OFGEM

NEDL

DPCR4 – FBPQ ANALYSIS AND CAPEX PROJECTIONS

OCTOBER 2004

LIST OF REVISIONS

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			REVISION HISTORY			
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Final	28/10/04	All	Revision of model and allowance levels following DNO meetings with Ofgem and Ofgem September paper.			

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APPENDICES:

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
NEDL	Northern Electric 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 NEDL'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	**155.6**	**195.9**	195.9	**195.9**	NEDL's DPCR4 forecast is reasonably in line with historic expenditure and only small savings of £3 m reinforcement may be possible. The model indicates that NEDL's forecast is reasonable.
Customer Contributions	(109.7)	(124.5)		(124.5)	
LRE Net	**45.9**	**71.4**		**71.4**	Net load related follows trend.
Asset Replacement	171.4	187.3	158.2	182.3	NEDL's DPCR4 forecast expenditures on cables and substations are lower than the model predictions whereas for overhead lines the reverse applies. As the forecast is in line with both the DPCR3 allowance and the adjusted DPCR3 projection, we propose that the forecast be accepted less £5m for overhead lines which is some £24m higher than the model output.
Other	71.2	79.3		79.2	£79.2 m comprises diversions (£8.2 m), SCADA (£1 m), metering (£22.4 m) and fault capex (£47.6 m).
NLRE Total	**242.6**	**266.6**		**261.5**	
Non Operational	14.9	14.5		14.5	
DNO Total	**303.5**	**352.5**		**347.4**	
DNO Total				*262.9*	*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.

NEDL'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

NEDL's reinforcement forecasts include a number of identified schemes. Over-forecasting of reinforcement may be of around £3 m. This is towards the end of the DPCR4 period

Non load related expenditure

- NEDL has advised that it operates in a manner that contains network risk. The forecast does not seek to adjust that risk position.
- NEDL has forecast a low 20 kV overhead line replacement primarily due to effectiveness of past refurbishment work primarily on the 20 kV network. This is more than offset by expenditures on lines at other voltages that are higher than the model output but reflect network need.
- NEDL has not separately identified ESQCR driven expenditure.

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 report 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.

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

Load-related expenditure

The model indicates that NEDL's DPCR4 forecast is reasonable.

Non-load related expenditure

NEDL's DPCR4 forecast expenditures on cables and substations are lower than the model predictions whereas for overhead lines the reverse applies. As the forecast is in line with both the DPCR3 allowance and the adjusted DPCR3 projection, we propose that the forecast be accepted less £5m for overhead lines, which is some £24m higher than 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 load related expenditure a benchmarked comparison of the each DNO forecast with a PB Power forecast using a PB Power model based on the methodology set out in Appendix D.

c. 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.

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.

2. DNO SUBMISSIONS

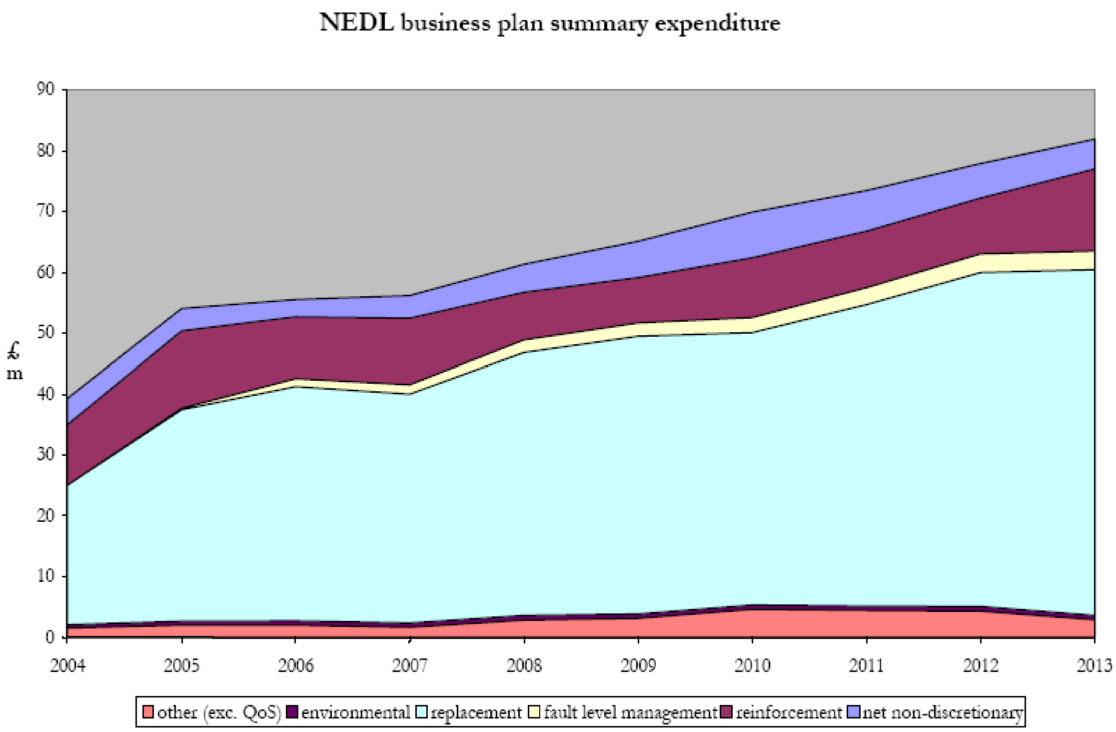
2.1 Base case

2.1.1 General

NEDL has not included provision for additional costs for pensions deficit and only those lane rentals associated with the trial scheme in Middlesbrough have been included in the forecasts. There are no adjustments to be made for profits on recharges. NEDL has incorporated identified efficiency improvements of 1% reduction in unit costs into their forecasts. NEDL has included £10.2 m of costs that are associated with aspects of the ESQCR.

