

Report on 2006/07 work undertaken under Ofgem Innovation Funding Incentive

Western Power Distribution (South West) plc

Western Power Distribution (South Wales) plc

WESTERN POWER DISTRIBUTION

1.0 INTRODUCTION

1.1 Western Power Distribution (South Wales) plc and Western Power Distribution (South West) plc hold electricity distribution licences issued by Ofgem under the Electricity Act (as amended). For brevity, "WPD" is used to refer to both licenced areas in this report.

2.0 OFGEM INNOVATION FUNDING INCENTIVE

- 2.1 During 2004, Ofgem introduced an "Innovation Funding Incentive" (IFI) to encourage the DNOs to apply innovation in the way they pursue the technical development of their networks. The incentives provided by the IFI mechanism recognized that the risk/reward balance for research, development and innovation, differs from that applying to normal Distribution Network Operator (DNO) core business. IFI came fully into effect in April 2005.
- 2.2 Qualifying IFI projects have to meet criteria set out in the Ofgem IFI Regulatory Instructions and Guidance (RIG) and a Good Practice Guide which had to be developed by IFI parties and agreed by Ofgem. IFI work is partially funded, on a reducing sliding scale. Whilst DNOs could submit their own individual GPGs, there has been collaboration between DNOs in consultation with Ofgem, and a common GPG produced, as Energy Networks Association Engineering Recommendation G85. This has received Ofgem agreement.
- 2.3 The RIGs published by Ofgem and applicable to the 2006/7 financial year provide the following definition of an Eligible IFI Project:

A project will qualify as an eligible IFI project provided that it is designed to enhance the technical development of distribution networks (up to and including 132kV). Eligible IFI projects will embrace all aspects of distribution system asset management from design through to construction, commissioning, operation, maintenance and decommissioning.

2.4 The current definition of technical development contained in the GPG, is as follows –

" In this context:

- "Technical" means "Being of a scientific and/or engineering nature and benefiting the design, construction, commissioning, operation, maintenance and decommissioning of the primary plant and equipment employed in the distribution of electrical energy and/or of the secondary plant and equipment employed to control, protect and maintain such Primary plant and equipment"
- "primary" means "heavy current equipment that carries power currents at voltages from LV up to and including 132kV"

2.5 Experience gained during "early start" projects in 2004/5 and the first full year of IFI in 2005/6 lead to further public discussion and consultation on the extent and operation of the IFI scheme. Ofgem hosted a workshop attended by a wide spectrum of interested parties on 21st November 2006, and the presentations made at that meeting, together with other information and IFI reports can be found on the Ofgem web site by following the following trail from the Home Page

-Networks - Technical - Network Support - Innovation.

www.ofgem.gov.uk/Networks/Techn/NetwrkSupp/Innovat/Pages/Innvtion.aspx

- 2.6 Subsequently, Ofgem have responded in a number of areas including
 - establishing new RIGs with a rolling 5 year commitment to IFI,
 - introducing a constant % support rather than a sliding scale reduction
 - recognising the desirability of revision of the GPG ER G85 and commenting on the drafting of a revision which seeks to address some difficulties surrounding eligibility criteria, for example relating to environmental, security and modelling type projects.

The scope of IFI is also expanding to embrace a wider range of energy networks. This can impact on the existing DNO IFI participants by bringing more potential partners to collaborative projects and increase gearing.

2.7 This report on WPD IFI activity for the year ending 31st March 2007, has been prepared in accordance with the RIGs and GPG applicable to that year.

3.0 NET PRESENT VALUE

- 3.1 There are several approaches to net present value assessments of research type work. One approach is to scale up test discount rates to reflect the "riskiness" of a project whilst another is to employ a standard test discount rate and employ a success probability factor, for example 25, 50, 75%. The latter was described in a report commissioned by Ofgem on Innovation in Electricity Distribution Networks and prepared by Mott MacDonald/BPI in March 2004, and is the approach employed by WPD.
- 3.2 Experience of the typical payback of successful projects undertaken within an STP Module is typically in the range of 6 - 8 X investment, which success probabilities of the programme projects tends to be at the 25% band. Timescales of individual projects within an STP Module are of the order of 3 years, with break milestones built in. The test discount rate employed is the WPD cost of capital from DPCR4, i.e. 6.9%. The average duration of benefit once a successful project has been achieved has been assessed as 10 years.
- 3.3 Whilst it is possible that the effect of some financial benefits might be taken into account by Ofgem in a subsequent Distribution Price Control Review (DPCR), Customers would continue to receive the benefits of such successful research and so our NPV benefit calculations do not terminate at 2010, the date of the next DPCR.

4.0 WPD's APPROACH TO RESEARCH AND DEVELOPMENT

- 4.1 Having regard to the need for prudent investment and use of resource, WPD's approach is to undertake targeted research on a range of short to medium term projects not having a high cost / high risk profile, normally through collaborative projects or programmes to gain added value and gearing. However, it is sometimes the case that collaboration in more speculative and blue sky research is pursued where the programme content is appropriate and there is very high gearing. The Supergen V EPSRC funded Amperes programme is a current example and Meteorological Office lead research, starting in 2007/8 on climate change impacts is another.
- 4.2 WPD have, in common with other DNOs, a long association of collaborative research working with EA Technology, Capenhurst, arising from the former Electricity Council Research Centre and the establishment of areas of UK expertise in specific and pertinent spheres of electricity distribution which are of relevance to WPD. Collaborative working has been undertaken with other UK DNOs and overseas partners in Strategic Technology Programme (STP) modules on substation, overhead line and underground cable subject areas. The costs of these are well below the de-minimis £40k per licenced DNO set in the GPG (para 3.4) for reporting at individual project level; programme level reporting is required.
- 4.3 In addition to work with EATL, WPD has previously engaged ERA Leatherhead and a wide range of other providers including Universities to undertake specific research work. Since April 2005, WPD has committed to supporting a large research proposal to EPSRC on Enhanced Management and Performance for a Sustainable UK Energy Infrastructure (Supergen V Amperes project), which would be heavily geared and involve collaboration with the Universities of Edinburgh, Liverpool, Manchester, Queens Belfast, Southampton and Strathclyde together with Industrial partners and other UK DNOs and transmission companies.
- 4.4 It is recognised that whilst research can often lead in the long term to real financial benefits, there are also significant benefits to the wider community through
 - improved network reliability and resilience
 - reduction in environmental impact
 - improved safety
 - acquisition and dissemination of knowledge
 - enhancing the quality and relevance of research through direct linkage with industry
 - development of a wider skills / knowledge base in Universities
 - greater exposure of own staff to direct engagement with research activity

5.0 2006/7 PROJECTS

- 5.1 WPD's 2006/7 IFI Programme contained the following projects -
 - EATL STP Module 2 Overhead Networks
 - EATL STP Module 3 Cable Networks
 - EATL STP Module 4 Substations
 - Supergen V Amperes extensive EPSRC joint funded programme

- ENA Fault Level Monitor
 - Lightning Protection ETR 134
 - Loss of mains relay (ROCOF)
 - Earthing
- EATL Underground cable condition based risk management (CBRM)

Further details on each of these are included later in this Report.

