OFGEM

YEDL

DPCR4 – FBPQ ANALYSIS AND CAPEX PROJECTIONS

NOVEMBER 2004

LIST OF REVISIONS

Current Rev.	Date	Page affected	Prepared by	Checked by (technical)	Checked by (quality assurance)	Approved By
Final	29/11/04	All	JM Tebbs	JAK Douglas	G Evans	TR Poots
			REVISION HISTORY			
Draft	01/04/04	All	First issue as 61877/PBP/000480 PE001352_PE_YEDL- V 3.DOC			
Final	23/06/04	All	Adjustment following submission of final capital allowance numbers.			
Final	21/10/04	All	Revision of model and allowance levels following DNO meetings with Ofgem and Ofgem September paper.			
Final	29/11/04	All	Minor amendment to the Executive Summary.			

CONTENTS

LIST OF ABBREVIATIONS

ASR	Asset Serviceability Register
Capex	Capital expenditure
CHL	Customer hours lost
CI	Customer interruptions per 100 customers
CML	Customer minutes lost per connected customer
Consac	A type of concentric LV mains cable
DNO	Distribution Network Operator
DPCR	Distribution Price Control Review
DTI	Department of Trade and Industry
EATS	Electricity Association Technical Specification
EHV	Extra High Voltage (i.e. > 22kV)
ESQCR	Electricity Safety, Quality and Continuity Regulations 2002
FBPQ	Forecast Business Plan Questionnaire
GDP	Gross Domestic Product
GVA	Gross Value Added
GWh	Gigawatthour (a unit of energy)
HBPQ	Historic Business Plan Questionnaire
HV	High Voltage (i.e. between 1kV and 22kV)
km	Kilometre
kV	Kilovolt
LV	Low voltage (i.e. less than 1kV and here 230/400V)
m	Million
MEAV	Modern Equivalent Asset Value
MPRS	Meter Point Registration System
OHL	Overhead line
PB Power	Parsons Brinckerhoff Power
QoS	Quality of supply (reliability/interruption performance)
SSAP	Standard accountancy practice
YEDL	Yorkshire Electricity Distribution Limited

FOREWORD

This report sets out the views of PB Power on the capital expenditure in the DNO's FBPQ submission to Ofgem for DPCR4. It supersedes the earlier (June 2004) report and changes reflect the outcome of the meeting with the DNO in August 2004.

The comments in the report are based on the information provided by the DNO concerned as part of the FBPQ submission to Ofgem, subsequent meetings and information exchanges between Ofgem, ourselves and all the DNOs. The volume of information submitted in support of the business plans has been substantial in both narrative and numerical form and, together with subsequent meetings and clarifications, has provided an insight to the rational for expenditure variation compared to that in DPCR3.

We have however reviewed the expenditure and drivers of the DPCR4 Base Case Scenario only, with a limited overview of the Ofgem Scenario/Sensitivity and the DNO Alternative Case. In particular, we have taken note that Ofgem's requirement that capital expenditure included in the Base Case Scenario should be only that necessary to maintain the distribution system at its existing performance level in respect of quality of supply. It follows in our view that the level of network risk experienced during DPCR3 should also be held constant during the forthcoming review period. Where DNOs have included expenditure that may not fit with those objectives then such expenditure is not deemed to be appropriate to the Base Case Scenario and has therefore been excluded from our considerations, except as part of the process of identifying such expenditure. This approach does not imply that we do not believe that the non-Base Case expenditure identified is inappropriate or unjustified; in fact in some instances we have observed that non-Base Case expenditure may be prudent. This approach of limiting consideration to only the Base Case Scenario seeks to ensure that all DNOs are considered on an equitable basis with any further consideration as to treatment of special cases resting between Ofgem and the DNO concerned.

Our approach to the modelling of both load-related and non-load related expenditure has been developed on principles agreed by Ofgem and discussed with the DNOs. The models have been populated with data submitted to Ofgem by the DNOs. The output from the models therefore reflects the input data comprising individual DNO data, practices and from these aggregate DNO data which has been used to create 'industry-level' data. The principle that has been applied is that the output of the models should reflect a general industry view against which each DNO's submission can be compared. In respect of the modelling of non-load related expenditure, no material age dispersion across DNOs has been observed for the main asset classes. Consequently any major difference between DNO submission and model output is likely to reflect a difference with general industry practice in terms of replacement or refurbishment policy and unit costs. Information provided by a DNO has been assumed to be correct although concerns on unsupported changes to the asset age profiles of certain DNOs have been raised with Ofgem.

In forming a "PB Power" opinion of the proposed allowance, we have observed the approach set out above. Our modelling has been used as a guide and, where expenditure differing from that indicated by the model has been justified and is in keeping with Base Case Scenario, we have duly taken account of such differences.

We would also like to take the opportunity of expressing our appreciation of the time taken and courtesy extended by the staffs of Ofgem and the DNOs during meetings and in responding to our queries.

EXECUTIVE SUMMARY

The following table summarises YEDL's adjusted DPCR3 projection, adjusted DPCR4 forecast (submission), PB Power's modelling results and PB Power's view of proposed expenditure.

Expenditure Category	Adjusted DPCR3 Projection (£m)	Adjusted DPCR4 Forecast (£m)	Model Output (£m)	PB Power Opinion (£m)	PB Power Comments
Load-Related Expenditure Gross	**244.4**	**290.0**	**127.5**	**285.0**	YEDL's forecast is reasonably in line with historic levels of new connections and identified reinforcement projects and savings of £5m should be possible towards the end of DPCR4. Modelling outcome is reduced due to historically high spend. The output of the model is some £157m lower than YEDL's load-related expenditure forecast for DPCR4, reflecting that the proposed expenditure is high in relation to both the forecast increase in units distributed and in customer numbers which may be related to a high level of churn and/or inward investment.
Customer Contributions	(174.1)	(187.0)		(187.0)	
LRE Net	**70.3**	**103.0**		**98.0**	Net load related expenditure follows trend.
Asset Replacement	158.2	237.5	**221.0**	232.5	Increase over the model reflects additional allowance for EHV overhead lines where YEDL has demonstrated network need.
Other	137.3	147.3		145.5	£145.5m comprises £10m diversions, £5.9m SCADA, £35.2m metering and £94.4m fault expenditure.
NLRE Total	**295.5**	**384.9**		**378.1**	
Non Operational	10.4	0		0	YEDL made no provision for non-operational capex in its submission.
DNO Total	**376.2**	**487.9**		**476.1**	
DNO Total				*346.5*	*As Ofgem Sep 04 paper, excl. meters, faults, non operational and ESQCR*

Base Case Submission

PB Power's review is of the Base Case capex forecasts excluding diversions, metering, fault capex and non-operational capex. Fault expenditure is considered separately. Where appropriate the forecasts and DPCR3 projections have been adjusted for the funding of the pension deficit, capitalised overheads, inter-company margins and lane rentals in line with figures provided by the DNOs in their submissions and summarised by Ofgem. Where companies have indicated a loss of new connections market share, PB Power has also made adjustments to gross load related expenditure to reflect the total connections market.

YEDL's forecast has been adjusted for loss of share of the new connections market in DPCR3 and DPCR4 to reflect the total new connections market in the gross load related capex figures (gross market LRE adjustment) and capitalised overheads.

Our principal findings are summarised below.

Load related expenditure

- YEDL's reinforcement forecasts include a number of identified schemes. This is a high forecast addressing demand issues. The level of over forecasting may be around £5m.

Non-load related expenditure

- YEDL has advised that it operates in a manner that contains network risk. The forecast does not seek to adjust that risk position.

- YEDL forecast overhead line replacement programme is high reflecting a need for EHV overhead line refurbishing above that indicated by the model.

- YEDL has not separately identified ESQCR expenditure. However, certain replacement expenditure appears to address similar ESQCR issues. This is estimated to be approximately £10.9m. If this does deliver the same output then it may need to be treat in a manner similar to other ESQCR related expenditure items and removed from the Base Case.

We would also make the following general comments:

- PB Power's non-load related modelling is based on the asset lives provided by DNOs. Subsequent refinements have been made to this modelling to reflect PB Power's view of efficient DNO policies and practice.

- There is some concern about the comparability of data between DNOs due to different policies applied by DNOs, particularly the boundary between fault and non-fault replacement and capitalisation of overheads.

- The data presented in this appendix includes comparisons between DPCR3 allowances, DPCR3 projections and DPCR4 forecasts. Care needs to be taken in reviewing these figures in respect of the following:

    - The DPCR3 allowance included £2.30 per customer per year (1997/98 prices) capex for quality of supply[1], which is not separately identified in the DPCR3 projections and is not included in the Base Case DPCR4 forecast.

PB Power view on load-related and non-load related allowances

Load-related expenditure

The output of the model is some £127.5m which significantly lower than YEDL's load-related expenditure forecast for DPCR4, reflecting that the proposed expenditure is high in relation to both the forecast increase in units distributed and in customer numbers which appears to reflect a high level of churn. YEDL's forecast is reasonably in line with historic levels of new connections and identified reinforcement projects but savings of £5m should be possible towards the end DPCR4.

Non-load related expenditure

YEDL's forecast of overhead line expenditure is higher than the model output due to the additional expenditure forecast for refurbishment of low voltage and EHV overhead lines based on risk assessment. An additional £11.5m has been allowed for this expenditure over the model output.

[1] Ofgem DPCR 3 Final Proposals Paper December 1999 para 3.14 page 28

1. INTRODUCTION

The Office of Gas and Electricity Markets (Ofgem) appointed PB Power to provide support for the 2005 Distribution Price Control Review (DPCR4) covering aspects of capital expenditure and repairs and maintenance forecasting, excluding distributed generation which is covered by a separate review. The project is in two parts.

- Part 1, covered the systems, processes, assumptions, asset risk management and data used by Distribution Network Operators (DNOs) to forecast capital expenditure and an analysis of variances and efficiency gains in the HBPQ period .

- This Part 2 report provides an analysis of forecast expenditure for the five year period to 31 March 2010 and builds on information obtained in Part 1 of the project.

Ofgem published the Forecast Business Plan Questionnaire (FBPQ) in October 2003, prior to appointing PB Power. Each DNO was requested to provide forecasts of future capital expenditure requirements against 3 scenarios: the Base Case Scenario; the Ofgem Scenarios/Sensitivities; and the DNO Alternative scenario.

The Base Case is intended to reflect the forecast investment requirement that would maintain existing network quality of supply performance and network fault rates together with the same level of network resilience for the period to 2020.

The Ofgem Scenarios/Sensitivities set out network performance improvement targets for 2010 and 2020 with sensitivities of ± 2% and ± 5% of the 2010 targets. The targets are based on Ofgem's view depending on the nature of each of the DNO networks.

The DNO Alternative Scenario is intended to reflect the DNO view of the efficient level of capital expenditure required to meet the outputs they consider appropriate for their area of supply.

The PB Power review of the DNO forecasts was undertaken as follows:

(a) Further questions and visits to companies to inform a review of each DNO capital expenditure forecast to give a bottom up view of the assumptions, risk assessments and justifications put forward by DNOs for their Base Case forecast, and a high level review of the Ofgem and DNO scenarios.

(b) For the Base Case non-load related expenditure, a comparison of the DNO forecast with the output of a PB Power model using industry average weighted asset replacement profiles and PB Power's unit costs.

(c) For the Base Case load-related expenditure a benchmarked comparison of the each DNO's forecast with a PB Power forecast using a PB Power model based on the methodology set out in Appendix D.

(d) From consideration of the above we have formed a "PB Power opinion" of the proposed allowance.

As indicated above Ofgem provided criteria for the Base Case forecasts. The DNOs' forecasts are based on different assumptions included in the DNO FBPQ submissions. As instructed by Ofgem, adjustments have been made to the DNO forecasts to take account of differing treatments of pension funding deficits, capitalised overheads, intercompany margins and lane rentals. Where appropriate the load-related expenditure, as submitted has been grossed up to take the cost of all connections into account including where these may have been provided by third parties.

In our review of asset replacement expenditure, only non-fault expenditure has been considered. Other items in non-load related expenditure namely diversions, SCADA, metering and fault capital expenditure have been treated as a pass-through. No assessment has been made of non-operational capital expenditure.

Adjustments to DPCR4 forecast

In the FPBQ submissions, allowances may have been made by DNOs for items including third party connections, pension funding deficit, capitalised overheads, inter-company margins and lane rentals. In order to bring the forecasts of capital expenditure onto a common basis, Ofgem has been in discussion with all DNOs as to the level of those adjustments and has arrived at an "Adjusted DPCR4 Forecast" as is indicated in tables in the report.

Such adjustments have been made after PB Power had completed a detailed review of the FPBQ submissions. Therefore certain numbers relating to capital expenditure items in the general text of the report refer to the original unadjusted numbers as presented by the DNOs. Such numbers have not been adjusted retrospectively.

However, for avoidance of doubt, all modelled outputs relying on DPCR4 submission (forecast) values have been based on the "Adjusted DPCR4 Forecast" values and not necessarily those values as originally submitted.