The Capex Base Case submission is strictly a Base Case with no additional expenditure for ESQCR, quality of supply or resilience. In addition NEDL 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 - NEDL's Summary of Expenditure



NEDL 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 low level 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.

NEDL 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 downward adjustments are required for the DNO case and distributed generation expenditure to reflect the bases 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 revised 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	**152.0**	**155.6**	**175.5**	**0.0**	**175.5**
Non Load Related	**245.9**	**242.7**	**247.5**	**0.0**	**247.5**
Gross Capex less Non Op Capex	***397.9***	***398.3***	***423.0***	***0.0***	***423.0***
Non Op Capex (Not Assessed)	16.8	14.9	14.5	0.0	14.5
Total Gross Capex	**414.7**	**413.2**	**437.5**	**0.0**	**437.5**
Contributions	-86.0	-109.7	-120.2	9.2	-111.0
Net Load Related	**66.0**	**45.9**	**55.3**	**9.2**	**64.5**
Total Net Capex	**328.7**	**303.5**	**317.3**	**9.2**	**326.5**
Non Load Related Summary					
Replacement	213.5		150.2	0.0	150.2
ESQCR			0.0	0.0	0.0
Heath & Safety			15.9	0.0	15.9
Environment			3.0	0.0	3.0
Sub Total - Model Comparison	**213.5**	**171.4**	**169.1**	**0.0**	**169.1**
Diversions	13.4	7.8	7.5	0.0	7.5
SCADA		2.6	0.9	0.0	0.9
Sub Total	***226.9***	***181.8***	***177.5***	***0.0***	***177.5***
Metering (Not Assessed)	19.0	23.2	22.4	0.0	22.4
Sub Total	***245.9***	***205.0***	***199.9***	***0.0***	***199.9***
Fault Capex (Not Assessed)		37.6	47.6	0.0	47.6
Non Load Related Total	**245.9**	**242.7**	**247.5**	**0.0**	**247.5**

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.

NEDL's forecast includes the effect of their forecast loss of market share of the connections market and an adjustment 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.

Base case

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	1.5	0.0	18.9	0.0	0.0	**195.98**
Non Load Related		0.0	19.1	0.0	0.0	**266.6**
Gross Capex less Non Op Capex	***1.5***	***0.0***	***38.0***	***0.0***	***0.0***	**462.5**
Non Op Capex (Not Assessed)						**14.5**
Total Gross Capex	**1.5**	**0.0**	**38.0**	**0.0**	**0.0**	**477.0**
Contributions	-1.5	0.0	-11.9	0.0	0.0	-124.5
Net Load Related	**0.0**	**0.0**	**6.9**	**0.0**	**0.0**	**71.4**
Total Net Capex	**0.0**	**0.0**	**26.1**	**0.0**	**0.0**	**352.5**
Non Load Related Summary						
Replacement		0.0	16.2	0.0	0.0	166.4
ESQCR		0.0	0.0	0.0	0.0	-
Heath & Safety		0.0	1.7	0.0	0.0	17.6
Environment		0.0	0.3	0.0	0.0	3.3
Sub Total - Model Comparison		**0.0**	**18.2**	**0.0**	**0.0**	**187.3**
Diversions		0.0	0.8	0.0	0.0	8.3
SCADA		0.0	0.1	0.0	0.0	1.0
Sub Total		***0.0***	***19.1***	***0.0***	***0.0***	***196.6***
Metering (Not Assessed)		0.0	0.0	0.0	0.0	22.4
Sub Total		***0.0***	***19.1***	***0.0***	***0.0***	***219.0***
Fault Capex (Not Assessed)		0.0	0.0	0.0	0.0	47.6
Non Load Related Total		**0.0**	**19.1**	**0.0**	**0.0**	**266.6**
Total Adjustments	**1.5**	**0.0**	**38.0**	**0.0**	**0.0**	**39.5**

2.1.2 Load related Capex

Load Related Expenditure has been above the levels in the DPCR3 allowance in line with NEDL's original forecasts.

There are no dramatic shifts in investment for distributor-funded spend; the chart shows a nine- to ten-year cycle of modest amplitude against a gently falling trend over these ten years.

2.1.2.1 Network reinforcement

NEDL's forecast DPCR4 of load related network reinforcement of £55.3 m is around £10 m higher than the DPCR3 projection. Reinforcement spend can be expected to be cyclical to a degree, since capacity is released in discrete blocks.