5.2 The management of these activities necessarily involves a level of WPD internal cost. Where these costs are directly associated with one of the projects, costs have been included with that project. There are some costs, amounting to some £6,400 in total, which span management of multiple projects and project proposals and are included only at the Licence summary report stage.

6.0 **2007/8 PROJECTS**

- 6.1 At the time of preparation of this report, WPD has given consideration to a wide range of potential projects for 2007/8 start and rejected a number. WPD has committed to supporting new projects on -
 - Climate change impact on energy networks
 - Radiometric arc location
 - Earthing
 - Harmonic modelling
 - Remote ultrasonic / discharge monitoring and development of associated algorithms

WPD has also issued an enquiry related to carbon / energy balance between competing energy loss reduction investment options on overhead networks.

7.0 **PROJECT REPORTS**

- 7.1 Summary and project reports in accordance with the RIGs are included in the following pages.
- 7.2 Appendix A provides a short non technical summary of the now completed WPD projects on
 - Remote updating of switching schedules by mobile communication
 - Economic charging method for electricity distribution networks

WPD South West Summary report of IFI Project activities year ending March 31st 2007

Number of active IFI	9
projects	(4 included in ENA Programme)
NPV of costs and anticipated benefits from committed IFI projects	NPV of costs - £ 0.567 M NPV of benefits - £0.826 M Positive NPV - £ 0.0259 M (rounded from information on following sheets
Summary of other benefits anticipated from active IFI projects	Reductions in CMLs through improved reliability, resilience and speed Maintaining or improving safety to the public and staff. Reduction of environmental risk of oil loss from plant and cables.
Total expenditure to date on IFI projects	£0.439 M up to end March 2007
Benefits	Economic Charging Method for Electricity Distribution
actually	Networks completed - Ofgem consulted and approved and
achieved from	now in use.
IFI projects to	Remote updating of switching schedules rolled out and
date	delivering anticipated benefits in switching time.

Regulatory report for DG incentive, RPZs and IFI Reporting year 2006/07					
Western Power Distribution - South West					
Innovation Funding Incentive	£m				
IFI carry forward (£m)	0.495				
Eligible IFI expenditure (£m) *	0.112				
Eligible IFI internal expenditure (£m)	0.016				
Combined distribution network revenue (£m)	198				
* includes internal expenditure					

WPD South Wales Summary report of IFI Project activities Year ending March 31st 2007

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IFI projects to	Remote updating of switching schedules rolled out and
date	delivering anticipated benefits in switching time.

Regulatory report for DG incentive, RPZs and Reporting year 2006/07 Western Power Distribution - South Wales	IFI
Innovation Funding Incentive	£m
IFI carry forward (£m)	0.403
Eligible IFI expenditure (£m) *	0.112
Eligible IFI internal expenditure (£m)	0.016
Combined distribution network revenue (£m)	161
* includes internal expenditure	

Description of project	Strategic Technology Programme Overhead Network Module 2					
Expenditure for financial year 06/07 per WPD Licence area	Total £20,651	External £18,486	Internal £2,165	Expenditure in previous financial years per WPD Licence area	£0	
Expenditure for financial year	£20,651 per WP	PD Licence A	rea			
Technological area and / or issue addressed by project	 The STP overhead network programme for budget year 2006/7 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: S2126_3 - Undertake long-term monitoring of conductor temperature by obtaining and analysing 12 months trial data. S2136_2 - Validate current and proposed new ice accretion models S2136_2 - Participation in European Project COST 727: Measuring and forecasting atmospheric icing on structures. S2138_2 - Investigate live-line jumper-cutting limitations Stage 2 is to undertake a controlled test programme. S2143_1 - To detect in-situ degradation of aluminium overhead line conductors S2145_1 - Explore the use of novel conductors for uprating tower line circuits. S2146_1 - Undertake torsion testing to evaluate possible limits for composite tension insulators S2140_1 - Explore high durability overhead line fittings through spiral vibration Dampers (SVD's) on the performance of overhead line fittings thride. 					

Type(s) of	Technical Subs	titution /	Radical			
innovation						
involved						
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: 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 metable. 					
Expected	Danga 1 5 year	6	Duration	a of	Dongo 2 10	110000
Expected Timescale to	dependent on n	S -	Duration bonofit (1 01	dependent	years -
adoption	dependent on p	lojeci	achieve	1	dependent	Jii project
Estimated	Danas 1 100/	1 1 .				
Success probability (at start of project)	Kange 1-10% -	depende	ent on pro	ject		
PV of Project Costs	£20,651 #	PV of Pr Benefits	roject	£31,782	NPV of Project	£11,131
	# (nb. This is likely full co- providing the o	identifie sts of i outcome o	ed early s mplemen of the earl	stage cost. tation. The ly stage is p	It does not ese will be ositive.)	reflect the identified
Commentary on project progress and potential for achieving expected benefits	 providing the outcome of the early stage is positive.) 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. S2126_3 - Undertake long-term monitoring of conductor temperature by obtaining and analysing 12 months trial data. First year form initial test site data suggests that uprating may be possible in specific circumstances. A further site has been established and is being monitored. S2132_2 - Validate current and proposed new ice accretion models. Data has been gathered from the test site and is being analysed prior to presentation to members. 					
		nor to pr			10.	