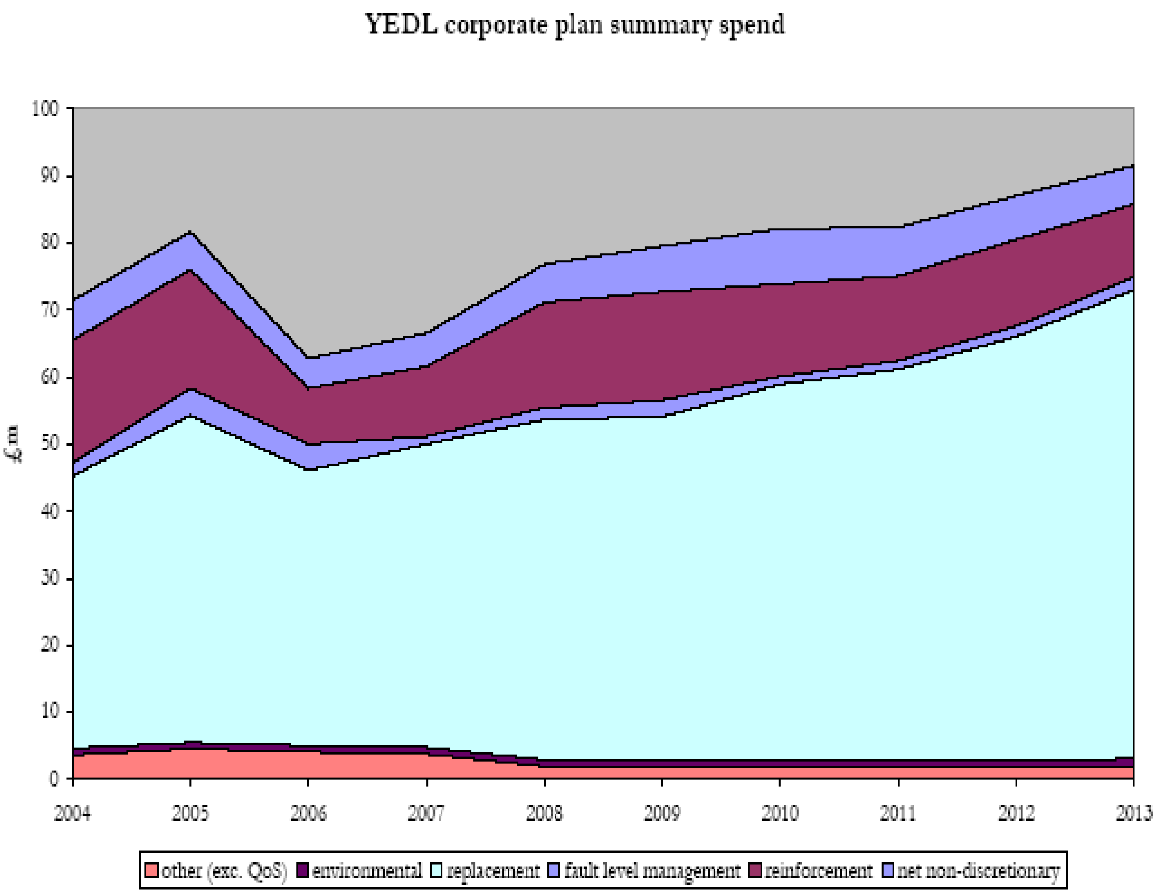
2. DNO SUBMISSIONS

2.1 Base Case

2.1.1 General

YEDL has not included provision for additional costs for pensions deficit and or lane rentals. There are no adjustments to be made for profits on recharges. YEDL has incorporated identified efficiency improvements of 1% reduction in unit costs into their forecasts. The Capex Base Case submission is strictly a Base Case with no additional expenditure for ESQCR, quality of supply or resilience improvements. In addition YEDL makes the point that there is an element of risk in the forecast which may not be the same as other DNO Base Cases and would expect to receive an allowance on an equal basis to other DNOs.

Chart 2.1 - YEDL's Summary of Expenditure



YEDL operates robust systems to calculate the quality of supply benefits from its investments so that the Base Case is considered to meet Ofgem's criteria for maintaining performance. The process has produced a relatively modest forecast in line with past practice. The catch up on past under investment in YEDL by former owners indicates that CE Electric is prepared to invest to meet a medium risk strategy and could be considered to be a benchmark company.

YEDL has provided its business plan investment schedules which set out the major schemes at 33 kV and above and programmes of work below 33 kV. The plan is provided in three levels of detail and which are summarised at an intermediate level (2) in Appendix A. The schedules represent the DNO case and downwards adjustments are required for the DNO case and distributed generation expenditure to reflect the Base Case.

The key features of the forecast are as follows:

- near-constant levels of gross new business, reflecting steady customer demand and stable customer contributions;
- levels of reinforcement that fluctuate year on year, dependent on the timing of individual schemes, but maintain a steady trend reflecting constant load growth;
- levels of replacement that show some fluctuation due to the timing of individual major schemes, but show a modest upward trend driven mainly by overhead line (OHL) investment;
- QoS investment ceases, for the purposes of the Base Case from 31 March 2005
- stable levels of investment (after a 20 per cent increase from 2004 to 2005) for environmental protection,
- levels of 'other' spend that fluctuate between 2004 and 2006 with the flood defence programme, then remain steady.

The following table presents the adjusted DPCR4 forecast expenditure together with the corresponding DPCR3 allowance and projection.

Table 2.1 - Base Case Capex Projections
(£m at 2003/03 prices)

Item	DPCR3 Allowance	Adjusted DPCR 3 Projection	DPCR 4 Forecast	DPCR4 Corrections	Revised DPCR4 Forecast
Gross Load Related	**217.3**	**244.4**	**262.7**	**0.0**	**262.7**
Non Load Related	**291.3**	**295.5**	**363.2**	**0.0**	**363.2**
Gross Capex less Non Op Capex	***508.6***	***539.9***	***625.9***	***0.0***	***625.9***
Non Op Capex (Not Assessed)	16.8	10.4	0.0	0.0	0.0
Total Gross Capex	**525.4**	**550.3**	**625.9**	**0.0**	**625.9**
Contributions	-161.0	-174.1	-184.0	15.6	-168.4
Net Load Related	**56.3**	**70.3**	**78.7**	**15.6**	**94.3**
Total Net Capex	**364.4**	**376.2**	**441.9**	**15.6**	**457.5**
Non Load Related Summary					
Replacement	253.2		192.4	0.0	192.4
ESQCR			0.0	0.0	0.0
Heath & Safety			20.7	0.0	20.7
Environment			4.3	0.0	4.3
Sub Total - Model Comparison	**253.2**	**158.2**	**217.4**	**0.0**	**217.4**
Diversions	14.6	*9.2*	10.8	0.0	10.8
SCADA		4.4	5.4	0.0	5.4
Sub Total	***267.8***	***171.8***	***233.6***	***0.0***	***233.6***
Metering (Not Assessed)	23.5	35.3	35.2	0.0	35.2
Sub Total	***291.3***	***207.1***	***268.8***	***0.0***	***268.8***
Fault Capex (Not Assessed)		88.4	94.4	0.0	94.4
Non Load Related Total	**291.3**	**295.5**	**363.2**	**0.0**	**363.2**

The forecast has been adjusted for:

- gross market LRE adjustment, to take account of customer connection expenditure by third parties
- pension funding deficit
- capitalised overheads
- inter-company margin and
- lane rentals.

YEDL's forecast is based on its forecast loss of market share of the connections market and an adjustment as described earlier to gross expenditure and capital contributions in the DPCR4 forecast to reflect the total connections market on a comparable basis with other DNOs, historic expenditure and modelling.

The adjusted DPCR4 forecast is presented in the table below.

Table 2.2 – Adjusted DPCR4 Base Case Capex Projection (£m at 2003/03 prices)

	Adjustment to DPCR4 Forecast					
Item	Gross Market LRE Adjustment	Pension Funding Deficit	Capitalised Overhead	Inter-company Margin	Lane Rentals Adjustment	**Adjusted DPCR4 Forecast**
Gross Load Related	3.0	0.0	24.3	0.0	0.0	**290.0**
Non Load Related		0.0	21.7	0.0	0.0	**384.9**
Gross Capex less Non Op Capex	***3.0***	***0.0***	***46.0***	***0.0***	***0.0***	**674.9**
Non Op Capex (Not Assessed)						**-**
Total Gross Capex	**3.0**	**0.0**	**46.0**	**0.0**	**0.0**	**674.9**
Contributions	-3.0	0.0	-15.6	0.0	0.0	-187.0
Net Load Related	**0.0**	**0.0**	**8.7**	**0.0**	**0.0**	**103.0**
Total Net Capex	**0.0**	**0.0**	**30.4**	**0.0**	**0.0**	**487.9**
Non Load Related Summary						
Replacement		0.0	17.8	0.0	0.0	210.2
ESQCR		0.0	0.0	0.0	0.0	-
Heath & Safety		0.0	1.9	0.0	0.0	22.6
Environment		0.0	0.4	0.0	0.0	4.7
Sub Total - Model Comparison		**0.0**	**20.1**	**0.0**	**0.0**	**237.5**
Diversions		0.0	1.0	0.0	0.0	11.8
SCADA		0.0	0.5	0.0	0.0	5.9
Sub Total		***0.0***	***21.7***	***0.0***	***0.0***	***255.3***
Metering (Not Assessed)		0.0	0.0	0.0	0.0	35.2
Sub Total		***0.0***	***21.7***	***0.0***	***0.0***	***290.5***
Fault Capex (Not Assessed)		0.0	0.0	0.0	0.0	94.4
Non Load Related Total		**0.0**	**21.7**	**0.0**	**0.0**	**384.9**
Total Adjustments	**3.0**	**0.0**	**46.0**	**0.0**	**0.0**	**49.0**

2.1.2 Load related capex

YEDL is completing some major reinforcement investment in 2005/06 and the fluctuations thereafter are due to the timing of major projects.

2.1.2.1 Network reinforcement

YEDL's forecast of DPCR4 load related network reinforcement amounts to £78.7m which is similar to the DPCR3 projection. Reinforcement spend can be expected to be cyclical to a degree since capacity is released in discrete blocks.

YEDL has produced its demand forecasts on the basis of rate of load growth and increase in customer numbers. We have reviewed these assumptions and find that the forecast increase in customer numbers is around the historic rate. The demand growth in units is considered to be comparable with government forecasts of Gross Value Added (GVA) growth for the region.

The methodology used for forecasting load related expenditure is based on growth rates at a substation level taking into account known spot load increases and churn and we consider that this is a reasonable planning assumption and is in line with the long term development statements which are in the public domain. The investments proposed by YEDL maintain the network compliant with P2/5 standards and YEDL takes into account network transfer capacity and its risk assessments of reinforcement schemes includes a detailed risk assessment of the probability of loss of load based on time series loading data from scada systems. The forecast is generally lower than YEDL's long term modelling and this may be explained by the effects of the overlap with replacement and lower levels of churn than are implied by the model.

The programme includes completion of work from DPCR3 and YEDL has reacted to reduce the level of risk and in some cases Ofgem P2/5 derogations resulting from the higher levels of risk adopted by the former owners.

The proposed development at Hull South of approximately £7m towards the end of DPCR4 is considered necessary due to the high existing network loading and the anticipation of inward investment in the Hull area. A further 132 kV substation and a cable supply from an alternative Grid Supply Point into the south of Hull may be required but the timing of the scheme will depend on load growth and it may be deferred.

Primary reinforcement varies from around £3.5m pa to around £6m pa based on identified schemes.

HV/LV reinforcement falls from around £2m p.a. to around £7m p.a.; the fluctuations again being due to the timing of identified schemes with a base work load of £2m per year.

YEDL recognises that there may be scope to re-profile the reinforcement expenditure.

YEDL has reviewed its approach to overstressed switchgear in the context of ESQCR and requires investing between £1m and £4m per year as adequacy of equipment is now an absolute requirement under regulation 3 (1). This is a prudent investment and is consistent with industry practice of operating switchgear inside certified ratings.

The reinforcement forecast reflects YEDL's current view of the balance between identified issues and generic provisions and YEDL recognizes that there may be scope to re-profile the reinforcement expenditure. This may give scope for a lower load related projection of around £10m lower than YEDL's forecast..

2.1.2.2 New connections forecast expenditure

YEDL has based its forecasts on the historic trends as there are few known projects into DPCR4 and recognising that new connections are difficult to predict in the long term as most developments have a short planning horizon. The forecast of new connections does not appear to be impacted by the over forecasting of customer numbers.

2.1.2.3 Comments and issues associated with the load related expenditure forecast

i. We have reviewed YEDL's assumptions of growth in load and customers and find that they are consistent with historic trends and government forecasts of Gross Value Added (GVA) growth for the region. Overall the forecast of new connections expenditure based on past trends is considered to be reasonable.

ii. The forecast of new connections are considered to be reasonable and in line with historic trends, subject to our further review of the time series data of YEDL's customer numbers.

iii. YEDL's forecast of reinforcement expenditure is based on identified major schemes for the whole of the DPCR4 many of which are currently in progress to meet P2/5 considerations and this leads to higher than historic forecast levels of reinforcement expenditure. The forecasts for major schemes trend downwards after the first two years. 11 kV reinforcement is based on historic run rates. YEDL recognizes that there may be scope to re-profile the reinforcement expenditure and in the event that the Hull South scheme and other schemes towards the end of the programme does not materialise in DPCR4 reinforcement expenditure may be some £5m lower than forecast.

2.1.3 Non-load related capex

YEDL's non load related replacement programme is described more fully in Appendix A.

Asset replacement of £198m has been strictly limited to that required to maintain network performance in the Base Case and generally aligns with about 80% of YEDL's load related modelling. The difference is accounted for by the overlap between load related and non load related expenditure. The implied average asset life from the investment programme is 109 years but this falls to 48 years after removing long life cable and services assets which are not yet being replaced in large numbers. It is also noted that modelling covers all NLRE except diversions and environment, i.e. it includes safety and environment expenditure. There is some mismatch between the level of residual risk in NEDL and YEDL measured by life extension. However this is not to be balanced in DPCR4 pending further analysis of asset data and the significance of age and replacement profiles adopted for overhead lines. The bottom up risk assessment plan is the best guide to network needs and this is being adopted by YEDL.

OHL replacement rises from £12m pa to £16m pa, spread across all voltage levels. This level of investment reflects extensive refurbishment, rather than full replacement.

Cable replacement remains fairly stable around £4m p.a.; these modest levels of expenditure reflect the poor cost/benefit of cable replacement, particularly at LV, due to difficulties in targeting spend effectively.

The programme includes approximately £17m of service replacement expenditure of which £12m is for replacement of fused neutrals under ESQCR regulations in addition to other service replacements.

HV/LV substation replacement drops from around £6m pa in 2005 to £5m pa in 2006, as YEDL complete the programme that eliminates high risk LV street feeder pillars. Expenditure then rises towards £7m pa, driven by the initiation of a new indoor substation replacement programme and we consider this to be a reasonable forecast.

YEDL has provided details of long term plans to replace oil based switchgear based on condition assessments.

The YEDL NLRE makes provision for replacement of certain assets which is driven by safety and the need for compliance with ESQCR amounting to around £2m per year but YEDL indicates that there is some uncertainty about the ESQCR requirements until full risk assessment is undertaken.

There are also safety related programmes of £21m not directly related to electrical asset renewal for network performance reasons that are driven entirely by risk. This expenditure in the next year or two is set directly from ASR and its view of risk and opportunity and thereafter based on trend.

Environmental expenditure of around £4m appears to be reasonably justified.

YEDL has a relatively low level of wayleave terminations and associated compensation and diversions of £11m which reflects its strong stance towards termination notices and historic rates of expenditure. YEDL includes £1.0m per year of easements in reinforcement expenditure.