NEDL has produced its demand forecasts on the basis rates of load growth and increase in customer numbers. We have reviewed these assumptions and find that the forecast increase in customer numbers of 1% per annum is higher than the historic rate of 0.6% per annum. The demand growth in units however is considered to be low compared with government forecasts of Gross Value Added (GVA) growth for the region.

However 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 NEDL's Long Term Development Statements. The investments proposed by NEDL maintains the network compliant with P2/5 standards and NEDL 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 NEDL's long term modelling, explained by the effects of the overlap with replacement and lower levels of churn than are implied by the model.

NEDL reinforcement expenditure is based on individual schemes for projects at 33 kV and higher voltages for the first three years of DPCR4 and on investment trends for the subsequent years and for reinforcement at 11 kV and below. Reinforcement is higher in the first three years of the plan due to the timing of major schemes and investment is forecast to fall to historic levels in years 4 and 5 of DPCR4.

Some large projects (Scarborough Grid and Melrosegate 132/33 kV, Blythe 66/11 kV and Harrogate 33/11 kV) create a peak in 2006 with a corresponding decline towards the end of the DPCR4 period.

Primary reinforcement is forecast to fall from around £5 m pa to around £2 m pa over DPCR4.

HV/LV reinforcement falls from around £5 m pa to around £4 m pa over DPCR4.

NEDL has reviewed its approach to switchgear overstressing in the context of ESQCR and requires investing £1 m per year as sufficiency of equipment is now an absolute requirement under regulation 3 (1). This is a prudent investment and lines up with industry practice of not operating switchgear outside equipment ratings. However it is not specifically identified as ESQCR expenditure.

The reinforcement forecast reflects NEDL's current view of the balance between identified issues and general allowances and NEDL recognizes that there may be scope to re-profile the reinforcement expenditure. This may give scope for a lower load related projection of around £3 m lower than NEDL's forecast particularly as there are no identified major projects after 2007. (Compare with the YEDL forecast which is based on identified projects over the five year period of DPCR4).

2.1.2.2 New connections forecast expenditure

NEDL has based its forecasts on 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. We consider the forecast to be in line with historic trends.

2.1.2.3 Comments and issues associated with the load related expenditure forecast

a. We have reviewed NEDL's assumptions of growth in load and customers and find that the forecast increase in customer numbers of 1% per annum is higher than the historic rate of 0.6% per annum. The demand growth in units however is considered to be low compared with 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.

b. The forecast of new connections are considered to be reasonable and in line with historic trends.

c. NEDL's forecast of reinforcement expenditure is based on identified major schemes for the first three years of the plan and continuing trend after that for major schemes and run rates for the 11 kV reinforcement forecast. NEDL recognizes that there may be scope to re-profile the reinforcement expenditure and in the event that no further major schemes are identified towards the end of DPCR4 reinforcement expenditure may be some £3 m lower than forecast.

2.1.3 Non-load related Capex

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

Asset replacement of £151 m has been strictly limited to that required to maintain network performance in the Base Case and generally aligns with about 80% of NEDL's non-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 96 years but this falls to 38 years after taking into consderation the long life cable and service assets which are not yet being replaced in large numbers. It is also noted that modelling covers all NLRE except diversions and environment, that is, 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 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 NEDL.

OHL replacement rises from £12 m pa to £22 m p.a., spread across all voltage levels. This level of investment reflects extensive refurbishment, rather than full replacement and there is a significant mismatch between the volumes forecast from bottom up risk assessment and NEDL's modelling which is higher than forecast.

Cable replacement rises from £2 m pa to £3.5 m pa these modest levels reflect the poor cost/benefit of cable replacement, particularly at LV, due to difficulties in targeting spend effectively and lower level of expenditure on asset replacement.

HV/LV substation replacement rises from around £6 m pa to around £8 m pa, driven by the initiation of an indoor substation replacement programme and is a reasonable forecast.

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

There are also safety related programmes of £16 m not directly related to electrical asset renewal that are driven entirely by risk assessment rather than age. 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 £3 m has been included and appears to be reasonably justified.

NEDL has a relatively low level of wayleave terminations and associated compensation and diversions of £7.5 m which reflects its strong stance towards termination notices and historic rates of expenditure. NEDL includes £0.6 m per year of easements in reinforcement expenditure.

2.1.3.1 Comments and issues associated with the non-load related expenditure forecast

a. NEDL’s non load related investment programme shows only a relatively modest increase on DPCR3. NEDL 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 HV overhead lines where reported age does not reflect the line strengthening work carried out in the 1990s. However this is offset by additional work on higher voltage lines.

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

c. Overall the forecast of replacement expenditure is therefore considered to be reasonable bearing in mind the comments above the allowance is some £5m below forecast for overhead line work.

d. NEDL’s DNO case includes £23 m as the first stage to improving the primary network to support the 20 kV network by reducing 20 kV circuit length which will impact on numbers of customers affected by faults on the 20 kV network. NEDL prefers this option to further replacement work as this may be required to meet changes in multiple interruption standards.