• S2136_2 - Participation in European Project COST 727: 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. Involvement is continuing with data exchange with other participants. This in turn will allow the most appropriate structure to be constructed.
• S2138_2 - Investigate live-line jumper-cutting limitations Stage 2 is to undertake a controlled testing programme. The aim is to establish practical and safe limits for operational jumper cutting.
• S2143_1 - To detect in-situ degradation of aluminium overhead line conductors. The preliminary work to explore available techniques has been completed.
• <i>S2144_1 - Determine the residual strength of tower fittings.</i> A possible technique is being investigated which has clear financial benefits compared with traditional methods.
• <i>S2145_1 - Explore the use of novel conductors for uprating tower-line circuits.</i> This project is determining the applicability at the distribution level of novel conductor designs used at transmission voltages to allow increased ratings using existing structures.
• S2146_1 - Undertake torsion testing to evaluate possible limits for composite tension insulators. Laboratory testing has indicated torsion limits for a range of such insulators, which can be used to inform field staff.
• S2147_1 - Investigate the effect of multiple Spiral Vibration Dampers (SVD's) on the performance of overhead line conductors. The application of either multiple SVD's or heavy duty SVD's could allow increased overhead line tension.
• S2149_1 - Explore high durability overhead line fittings. Initial stage to identify the range of fittings and materials. This project is at an early stage and possible materials and treatments to improve corrosion resistance have been identified.

*The above figures are the same for each licence area. Ofgem have agreed (meeting 09-08-05) that both may be shown together

Description of	Strategic Technology Programme Cable Networks Module 3						
project							
Expenditure for	Total	External	Internal	Expenditure			
financial year				in previous	£0		
06/07 per WPD	£19,849	£18,486	£1,362	financial			
Licence area				years per WPD			
				Licence area			
Technological	The STP c	able network	programme	for budget yea	r 2006/7 aimed		
area and / or	at identify	ing and devel	oping oppo	rtunities to redu	ice the costs of		
issue addressed	owning ca	ble networks.	The reduct	tion of whole li	fe cost through		
by project	greater re	liability and	improved	performance	of cables and		
	associated	accessories co	omes under	the remit of M	odule 3. Where		
	appropriate	e, Module 3	worked w	ith other Modu	les to achieve		
	common g	oals.					
	The proje	ets undertaker	n within th	e programme o	during 2006-07		
	aimed to:						
	• S3132	_6 - Addition	of single c	core MV paper	cable modeling		
	functio	onality within	CRATER c	able rating soft	ware.		
	• S3132	_7 - Addition	of cable ci	rossing modellin	ng functionality		
	within	CRATER cat	ole rating so	oftware.			
	• \$3132	_8 - Addition	n of load	curve modellin	g functionality		
	within	CRATER cab	ole rating so	oftware.			
	• S3132_9 - Addition of fluid filled cable modelling						
		functionality within CRATER cable rating software.					
	• S3132_11 - Addition of EHV polymeric cable modelling						
	S2140.2 Towards Past anging practice for dusted solution						
	 S5140_2 - Towards Best engineering practice for ducted cable systems 						
	• S3145	1 - Investiga	te shrink b	ack performanc	e of PE sheath		
	and in	sulation - Esta	blish reliab	le test method.			
	• S3146	1 - Testing of	f fire retard	ant coatings and	l tapes.		
	• S3148	$\begin{bmatrix} -1 \\ 1 \end{bmatrix}$ and $\begin{bmatrix} -2 \\ 31 \end{bmatrix}$	48 2 - Re	auirements for	earthing and		
	bondir	ng of single co	re MV pow	er cables	6		
	• S3149	1 - Assessi	nent of d	ifferent HV p	olvmeric cable		
	design			ľ	- <u>-</u>		
	• S4158	1 - Investigat	te user requ	irements for due	cts		
	• S3159	1 - Series re	sonant testi	ng of short leng	ths of HV cable		
Type(s) of	Technical	Substitution /	Radical				
innovation							
involved							
Expected	If the pro	jects are tech	nically and	cessful and th	e findings and		
Renefits of	recommen	dations from	the project	ts are impleme	e internet then the		
Project	nrojecte v	vill notential	v enable	each DNO m	hember of the		
110,000	projects v	$r_{\rm potential}$	ollowing be	nefits including	y.		
		future increase	$rac{1}{2}$ in $C \wedge DE^{2}$	Y and ODEV.	5·		
	Uliset	intuit muteast	lo III CAFE	Λ and OF $L\Lambda$,			