2.1.3.1 Comments and Issues associated with the Non-load related expenditure forecast

i. YEDL's non load related investment programme shows a modest increase on DPCR3 and consideration has been given to whether this is adequate to meet the ageing asset base. YEDL has explained that the replacement expenditure is lower than their modelling due to the overlap with reinforcement and the detailed risk assessment indicating a lower forecast than the modelling especially for overhead lines where reported age does fully reflect the sound condition of the assets.

ii. Cable replacement expenditure is relatively low but service replacement of £12m is relatively high as YEDL addresses replacement of fused neutrals.

iii. YEDL has also explained that their forecast is a strictly Base Case forecast and does not include provision for pensions, lane rentals and relatively little expenditure for ESQCR. YEDL indicates that there is no room in the forecast to meet new obligations and cost pressures such as pensions and lane rentals and improvements in quality of supply.

iv. Overall the forecast of replacement expenditure is therefore considered to be reasonable bearing in mind the comments above. The PB Power view is higher than the model by £11.5m which reflects additional allowance for EHV overhead lines where YEDL has demonstrated network need.

2.1.4 Major schemes submitted

YEDL has submitted scheme papers for 4 projects. The papers indicate a robust investment appraisal methodology with detailed risk assessment for each scheme, exploration of alternative projects and benchmarks against alternative investments to ensure correct prioritisation of investment. The 4 projects submitted are:

- Sweet Street New Substation
- Guardian Glass Customer Connection
- Low Road Substation Reinforcement
- Elland 275/132kV Substation Asset Replacement

The schemes provide a good level of justification for expenditure and include detailed risk assessments as a part of investment appraisal.

2.2 Quality of supply/sensitivity scenarios

2.2.1 Network performance improvements

The following table sets out the proposed targets for the Ofgem QoS targets.

Table 2.2 - Network Performance Targets 2010 – 2020

	02/03 actual		01/02 & 02/03 ave		2010 Scenario		2020 Scenario		(ave/2010)%	
	CI	CML	CI	CML	CI	CML	CI	CML	CI	CML
YEDL	61.0	62.8	68.6	66.8	66.5	61.9	62.9	54.7	104%	108%

YEDL has proposed a significant programme for improvement in quality of supply to meet performance targets of some £25.6 m mainly for further deployment of remote control of urban circuit breakers, rural remote control and arc suppression coils on rural networks.

2.2.2 Overhead line upgrade

YEDL's programme on network resilience and upgrading overhead lines of £36.0m is aimed at older BS 1320 overhead lines.

2.2.3 Resilience undergrounding

YEDL has forecast £43.5m for resilience undergrounding and does not favour under grounding solely for amenity purposes but would prefer more selective undergrounding in fringe urban areas.

2.2.4 Amenity undergrounding

YEDL would need to invest £208m to under ground all circuits in National Parks and AONB s.

2.3 DNO alternative scenario

The DNO scenario includes £35.6m on quality of supply improvements using adopting a similar strategy as the quality of supply scenarios but with greater emphasis on improvements to worst served customers. The programme is a reasonable balance of meeting overall IIP targets and improving performance for worst served customers.

3. PB POWER MODELLING AND COMPARISONS

3.1 Introduction

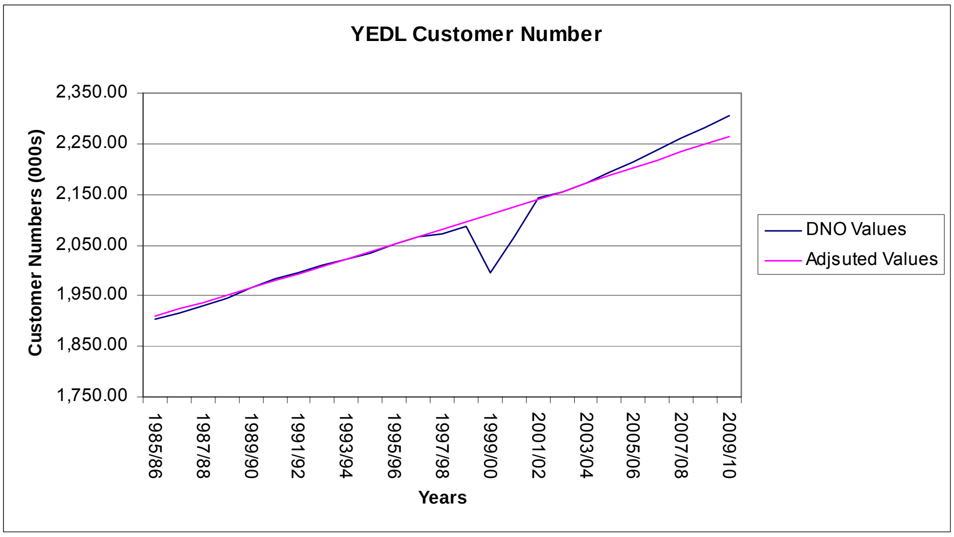
PB Power has carried out modelling of forecast expenditure using both DNO data and PB Power data with a view to understanding better how DNOs have arrived at forecast expenditure and with a view to informing Ofgem of issues that may be considered in arriving at allowances for DPCR4.

Detailed descriptions of the models are provided in Appendices D and E and the following sections discuss the validation and adjustment of the input variables and the model outputs.

3.2 Load related expenditure

3.2.1 Model inputs

A discontinuity in the customer numbers between 1998/99 and 2000/01 may be observed. In order to limit the impact of this discontinuity it has been necessary to derive an average growth rate. This growth rate has been calculated to be 0.71% and has been applied working back from 2002/03 to remove this affect. The basis upon which the average growth has been derived is based on review of the change in customer numbers over the preiod 1986/87 to 1998/99. We have also noted that the the forecast growth from 2003/04 is significantly higher than the historic trend. In order to make allowance for this a forecast growth has been derived and applied in to reduce the forecast growth to be more in keeping with with the historic value.



The GVA analysis indicated that YEDL GWh forecast was satisfactory.

CE Electric supplied their submission net of 3rd party connection costs and accordingly an adjustment has been made to the gross LRE in the DPCR4 forecast as described earlier. After discussions with the DNOs the load related expenditure has been increase as shown

3.2.2 Model outputs

The following table sets out the model output compared to the actual DPCR2 expenditure, the actual and forecast DPCR3 expenditure and the DPCR4 submission.

Table 3.1 - Load Related Expenditure Model Output

LRE DPCR2 (excluding generation)	**LRE DPCR3 (excluding generation)**	**Submitted LRE Gross DPCR4 (excluding generation)**	**Model Output LRE for DPCR4 using**
(£m)	(£m)	(£m)	(£m)
223	244	290	**128**

3.2.3 Load related expenditure modelling comments

The output of the model is some £162m lower than YEDL's load-related expenditure forecast for DPCR4 indicating that the proposed expenditure is high in relation to both the forecast increase in units distributed and in customer numbers.

The forecast net load related expenditure is similar to the DPCR3 projection and although the modelling indicates a reduced level of expenditure for DPCR4, our assessment is that YEDL's bottom up forecasts are considered to be reasonable. This opinion is also influenced to some degree by th number of schemes already in progress to meet growth in the city of Leeds and in Doncaster.

The low level of projection from the model may be due to high past expenditure relative to customer and demand growth which has been masked by the churn effect of the closure of coal mines and steelworks and the need for reinvestment in new infrastructure and businesses including the fast growing city of Leeds. Growth is expected to continue and extend to Hull in DPCR4 although we consider, based on the supporting information, that the forecast reinforcement at the end of the DPCR4 period is at risk of deferral. If this were to occur a saving of £5m on the forecast costs may be realised by YEDL.

3.3 Non-load related expenditure

3.3.1 Model inputs

No specific model input adjustments were made for YEDL.

With the exception of wood pole overhead lines which were modelled on a cyclic replacement basis, all other assets were modelled on an age based replacement profile basis.

3.3.2 Model outputs

Table 3.2 below provides a comparison between the DNO submission and the model outputs for the main asset classes.

Table 3.2 - Non Load Related Expenditure Model Output

Submission	FBPQ Table 26	Adjusted submission	Combined	Adjusted submission	Model output	Bench-marked output	PB Power Opinion
Lines	55.3	59.4	Lines & services	71.0	58.1	62.6	
Cables	23.5	25.2	Cables & services	28.7	35.0	28.7	
Transformers	29.1	31.2	Substations	134.0	149.4	129.7	
Switchgear	54.4	58.4	Part Submission Total	233.7	242.5	221.0	
Services and Lines	14.1	15.1					
SMC	0.0	0.0					
Other Substations	41.3	44.3					
Other Not Modeled	0.0	0.0	Other Not Modeled	0.0		0.0	
Total	217.4	233.7	Total	233.7		221.0	232.5

3.3.3 Non load related expenditure modelling comments

The model projects a lower expenditure for lines and services than in YEDL's submission. This difference is attributed to the expenditure for refurbishment of LV and EHV lines which have been risk assessed by YEDL. We have accordingly taken this justification into account when arriving at our opinion below on the allowed level of expenditure.

Cable replacement forecast is lower than the model output in common with many other DNOs.

YEDL service replacements are higher than the model due to work to replace fused neutrals and overhead line services which is mainly safety related work.

The forecast of lower switchgear and transformer replacement than predicted by the model reflects YEDL's prudent medium risk approach to asset management and its robust risk assessment and investment appraisal.

In PB Power's opinion, the allowed non-load related expenditure corresponding to the model output should be £232.5m, being YEDL's adjusted DPCR4 submission less £5mbut 11.5m higher than the model output due to the additional work justified for overhead lines. This amount excludes ESQCR expenditure, diversions, SCADA, metering and fault capital expenditure. Furthermore ESQCR expenditure has been excluded from the overall total as this matter is being considered separately.

3.4 PB Power's opinion of allowances

Our findings are summarised in the table below.

Table 3.3 – PB Power's Opinion of Allowances (£m)

Item	Adjusted DPCR 3 Projection	Adjusted DPCR4 Forecast	Model Output, benchmarked	PB Power Opinion
Gross Load Related	**244.4**	**290.0**	**127.5**	**285.0**
Non Load Related	**295.5**	**384.9**		**378.1**
Gross Capex less Non Op Capex	**539.9**	**674.9**		**663.1**
Non Op Capex (Not Assessed)	10.4	**-**		0.0
Total Gross Capex	**550.3**	**674.9**		**663.1**
Contributions	-174.1	-187.0		-187.0
Net Load Related	**70.3**	**103.0**		**98.0**
Total Net Capex	**376.2**	**487.9**		**476.1**
Non Load Related Summary				
Replacement		210.2		
ESQCR		-		
Heath & Safety		22.6		
Environment		4.7		
Sub Total - Model Comparison	**158.2**	**237.5**	**221.0**	**232.5**
Diversions	9.2	11.8		10.0
SCADA	4.4	5.9		5.9
Sub Total	***171.8***	***255.3***		***248.5***
Metering (Not Assessed)	35.3	35.2		35.2
Sub Total	**207.1**	***290.5***		**283.7**
Fault Capex (Not Assessed)	88.4	94.4		94.4
Non Load Related Total	**295.5**	**384.9**		**378.1**

Notes:

- Non operational capital expenditure has not been assessed
- Non-load related expenditure modelling covers all non-load related headings except diversions, metering, fault capex and SCADA
- Metering and fault capex are passed through
- Diversions are passed through, where compliant, with the Base Case the same as for DPCR3
- SCADA is separately assessed but not included in the modelling
- PB Power's model output and Opinion are based on retirement profile modelling and exclude any additional expenditure that may arise under ESQCR legislation.

APPENDIX A

BASE CASE SUBMISSION

APPENDIX A – BASE CASE SUBMISSION

A.1 Actual and Forecast Capital Expenditure Projection for DPCR3

In the table below we present the actual and forecast capital expenditure projection for DPCR3.

Table A.1 - Actual and Forecast Capital Expenditure Projection for DPCR3 (£m at 2003/2003 prices)

	Actual			Forecast		Total
	2000/01	2001/02	2002/03	2003/04	2004/05	
Capital Expenditure						
Load Related	46.1	38.9	48.4	58.3	59.2	250.9
Capital Contributions	(38.2)	(39.4)	(28.8)	(33.2)	(35.5)	(175.1)
Non Load Related	51.0	50.2	55.3	65.9	78.1	300.5
Non-operational capex	7.7	2.7	-	-	-	10.4
Total Capital Expenditure	66.6	52.4	74.9	91.0	101.8	386.7

A.2 Base Case Capital Expenditure Forecast for DPCR4

The Base Case Capital Expenditure Forecast for DPCR4 follows the Ofgem FBPQ guidelines and is summarised as follows:

Table A.2 - Base Case Capital Expenditure Forecast for DPCR4 (£m at 2003/2003 prices)

	Forecast					Total
	2005/06	2006/07	2007/08	2008/09	2009/10	
Capital Expenditure						
Load Related	59.4	49.8	49.6	54.5	55.0	268.3
Capital Contributions	(36.0)	(38.1)	(38.7)	(38.4)	(38.4)	(189.6)
Non Load Related	76.6	69.1	72.7	72.7	72.1	363.2
Non-operational capex	0	0	0	0	0	0
Total Capital Expenditure	100.0	80.8	83.6	88.8	88.7	441.9

Note that the above figures are presented without normalisation or adjustment for pensions, lane rentals profits on recharges or ESQCR.

YEDL's forecast is based on their forecast loss of market share of the connections market and £5.6 m has been added to gross expenditure and capital contributions in the DPCR4 forecast to reflect the total connections market on a comparable basis with other DNOs, historic expenditure and modelling.

YEDL has provided its business plan investment schedules which set out the major schemes at 33 kV and above and programmes of work below 33 kV. The plan is provided in three levels of detail and which are summarised at an intermediate level (2) in the Table below. The schedules represent the DNO case and adjustments are required of £35.6m for the DNO case and distributed generation expenditure to reflect the bases case.