2.1.4 Major schemes submitted

NEDL has submitted scheme papers for 3 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 3 projects submitted are:

- Norton GSP asset replacement;
- Security of supply to Whitby;
- Quality and continuity of supply in the Wooler area of North Northumberland.

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 2.3 - 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
NEDL	74.1	62.3	77.3	70.9	75.9	67.6	73.7	63.7	102%	105%

NEDL has proposed a modest programme for improvement in quality of supply of some £11.5 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

On network resilience and upgrading overhead lines NEDL's 20 kV network is already built to a reasonable specification and the cost would be of the order of £160 m overall for a 20 year programme. In response to this particular scenario, NEDL has proposed the rebuilding of 1450 km of HV light duty line at an estimated cost of £43.5 m up to year 2010.

NEDL have indicated a preference to provide more primary substation infrastructure (see DNO alternative) as noted earlier.

2.2.3 Resilience undergrounding

NEDL forecasts £45 m for undergrounding but would favour selective under grounding in fringe urban areas.

2.2.4 Amenity undergrounding

NEDL would need to invest £900 m to under ground all circuits in National Parks and AONBs

2.2.5 Comments and issues associated with the quality of supply scenarios

2.3 DNO alternative scenario

2.3.1 Comments on DNO alternative scenario

The DNO scenario includes £19.8 m on quality of supply improvements 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.

NEDL has large rural and semi rural areas which are supplied from 66/11 kV substations on long 20 kV circuits which are reliable but of such length that downstream customers experience unacceptable multiple interruptions outside current industry norms. NEDL has looked at the implications of tightened standards on multiple interruptions and would not be able to meet these standards with the present network. The solution favoured by NEDL in the DNO case is to provide an additional 36 single transformer 66/20 kV 5 MVA substations (mainly) at a cost of around £80 m of which £23 m would be in DPCR4. This would also improve network resilience.

3. PB POWER MODELLING AND COMPARISONS

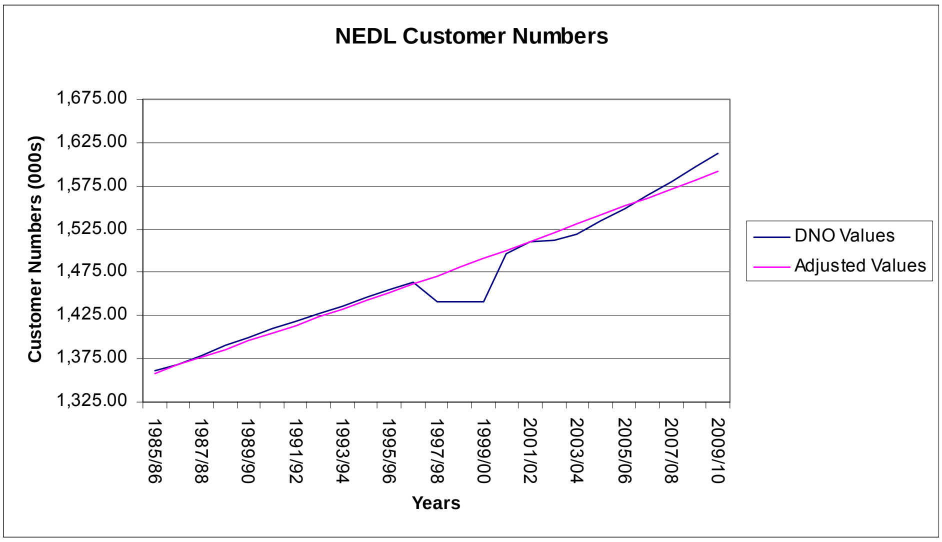
3.1 Introduction

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, E and F and the following sections discuss the validation and adjustment of the input variables and the model outputs.

3.2 Load related expenditure

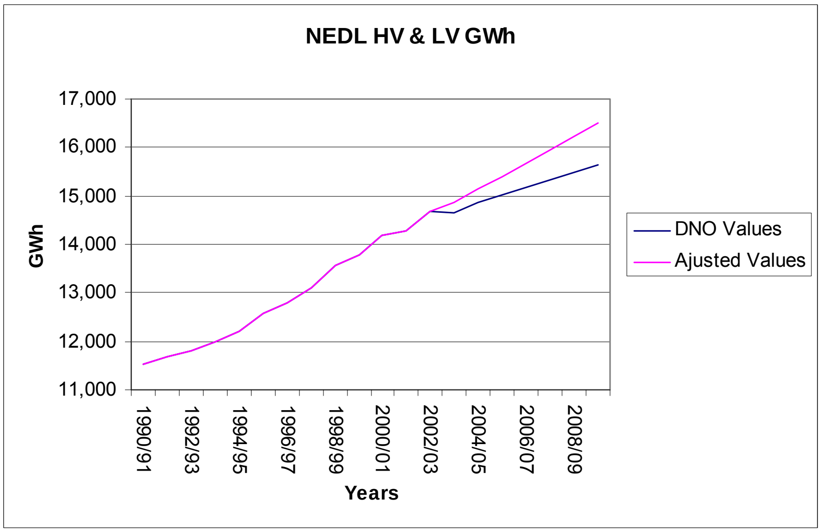
3.2.1 Model inputs

There are fluctuations in NEDL's customer numbers between 1997/98 and 2000/01. To remove these, an average growth of 0.66% has been applied working back from 2002/03. The average growth has been calculated from 1986/87 to 1996/97. The forecast growth from 2003/04 is also significantly higher than the historic rate. With this is mind the forecast growth has been reduced accordingly.