	CI/CML savings per connected customer;						
	• increased safety of staff and public by reducing the number of						
	accidents / incidents.						
Expected	Range 1-3 y	ears -	Duration of	Range 2-7	years -		
Timescale to	dependent of	n project	benefit once	dependent	on project		
adoption			achieved				
Estimated	Range 2-209	% - depender	nt on project				
Success							
probability (at							
start of project)			[
PV of Project	C10 940 #	PV of	606 745	NPV of	66.906		
Costs	£19,849#	Project	£20,745	Project	£0,890		
		Denents					
	# (nb This	is identified	l early stage co	nst It does	not reflect the		
	likely full	costs of in	plementation.	These wil	be identified		
	providing th	e outcome of	f the early stage	is positive.			
Commentary on	Some projec	te within th	e programme a	re at an ear	ly stage whilet		
project progress	others are c	omplete Iss	ues have been	identified	relating to both		
and potential for	operational	and capita	al expenditure	which.	if successfully		
achieving	addressed, v	vould enable	the expected be	enefits to be	achieved.		
expected	,		1				
benefits	• S3132_0	5 - Addition	of single core	MV paper	cable modeling		
	function	ality within	CRATER ca	ble rating	software. The		
	function	ality to mo	del and analys	se this cabl	le type is now		
	availabl	e within the	CRATER softw	vare tool, al	lowing member		
	compan	ies to evalua	te a wider range	e of circuits.			
	• S3132_2	7 - Addition	of cable cross	ing modelli	ng functionality		
	within C	CRATER cal	ole rating softw	vare. Comp	rehensive cable		
	crossing	functionalit	y is now availa	able in CRA	TER, allowing		
	member	member companies to determine their own cable ratings and					
	the inter	action with I	NGC cables.				
	• S2122	Addition	a of load our		a functionality		
	• S3132_8 - Addition of load curve modelling functionality						
	modelin	g functiona	lity in $CR\Delta T$	FR now	allows a more		
	accurate	representati	on of the loads	when deter	mining ratings		
	uccurute	representati	on of the lotds	when deten	ining rungs.		
	• S3132 9	9 - Addition o	of fluid filled ca	ble modelli	ng functionality		
	within	CRATER c	able rating s	oftware. A	user-friendly		
	spreadsl	neet tool fo	or the cable	engineer v	vas created to		
	determin	ne sustained,	cyclic and dist	ribution cu	rrent ratings for		
	fluid fi	illed cable	ratings, using	g approved	d methods of		
	calculat	ion.					
	• S3132_1	11 - Additio	on of EHV p	olymeric c	able modelling		
	function	ality within	CRATER ca	ble rating	software. The		
	function	ality to mo	del and analys	se this cab	le type is now		
	availabl	e within the	CKAIEK Softw	vare tool, al	lowing member		
	compan		ic a which fallge				
Timescale to adoption Estimated Success probability (at start of project) PV of Project Costs Commentary on project progress and potential for achieving expected benefits	dependent o Range 2-209 £19,849 # # (nb. This likely full providing th Some project others are c operational addressed, w • S3132_6 function function available compan • S3132_6 within C crossing member the inter • S3132_6 within Gerossing member the inter • S3132_6 within modelin accurate • S3132_6 within spreadsl determin fluid ft calculatt • S3132_1 function available compan	PV of Project Benefits is identified costs of in e outcome of cts within the omplete. Iss and capita yould enable <i>6 - Addition</i> ality within hality to mo e within the ies to evalua <i>7 - Addition</i> <i>CRATER call</i> functionality companies functionality companies functionality functionality <i>CRATER call</i> functionality <i>CRATER call</i> functionality companies functionality <i>CRATER call</i> functionality <i>CRATER call functionality</i> functionality <i>CRATER call functionality</i> functionality <i>CRATER call functionality</i> functionality <i>CRATER call functionality</i> functionality <i>CRATER call functionality</i> functionality <i>CRATER call functionality</i> functionality	benefit once achieved achieved at on project to n project £26,745 d early stage con plementation. f the early stage e programme a ues have been al expenditure the expected be of single core cRATER can del and analys CRATER softw te a wider range of cable crossic of fluid filled ca cable crossic of crossic of cable crossic of cable crossic of fluid filled ca cable crossic of crossic of cable crossic of crossic of cable crossic of cable crossic of fluid filled ca cable crossic of crossic of crossic of crossic of crossic of crossic of cable crossic of cable crossic of cable crossic of cable crossic of fluid filled ca cable crossic of c	NPV of Project Ost. It does These will is positive. re at an ear identified which, is enefits to be <i>MV paper</i> ble rating se this cable vare tool, al e of circuits. ing modellin pare. Comp able in CRA neir own ca when detern oftware. The ER now a when detern oftware. A engineer w tribution curs g approved olymeric cu ble rating se this cable are tool, al e of circuits.	en project £6,896 not reflect the be identified) ly stage, whilst relating to both if successfully achieved. <i>cable modeling</i> <i>software</i> . The le type is now lowing member <i>ng functionality</i> rehensive cable ATER, allowing able ratings and <i>the load curve</i> allows a more mining ratings. <i>ng functionality</i> the load curve allows a more mining ratings. <i>ng functionality</i> A user-friendly vas created to rrent ratings for d methods of <i>able modelling</i> <i>software</i> . The le type is now lowing member		

•	<i>S3140_2 - Towards best engineering practice for ducted cable systems.</i> The report will form a sound basis for the creation of engineering recommendations and guidance documents for ducted cable systems.
•	<i>S3145_1 - Investigate shrink back performance of PE sheath and insulation - Establish reliable test method.</i> The project has demonstrated that shrink back can occur at lower temperatures and proposed a test to predict in service shrink back.
•	<i>S3146_1 - Testing of fire retardant coatings and tapes.</i> The project has, through testing, demonstrated an effective means of fire protection for triplex cables.
•	<i>S3148_1 and S3148_2 - Requirements for earthing and bonding of single core MV power cables.</i> Cable engineers can now determine the size of circulating currents and losses for their cable networks and use this information to determine, if appropriate, a cable size based on whole life costs.
•	<i>S3149_1 - Assessment of different HV polymeric cable designs.</i> The initial stage of this project has not identified a suitable replacement design to lead sheaths for use as an effective moisture barrier in HV XLPE insulated cables rated at 66kV and higher.
•	<i>S4158_1 - Investigate user requirements for ducts.</i> This project will allow DNOs to better tender for all types of plastic cable ducts since the requirements have been agreed between all users and all the major manufacturers.
•	<i>S3159_1 - Series resonant testing of short lengths of HV cable.</i> This project will determine whether the use of variable frequency test sets is too onerous for the commissioning of short lengths of HV cable.

* The above figures are the same for each licence area. Ofgem have agreed (meeting 09-08-05) that both may be shown together

