OPEX** and **CAPEX** per year; • average savings of 1 CML per connected customer; • increased safety of staff and public by reducing the number of accidents / incidents;				
Expected Timescale to adoption	7 years		Duration of benefit once achieved		10 years
Estimated Success probability (at start of project)	25%				
PV of Project Costs	£106,920	PV of Project Benefits	£373,577	NPV of Project	£266,657

Commentary on project progress and potential for achieving expected benefits	Projects making good progress and are currently on target.

Individual IFI Project Report

Description of project	Strategic Technology Programme Plant Network Module		
Expenditure for financial year	£19,250	Expenditure in previous financial years	
Technological area and / or issue addressed by project	The Module encompasses both developing new innovative asset management processes and practices to developing innovative diagnostic instruments. The aim is to develop already well established themes such as life extension of aged assets within legal and heath and safety constraints, examination of new technologies, developing an understanding of, and innovative solutions for, the impact on substation assets of increasing levels of distributed generation on networks and condition monitoring techniques. The programme of work aims to: • Improve lightning protection of substation plant. • Develop techniques to safely increase transformer loading capabilities. • Develop and define the functionality of protection software. • Establish new techniques for assessing the condition for oil filled circuit beakers. • Develop new tools to extend the range of plant items that can be monitored non-intrusively. • Develop control and protection techniques to assist with the removal of the barriers to the increased connection of distributed generation. • Examine, test and develop new techniques and instruments to ensure the integrity of substation earthing systems. .		
Type(s) of innovation involved	Technical 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 offset future increases in CAPEX and OPEX of the order of: • Potential savings of £288k OPEX and CAPEX per year. • 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.		

	It is recognised that there will be further significant costs associated with implementation of technically successful projects.				
Expected Timescale to adoption	7 years		Duration of benefit once achieved	10 years	
Estimated Success probability (at start of project)	25%				
PV of Project Costs	£106,920	PV of Project Benefits	£373,577	NPV of Project	£266,657
Commentary on project progress and potential for achieving expected benefits	Projects making good progress and are currently on target.				

Individual IFI Project Report

Description of project	Strategic Technology Programme Distribution Generation Module		
Expenditure for financial year	£19,250	Expenditure in previous financial years	
Technological area and / or issue addressed by project	The projects which it is proposed to undertake through budget year 2005/6 are 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 have positive impacts 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 programme of work aims to: • Provide the foundation knowledge to enable a cost effective increase in the network's capacity for generation connections. • Ensure members are provided with technical best practice information on DG connection issues that they can then immediately implement; • Identify and develop innovative techniques and systems for active control of voltage and power flow within Distribution Networks; • Improve the functionality of protection modules that maximise generator contribution to security of supply whilst meeting statutory safety and functional requirements. Develop innovative means to establish the performance of protection without individual "witness" testing of generator installations; • Enable an increased amount of power to be carried by existing Distribution Circuits without exceeding the thermal and statutory safety limits, by implementing dynamic rating systems; • Establishing the risk to network operation and consequently security of supply from widespread implementation of active network management measures.		
Type(s) of innovation involved	Technical Substitution / Radical		
Expected Benefits of Project	With government policy driving significant increases in generation connection to distribution networks the members will 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 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 offset future increases in CAPEX and OPEX of the		

<table>
<tr><td></td><td colspan="5">order of:

• potential savings of £288k OPEX and CAPEX;
• savings in interruptions and CMLs from avoided outages and reduced erroneous protection trips;
• increased safety of staff and public by reducing the number of accidents / incidents;
• environmental benefits through reduced disruption due to avoided reconductoring / rebuilding, reinforcement or equipment replacement on capacity / fault level or voltage control grounds.

It is recognised that there will be further significant costs associated with implementation of technically successful projects.</td></tr>
<tr><td>Expected Timescale to adoption</td><td colspan="2">7 years</td><td>Duration of benefit once achieved</td><td colspan="2">10 years</td></tr>
<tr><td>Estimated Success probability (at start of project)</td><td colspan="5">25%</td></tr>
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<tr><td>Commentary on project progress and potential for achieving expected benefits</td><td colspan="5">Projects making good progress and are currently on target.</td></tr>
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Individual IFI Project Report