UK Distribution

3. YEDL Lvl 2 Efficency (PRIME)

YEDL Level 2 Prime	Estimate 2004 (£k)	Estimate 2005 (£k)	Estimate 2006 (£k)	Estimate 2007 (£k)	Estimate 2008 (£k)	Estimate 2009 (£k)	Estimate 2010 (£k)	Estimate 2011 (£k)	Estimate 2012 (£k)	Estimate 2013 (£k)	Total 10 Year Plan (£k)
CUSTOMER DRIVEN CAPEX											
Total Demand Connections Expenditure	39743	40154	41010	41894	42781	44199	45139	46102	47091	47226	435338
Total Generation Connections Expenditure	0	3145	4718	7863	11008	15726	20444	17202	13292	10165	103564
Total Connections and Generation Expenditure	*39743*	*43299*	*45728*	*49757*	*53789*	*59925*	*65583*	*63304*	*60383*	*57391*	538902
Diversions Prime	8209	10156	14258	12121	10012	8258	8460	8669	8888	9110	98142
Diversions and New business Oncost	1748	1737	1764	1805	1851	1901	1953	2004	2052	2103	18918
Total Connections Costs	49700	55192	61750	63684	65652	70084	75996	73977	71323	68604	655962
Total Demand Connections Income	(36564)	(38146)	(41010)	(41894)	(42781)	(44199)	(45139)	(46102)	(47091)	(47226)	(430151)
Generation Income	0	(2515)	(3662)	(6065)	(8468)	(12018)	(15342)	(13146)	(10110)	(7733)	(79060)
Total Diversions Income	(7200)	(8940)	(12657)	(10724)	(8778)	(7111)	(7289)	(7471)	(7658)	(7849)	(85678)
INCOME	(43763)	(49601)	(57329)	(58682)	(60028)	(63329)	(67770)	(66719)	(64859)	(62808)	(594889)
NET NON DISCRETIONARY CAPEX	**5936**	**5591**	**4421**	**5001**	**5624**	**6756**	**8226**	**7258**	**6464**	**5796**	**61073**
DISCRETIONARY CAPEX											
Replacement of Failed Assets	12541	12726	12913	13100	13303	13494	13686	13894	14104	14315	134077
Meter Recertification	6408	6571	6577	6713	6829	6499	6578	6550	6402	6252	65379
New Meters	1653	1525	1195	1198	1256	1270	1185	1217	1063	1036	12596
Replace CNDB/ NMS /TMS	2734	2281	80	80	25	1750	275	275	25	23	7548
SYSTEM IMPROVEMENT											
Reinforcement load related grid	7134	6775	2111	2441	4961	3915	4474	4463	3481	3662	43418
Reinforcement load related primary	5084	3479	3645	3909	5256	6741	2599	3379	5275	4067	43433
Reinforcement load related 11kv	3602	6401	2638	3206	4697	5192	4376	4784	2966	3024	40888
Fault level management	1994	3930	3813	776	1941	2364	1132	1239	1504	1777	20471
Asset replacement grid ss	4660	9903	4749	9315	8698	8713	8786	9836	12638	9828	87127
Asset replacement primary ss	5856	8876	6045	4341	7503	6719	11513	9402	9544	14368	84168
Asset replacement distribution ss	3305	5726	5283	5359	6205	6845	6943	7048	7155	7262	61131
Asset replacement cables	7008	4175	3969	4025	3756	4195	4924	5565	7432	10664	55714
Asset replacement overhead lines	14144	13239	12840	15115	15981	15221	16389	16360	16643	18881	154814
Asset replacement services	3230	3167	3326	3374	3869	4371	3980	4039	4568	2576	36499
Legal	615	2028	2037	1852	468	474	481	488	496	503	9443
Quality of supply	5246	7400	7086	7281	7394	7500	6711	6813	4957	4680	65067
Efficiency	223	364	280	286	286	468	327	335	306	312	3187
Operator safety	1122	1154	1101	1021	1037	976	990	1003	1016	1031	10451
Environmental	955	884	823	796	806	807	806	812	818	824	8331
Major system risk	1036	720	317	247	0	0	0	0	0	0	2320
TOTAL SYSTEM IMPROVEMENT	*67949*	*80503*	*60142*	*63425*	*72884*	*76251*	*74707*	*75841*	*78824*	*83483*	*734011*
TOTAL NET DISCRETIONARY CAPEX (PRIME)	**94487**	**106915**	**85248**	**89437**	**99897**	**104270**	**104382**	**104761**	**106857**	**110883**	**1007136**
SI ON - COST	13914	13854	14081	14410	14774	15168	15580	15992	16372	16781	150926
TOTAL NET DISCRETIONARY CAPEX (GROSS)	**108401**	**120769**	**99328**	**103847**	**114671**	**119438**	**119962**	**120753**	**123229**	**127664**	**1158062**
TOTAL OPERATIONAL CAPEX (DISC + NON DISCRETIO	**151770**	**166834**	**151206**	**153901**	**162913**	**165745**	**166475**	**169437**	**173940**	**180308**	**1642530**
ADD CAP INTEREST	4398	4459	2895	2905	2962	2996	3026	3046	3274	3274	33235
ADD NON OP CAPEX	3285	4002	2061	3932	4183	1890	1837	1647	2045	2045	26927
TOTAL CAPEX	**159453**	**175295**	**156162**	**160738**	**170058**	**170631**	**171338**	**174130**	**179259**	**185627**	**1702692**

Projections of future load related Capex

YEDL's load related capital expenditure projections for the Base Case Scenario are as set out in the following table:

Table A.4 - Base Case Load Related Capex Projections

LOAD RELATED CAPITAL EXPENDITURE - £M	2005/06	2006/07	2007/08	2008/09	2009/10
Reinforcement	23.4	11.7	10.9	16.1	16.6
New Connections	36.0	38.1	38.7	38.4	38.4
LRE Total Gross	**59.4**	**49.8**	**49.6**	**54.5**	**55.0**
Customer Contributions	36.0	38.1	38.7	38.4	38.4
LRE Total Net	**23.4**	**11.7**	**10.9**	**16.1**	**16.6**

Network reinforcement

YEDL has provided information on major network reinforcements to relieve overloaded substations at 33 kV and above and provided information on major projects planned for all five years of DPCR4.

Table A.5 – 132 kV Reinforcement Expenditure – Prime Costs

	2005/06	2006/07	2007/08	2008/09	2009/10
	£m	£m	£m	£m	£m
Staygate 132/33kV feeder protection refurbishment		1527	1372		
Bradford West 132kV feeder protection	518	354			
Risk to system security from obsolete electromechanical relays	228	232			
Elland switchgear replacement	311				
Wakefield B site renewal	2153	2080			
Ferrybridge 'A' 66kV switchgear, transformer & 11kV switchgear		2902	1538	1071	
Creyke Beck 132kV switchgear replacement		2080	1538	321	
Doncaster B transformer change	1420	960			
Grimsby West switchgear replacement				3533	1087
West Melton 132/66kV transformer change			211	2784	

YEDL has explained in detail the issues related to replacement of equipment on nine sites. To maintain alignment between the programmes NGC would need to defer one project and advance four projects at an estimated net cost of £700k. Some of the projects are linked to short circuit levels where YEDL equipment is overstressed and NGC equipment is not overstressed.

These projects are supplemented by a generic provision of £9m per annum influenced by long-range modelling.

Primary replacement varies between around £6m pa and around £10m pa with a peak in 2005 and 2006, reflecting increased sensitivity to loss of major sites.

New connections forecast expenditure

New connections expenditure and customer contributions are forecast as follows:

Table A.6 - New Connections Expenditure

£M	2005/06	2006/07	2007/08	2008/09	2009/10
New Connections	24	24.5	24.8	24.8	24.8
Customer Contributions	24	24.5	24.8	24.8	24.8
New Connections - Net	0	0	0	0	0

Non-load related expenditure

The amount of non-load related expenditure projected by YEDL for the Base Case Scenario is as follows:

Table A.7 - Non-load related expenditure

Expenditure Classes	Non-Load Related (£m)					
	2006	2007	2008	2009	2010	Total
Non Fault Replacement	42.0	34.4	39.2	41.2	41.3	**198.1**
Metering	7.4	7.1	7.0	6.9	6.5	**34.9**
Faults	19.1	19.2	18.8	18.7	18.6	**94.4**
Diversions	2.3	2.7	2.3	1.9	1.6	**10.8**
Health and Safety	4.9	4.8	4.5	3.2	3.3	**20.7**
Environmental	0.9	0.9	0.9	0.8	0.8	**4.3**
Total	**76.6**	**69.1**	**72.7**	**72.7**	**72.1**	**363.2**

This report does not consider capitalised fault expenditure and metering.

YEDL's non-load related investment is based on risk assessed programme of major projects and over 40 programmes of work on other assets.

Asset replacement

YEDL's non load related replacement programme of £198m has been strictly limited to that required to maintain network performance in the Base Case.

YEDL generally refurbishes an asset rather than replace it whenever that course of action will yield a lower NPV of costs, i.e. where the lower expected interval to next intervention is offset by the lower cost of intervention. Thus, for example, the plan explicitly provides for extensive refurbishment of overhead lines and EHV transformers.

YEDL has produced a report[1] on its modelling of replacement expenditure and the implications of the comparison of modelling with the bottom up risk assessed approach inherent in the forecasts. Age related modelling is based on a simple birthday model where normal lives have been stretched modestly since DPCR3 by aligning the NEDL lives with the longer YEDL lives on merger. This is backed up by some analysis of average and oldest lives. NEDL/YEDL are conservative on replacement of assets and take into account the overlap between reinforcement expenditure and replacement and attempt to match at about 80% of the model.

YEDL argues that the balance is made up by the contribution to replacement in expenditure classified as load related expenditure. YEDL measures residual risk by service life extension which for DPCR4 increases over the period. Service life extension is a measure ofthe time required to recover any backlog and during DPCR4 represents the ramp up of investment over the period. The implied average asset life from the investment programme is 109 years but this falls to 48 years when taking out the long life cable and services assets. YEDL has a significantly higher risk in its network assets than NEDL and the risk increases over DPCR4. YEDL intends to normalise the risk over a period longer than 5 years when further work is carried out to understand any anomalies in the modelling especially of overhead lines as its bottom up risk assessment indicates satisfactory levels of risk.

It is also noted that modelling covers all NLRE except diversions and environment, i.e. it includes ESQCR, safety and environment expenditure. There is some mismatch between the level of residual risk in NEDL and YEDL measured by life extension. However this is not to be balanced in DPCR4 pending further analysis of asset data and the significance of age. The bottom up risk assessment plan is the best guide to network needs The bottom up assessment gives prominence to replacement of EHV assets and refurbishment of overhead lines. All asset replacement is determined on a risk assessed basis rather than on policy; for example, it is not planned to replace all oil based 11 kV switchgear as an asset management policy.

Details of the projects and programmes of work below have been provided by YEDL as prime costs.

[1] YEDL System Strategy Report - Age based asset replacement expenditure

Major 132 kV Replacement Projects

Table A.8 - 132 kV Replacement Projects

	2005/06	2006/07	2007/08	2008/09	2009/10
	£k	£k	£k	£k	£k
Staygate 132/33kV feeder protection refurbishment		1527	1372		
Bradford West 132kV feeder protection	518	354			
Risk to system security from obsolete electromechanical relays	228	232			
Elland switchgear replacement	311				
Wakefield B site renewal	2153	2080			
Ferrybridge 'A' 66kV switchgear, transformer & 11kV switchgear		2902	1538	1071	
Creyke Beck 132kV switchgear replacement		2080	1538	321	
Doncaster B transformer change	1420	960			
Grimsby West switchgear replacement				3533	1087
West Melton 132/66kV transformer change			211	2784	

YEDL has explained in detail the issues related to replacement of equipment on nine sites. To maintain alignment between the programmes NGC would need to defer one project and advance four projects at an estimated net cost of £700k. Some of the projects are linked to short circuit levels where YEDL equipment is overstressed and NGC equipment is not.

These projects are supplemented by a generic provision of £9m p.a.determined by long-range modelling.

Primary replacement varies between around £6m p.a. and around £10m p.a. with a peak in 2005 and 2006, reflecting increased sensitivity to loss of major sites.

Overhead lines

OHL replacement rises from £12m p.a. to £16m p.a. spread across the voltage level;: this level of investment reflects extensive refurbishment, rather than full replacement.

Table A.9 - YEDL average refurbishment/replacement rate in km per year (2004 – 2013)

Voltage	LV	HV	33/66kV	132kV
Refurbishment (km/yr)	10.7	84.9	6.3	22.9
Rebuild (km/yr)	48.7	225.0	14.7	2.6
Total Asset Renewal (km/yr)	59.4	309.9	21.0	25.5
Assumptions	Rebuild work anticipated to include approximately 20% replacement with underground cable as part of Rebuild ‘off line’.	Rebuild work will typically include 60% ‘on line’ and 40% ‘off line’.	Anticipated number of circuit km/yr taken from KPIs in current ten-year plan. Approximately 70% of total asset renewal assumed to be rebuild ‘off line’ only. This targets now obsolete overhead line designs that pose a risk to YEDL (Woodhouse masts).	Anticipated number of circuit km/yr taken from KPIs in current ten-year plan. Approximately 10% of total asset renewal assumed to be rebuild ‘on line’ only.

The largest mismatch between YEDL’s model and their plan is in overhead lines. The simple age approach produces expenditure profile well in excess of the risk assessed plan. This may be due to the past work on overhead lines which makes it difficult to assign a realistic age. In practice YEDL considers that there is not the same level of work required as predicted by the model.

YEDL has a significant length of network which is built to light line standards with small section conductors and narrow spacing crossarams and this type of overhead line is to be targeted by the overhead line replacement programme.

YEDL has included significant refurbishment of lines at low voltage and lines above 11kV in its forecast based on condition based risk assessment.

Underground cables

Cable replacement remains fairly stable around £4m p.a.; these modest levels of expenditure reflect the poor cost/benefit of cable replacement, particularly at LV, due to difficulties in targeting spend effectively.

11 kV substation equipment

HV/LV substation replacement drops from around £6m pa in 2005 to £5m pa in 2006 as YEDL completes the programme that eliminates high risk LV street feeder pillars. Expenditure then rises towards £7m pa, driven by the initiation of a new indoor substation replacement programme.

YEDL has provided details of long term plans to replace oil based switchgear based on condition assessments.

Services

The programme includes £12m for replacement of fused neutrals under ESQCR regulations in addition to other service replacements giving total expenditure of approximately £17m.

ESQCR Non load related investment

The YEDL NLRE makes provision for replacement of certain assets which is driven by safety requirtements and the need for compliance with ESQCR amounting to around £2m per year as follows:

- safety enhancements arising from substation risk assessments: £630k p.a.;
- safety enhancements arising from OHL risk assessments: £290k p.a.; and
- replacing fused neutral cut-outs: £1,260k pa.

In addition some £6m is required for overstressed switchgear in the load related forecasts.

This is a modest investment compared with some DNOs and the full extent of the work will not be known until the risk assessments are complete in 2004.

Health and safety

There are also programmes of work not directly related to electrical asset renewal that are driven entirely by risk assessment rather than age. For these, expenditure in the next year or two is set directly from ASR and its view of risk and opportunity and thereafter based on trend.

Such investment of £21m includes:

- replacement of inadequate LV switchgear - WP 95/24;
- Buchholz replacement - WP 00/54;

- surge arrestor installation and replacement - WP 00/55;
- removal of operational restrictions WP02/66;
- substation rewiring;
- asbestos abatement - WP 00/60;
- HV compound flags and signs;
- changing requirements for system earthing driven by outcomes of
- recent EME incident - impact upon staff safety & legal compliance;
- fire detection equipment installation;
- operational site security - WP 95/17;
- replacement of Syndanio meter boards due to presence of asbestos;
- provision of LV earthing terminals;
- operational issues with defective cut-outs; and
- under-eaves wiring.