Description of	Strategic Technology Programme Substation Module 4						
project							
1 5							
Expenditure	Total	External	Internal	Expenditure			
for financial	Total	External	memai	in previous			
101 matchat	£21 286	£18 186	£2 800	financial	£0		
WDD Licence	221, 200	210,400	12,000		20		
WPD Licence				years per			
area							
T 1 1 1 1	T '.1	.1		Licence area	.11 TTZ		
Technological	Issues with	the age prof	file of substa	tion assets wi	thin the UK		
area and / or	electricity d	istribution	system are	well known.	Also, both		
issue addressed	regulatory	and shareh	older pressu	ires preclude	substantial		
by project	investments of	of the large so	cale that was s	seen in the 1950	0's to 1970's.		
	The challenge	e is to consta	ntly review ar	nd innovate nev	v solutions to		
	monitor and	define asset	condition th	ereby allowing	g risks to be		
	clearly define	ed and sound	investment de	ecisions to be ta	iken.		
	The program	me of projec	ts which were	approved for	funding from		
	the STP subs	tations modu	le budget and	were undertake	en in 2006/07		
	encompass b	oth develop	ing new inn	ovative asset	management		
	processes ar	nd practices	and develop	oing innovativ	e diagnostic		
	techniques. T	The aim is to	develop alrea	ady well establ	ished themes		
	such as life	extension of	aged assets	within legal a	nd heath and		
	safety constra	aints, examin	ation of new	technologies, d	leveloping an		
	understanding	g of, and in	nnovative sol	utions for, the	e impact on		
	substation as	sets of incre	asing levels o	of distributed g	generation on		
	networks and	condition m	onitoring tech	niques.	···· ··· ··· ···		
			8				
	Eighteen nev	v projects w	vere approved	during the v	ear and they		
	aimed to:	, brolette u	ere approved				
	• \$4164	3 - On load t	an changer mo	nitor – Stage 3			
	• S4176	2 Comparia	on of availabl	a corth testing	netrumonte		
	• 54170_	2 - Comparis	m mambarabi	e eartif testing I	instruments		
	• 54185_	2 - AM Foru	m membersnij	p.			
	• S4191_	I - Update ar	nd populate Cl	BMVAL databa	ase.		
	• S4193_	2 - Enable	effective q	uantification	of risk and		
	reliabili	ty.					
	• S4194 -	Regenerativ	e transformer	breathers.			
	• S4197_	1 - Concrete	structure asse	ssment.			
	• S4200_	1 - Methods	to assess oil	bunds and inte	elligent pump		
	technolo	ogy.					
	• S4201	1 - Corrosive	sulphur in tra	unsformers			
	• S4202	1 - Out of ph	ase switching				
	• <u>\$4203</u>	1 - Review of	f INSUCON				
	• \$4205_		ment of cor	itact greases	for outdoor		
	annlicat	ions		nuor greases			
		1 Cubatatia	n soopuitr				
	• 54200_	1 - Substation		4 J - 1 - 1 - 1			
	• \$4207_	1 - EKS33 sv	vitchgear ratin	ig at reduced te	mperature		
	• S4208_	1 - Investigat	te the re-asses	sment of switch	ngear ratings		

	• S4209_1 - Post maintenance testing					
	• S4211_1 - Management and use of actuators					
T () (• <u>\$4215_1</u> -	- Internal arc con	sideration	$\frac{\text{ons in s}}{1 \text{ g s}}$	ubstations	1. 1
Type(s) of innovation involved	Incremental / Si	ignificant / Techi	10log1ca	al Subst	itution / Ra	dical
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	1-3 years -	Duration of ben	efit	2-7 ye	ars - depen	dent on
Timescale to	dependent on	once achieved		projec	t	
adoption	project					
Estimated Success probability (at start of project)	5-40% - depend	lent on project				
PV of Project	£21,286 #	PV of Project			NPV of	
Costs		Benefits	£29,78	30	Project	£8,494
Commentary on project progress and potential for achieving expected benefits	 # (nb. This is id full costs of im outcome of the Some projects others are com operational ar addressed, wou <i>S4164_3</i> - from exte have been an extende <i>S4176_2</i> - The projection 	lentified early sta plementation. Th early stage is pos- within the progra plete. Issues hav nd capital exp ld enable the exp - <i>On load tap cha</i> ending the labora very encouragin ed trial on a wide - <i>Comparison of</i> ect permitted co ypes of electrode to accuracy, cos	ge cost. ge cost. aese wil sitive.) amme a ve been enditure ected be unger m atory sy g and a r range availab ost effe system t, usabil	It does I be ide are at a identifie whice enefits the onitor - rstem in subseq of tap co le earthe ective of to eval lity and	not reflect not reflect ntified pro- n early sta fied relatin ch, if su- to be achiev - <i>Stage 3</i> . T nto a live s uent stage changers. <i>testing ins</i> comparison uate each i robustness	the likely viding the ge, whilst g to both ccessfully red. The results substation will allow struments. of four nstrument

•	<i>S4185_2 - AM Forum membership.</i> This project allowed members to be updated on substation asset management policies and practices adopted by other European Transmission System Operators (TSOs) and Distribution Network Operators in a cost effective manner.
•	<i>S4191_1 - Update and populate CBMVAL database.</i> This project has delivered an up-to-date and easy-to-use software tool that enables members to make a valid assessment of the net financial benefits that might accrue from the implementation of CBM.
•	S4193_2 - Enable effective quantification of risk and reliability. The project collated and analysed the consequences of recent events (over the past 10 years) in order to establish 'benchmarks' to quantify risk.
•	<i>S4194 - Regenerative transformer breathers.</i> The project undertook an independent evaluation and cost benefit analysis of "maintenance-free" desiccant breathers.
•	<i>S4197_1 - Concrete structure assessment.</i> The project highlighted the more common types of concrete degradation and the testing that is available to assess the extent of this degradation.
•	<i>S4200_1 - Methods to assess oil bunds and intelligent pump technology.</i> The project will enable members to compare the different policies, practices and bund pump technologies that have been adopted and to identify best practice.
•	<i>S4201_1 - Corrosive sulphur in transformers.</i> The project informed members regarding the issues and consequences of the failures in transformers due to corrosive sulphur.
•	<i>S4202_1 - Out of phase switching.</i> The project facilitated expert debate of out of phase switching issues. It was necessary for DNOs to fully understand the underlying system conditions and agree a common approach in this matter.
•	<i>S4203_1 - Review of INSUCON</i> . This project provided a cost effective summary commentary of INSUCON content and its relevance to members.
•	<i>S4205_1 - Assessment of contact greases for outdoor applications.</i> The project will recommend suitable products for the lubrication of outdoor contacts and identify best practice for their application.
	15 -6 25
	- 13 01 23 -

• <i>S4206_1 - Substation security.</i> This project will undertake a wide review of the concept of, and approach to, the physical security of substations in order to deter theft.
• S4207_1 - ERS33 switchgear rating at reduced temperature. The project will provide guidance that may allow utilities to run switchgear above maximum normal rated current values under specific conditions.
• <i>S4208_1 - Investigate the re-assessment of switchgear ratings.</i> The project will consider the provision of a methodology for understanding the risk of re-assigning switchgear fault level ratings without type testing.
• <i>S4209_1 - Post maintenance testing.</i> The project will enable members to carry out the most appropriate testing regimes both from a financial and technical perspective and to establish pass/fail criteria.
• <i>S4211_1 - Management and use of actuators.</i> This project should assist the members in ensuring that the risk of actuator failure is reduced, their reliability is increased and maintenance and testing is optimised.
• <i>S4215_1 - Internal arc considerations in substations.</i> The project will enable members to better select HV/LV switchgear with respect to internal arc and ultimately lead to enhanced safety within the substation environment.