The GVA analysis indicated that NEDL GWh forecast was low. To adjust this forecast linear regression analysis has been carried out on the historic data; the resulting equation is shown below. This equation has been applied to the forecast values.

$$y = 274.38x + 11015$$



CE Electric supplied their submission net of 3rd party connection costs. After discussions with the DNO the load related expenditure was increased as stated earlier.

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
(£m)	(£m)	(£m)	(£m)
167	156	196	**196**

3.2.3 Load related expenditure modelling comments

The model tends to indicate that NEDL's DPCR4 forecast is reasonable. Nevertheless Section 2.1.2.3 indicated that reinforcement expenditure may be some £3 m lower than forecast due to the timing of schemes and the lack of identified reinforcement schemes in the final two years of the forecast although this is within the accuracy of the modelling.

3.3 Non-load related expenditure

3.3.1 Model inputs

No specific model input adjustments were made for NEDL.

With minor exceptions, 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- Comparison of NLRE Model Outputs with DNO Submission (£m)

Submission	FBPQ Table 26	Adjusted submission	Combined	Adjusted submission	Model output	Bench-marked output	PB Power Opinion
Lines	62.1	67.7	Lines & services	73.6	44.2	47.6	
Cables	14.6	15.9	Cables & services	17.7	42.9	17.7	
Transformers	17.4	19.0	Substations	93.0	125.4	93.0	
Switchgear	40.9	44.6	Part Submission Total	184.3	212.6	158.2	
Services and Lines	7.1	7.7					
SMC	0.0	0.0					
Other Substations	27.0	29.4					
Other Not Modeled	0.0	0.0	Other Not Modeled	0.0		0.0	
Total	169.1	184.3	Total	184.3		158.2	182.3

3.3.3 Non load related expenditure modelling comments

The model has predicted higher expenditures for cables and services and for substations than NEDL's forecast. Hence we would propose that NEDL's forecast for these items be accepted. However for overhead lines the model predicts lower expenditure for overhead lines. NEDL's forecast is lower than the model output for 11 kV and 20 kV lines but this is more than offset by expenditure on lines of other voltages where risk assessment has indicated a network need for refurbishment. A contributing factor is that NEDL's unit costs for both replacing and refurbishing HV lines are higher than the unit cost used in our model. The difference between the submitted value for cables and services compared to that modelled is atypical of the industry-level variance. In that regard, the targetting of investment by the company may well be focused more on lines and services replacement. Therefore, by constraining the level of investment to the benchmarked output this may unduly penalise the company. In addition, given that the benchmarked output of the model would be lower than the DPCR3 allowance, the adjusted DPCR3 projection and the adjusted NEDL DPCR4 forecast, we propose that the forecast be accepted less £5m for overheads lines.

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	**155.6**	**195.9**	**195.9**	**195.9**
Non Load Related	**242.7**	**266.6**		**261.5**
Gross Capex less Non Op Capex	**398.3**	**462.5**		**457.4**
Non Op Capex (Not Assessed)	14.9	**14.5**		14.5
Total Gross Capex	**413.2**	**477.0**		**471.9**
Contributions	-109.7	-124.5		-124.5
Net Load Related	**45.9**	**71.4**		**71.4**
Total Net Capex	**303.5**	**352.5**		**347.4**
Non Load Related Summary				
Replacement		166.4		
ESQCR		-		
Heath & Safety		17.6		
Environment		3.3		
Sub Total - Model Comparison	**171.4**	**187.3**	**158.2**	**182.3**
Diversions	7.8	8.3		8.2
SCADA	2.6	1.0		1.0
Sub Total	***181.8***	***196.6***		***191.5***
Metering (Not Assessed)	23.2	22.4		22.4
Sub Total	**205.7**	***219.0***		**213.9**
Fault Capex (Not Assessed)	37.6	47.6		47.6
Non Load Related Total	**242.7**	**266.6**		**261.5**

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	35.1	33.3	31.8	33.7	36.1	170
Capital Contributions	(22.0)	(24.2)	(21.9)	(21.8)	(23.8)	(113.7)
Non Load Related	43.6	52.8	46.4	43.3	46.3	232.4
Non-operational capex	1.1	3.0	3.4	3.2	4.2	**14.9**
Total Capital Expenditure	57.8	64.9	59.7	58.4	62.8	303.6

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	37.8	36.2	36.9	33.9	33.4	178.2
Capital Contributions	(24.0)	(24.5)	(24.6)	(24.8)	(24.8)	(122.7)
Non Load Related	45.3	47.8	47.3	52.4	54.7	247.5
Non-operational capex	3.0	2.7	3.4	3.0	2.4	14.5
Total Capital Expenditure	62.1	62.2	62.8	64.5	65.7	317.3

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

NEDL's forecast includes the effect of their forecast loss of market share of the connections market and £2.6 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.