This work is justified and prioritized under YEDL's risk assessment and investment appraisal process.

YEDL has not included significant expenditure in relation to ensuring clearances to buildings and trees required under ESQCR although it expects that such expenditure may be required when it has completed its assessment and will expect to be funded for such work. . ESQCR expenditure does not include additional expenditure on overhead line clearances which requires more detailed risk assessment.

Environment

Environmental expenditure of around £4m is required for the following and appears to be reasonably justified:

- reduction of environmental impact of substations - WP 95/25;
- transformer oil bunding - WP 96/29; and
- noise abatement.

Diversions

YEDL has a relatively low level of way leave terminations and associated compensation and diversions of £10.8m which reflects its strong stance towards termination notices and historic rates of expenditure. YEDL includes £1.0m per year of easements in reinforcement expenditure.

APPENDIX B

QUALITY OF SUPPLY SCENARIOS

APPENDIX B – QUALITY OF SUPPLY SCENARIOS

B.1 Network performance improvements

In order to achieve the benchmark performance for 2020, set by Ofgem in the guidance to this scenario, YEDL is required to reduce the number of unplanned Customer Interruptions (CI) by 4% and unplanned Customer Minutes Lost (CML) by 8% by 2010, in comparison to the average performance experienced in the last two years.

Of the proposed 2010 CI and CML targets, the CML target of 66.5 will be the most difficult one to meet. As a consequence the mix of investments to achieve the proposed targets has been optimised to deliver CML.

To meet the 2010 target it is likely that the following investments will be required:

Programme	**Estimated investment** (£m)	**Estimate of benefits**	
		CI	**CML**
Auto-sectionalisers	0.7	0.3	0.2
Intermediate CBs (urban circuits)	5.1	2.1	1.2
Remote control – rural	19.8	5.6	6.8
Total YEDL	**25.6**	**8.0**	**8.2**

The company has indicated that customers in urban areas already enjoy an interruption rate due to HV faults that is, on average, five times better than that experienced by rural customers. The company is therefore targeting improvements to the rural areas.. However, urban performance now makes up over half of the HV CI/CML figures for the company and the company has have advised that in order to meet the required performance level need to invest in that area.

The quality of supply investments described above involves the use of complex devices in a relatively harsh environment. YEDL expects that these will involve a higher than normal cost to maintain them in an operational state. This is estimated by YEDL to be the equivalent of three per cent per annum of the installed cost.

B.1.1 Description of investments 2005 to 2010

1. Remote control - rural - this is a continuation of the present programme of equipping main-line auto-reclosers and key switching positions with remote control.

2. Auto-sectionalisers - these are 'electronic fuses' that co-ordinate with auto-reclosing circuit-breakers to minimise the risk of interruptions on spur and main lines. They do not operate on a transient fault, thereby protecting spur lines from unnecessary interruptions. This arrangement provides benefit to a small numbers of customers connected to spur lines and hence provide only a limited

headline CI and CML performance improvement. Consequently only a small programme of targeted work is viable.

3. Intermediate circuit breakers (CBs) on urban circuits - these provide extra stages of protection on a radial urban circuit. The low fault rate on urban circuits limits the effectiveness of this option.

4. Remote control - rural - this is a continuation of the present programme of equipping main-line auto-reclosers and key switching positions with remote control.

B.1.2 Ofgem sensitivity scenario three: further two per cent improvement in CI by 2010

This scenario requires the company to achieve a CI performance of 65.1 by 2010.

Assuming that the company continues with its present range of QoS improvement investments through 2004/05, the probable 2005/06 CI performance is likely to be 74.5. An improvement of 9.4 CI is therefore needed. To meet this it is likely that the following investments will be required:

Programme	Estimated investment (£m)	Estimate of benefits	
		CI	CML
Auto-sectionalisers	1.3	0.3	0.2
Intermediate CBs (urban circuits)	6.6	2.3	1.4
Remote control – rural	31.8	6.8	8.1
Total YEDL	39.7	9.4	9.7

As performance targets are tightened it becomes increasingly difficult and much more expensive to achieve them. As explained in respect of earlier scenarios, although urban customers are generally satisfied with their level of service, urban performance makes up such a large part of the company's overall performance that we need to invest in this area if the targets are to be met.

B.1.3 Ofgem sensitivity scenario five: further five per cent improvement in CML by 2010

The proposed CML target for 2010 will be 58.6 for this scenario.

Assuming that the company continues with its present range of QoS improvement investments through 2004/05, the probable 2005/06 CML performance is likely to be 64.5. An improvement of 5.9 CML is therefore required.

The following investments will probably be required to meet this target:

Programme	Estimated investment (£m)	Estimate of benefits	
		CI	CML
Auto-sectionalisers	0.2	0.1	0.2
New generation fault passage indicators	0.4	0.0	0.1
Intermediate CBs (urban circuits)	3.7	1.9	1.1
Remote control – rural	10.1	3.9	4.5
Total YEDL	14.4	5.9	5.9

B.2 Overhead Line upgrade

YEDL's programme on network resilience and upgrading overhead lines of £36.0m is aimed at older BS 1320 overhead lines.

B.3 Resilience undergrounding

YEDL has forecast £43.5m for resilience undergrounding and does not favour under grounding solely for amenity purposes but would prefer more selective undergrounding in fringe urban areas.

B.4 Amenity undergrounding

YEDL has made no proposal for undergrounding for amenity reasons.

APPENDIX C

DNO ALTERNATIVE SCENARIO

APPENDIX C – DNO ALTERNATIVE SCENARIO

C.1 DNO Alternative Scenario

The following investments are proposed for the five years of DPCR4:

Programme	Costs (£m)	Benefit (CI)	Benefit (CML)
Arc Suppression Coils	0.8	0.1	0.1
Auto Sectionalisers	0.7	0.2	0.1
Intermediate CBs (urban circuits)	0.0	0.0	0.0
New generation of fault passage indicators	1.5	0.0	0.5
Remote control – rural	32.6	6.9	8.2
Remote control – urban	0.0	0.0	0.0
Total YEDL	**35.6**	**6.7**	**8.9**

The arc suppression coil (ASCs) initiatitive completes the programme started in 2002 according to YEDL. On completion of this programme the longest circuits, and overall sixteen per cent of the company's HV overhead lines, will be protected by this form of earthing. This programme is particularly important to reduce the number of interruptions seen by the few customers connected to the very remote ends of the network.

The company is currently installing remote control on its rural systems to cover main circuit breakers and key switching points. YEDL intends to continue this programme with the intention of covering all suitable rural circuits by 2010. This programme is designed to address customer's issues with restoration time and, to a small extent, reduces the impact of multiple interruptions and helps with storm resilience.

The other programmes in the table, auto-sectionalisers and the new generation of fault passage indicators are as described in the Ofgem quality of supply scenarios. Auto-sectionalisers are again aimed at improving the reliability to customers connected at the extreme ends of the network while the fault passage indicators will help with restoration time.

APPENDIX D

LOAD RELATED EXPENDITURE MODELLING

APPENDIX D – LOAD RELATED EXPENDITURE MODELLING

The methodology used in the modelling of the companies forecast for load related expenditure is based on 3 discreet steps:

- a review of the main investment drivers, growth in customer numbers and units distributed (GWh) over the period to be reviewed;
- a comparison of LRE outturns and projections using Modern Equivalent Asset (MEA) values of the companies total network assets and, finally,
- a benchmarking of the relative evolution of each company's LRE against the those of the rest of the companies which included a representation of relative efficiencies and provides an implicit 'Industry view' on the evolution of LRE.

These issues are further discussed below and consideration is given to the period over which the analysis was carried out. Flow charts for the process showing the derivation and combination of the MEAV/Customer and MEAV/GWh factors are included in the Appendix.

D.1.1 Stage 1: Review of growth in customer numbers and units distributed (GWh)

Load related expenditure is affected by two main drivers, customer connections and demand growth, which underpin the majority of the companies' expenditure forecast associated with the New Business and Reinforcement categories respectively. The importance of these variables on the LRE has been reflected by the companies, many of which receive regular specialist advice for forecasting main economic trends in their distribution area. These forecasts have been presented as supporting evidence for the companies' own projections. The companies have assessed the impact of the overall trends and other external factors beyond their control upon customer connections and demand growth in their elaboration of the projected LRE for DPCR4.

The first stage of the review process was therefore to examine the historical evolution of customer and demand growth and its comparison with the company expenditure projections for the next control period and to make adjustments for modelling purposes as necessary.

D.1.1.1 Analysis of demand growth

The companies were asked to submit outturns and forecasts for regulated distributed units at different voltage levels and peak demand including weather corrected (Average Cold Spell, ACS) peak system demand.

Demand growth can be used as a proxy for the overall level of economic activity, which drives new business spend, and is also an indicator of the need to reinforce the system. The data regarding energy growth is comprehensive since it is associated with the Ofgem formula set for the calculation of the regulated revenue of the companies at the start of the present control. Units distributed are generally considered to be a more robust indicator of growth than Maximum Demand.

EHV units are associated with a small number of large customers and are therefore subject to the volatility associated with the activity of a small number of users that, in turn, may have a distorting effect on the observed variability of the company total distributed units. In order to enable a more consistent comparison, the demand growth of HV/LV units only was adopted as an indicator of demand growth.

In order to form an independent view of future demand growth, a review of the comparability between units distributed and a macro-economic indicator (gross value added, GVA) was carried out for each DNO. This analysis is described fully in Appendix E.

Where trend analysis and the independent GVA based view of forecast growth both showed that DNO forecast GWh growth was either higher or lower than anticipated, then the forecast was adjusted by the minimum necessary to match either the trend analysis or the GVA based forecast.

D.1.1.2 Analysis of new customers

There are large fluctuations in reported customer numbers due largely to changes in reporting following the opening of the retail market (and introduction of Meter Point Administration Numbers in about 1998) and the improvements in customer connectivity reporting under the Information and Incentives Project (IIP) in about 2002. The net effect of these fluctuations is to cause a step increase or decrease in the total number of customers connected to the network. For modelling purposes, we consider it necessary to remove such step changes to reflect the true growth in customer numbers. Profiling the customer numbers before and after the fluctuations and shifting the pre-fluctuation profile to align with the post fluctuation profile achieved this.

Where trend analysis showed that the forecast growth in customer numbers was out of step with historic growth, customer numbers were adjusted accordingly. This was considered particularly appropriate for load related modelling since investment normally lags growth by two to three years and any change in growth in the later years of the review period should not influence the investment required in the period.

D.1.2 Stage 2: Benchmarking of LRE using MEA network values

The companies' networks are a reflection of the particular circumstances affecting their areas of supply. These circumstances include not only physical factors, such as geographical location, customer density etc., but also other effects such as company historical design policies, operating practices etc. All these have been historically been built into the existing network and amount to an average network cost per customer which is then specific to each company. As new customers are connected, it can be expected that the additional cost per new customer, over a reasonable period, should approximate to the Modern Equivalent Asset Value (MEA) of the entire network per existing customer. In so doing, the effects of load density or high location-related costs such as underground networks in congested areas are taken into account.

The proposed MEA method is also robust regarding network design policy since all companies work against a common security standard with variations in LPN and SHEPD for network reinforcement. The companies' submissions indicate that the network design does not vary significantly from the requirements embodied in the Licence Security Standard and hence network MEA provides a consistent basis for comparison of the companies.

The procedure followed in the calculation of MEA builds on the information used in the analysis of Non-Load Related expenditure. As part of the Non-Load Related submission the companies were asked to provide age profiles of all the main network assets and a cost database for all the main categories of equipment. The cost data submitted by all the companies was used to inform our own "PBP Cost Database' in order to arrive at an aggregate PES view of cost levels. Modern Equivalent Asset (MEA) value of the companies' networks was then obtained by cross-multiplying the cost database and the assets database. The results so obtained for the analyses of the LRE are therefore consistent with the figures used in the analysis of NLRE. In order to eliminate distorting variables from the analysis, Generation expenditure is removed from the analysis.

Future expenditure is therefore assessed on a cost per new customer and GWh added compared to MEAV per existing customer and GWh distributed (referred to as the 'Combined Model'); this not only assesses future expenditure compared to past expenditure on a DNO basis but it allows comparisons between companies to be made.

D.1.3 Stage 3: Inter-companies benchmarking of LRE projections

The companies forecast of LRE weighted by their relative MEA per customer as indicated above can be benchmarked among the companies using the "prevalent" industry trend. In the analysis undertaken, the prevalent industry trend has been represented by using the median figure in order to arrive at appropriate factors for all the companies. This benchmarking approach is also consistent with the method adopted in the analysis of NLRE.

The overall trend resulted in MEA value per customer below unity. This indicates than on the whole the companies expect to spend on average during the next control period below what they would have spent historically and is justified on the efficiencies already achieved and forecast into the next period. The lower than unity MEA value per customer also tends to indicate the marginal costs of extending an already mature network. These efficiencies are expected to come from procurement, design and better asset utilisation via greater use of network knowledge relating to demand distribution variations over time, plant loading and system risks. Some companies have planned on reductions in their New Business spend through the loss of a significant proportion of new connections business over the next period which has been duly accounted for in the models in respect of forecast expenditure.