* The above figures are the same for each licence area. Ofgem have agreed (meeting 09-08-05) that both may be shown together

Description of project	SuperGen	V Amperes					
Expenditure for financial year 06/07 per WPD Licence area	Total £28,170	External £25,000	Internal £3,170	Expenditure in previous financial years per WPD Licence area	£13,664		
Technological area and / or issue addressed by project	The EPSF research-fo of its initia and Suppl group of which add and has ac on plant, s The Unive Mancheste Southamp Edinburgh Liverpool Strathclyd Queens Un In essence improving developing developing enhanced for Further de being set u	The EPSRC (Engineering and Science Research Council) is the major research-funding agency for Universities in its area, and is run by DTI. One of its initiatives is funding work in the area of Sustainable Power Generation and Supply. A call was put out in 2004 and EPSRC have put together a group of universities to address the UK energy infrastructure. EPSRC, which addresses UK emission targets, produces step changes in technology, and has active collaboration with UK industry. This call is intended to focus on plant, systems aspects having been addressed in other Supergen calls. The Universities involved in the £2.8M proposal are; Manchester University: the management hub for this activity Southampton University; the finance hub Edinburgh University, Liverpool University, Strathclyde University Queens University, Belfast In essence there are 5 main activities: improving knowledge of plant ageing developing condition monitoring techniques developing plant with reduced environmental impact developing new protection and control techniques enhanced network performance and planning tools					
Type(s) of innovation involved	Technical Substitution / Radical						
Expected Benefits of Project	The consortium expect to deliver: a suite of intelligent diagnostic tools for plant integrated network planning and asset management improved and reduced environmental impact plant models and recommendations for network operation and management						
Expected Timescale to adoption	12 Years						

Estimated Success probability (at start of	25%							
project)								
PV of Project	£99,384	PV of	£141,073	NPV of Project	£41,689			
Costs		Project Benefits						
Commentary of	n project	Progress:	•					
progress and po	otential for	As a result	lt of a number	r of issues the Cons	ortium Agreement			
achieving expected benefits achieving expected benefits was not signed until November 2006. The agreement has to the establishment of a Steering Group and an Execu Management group to provide full engagement, and effec participation, of all parties. Dependant on their inter regulations, some universities were able to start work February 06 (when the offer letter was received), and ot had to wait until November 06. Unfortunately November not a good time of year to recruit PhD students or Rese Associates.								
		The project is being brought on track, after the delayed start and is expected to meet original objectives. In particular there have been some delays in Work Package 3, as a result of delays in recruitment, and these are being managed in the context of the whole project. It is likely however that, although the majority of the project will be complete at the end of the four years, some students will still be active for a short period thereafter.						
	Overall the management processes are strong and have been effective. Key links to industrial partners are now bein formed, and in particular through Work Package 6, the fin demonstrators on networks are being discussed. The fin technical meeting was a major success with excelled attendance and participation. A number of papers have been written on work from within the project.							
		Outputs and Deliverables The following are formal outputs from the consortium.						
		Reports: - Report - Discus Industr - Condit - Lesson - A revie - Condit 5.2	on 'Evaluatio sion Documer ial demonstra ion Monitorin s learnt from ew of voltage ion monitorin	n of G59 Protection nt on Vision and Pri- tion g Specification writing consortium control g -State of the art re	relays orities for agreement port from Activity			

Technology:
- A low cost RF unit has been produced based on the
chromatic methodology of deploying the RF sensors.
- A fibre optic based acoustic sensor for detecting abnormal
signatures from plant is near completion.
 Prototype knowledge based partial discharge analysis software. This is generic and can be applied to all partial discharge phase resolved signatures. It can categorise the discharge. Equipment to control power quality of a voltage supply is nearing completion.
The above has been extracted from the full Supergen V Amperes annual report. For further information please see the Supergen Amperes web site <u>www.supergen-amperes.org</u>

Description of	ENA R&D Programme								
project	Four projects initiated by the ENA R&D Working Group.								
	The Energy Networks Association (ENA) represents all UK DNOs.								
Expenditure for	Total	External	Internal	Expenditure					
financial year per				in previous					
WPD Licence area	£4,000	£4,000	£ **	financial	£8,400				
				years					
Technological area and / or issue addressed by project	 years ** The internal cost for these ENA projects relate to meetings covering multiple projects, and the costs of these together with general IFI R&D management amount to only £3,200 per WPD Licence area and are added at Company summary level in this report. The projects undertaken through budget year 2006/7 addressed real problems that had been identified by the ENA Working Groups as significant and which required technical investigation and development. ROCOF Relay functional specification - Produce an Engineering Report into the sensitivity of loss of mains relays to genuine loss of mains by determining the number of sample cycles required and the percentage change of load compared to generator ratings (of different construction and size). The test information will be used to develop a matrix of optimum settings and test procedures for relay specification. SG12 Fault Level Monitor - Develop a Fault Level Monitor (FLM) that can successfully measure fault level on a distribution network with repeatability and reliability. The FLM instrument shall use the 								
	events (e.g. small scale disturbances resulting from tap changer operation), so no customer supply interruption will be required.								
	impact of lower voltage earth electrodes on higher voltage 'hot zones' and to measure the resistance of distribution substation earth systems.								
	• SG17 Lightning Protection - Produce a new Engineering Technical Report on lightning protection to include:								
	 Background information on lightning density across the UK, annual variations and effect of topography. Catalogue and provide a view on current practices and procedures. Determine and advise on equipment protection levels and arrangements. 								
Type(s) of innovation involved	Incremental an	nd Significant i	nnovation type	s are involved.					