NEDL 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) below. The schedules represent the DNO case and adjustments of £42.8m are required for the DNO case and distributed generation expenditure in order to reflect the bases case.

Table A.3 - NEDL's Business Plan Investment Programme

UK Distribution **2004 Investment Plan 3. NEDL Level 2 10 yr (PRIME)**

NEDL GROSS COSTS - Outturn Prices	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
Expenditure											
Connections											
Total Demand Connections Expenditure	27114	26631	26420	27107	27791	28493	29211	29942	30690	31454	284854
Total Generation Connections Expenditure	0	3712	5568	9280	12992	18560	24128	21434	16563	12666	124903
Total Diversions Expenditure	7293	7475	5508	5646	5787	5932	6080	6232	6388	6548	62889
Total Connections and Diversions Expenditure	***34407***	***37818***	***37496***	***42033***	***46571***	***52984***	***59419***	***57609***	***53641***	***50668***	***472645***
Income											**0**
Total Demand Connections Income	(24945)	(25300)	(26420)	(27107)	(27791)	(28493)	(29211)	(29942)	(30690)	(31454)	(281353)
Generation Income	0	(2970)	(4360)	(7234)	(10108)	(14372)	(18448)	(16598)	(12785)	(9776)	(96651)
Total Diversions Income	(5146)	(5831)	(3856)	(3952)	(4051)	(4152)	(4256)	(4362)	(4472)	(4583)	(44661)
Total Income	(30091)	(34100)	(34636)	(38293)	(41950)	(47017)	(51915)	(50903)	(47946)	(45813)	(422665)
NET NON DISCRETIONARY CAPEX	**4316**	**3718**	**2860**	**3740**	**4620**	**5968**	**7504**	**6706**	**5694**	**4854**	**49981**
DISCRETIONARY CAPEX											**0**
Replacement of Failed Assets	8816	8946	9077	9209	9352	9486	9621	9767	9914	10063	94251
Meter Recertification	3186	3375	3598	3661	3774	3856	3580	3270	3559	3288	35147
New Meters	1498	1449	1381	1320	1287	1190	1303	1290	1337	1135	13189
Replacement of CNDB / NMS and TMS	286	490	80	80	25	2250	275	275	25	25	3811
System Improvement											0
Reinforcement load related grid	424	2343	697	1533	1582	1792	3042	3091	2346	5077	21927
Reinforcement load related primary	4258	5875	5056	4428	2308	1783	2857	2187	2794	4227	35775
Reinforcement load related 11kv	2465	4373	3849	4014	3185	3231	3277	3326	3377	3104	34199
Fault level management	0	234	1222	1480	1992	2108	2377	2656	2942	2986	17998
Asset replacement grid ss	3103	2772	2744	3683	4567	3198	1790	2839	7262	8658	40615
Asset replacement primary ss	5579	7998	9871	5838	5541	5907	5052	7807	5607	7803	67004
Asset replacement distribution ss	2386	4803	4871	4944	6698	6825	6994	7147	8784	7161	60615
Asset replacement cables	1110	1781	2747	2444	2853	3209	3775	4247	5349	6248	33763
Asset replacement overhead lines	7188	10467	12234	14966	17395	19943	21151	21327	21673	21120	167465
Asset replacement services	1331	2004	1929	1958	1987	2015	2045	2075	1753	1461	18560
Legal	256	260	264	268	272	276	280	284	288	292	2740
Quality of supply	5795	5307	7841	7923	7883	7841	12863	13059	12910	12987	94410
Efficiency	110	124	110	113	2	231	33	37	4	4	768
Operator safety	836	846	859	872	1887	2080	3399	3246	3136	1869	19030
Environmental	402	408	414	420	427	433	439	446	452	459	4299
Major system risk	331	336	341	0	0	0	0	0	0	0	1008
TOTAL SYSTEM IMPROVEMENT	*35575*	*49931*	*55047*	*54885*	*58580*	*60874*	*69372*	*73774*	*78679*	*83458*	*620174*
TOTAL OPERATIONAL SYSTEM CAPEX PRIME	**53677**	**67909**	**72043**	**72896**	**77638**	**83623**	**91655**	**95080**	**99209**	**102823**	**816553**
SI ON - COST	8675	8607	8651	8832	9053	9269	9483	9816	10092	10093	92569
TOTAL NET OPERATIONAL SYSTEM CAPEX	**62351**	**76516**	**80694**	**81728**	**86691**	**92893**	**101138**	**104896**	**109301**	**112916**	**909122**
TOTAL OPERATIONAL CAPEX (DISC + NON DISCRETIONARY)	92442	106904	109762	110741	115650	121349	128924	134363	140684	146063	1206884
ADD CAP INTEREST	1641	2020	2199	2269	2476	2745	2873	2961	3035	3035	25254
ADD NON OP CAPEX	7538	2091	1326	1899	2370	2236	2739	2217	2249	2249	26914
TOTAL CAPEX	**101621**	**111015**	**113287**	**114909**	**120496**	**126330**	**134536**	**139541**	**145968**	**151347**	**1259052**

Projections of future load related Capex

NEDL'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	13.8	11.7	12.1	9.1	8.6
New Connections	24.0	24.5	24.8	24.8	24.8
LRE Total Gross	**37.8**	**36.2**	**36.9**	**33.9**	**33.4**
Customer Contributions	(24.0)	(24.5)	(24.8)	(24.8)	(24.8)
LRE Total Net	**13.8**	**11.7**	**12.1**	**9.1**	**8.6**

Network reinforcement

NEDL has provided information on major network reinforcements to relieve overloaded substations at 33 kV and above and provided information on major projects planned for the first three years of the plan.