Description of Project	Condition Based Risk Management (CBRM)				
Expenditure for financial year 04/05	£15k		Expenditure in previous financial years	£0	
Technological area and/or issue addressed by Project.	Condition Based Risk Management (CBRM) is a methodology that uses all available knowledge, experience and information relating to physical assets in order to define the present condition of the asset and then estimate future performance on the basis of ongoing degradation				
Type(s) of innovation involved	Incremental Innovation				
Expected Benefits of Project	Financial - better targeting of Asset Replacement, methodology to justify reduction in Capex whilst maintaining fault rates at their current level. Supply Quality, Environmental and Safety - removal of assets most likely to fail				
Expected Timescale to adoption	3 years		Duration of benefits once achieved	5 years	
Estimated Success probability (at start of project)	50%				
PV of Project Costs	£157,474	PV of Project Benefits	£353,678	NPV of project	£196,204
Commentary on project progress and potential for achieving expected benefits	The review and modification of current data structures, data and extract of data has been more difficult than expected and delayed the project. The time has been spent evaluating and piloting changes to asset data structures and the weighting of different condition states for different asset groups				

Individual IFI Project Report

Description of Project	Criticality Assessment (or Trade-Off Diamond)				
Expenditure for financial year 04/05	£9.5k		Expenditure in previous financial years	£0	
Technological area and/or issue addressed by Project.	Organisational changes have brought in the issue of the 'Trade-off Diamond' and the existing criticality assessment work done by Asset Performance will help to support this work being done across SD. The key elements of this approach are Investment, Maintenance, Operation and Service and their effect on Company risk and profit. Criticality assessment helps to identify the optimum intervention strategy for an asset, a combination of investment in new assets, maintenance and operation, to deliver the desired level of service for the business.				
Type(s) of innovation involved	Incremental Innovation				
Expected Benefits of Project	Financial - better targeting of Asset Replacement, methodology to justify reduction in Capex (if necessary). Supply Quality, Environmental, Operational and Safety - removal of assets most likely to fail				
Expected Timescale to adoption	3 years		Duration of benefits once achieved	5 years	
Estimated Success probability (at start of project)	50%				
PV of Project Costs	£159,282	PV of Project Benefits	£353,678	NPV of project	£194,396
Commentary on project progress and potential for achieving expected benefits	It has taken longer than expected to carry out a pilot project based on distribution substation sites and to modify the corporate asset record systems. This pilot has identified the efficiencies that can be obtained from information held and managed by UU ADR (Asset data records), these lessons will be used more extensively as the project develops.				

Individual IFI Project Report

Description of Project	Alternative Oils for Transformers				
Expenditure for financial year	£10,400		Expenditure in previous financial years	£0	
Technological area and/or issue addressed by Project.	Evaluation Of The Characteristics Of Alternative Oils For Retro-Filling Power Transformers And For Use In New Transformers				
Type(s) of innovation involved	Technological substitution				
Expected Benefits of Project	The benefits of using alternative oils in transformers are based around two main points, safety/environment and lifetime ageing performance				
Expected Timescale to adoption	7 years		Duration of benefits once achieved	20 years	
Estimated Success probability (at start of project)	50%				
PV of Project Costs	£24,057	PV of Project Benefits	£40,429	NPV of project	£16,372
Commentary on project progress and potential for achieving expected benefits	Stages completed:- *Basic Testing*: Test a range of alternative oils and a mineral oil to compare electrical characteristics for new and aged oils with cellulose materials found in transformers.				

Individual IFI Project Report

Description of Project	GROND - Assessment of HV Network and Policy Module				
Expenditure for financial year	£10,300		Expenditure in previous financial years	£0	
Technological area and/or issue addressed by Project.	Carry out a full assessment of HV network performance for all parts of the network where improvements in performance can make a significant contribution overall network performance. It is intended that the methodology used could be repeated at intervals to review improvements due to investment and or increased operating efficiency as well as deterioration caused by ageing of the network				
Type(s) of innovation involved	Incremental Innovation				
Expected Benefits of Project	Ensuring that capital expenditure on improving the performance of the network will be optimised both in respect of applying the expenditure to circuits where the greatest benefit can be obtained and also in respect of the number and location of switching and protection devices applied to those circuits				
Expected Timescale to adoption	3 years		Duration of benefits once achieved	5 years	
Estimated Success probability (at start of project)	75%				
PV of Project Costs	£18,334	PV of Project Benefits	£371,362	NPV of project	£353,028
Commentary on project progress and potential for achieving expected benefits	Stage 1 (Pilot Study) of the project has been completed and a stage report received. Arising from the work of stage 1, a number of points of clarification and additional data requirements were identified. These have been documented and good progress has been made and is continuing towards satisfying these, prior to the commencement of stage 2.				