 ROCOF Relay functional specification - Improved understanding will allow more effective settings to be applied to these relays, which will reduce the number of spurious trips. This will improve power quality to other connected customers and the specification should reduce the cost associated with generation scheme quotes. SG12 - The FLM instrument will allow fault infeed levels to be accurately assessed. This will provide an objective measurement tool that can be used to facilitate both the initial connection of distributed generation and ongoing assessment of its effects. SG14 - This project will investigate the effects of LV earth systems on HV systems. The results of this should determine the means to provide cost effective, safe earthing system without the need for expensive separations between HV and LV electrodes which in a PME system may be impractical and costly to achieve and maintain. SG17 - Identification of required lightning protection application will reduce equipment failure and faults due to lightning. This will improve performance and reduce fault costs. 							
		Duration of					
1 - 10 years		benefit once achieved		10 - 40	years		
25 - 75%							
£380.967	PV of Project	£513.265	NPV Proi	/ of ect	£132 297		
(see note below)	Benefits	2010,200	Cos	ts	2152,277		
osts include implement a.	ation and	have been calcu	lated	assumir	ng a typical		
• ROCOF Relay f the Final report in	unctional n March 2(specification -)07.	EA T	echnolo	gy published		
• SG12 Fault Level Instrument - EA Technology and the University of Strathclyde have pursued the following activities							
1. Candidate monitoring sites and Deployment of loggers - Network disturbance data has been obtained using Dranetz PX5 Power Quality instruments.							
2. Algorithm Evaluation and assessment - The Fault Level Algorithm has been coded within the Matlab environment. A network model with known parameters has been created in Matlab/Simulink and the fault level estimated for a range of scenarios. Results from the applied scenarios (voltage and current waveforms) are passed into the Fault Level algorithm and results compared.							
	 ROCOF Relay will allow more of will reduce the re- quality to other reduce the cost as SG12 - The FL accurately assess that can be used generation and or SG14 - This proje HV systems. The cost effective, sa separations betwo may be impractic SG17 - Identificar reduce equipmer improve performation 1 - 10 years 25 - 75% £380,967 (see note below) osts include implement a. ROCOF Relay for the Final report in SG12 Fault Leve Strathclyde have Candidate monit disturbance data instruments. Algorithm Evaluat been coded with known parameter level estimated f scenarios (voltag Level algorithm a 	 ROCOF Relay functional will allow more effective sa will reduce the number of quality to other connected reduce the cost associated w SG12 - The FLM instrum accurately assessed. This w that can be used to facilitat generation and ongoing associated w SG14 - This project will inv HV systems. The results of cost effective, safe earthin separations between HV at may be impractical and cost SG17 - Identification of reareduce equipment failure improve performance and reduce equipment failure improve performance equipment failure improve performance equipment failure improve performance equipment failure improve performance equipment failure equipment failure improve performance equipment failure equipment	 ROCOF Relay functional specification will allow more effective settings to be ap will reduce the number of spurious trips quality to other connected customers ar reduce the cost associated with generation SG12 - The FLM instrument will allow accurately assessed. This will provide an that can be used to facilitate both the initig generation and ongoing assessment of its e SG14 - This project will investigate the eff HV systems. The results of this should dett cost effective, safe earthing system with separations between HV and LV electrod may be impractical and costly to achieve at improve performance and reduce fault cost SG17 - Identification of required lightning reduce equipment failure and faults du improve performance and reduce fault cost SG17 - Identification of required lightning reduce equipment failure and faults du improve performance and reduce fault cost SG17 - Identification of required lightning reduce equipment failure and faults du improve performance and reduce fault cost SG17 - Identification of required lightning reduce equipment failure and faults du improve performance and reduce fault cost SG17 - Identification of required lightning reduce equipment failure and faults du improve performance and reduce fault cost SG17 - Identification of required lightning reduce equipment failure and faults du improve performance and reduce fault cost SG17 - SG17 - Identification of Project £513,265 SG12 Fault Level Instrument - EA Techn Strathclyde have pursued the following act Candidate monitoring sites and Deployn disturbance data has been obtained using 1 instruments. Algorithm Evaluation and assessment - Th been coded within the Matlab environme known parameters has been created in Malevel estimated for a range of scenarios. scenarios (voltage and current waveforms Level algorithm and results compared. 	 ROCOF Relay functional specification - Imwill allow more effective settings to be applied will reduce the number of spurious trips. Thi quality to other connected customers and the reduce the cost associated with generation schen SG12 - The FLM instrument will allow faul accurately assessed. This will provide an objec that can be used to facilitate both the initial congeneration and ongoing assessment of its effects of HV systems. The results of this should determin cost effective, safe earthing system without the separations between HV and LV electrodes wh may be impractical and costly to achieve and material to a separation of required lightning protor reduce equipment failure and faults due to improve performance and reduce fault costs. SG17 - Identification of required lightning protor reduce equipment failure and faults due to improve performance and reduce fault costs. 1 - 10 years Duration of benefit once achieved 25 - 75% KOCOF Relay functional specification - EA T the Final report in March 2007. SG12 Fault Level Instrument - EA Technology Strathclyde have pursued the following activities Candidate monitoring sites and Deployment of disturbance data has been obtained using Drane instruments. Algorithm Evaluation and assessment - The Fau been coded within the Matlab environment. A known parameters has been created in Matlab// level estimated for a range of scenarios. Res scenarios (voltage and current waveforms) are Level algorithm and results compared. 	 ROCOF Relay functional specification - Improved will allow more effective settings to be applied to these will reduce the number of spurious trips. This will in quality to other connected customers and the specific reduce the cost associated with generation scheme quote SG12 - The FLM instrument will allow fault infece accurately assessed. This will provide an objective mer that can be used to facilitate both the initial connection generation and ongoing assessment of its effects. SG14 - This project will investigate the effects of LV ea HV systems. The results of this should determine the med cost effective, safe earthing system without the need separations between HV and LV electrodes which in a may be impractical and costly to achieve and maintain. SG17 - Identification of required lightning protection a reduce equipment failure and faults due to lighthi improve performance and reduce fault costs. 1 - 10 years Duration of benefit once achieved 25 - 75% F380,967 PV of Project £513,265 Project Costs costs include implementation and have been calculated assumin a. ROCOF Relay functional specification - EA Technology and the Strathclyde have pursued the following activities Candidate monitoring sites and Deployment of logged disturbance data has been obtained using Dranetz PX5 instruments. Algorithm Evaluation and assessment - The Fault Level been coded within the Matlab environment. A networ known parameters has been created in Matlab/Simulini level estimated for a range of scenarios. Results fro scenarios (voltage and current waveforms) are passed Level algorithm and results compared. 		