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

	2005	**2006**	**2007**
	£k	**£k**	**£k**
Knaresborough – establish 132 kV connection	50		
Melrosegate – install third 132/33 kV transformer, GT3	653	659	
Malton – install 132 kV switchgear for third circuit			518
Scarborough grid – replace 132/33 kV transformers	1088		
Sheriff Hutton – convert to single switch 132/11 kV			1009

These are supplemented by a higher-level provision rising from £1.5 m to £3 m, influenced by long-range modelling.

Primary reinforcement falls from around £5 m pa to around £2 m pa.

HV/LV reinforcement falls from around £5 m pa to around £4 m pa.

This approach reflects NEDL's current view of the balance between identified issues and general activty. NEDL recognizes that there may be scope to re-profile the reinforcement expenditure. This may give scope for a lower load related allowance particularly as there are no identified major projects after 2007. (Compare with the YEDL forecast which is based on greater number of identified projects over the five year period of DPCR4).

However, the front loading of specific projects does provide increased certainty that deliverey will occuir in this review period and not slip to DPCR5. NEDL adopts a method of long range load related forecasting based on a model of generic transformer configurations. The model assumes growth rates at a substation level of 1.7% and produces long term reinforcement profiles. NEDL has provided a report[1] on the reconciliation of the model with the bottom up risk assessed programme and the planned expenditure over the ten year period to 2013 is within 87% to 94% of the model. The model does not reflect the reinforcement investment due to overstressed switchgear. NEDL has benchmarked its reinforcement expenditure as 0.2% of MEA per annum compared with the 0.7% of MEA pa implied in the DPCR3 allowance but is satisfied that the residual risk is acceptable and that the network meets P2/5 security standards.

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 NEDL 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	26.0	28.8	28.5	32.8	35.0	**151.1**
Metering	4.6	4.5	4.5	4.4	4.4	**22.4**
Faults	9.8	9.6	9.5	9.4	9.3	**47.6**
Diversions	1.5	1.5	1.5	1.5	1.5	**7.5**
Health and Safety	2.8	2.8	2.7	3.7	3.9	**15.9**
Environmental	0.6	0.6	0.6	0.6	0.6	**3.0**
Total	**45.3**	**47.8**	**47.3**	**52.4**	**54.7**	**247.5**

This report does not consider capitalised fault expenditure and metering.

NEDL's non-load related investment is based on risk assessment for major projects and over 40 programmes of work on other assets.

[1] NEDL System Strategy Report – Load Driven Reinforcement Expenditure

Asset replacement

NEDL's non load related replacement programme of £151 m has been strictly limited to that required to maintain network performance in the Base Case.

NEDL generally refurbishes an asset rather than replace it whenever that course of action will yield a lower NPV of costs, ie 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.

NEDL has produced a report[2] 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 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.

NEDL argues that the balance is made up by asset replacement included in expenditure classified as load related expenditure. NEDL measures residual risk by service life extension which for DPCR4 initially increases by a maximum of two years before falling back. Service life extension is a measure of the 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 96 years but this falls to 38 years after removing long life cables and services assets.

It is also noted that modelling covers all NLRE with the exception of diversions and environment, ie 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 and this is being adopted.

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.

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

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[2] NEDL System Strategy Report - Age based asset replacement expenditure

Major 132 kV replacement

The key 132 kV replacement projects identified in the plan are:

Table A.8 - 132 kV Replacement Projects

	2005	2006	2007
	£k	£k	£k
Barrack Road – replace 132/33 kV transformers, GT1 & GT2		879	
Chirton Grange – replace 132/33 kV transformers, GT1 & GT2		879	
Coalburns site refurbishment (transformer and switchgear)	1632	550	
Potter House – replace 132/66 kV and 66/20 kV transformers, GT1, GT2, T1 & T3			2018
Seal Sands – replace 132/66 kV transformers, GT1 & GT2	723		
Spennymoor - replace 132 kV Switchgear	1305	659	
Norton - replace SCADA & VFI			1278

These projects are supplemented by a general programme that reduces from £4.5 m to £3 m. This general activity forecast is influenced by long-range modelling.

NEDL has explained in detail the issues related to replacement of equipment on seven sites and there are no conflicts in coordinating replacement with NGC.

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

Overhead Lines

OHL replacement rises from £12 m pa to £22 m pa, spread across the voltage levels: this level of investment reflects extensive refurbishment, rather than full replacement.