Individual IFI Project Report

Description of Project	Software Tool for Allocating Distribution Losses				
Expenditure for financial year	£20,000		Expenditure in previous financial years		
Technological area and/or issue addressed by Project.	As a result of increased penetration of Distributed Generation (DG), with their highly variable output profiles, there is a need for the development of a new fair and equitable methodology for the allocation of losses to both generation and demand customers				
Type(s) of innovation involved					
Expected Benefits of Project	The development of this approach will enable UU to allocate losses to generators more accurately, which will be crucial in complying with the licence obligations and optimising UU's overall performance against the proposed Ofgem loss incentive. The benefits of reducing the losses on the EHV networks by 0.5% is estimated to be £63k pa.				
Expected Timescale to adoption	3		Duration of benefits once achieved	6	
Estimated Success probability (at start of project)	75%				
PV of Project Costs	£18,868	PV of Project Benefits	£221,464	NPV of project	£202,596
Commentary on project progress and potential for achieving expected benefits	The marginal pricing methodology for allocating distribution losses has been completed by deriving the nodal marginal apportionment factors based on the DC load flow model. An integrated desktop software package has been developed, enabling calculation of both the fixed and the variable distribution losses by voltage levels/transformations and allocation of these losses to the generation and demand customers. The developed methodology and the software package have been successfully tested on a part of the United Utilities' EHV system. The test results clearly indicate which generators contribute to the losses most and which generators reduce the losses. Hence, the generation profiles can be altered in order to reduce the overall distribution losses. The potential for achieving expected benefits from this project is therefore very high.				

Individual IFI Project Report

Description of Project	Cost effective Marginal Distribution Network Pricing Methodology				
Expenditure for financial year	£37,482		Expenditure in previous financial years	£0	
Technological area and/or issue addressed by Project.	Establish a new methodology for attribution of network costs to customer groups (including generation as well as demand) through a combination of models of network usage and cost allocation.				
Type(s) of innovation involved	Radical				
Expected Benefits of Project	Provides ability to produce cost justified G-DUoS prices for application in the 'Interim Arrangements', and a framework on which to build an enduring approach to charging that meets licence requirements. The ability to apportion use of system costs between demand and generation is a step change in use of system pricing for distribution companies in the UK				
Expected Timescale to adoption	3 years		Duration of benefits once achieved		
Estimated Success probability (at start of project)	75%				
PV of Project Costs	£35,377	PV of Project Benefits	Not known (see below)	NPV of project	Not known (see below)
Commentary on project progress and potential for achieving expected benefits	This research work has proved it is conceptually possible to apply a new approach to marginal pricing methodology to the higher voltage levels and to calculate G-DUoS prices. The work has extended the knowledge of UU and UoM but also uncovered questions on applicability of costs drivers, time of use charging and connection charging boundary flexibility. Knowledge of these issues will assist in the development of a practical solution in the next phase of this research and development work. A separate project definition has been developed that will review the costs and benefits of application of the new approach to different classes of customer. Without this is is not possible to quantify the benefits of the work to date.				

Individual IFI Project Report

Description of Project	Reference Networks - Phase 2				
Expenditure for financial year	£16,000		Expenditure in previous financial years	£0	
Technological area and/or issue addressed by Project.	Phase II of the project will produce a practical software tool to create optimum disaggregation groups and analyse existing networks and proposed performance improvement strategies				
Type(s) of innovation involved	Incremental				
Expected Benefits of Project	Ensuring that capital expenditure on improving the performance of the network will be optimised both in respect of the type of improvement work to be considered and in applying the improvements to circuits where the greatest benefit can be obtained. Providing a standardised method for comparing the performance of different types of circuit, both internally within United Utilities and externally between DNOs.				
Expected Timescale to adoption	3 years		Duration of benefits once achieved	5 years	
Estimated Success probability (at start of project)	75%				
PV of Project Costs	£52,689	PV of Project Benefits	£318,310	NPV of project	£265,621
Commentary on project progress and potential for achieving expected benefits	Good progress is being made in ensuring that the reference networks derived by the developing software are truly representative of the real networks from which they are derived. It is now necessary for United Utilities to supply data about its network, in order for the developing software to deliver the benefits. The project remains on-track to achieve the expected deliverables.				