3.	Dranview disturbance record analysis - Dranview data is being processed for integration into the coded Fault Level algorithm. The results from the 'real' data and the result from the Fault Level algorithm are to be compared to the relevant power network models supplied by the site hosts (studied in PSS/E).
4.	Experimentation and Laboratory investigations - A fault level monitor instrument is being tested on the University of Strathclyde Micro-grid system with static and active loads. This laboratory work will enable scenario results from a very well known and modelled network to be compared against the performance of an existing Fault Level instrument.
•	SG14 Earthing Techniques - EA Technology
1.	Investigation at Test Facility - Report and CIRED paper completed. Measurements carried out at the S&S Ltd test facility to enable better understanding of transfer potential. The measurement results were compared to predictions using the CDEGS software.
2.	Investigation at 11kV substations - Identification of suitable test sites is underway. Site testing has commenced at two suitable sites.
•	SG17 Lightning Protection - Engineering Technical Report (ETR 134) awaiting final approval before publishing.

Description of project	EATL - Condition based risk management of underground cable systems (CBRM)							
Expenditure for financial year per WPD licence area	Total £17,878	ernal ,368	Internal £2,510		Exper in pre financ years	nditure vious cial	£18,181	
Technological area and / or issue addressed by project	The creation of condition based risk management model that develops theoretical concepts into a real application covering all WPD underground cable systems							
Type(s) of innovation involved	Incremental and radical							
Expected Benefits of Project	 To move CBRM from the theoretical base to real use, requiring significant and innovative steps. (The knowledge gained by EATL will also assist other DNOs.) To target future investment on cable systems to deliver required performance and risk at minimum cost. 							
Expected Timescale to adoption	Years 1 Duration of benefit once achieved							
Estimated Success probability (at start of project)	75%							
PV of Project Costs	£ 25,344	PV o Proj Beno	of £ ject efits	83,04	8 N Pi	PV of roject	£58,1	61
Commentary on project progress and potential for achieving expected benefits	The project was completed in 2006/7, with the provision of populated software and report. The work has, for the first time, provided a pan cable asset assessment of condition based risk and delivered a risk management tool to inform long term asset management and investment. This is consistent with Ofgem's desire for longer term horizons and with a PAS 55 approach During the course of the work it was necessary to also innovate approaches to quantification of related environmental risk, and network security risk of assets employed in an n-1 planning standard configuration. These aspects have been shared with industry partners at a CBRM risk workshop arranged by EA Technology in April 2007.							

APPENDIX A

Further information on completed IFI projects

REMOTE UPDATING OF SWITCHING SCHEDULES BY MOBILE COMMUNICATION



One of the features associated with switching in the field is the need to communicate actions from the field to update control diagrams. This has traditionally been done using voice communication with Control Engineers and can impacts on the time taken to restore supplies to customers, particularly when there are high volumes of activity.

A new method of enabling real time communications between Field staff and the GE ENMAC SCADA system, has been developed using Hand Held devices to confirm switching operations.

At the beginning of a job, the schedule is downloaded onto the Hand Held Device by the Control Engineers. When the download is complete, the field staff confirm acceptance of the job and can begin work immediately without waiting to have the fact confirmed by the Control

Engineer. As each switching operation is completed the field staff update the Hand Held. The information is then automatically relayed to the ENMAC Distribution Management System in the Control Room where all of the appropriate data is modified to reflect the switching. At the end of the job, the field staff log off and the work is shown as complete.

The significant advantage to all of this is the fact that field staff do not have to wait for a Control Engineer to agree that switching can commence and similarly, they do not have to tell the Control Engineer of every switching operation through the job. This means that there is no delay in restoring customers and the new system will deliver reductions in duration of outages, which are measured as Customer Minutes Lost.

The work was a joint collaboration between Western Power Distribution, GE Energy and YAMBAY.

Further information on completed IFI projects

ECONOMIC CHARGING METHOD FOR ELECTRICITY DISTRIBUTION NETWORKS

Charges for setting prices for the use of the distribution network in South West England and South Wales have been set using a methodology called the 500MW Distribution Reinforcement Model (DRM). It is based on an approach outlined in 1977 for cost reflective retail tariffs in England and Wales.

The DRM measures the cost of an additional 500MW of capacity at time of peak demand and averages this cost across users at each voltage level, and enables yardstick costs to be developed by customer class taking into account diversity factors and load profile. Whilst the approach has served well, its continued use at 132, 66 and 33kV has been criticised due to the lack of locational message and its inability to reflect the costs and benefits that distributed generation provides.

To ensure the most economic development of the network over the long term, a new economic charging method is needed. Western Power Distribution (WPD) placed a research contract with the University of Bath with the specific objectives of developing a model of the WPD distribution network for the purpose of evaluating different methodologies for charging users for use of the distribution system.

The research examined alternative methodologies and established a Long Run Incremental Cost (LRIC) approach which considers the time horizon until reinforcement is needed and the costs of that reinforcement. The LRIC approach uses load flow analyses and calculates the brought forward (or deferred) reinforcement cost as the result of an addition of an increment of demand or generation at each node. The objective is to link the behaviour of a user to the reinforcement of the assets they utilise.

For each node, an increment of demand/ generation is added and a new load flow generated. The evaluation of net present value of the future reinforcement is repeated for the network with this increment present and employing an annuity factor, generates an annual \pounds / kVA at each node.

Ofgem has since undertaken a study with Bath University to assess the potential benefits arising from the revised charging model encouraging more economic utilisation and reducing the requirement for investment. That analysis argued that if similar proposals to WPD's modifications were implemented across GB by all DNOs, there were likely to be significant benefits; of the order of £200M cost saving compared with the status quo, and lead to lower prices for consumers.

Since undertaking this work, WPD submitted the methodology to Ofgem, who in turn initiated a public consultation, and subsequently approved the methodology which went "live" in April 2007.

Papers published - CIRED Vienna May 2007 (<u>www.cired2007.org</u>)

Turvey, Nigel (WPD) Economic Charging Method for Electricity Distribution Networks

Li, Furong (Bath University) Benefits of Long-Run Incremental Cost Pricing for Distribution Network Charges - 0206

Li, Furong (Bath University) Comparison Between Long-Run Incremental Cost Pricing and Investment Cost-Related Pricing for Electricity Distribution Network – 0717