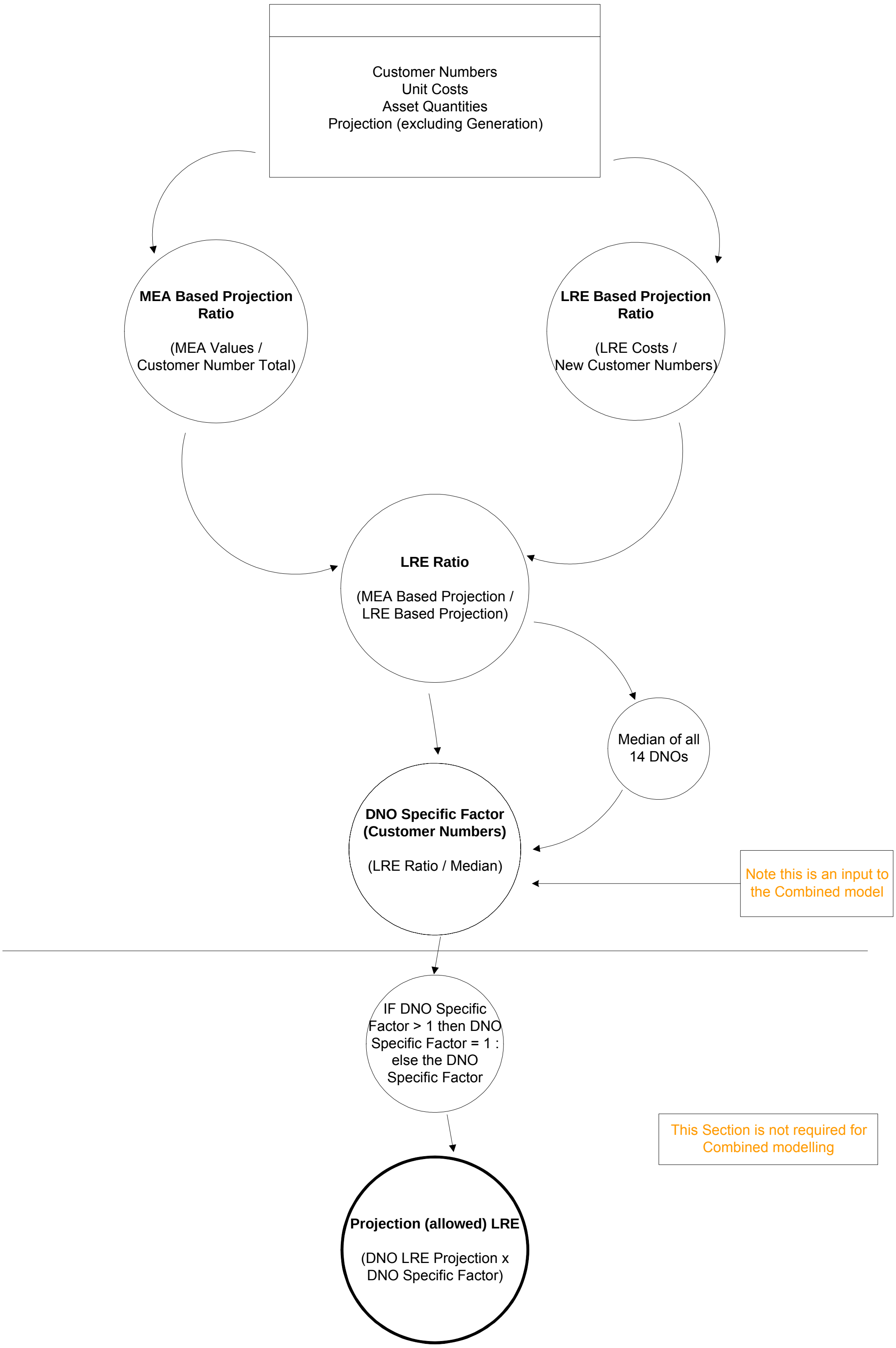
Being benchmarked on a median rather than on an average implies that extremes do not affect the adopted benchmarking position. It also means that the LRE of each company is compared relative to its cost base against the Industry Trend and not in absolute cost terms. This approach recognises therefore the historic cost of distribution within the area of influence of each company and, at the same time, requires the company to drive their costs down in accordance with the prevalent industry trend. In this respect and similarly to the case of Non-Load related expenditure PB Power's view is impartial in that it is the Industry that ultimately sets the trend by which all the companies are measured.

Period of analysis

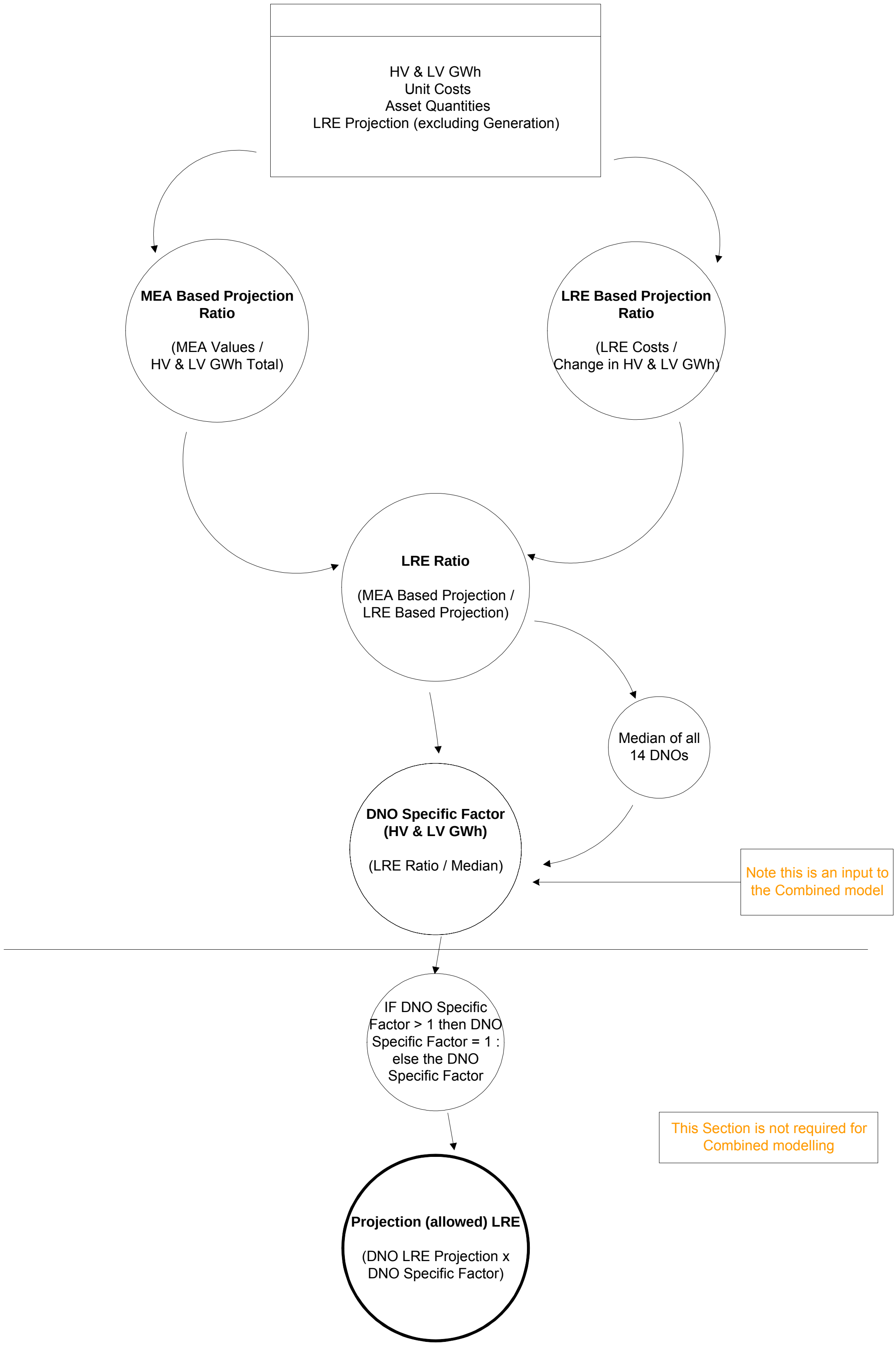
Although each DNO's network is comprised of a large number of smaller networks and that it would be expected that these would have a range of spare capacities depending on local load growth and when individual networks were last reinforced, it is possible that a larger number of the smaller networks would require reinforcement within one regulatory period and fewer in a subsequent period and hence cause a peak in expenditure in one period rather than another.

This issue can be addressed by modelling the expenditure required over a number of review periods and assessing future expenditure requirements by taking into consideration the expenditure already incurred in previous review periods. The modelling carried out in the current review therefore looked at growth and expenditure over DPCR2 and DPCR3 in addition to the forecast growth and expenditure for DPCR4.

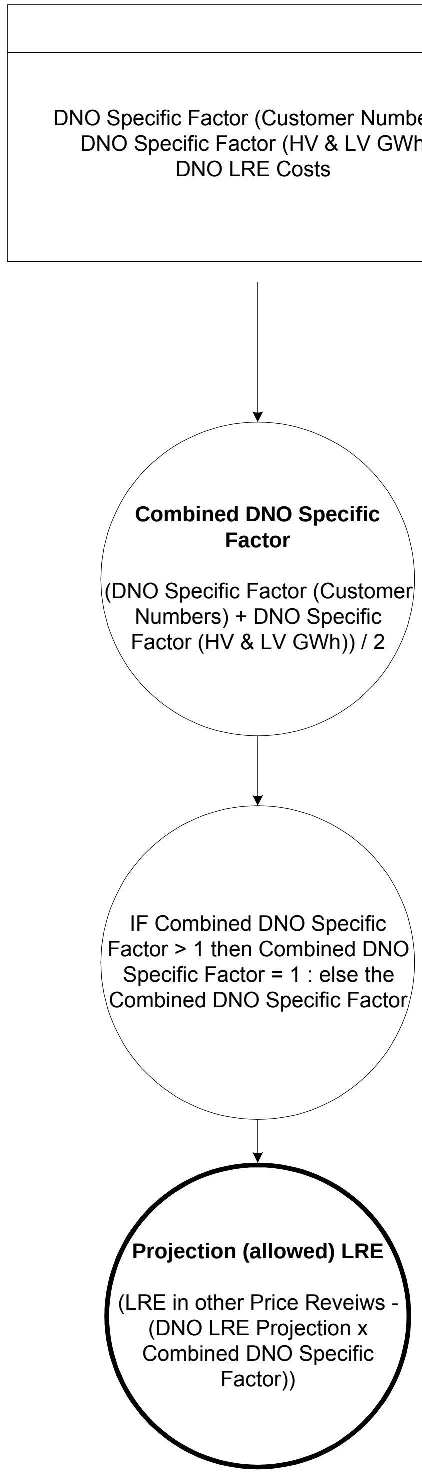
Combined Load Related Expenditure Modelling
(Phase 1A Customer Numbers)



Combined Load Related Expenditure Modelling (Phase 1B Load Forecast HV & LV GWh)



Combined Load Related Expenditure Modeling (Phase 2 Customer Numbers & Load Forecast)



APPENDIX E

DEMAND GROWTH ANALYSIS

APPENDIX E - DEMAND GROWTH ANALYSIS

E.1.1 Introduction

The purpose of the review of the load forecasts provided by the DNOs in their HBPQ and FBPQ submissions is to review the consistency of the load forecasts as a comparator for load-related modelling. Three candidate data sets for comparison purposes were provided as part of the key performance indicators (KPIs), namely customer numbers (by voltage), energy or units distributed (GWh, by voltage) and system power demand (MW). A review was subsequently made of the comparability between units distributed and a macro-economic indicator (gross value added, GVA). Only HV and LV units distributed were considered as the trend in EHV units exhibited volatility, often due to changes (reductions) in manufacturing output.

Although strictly power demand should be the direct capacity driver, energy trends are generally considered to provide a more consistent long-term indicator of load growth. System maximum power demand occurs at a single instant and may vary year on year, although maximum demand data is corrected for weather (average cold spell – ACS correction). Energy is however integrated over time and less prone to instantaneous influences. In this case a simple check was also carried out to show that the change in load factor was not a significant issue.

Customer numbers were declared by voltage level, but not by sector (domestic, commercial and industrial) and some of the DNOs stated that since the separation of distribution and supply businesses such (traditional) disaggregation of load data is no longer available to them. (A similar comment has been made by NGC in the 2002 and 2003 editions of its Seven Year Statement.) Consequently a comparison between, say, new housing starts and net increase in LV customer numbers was not possible without disproportionate effort in this instance.

Furthermore discontinuities were found in DNOs' declarations of customer numbers due to changes in reporting following the opening of the retail market (and introduction of MPAN numbers in about 1998) and the improvements in customer connectivity reporting under the Information and Incentives Project (IIP) in about 2002. These discontinuities particularly affected the calculation of net increases in customer numbers. (For analysis purposes a method of deriving a smoothed projection was subsequently derived and is described in the main text of this report.)

As GVA data was more readily available in a form that could be analysed and as units distributed were viewed as a more consistent comparator than customer numbers, the review of load forecasts was confined to a comparison of increases in units distributed with GVA.

E.1.2 Gross Value Added (GVA)

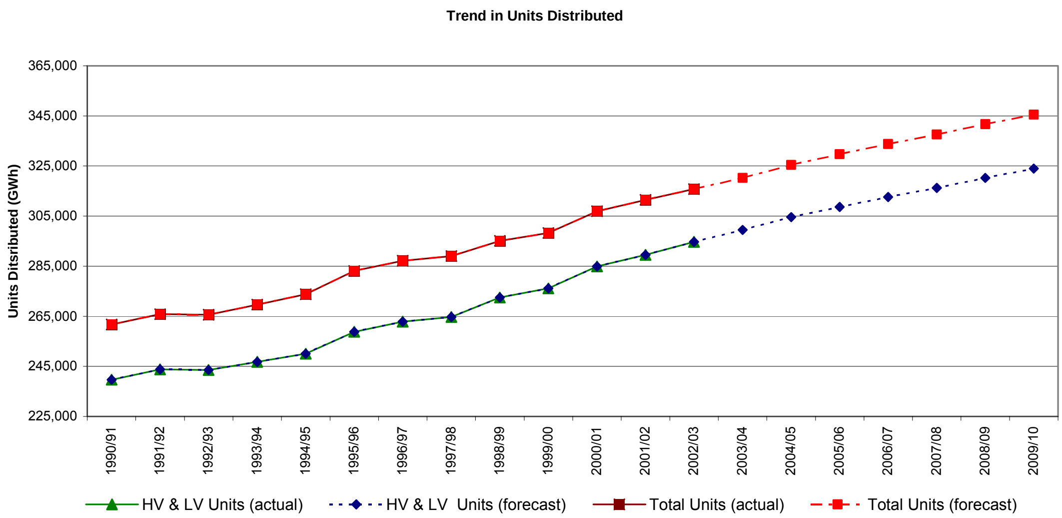
For the purposes of this review, GVA is treated as being synonymous with gross domestic product (GDP). Furthermore Regional Accounts are currently published in terms of GVA1 only. Statistics are published by geographical region in accordance with the Nomenclature of Units for Territorial Statistics (NUTS) classification. NUTS1 covers regions, NUTS2 covers sub-regions and NUTS3 covers unitary authorities or districts. At present NUTS2 data is available for the years 1995 to 2001 and NUTS3 data for 1993 to 1998 only.

In the review NUTS2 headline GVA data on a sub-regional basis was reconfigured to reflect the corresponding GVA per DNO service area. For example the NEDL area GVA was derived as comprising the North East Region and North Yorkshire (part of the Yorkshire and the Humber Region). In other instances where a more detailed disaggregation was required, NUTS3 data was used to indicate the proportioning of GVA by district (for example the disaggregation of Welsh GVA into SP Manweb and WPD South Wales distribution service areas).

As GVAs are published at current basic prices, the GVAs were brought onto a common 2002/03 price basis using the indices in the RP02 “All Items” index.

The trend of energy distributed against time is presented in the chart below

Trend of energy distributed against time



The total regulated units are HV and LV units and the total regulated units include EHV units. Up to and including 2003/03, the units distributed are actual units whereas from 2003/04 onwards these are forecast.

The average annual load growth of both total and combined HV and LV units from 2004/5 to 2009/10 is about 1.2 per cent nationally.

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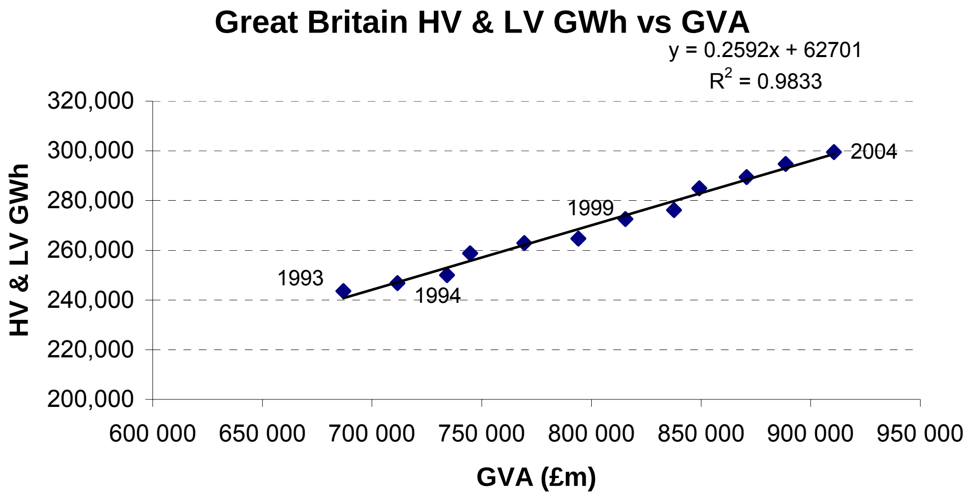
[1] Office of National Statistics: Local area and sub-regional gross domestic product, 26 April 2001, www.statistics.gov.uk

E.1.3 Historic trend of units distributed against GVA

The trend of HV and LV units distributed against GVA in Great Britain is presented in the chart below and shows a good correlation[2].



A comparison was also made between the percentage increases in units distributed (%ΔGWh) and (%ΔGVA). The national (Great Britain) average of %ΔGWh/%ΔGVA covering the years 1995/96 to 2001/02 (years of NUTS2 data availability) is about 0.7. Typical corresponding values for DNOs were calculated to be in the range of about 0.5 to 0.9.

E.1.4 GVA growth rates

Growth rates for GVA nationally for the years 2002/03 to and 2003/04 were obtained from ONS GDP statistics. By region a variety of published sources was used, including regional assemblies, regional development agencies and prominent econometric consultants.

For the years 2004/05 onwards, the HM Treasury “Forecasts for the UK Economy” dated February 20043 was used as the forecast for national growth. In a number of cases and, depending on the availability of published data, regional growth trends were estimated from the national trend but with a difference applied depending on the relative positions in 2003/2004.

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[2] To align GVA and GWh data, ONS data for 2001 was treated as corresponding to the review year 2001/02 and so on.

[3] www.hm-treasury.gov.uk/media//E7910/ACF11CB.pdf, "Forecasts for the UK Economy", February 2004.

FORECAST UK ANNUAL CHANGE IN GDP (GVA)
(%)

2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10
1.7	2.1	2.8	2.6	2.5	2.5	2.3	2.3

As might be expected the highest forecast growth rates are in London and the South East. The lowest are in the North East of England and in Scotland. The underlying driver in the forecast growth is the service industry.

E.1.5 Derivation of GVA-based load forecasts

Forecasts of GVAs up to 2009/10 for each DNO service area were obtained by applying the forecast growth rates to the 2001/02 GVA data derived from the NUTS2 sub-regional GVA data referred to earlier.

For each of the years 1995 to 2001 and for each DNO, a plot was made of HV and LV units distributed against corresponding GVA and a linear "least squares fit" regression line applied. For 12 of the DNOs a good correlation (R-squared value > 0.8) was obtained. The remaining two DNOs showed R-squared values of about 0.6 and 0.7 respectively, reflecting year-on-year variations in units distributed.

The regression formulae for GWh versus GVA were applied to the forecast GVAs in order to obtain GVA-based forecasts of units distributed for each DNO. The individual forecasts for DPCR4 were adjusted pro rata so that the overall increase nationally was equal to that forecast by the DNOs.

APPENDIX F

NON-LOAD RELATED CAPEX MODELLING

APPENDIX F – NON-LOAD RELATED CAPEX MODELLING

F.1.1 NLRE Asset Replacement Modelling for DPCR4

The NLRE that is modelled is that concerned with asset replacement and refurbishment, as charged against capital expenditure. The asset replacement modelling procedure and associated assumptions adopted for DPCR4 are described in this Appendix and are consistent with those discussed with DNOs during the course of the review. The input data used is, in the main, based on that provided by DNOs as part of the DPCR4 FBPQ process. Where PB Power has had need to supplement the DNO input data, such as the process of deriving a industry weighted average replacement profiles or use of PB Power's own replacement unit costs, then such actions have been highlighted.

F.1.1.1 Age-based replacement

A modelling technique has been employed for all switchgear, transformer, underground cable, submarine cable and overhead line asset types, with detailed variations as appropriate. This technique is equivalent to the "survivor" type analysis that formed the main input into DPCR3 non-load replacement modelling.

Fundamentally the model requires three input data items for each defined asset category, viz:

i. age profile

ii. retirement profile and

iii. unit cost.

The age profile defines the number of assets still in service and the current age of those assets.

The retirement profile represents the ages at which assets are retired from the system. These profiles are generally expressed as the fraction of assets that would be expected to be retired in each year over a given number of years of operation. For DPCR4 the retirement profiles have been based on Gaussian distributions defined according to the standard deviation and mean life of the asset types represented. As part of the modelling process we have derived industry weighted average replacement profiles for each asset type. These are normal distributions with mean asset lives obtained by weighting each DNO's expected useful life for the asset by the corresponding DNO asset population.

The unit costs are the replacement costs for items new plant and equipment on a per unit basis namely per transformer, per switchgear bay and per kilometre of underground cable. The schedule of PB Power's unit costs is presented in Appendix G.

The asset replacement calculation involves the cross-multiplication of the estimated original population of the assets of a given age with the assumed retirement fraction for assets of the same age. This process is carried out for assets of all ages such that the output of the model represents the total volume of assets to be replaced. The asset volume is then multiplied by the appropriate unit replacement cost to give an estimate of the replacement expenditure for that asset type.

Our modelling of asset replacement and refurbishment concerns non-fault replacement and refurbishment; DNOs have been required to segregate fault and non-fault expenditure and the former may be considered as operating expenditure. Discussion with DNOs has been held on the issue of overlap between assets replaced due to fault and those replaced as a consequence of other asset management drivers. Given that these areas are modelled separately it is important that the risk of double-counting is reduced. In terms of transformer replacement it has been decided that, in general, replacement of pole-mounted transformers occur mainly as a result of a fault. Therefore, no pole-mounted transformers have been included in the modelled output of (non-fault) expenditure. The majority of cable replacement tends to be undertaken due to fault. Nevertheless DNOs have classified a certain volume of cable replacement as non-fault replacement . It is this non-fault replacement activity that is considered and hence included in the modelled output

F.1.1.2 Cyclic refurbishment / replacement

We investigated the direct modelling of refurbishment and replacement of overhead lines on a cyclic basis and found that it was not sufficiently robust in volumetric terms to reflect the refurbishment activity over a five-year period (DPCR4). Instead we found that replacement profile approach using an adjusted replacement profile provided an effective modelling approach, particularly in the case of HV and 33kV overhead line assets.

For these lines, in contrast to the single replacement unit cost required for the age-based replacement expenditure projection, the ‘adjusted’ refurbishment / replacement based model requires a blended unit cost based on an weighted average industry view taking account of the proportions of activity associated with refurbishment and replacement.

F.1.1.3 Assumptions

In order to complete our modelling of asset replacement we have found it necessary to make a number of assumptions. These are outlined below:

F.1.1.3.1 Overhead lines

LV mains and services. We compared the volumes forecast by the model for the five years of DPCR4 with those in the DNO submission and found that there was little difference between the two forecasts. Accordingly our modelling has used the industry weighted replacement profiles and our unit costs.

HV and 33kV overhead lines. The replacement/refurbishment of these lines has been modelled using 'adjusted' weighted industry average replacement profiles, obtained by "back-fitting" the replacement profile in order to match the volumes forecast by the model for the five years of DPCR4 with those in the DNO submission. The back-fitting resulted in adjustments to the mean asset lives, some increasing and others decreasing. The volumes derived from these profiles have been applied to a blended unit cost based on industry refurbishment and replacement activity.

For all assets with a rated voltage of 66 kV and greater (i.e. age-based asset replacement expenditure calculation) the mean life has been assumed to be 70 years. In PB Power's view the industry weighted average calculated for these asset types was considered too low.

The 12-year mean expected asset life declared in the FBPQ submission of one DNO for a number of asset types was considered to be a misinterpretation of the FPBQ as the 12 year life reflects the cyclic refurbishment period and not the mean asset life. That particular DNO's data has therefore been excluded from the industry weighted average replacement profile calculation. The asset types affected include LV mains and services, 6.6 & 11 kV bare and covered conductor, and 33 kV single and double circuit conductor overhead lines.

F.1.1.3.2 Underground cables

In general, the approach taken by the industry with regard to cable replacement is based largely on a reactive policy of undertaking fault repairs and of replacing lengths of cable only when such cable exhibits poor condition. In order to avoid possible over-forecasting of cable replacement volumes and to reflect the non-fault replacement volumes forecast by the DNOs, we have therefore adjusted the industry weighted average replacement profile of each main cable type before proceeding with age-based modelling. In general the resulting average asset lives have been increased. At LV, Consac cable has been modelled separately from the other LV cable types (PILC and Waveform have been combined) with the Consac replacement profile based on a much shorter average asset life than other types. One particular DNO's data on expected useful asset lives of LV, HV and 33kV cables was found to be inconsistent with that of other DNOs and has been excluded from the calculation of the industry average weighted replacement profiles.

F.1.1.3.3 Submarine cable

A 50-year mean life has been assumed for all asset types. One DNO has declared a 15 year mean life. As the DNO concerned has a relatively high forecast of submarine cable replacement its data would have had a significant impact on the industry weighted average asset life. Furthermore, 15 years is not in PB Power's view considered representative of the mean expected life of this asset type.

F.1.1.3.4 Benchmarking of DNO forecasts

Benchmarking of individual DNO submissions against corresponding outputs of the asset replacement model has been undertaken. This process has enabled the forecasts of individual companies to be compared thereby providing greater transparency with regard to asset class activity and highlighting any activity that may be atypical compared with industry norm performance levels. In the benchmarking process assets have been grouped under overhead lines and services, underground cables and services and substations (transformers, switchgear and substation other) enabling the forecast expenditure for each group to be benchmarked against corresponding model output. The output for each DNO by the asset classes of lines and services, cables and services and substations has been benchmarked against a median industry performer.

The approach to benchmarking has considered the DNO submission for asset replacement to include all asset replacement irrespective of the primary classification of causation such as: health and safety, environment or non-fault replacement. Expenditure associated with ESQCR has not been considered in this assessment and instead is expected to be the subject of a separate consideration by Ofgem. Combining the various asset replacement drivers into a single element overcomes differences in allocations between individual DNOs and hence avoids unduly penalising a particular company for internal allocation issues.

Certain asset classes have been combined for each DNO prior to any benchmarking assessment. This has been undertaken where the opportunity for imprecise asset replacement definition, common elements within unit cost and or related work may exist. For instance, certain expenditure items submitted as part of the DNO submission are referenced to substations with no clear attribution to either switchgear or transformer replacement. In order to avoid the risk of unjustified scaling back of companies through lack of a clear definition a generic class of substations has been created. This particular example is defined as all expenditure allocated to switchgear, transformer and other, including protection and civil works. Similarly, overhead line replacement has been combined with overhead service replacement given the likelihood that both activities will be undertaken within the same programme of work.

Certain adjustments to individual DNO submissions to compensate for pension deficit funding, lane rentals, inter-company margin and capitalised overheads have been made by Ofgem and these adjustments are taken into account. In order to determine a disaggregated forecast of capital expenditure that reconciles back to an Ofgem 'adjusted' submission it has been necessary to calculate a ratio between the company's initial submission and the 'adjusted' submission. That ratio has been applied equally to each main asset class. These adjusted and combined generic-asset-classes form the basis from which a comparison to an equivalent asset replacement model output is drawn.

The model output is based on DNO data with regard to asset age profiles and replacement profiles from which industry average weighted replacement profiles have been derived. In that regard, the output from the model is industry-driven in terms of its input parameters. The only information that has been derived directly by PB Power has been asset replacement unit costs. A comparison of MEAVs for all 14 DNOs calculated using (new build) DNO unit costs and PB Power unit costs showed that these MEAVs were within 2 per cent of each other. A disaggregation of corresponding MEAVs by DNO in percentage terms by main asset groups and voltage levels is presented in Appendix G.

In the benchmarking process a comparison is made between the adjusted DNO submission and the corresponding model output for each of the three main asset groups:

- lines and services
- cables and services and
- substations

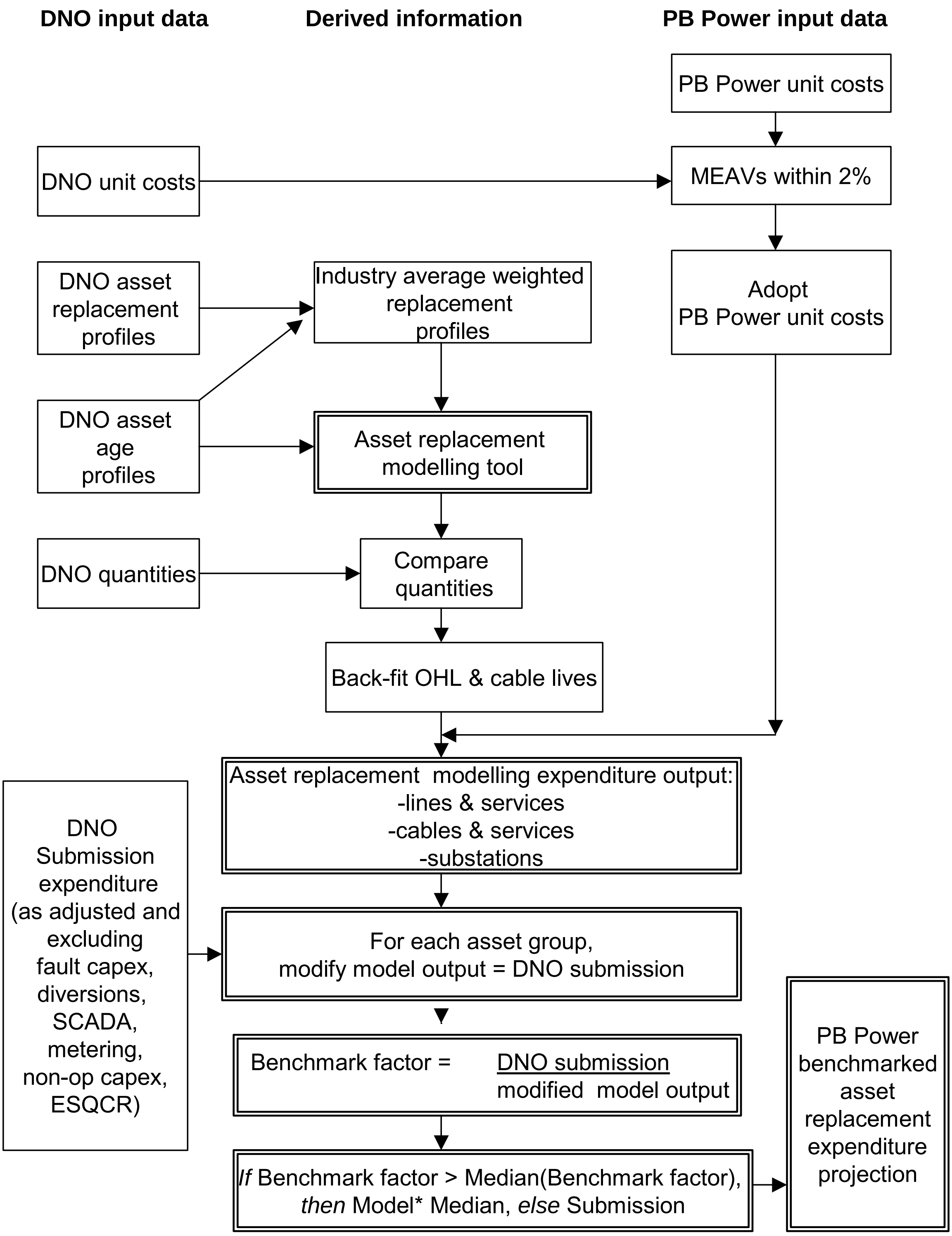
The model output is initially modified so that for each of the asset groups the overall industry (14 DNOs') expenditure predicted by the model is the same as that forecast by the DNOs. (The differences had in any case been small.) For each asset group, benchmark factors of DNO submission/model output are calculated and medians (about unity) obtained. Where the benchmark factor exceeds the median (submission exceeds model output), the resulting benchmarked output is the model output multiplied by the median. Otherwise the benchmarked output is the submission itself. Minor miscellaneous amounts not specifically included within asset groups in the FBPQ submission have been treated as pass-through with minor adjustments.

PB POWER INDUSTRY AVERAGE WEIGHTED REPLACEMENT PROFILES	MEAN LIFE (years)	STANDARD DEVIATION (years)
Overhead lines		
LV lines		
- LV mains Bare conductor	52	13
- LV mains Covered conductor	55	11
- LV services Bare conductor	51	12
- LV services Covered conductor	51	8
HV lines		
- 6.6 & 11 kV Bare conductor	45	11
- 6.6 & 11 kV Covered conductor	33	11
- 20kV Single circuit	51	11
EHV Lines		
- 33kV Single Circuit length	46	11
- 33kV Double Circuit length	69	8
- 66kV Single Circuit length - Towers	46	8
- 66kV Single Circuit length - Poles	55	8
- 66kV Double Circuit length	13	8
132kV		
- 132kV Single Circuit length	66	9
- 132kV Double Circuit length	67	12
Underground cables		
LV cables		
- LV mains (Consac)	54	14
- LV mains (PILC)	103	13
- LV mains (Plastic Waveform)	103	13
- LV services (PILC)	100	10
- LV services (Plastic Concentric)	100	10
HV cables		
- 6.6 & 11kV	85	12
- 20kV	103	16
EHV cables		
- 33kV	76	10
- 66kV	77	11
- 132kV	61	9

PB POWER INDUSTRY AVERAGE WEIGHTED REPLACEMENT PROFILES	MEAN LIFE (years)	STANDARD DEVIATION (years)
Submarine cables		
HV cables		
- 6.6 & 11kV	50	5
EHV cables		
- 33kV	50	5
- 132kV	50	6
Switchgear		
LV network		
- LV pillar	56	11
- LV Link box	90	12
HV network		
- 6.6 & 11kV switches (excluding RMU & CB)	47	8
- 6.6 & 11kV RMU	46	8
- 6.6 & 11kV CB	52	7
- 6.6 & 11kV A/RC & Sect, urban automation	42	8
EHV network		
- 33kV CB (I/D)	53	7
- 33kV CB (O/D)	52	10
- 33kV Isol (I/D)	59	8
- 33kV Isol (O/D)	53	10
- 66kV CB (GIS) (I/D)	53	10
- 66kV CB (GIS) (O/D)	50	6
- 66kV CB - other (I/D)	52	9
- 66kV CB - other (O/D)	49	7
- 66kV Isol (I/D)	55	12
- 66kV Isol (O/D)	58	10
- 132kV CB (GIS) (I/D)	56	6
- 132kV CB (GIS) (O/D)	50	8
- 132kV CB - other (I/D)	48	9
- 132kV CB - other (O/D)	49	10
- 132kV Isol (I/D)	50	7
- 132kV Isol (O/D)	48	9

PB POWER INDUSTRY AVERAGE WEIGHTED REPLACEMENT PROFILES	MEAN LIFE (years)	STANDARD DEVIATION (years)
Transformers		
HV network		
- 6.6kV PMT	55	15
- 6.6kV GMT	54	14
- 11kV PMT	56	10
- 11kV GMT	58	11
- 20kV PMT	60	9
- 20kV GMT	50	10
EHV network		
- 33kV PMT	55	12
- 33kV GMT	60	10
- 66kV	53	9
- 132kV	55	11

ASSET REPLACEMENT BENCHMARKING FLOWCHART



APPENDIX G
UNIT COSTS AND MODERN EQUIVALENT ASSET VALUE

APPENDIX G - UNIT COSTS AND MODERN EQUIVALENT ASSET VALUE

PB POWER – SCHEDULE OF UNIT COSTS

PB POWER – SCHEDULE OF UNIT COSTS		**LRE**	**NLRE**
NB. Unit costs of OHL circuit lengths include costs of supports (poles/towers), except for 66kV and 132kV replacement/refurbishment costs which exclude supports.	Unit	(new build)	(replacement/ refurbishment)
(2002/03 price levels)		(£ 000s)	(£ 000s)
Overhead lines			
LV lines			
- LV mains Bare conductor	km	25.5	25.5
- LV mains Covered conductor	km	27.5	27.5
- LV services Bare conductor	km	20.7	20.7
- LV services Covered conductor	km	23.6	23.6
HV lines			
- 6.6 & 11 kV Bare conductor	km	33.1	20.0
- 6.6 & 11 kV Covered conductor	km	43.2	26.0
- 20kV Single circuit	km	34.9	34.9
EHV Lines			
- 33kV Single Circuit length	km	38.2	38.2
- 33kV Double Circuit length	route km	60.0	60.0
- 66kV Single Circuit length - Towers	km	130.4	71.7
- 66kV Single Circuit length - Poles	km	85.1	46.8
- 66kV Double Circuit length	km	204.9	112.7
132kV			
- 132kV Single Circuit length	route km	168.4	92.6
- 132kV Double Circuit length	route km	332.8	183.1
Underground cables			
LV cables			
- LV mains (Consac)	km	58.8	58.8
- LV mains (PILC)	km	58.8	58.8
- LV mains (Plastic Waveform)	km	58.8	58.8
- LV services (PILC)	km	35.6	35.6
- LV services (Plastic Concentric)	km	35.6	35.6
HV cables			
- 6.6 & 11kV	km	88.7	88.7
- 20kV	km	127.6	127.6
EHV cables			
- 33kV	km	195.8	195.8
- 66kV	km	826.9	826.9
- 132kV	km	1,012.5	1012.5

PB POWER - DATABASE OF UNIT COSTS (continued)		LRE	NLRE
(2002/03 price levels)	Unit	(new build) (£ 000s)	(replacement/ refurbishment) (£ 000s)
Submarine cables (km)			
HV cables			
- 6.6 & 11kV	km	105.8	105.8
EHV cables			
- 33kV	km	496.1	496.1
- 132kV	km	1,277.6	1277.6
Switchgear (units)			
LV network			
- LV pillar	each	4.3	4.3
- LV Link box	each	1.1	1.1
HV network			
- 6.6 & 11kV switches (excluding RMU & CB)	each	7.3	7.3
- 6.6 & 11kV RMU	each	11.3	11.3
- 6.6 & 11kV CB	each	27.8	27.8
- 6.6 & 11kV A/RC & Sect, urban automation	each	11.0	11.0
EHV network			
- 33kV CB (I/D)	each	76.8	76.8
- 33kV CB (O/D)	each	54.0	54.0
- 33kV Isol (I/D)	each	7.6	7.6
- 33kV Isol (O/D)	each	7.6	7.6
- 66kV CB (GIS) (I/D)	each	311.7	311.7
- 66kV CB (GIS) (O/D)	each	311.7	311.7
- 66kV CB - other (I/D)	each	311.7	311.7
- 66kV CB - other (O/D)	each	311.7	311.7
- 66kV Isol (I/D)	each	8.0	8.0
- 66kV Isol (O/D)	each	8.0	8.0
- 132kV CB (GIS) (I/D)	each	1,012.5	1012.5
- 132kV CB (GIS) (O/D)	each	519.6	519.6
- 132kV CB - other (I/D)	each	519.6	519.6
- 132kV CB - other (O/D)	each	519.6	519.6
- 132kV Isol (I/D)	each	13.5	13.5
- 132kV Isol (O/D)	each	13.5	13.5

PB POWER - DATABASE OF UNIT COSTS (continued)		LRE	NLRE
(2002/03 price levels)	**Unit**	(new build) (£ 000s)	(replacement/ refurbishment) (£ 000s)
Transformers (units) - including tap changes and reactors			
HV network			
- 6.6kV PMT	each	3.0	3.0
- 6.6kV GMT	each	10.5	10.5
- 11kV PMT	each	3.0	3.0
- 11kV GMT	each	10.5	10.5
- 20kV PMT	each	3.7	3.7
- 20kV GMT	each	15.7	15.7
EHV network			
- 33kV PMT	each	4.3	4.3
- 33kV GMT	each	317.5	317.5
- 66kV	each	337.8	337.8
- 132kV	each	929.8	929.8

MODERN EQUIVALENT ASSET VALUE (MEAV)

On the following page a disaggregation of the MEAVs of the DNOs is presented, from asset quantities declared by the DNOs and from PB Power's unit costs. The total MEAV of all the 14 DNOs is calculated at some £86.6 billion.

MEA SUMMARY		Calculated using PB Power's Unit Costs					
		Trans-formers	**Switchgear**	**Overhead Line**	**Under-ground Cable**	**Services**	**Total**
1	**EHV**	52%	34%	32%	17%	0%	23%
	HV	48%	52%	53%	36%	0%	35%
	LV	0%	14%	14%	47%	100%	42%
	Total	11%	10%	23%	34%	22%	100%
2	**EHV**	63%	51%	39%	28%	0%	34%
	HV	37%	45%	45%	26%	0%	31%
	LV	0%	4%	16%	46%	100%	34%
	Total	11%	14%	19%	45%	10%	100%
3	**EHV**	60%	26%	53%	14%	0%	22%
	HV	40%	60%	36%	32%	0%	29%
	LV	0%	15%	11%	54%	100%	49%
	Total	8%	10%	15%	44%	22%	100%
4	**EHV**	54%	25%	60%	20%	0%	23%
	HV	46%	57%	25%	33%	0%	28%
	LV	0%	18%	15%	47%	100%	49%
	Total	8%	10%	12%	46%	23%	100%
5	**EHV**	54%	23%	51%	17%	0%	26%
	HV	46%	64%	35%	35%	0%	34%
	LV	0%	13%	13%	48%	100%	40%
	Total	10%	9%	20%	49%	12%	100%
6	**EHV**	56%	28%	47%	14%	0%	22%
	HV	44%	62%	40%	36%	0%	33%
	LV	0%	10%	13%	50%	100%	45%
	Total	8%	13%	18%	39%	22%	100%
7	**EHV**	51%	30%	100%	29%	0%	26%
	HV	49%	51%	0%	26%	0%	26%
	LV	0%	19%	0%	44%	100%	48%
	Total	6%	9%	0%	71%	15%	100%
8	**EHV**	55%	31%	50%	24%	0%	28%
	HV	45%	66%	41%	33%	0%	33%
	LV	0%	3%	9%	44%	100%	39%
	Total	7%	12%	18%	47%	17%	100%
9	**EHV**	62%	28%	58%	17%	0%	26%
	HV	38%	68%	33%	30%	0%	32%
	LV	0%	4%	10%	53%	100%	42%
	Total	9%	13%	13%	54%	11%	100%
10	**EHV**	62%	28%	63%	27%	0%	31%
	HV	38%	70%	32%	27%	0%	31%
	LV	0%	3%	5%	46%	100%	38%
	Total	8%	14%	14%	49%	14%	100%
11	**EHV**	54%	45%	36%	14%	0%	24%
	HV	46%	43%	55%	38%	0%	35%
	LV	0%	12%	8%	49%	100%	41%
	Total	11%	12%	21%	34%	21%	100%
12	**EHV**	51%	12%	15%	16%	0%	16%
	HV	49%	73%	68%	35%	0%	40%
	LV	0%	15%	17%	50%	100%	45%
	Total	9%	13%	12%	51%	15%	100%
13	**EHV**	47%	16%	25%	22%	0%	23%
	HV	53%	68%	65%	39%	0%	48%
	LV	0%	16%	10%	39%	100%	29%
	Total	11%	10%	33%	35%	11%	100%
14	**EHV**	56%	23%	57%	25%	0%	31%
	HV	44%	64%	29%	32%	0%	33%
	LV	0%	13%	14%	43%	100%	36%
	Total	10%	14%	19%	46%	11%	100%
All 14 DNOs	**EHV**	56%	28%	46%	21%	0%	26%
	HV	44%	61%	41%	32%	0%	33%
	LV	0%	11%	12%	47%	100%	58%
	Total	9%	12%	16%	48%	16%	100%