Table A.9 - Overhead Line Replacement Programme
NEDL average refurbishment/replacement rate in km per year (2004 – 2013)

Voltage	LV	HV	33/66 kV	132 kV
Refurbishment (km/yr)	10.7	80.8	50.3	29.0
Rebuild (km/yr)	45.3	180.9	5.6	3.2
Total Asset Renewal (km/yr)	56.0	251.3	55.6	32.2
Assumptions	Rebuild work anticipated to include approximately 18% replacement with underground cable as part of Rebuild 'off line'.	Rebuild work will typically include 87% 'on line' and 13% 'off line'.	Approximately 10% of total asset renewal assumed to be rebuild 'on line' only. No major 33/66 kV rebuild 'off line' anticipated in next ten years.	Approximately 10% of total asset renewal assumed to be rebuild 'on line' only. No major 132 kV rebuild 'off line' anticipated in next ten years

The largest mismatch between NEDL's model and 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. For example much of the NEDL 11/20 kV line network has been refurbished by replacing crossarms with 2 m crossarms whilst retaining conductors including 5500 m of cad copper 0.017 sq mm^3 strand conductor (1500 m remain in YEDL). The poles are also generally old but rotten poles have been replaced. In practice NEDL considers that there is not the same level of work required as predicted by the model. NEDL and YEDL gave details of their line refurbishment programme at the HBPQ stage and in the context of their risk profile to retain cad copper conductor the plan appears fit for purpose. It is noted that during the recent ice storm affecting 56000 customers (mainly N Yorks Moors), failures were mainly cad copper conductors and poles generally did not fail. This was the first time that the new arrangements for GOS payments had been applied and NEDL performed satisfactorily in the context of these arrangements. This may be a reasonable benchmark for resilience and it would be useful to compare with other companies which were set as a benchmark companies on previous storm events.

NEDL has included for significant refurbishment of low voltage lines and lines above 20 kV in its forecast again based on condition based risk assessment.

Underground cables

Cable replacement rises from £2 m pa to £3.5 m pa. These modest levels reflect the poor cost/benefit of cable replacement, particularly at LV, due to difficulties in targeting spend effectively and hence the lower level of expenditure on asset replacement.

There is some risk in the Capex cable replacement programme proposed by NEDL as they plan to manage the Consac cable problem reactively and this leads to pressure on operating costs. Other DNOs appear to have included much larger sums for pro-active replacement of Consac cables.

11 kV Substation equipment

HV/LV substation replacement rises from around £6 m pa to around £8 m pa, driven by the initiation of an indoor substation replacement programme.

NEDL has provided details of long term plans to replace oil based switchgear based on condition assessment.

Services

The programme includes £11 m of service replacement including £8 m for replacement of fused neutrals under ESQCR regulations in addition to other service replacements.

ESQCR Non load related investment

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

- safety enhancements arising from substation risk assessments: £720 k pa;
- safety enhancements arising from OHL risk assessments: £360 k pa;
- replacing VIR surface wiring (eaves mains): £350 k pa;
- replacing fused neutral cut-outs: £610 k pa.

In addition some £3 m 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. ESQCR expenditure does not include additional expenditure on overhead line clearances which requires more detailed risk assessment. NEDL has not separately qunatified this expenditure as ESQCR and in that regard it is all captured by non-load replacment expenditure.

Health and safety

There are also programmes of work not directly related to electrical asset renewal for network performance reasons but which are driven entirely by risk assessment. 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 £16 m 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 NEDL's risk assessment and investment appraisal process. No action has been taken by us to review that process in detail. However, as part of this exercise it has been necessary to understand the objectives and approach taken by NEDL.

NEDL 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.

Environment

Environmental expenditure of around £3 m is required for the following and appears to be reasonably justified.

- To deal with risks as found from Asbestos;To monitor fluid filled cables;For further bunding of transformers to mitigate oil leaks; andTo reduce transformer noise and for enhanced tests & remedial work.

Diversions

NEDL has a relatively low level of way leave terminations and associated compensation and diversions of £7.5 m which reflects its strong stance towards termination notices and historic rates of expenditure. NEDL includes £0.6 m 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, NEDL is required to reduce the number of unplanned Customer Interruptions (CI) by 2% and unplanned Customer Minutes Lost (CML) by 5% 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 67.7 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	0.2	0.2	0.1
Intermediate CBs (urban circuits)	1.5	1.2	0.7
New generation of fault passage indicators	0.9	0.0	0.5
Remote control – rural	6.5	2.5	4.6
Remote control – urban	2.6	1.0	1.2
Total NEDL	11.7	4.9	7.1

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 they need to invest in that area.

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

B.1.1 Description of investments 2005 to 2010

a. 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.

b. 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.

c. Fault passage indicators (FPIs) - the latest generation of pole-mounted FPIs include a communications device that signals to a central controller that a fault is beyond the device. For the long circuits that are characteristic of NEDL's rural distribution system, the company expects that such devices will be particularly effective in reducing the time it takes to locate faults.

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

e. Remote control - urban - this is a continuation of the present programme of equipping selected ground-mounted ring switches with remote control. This work is targeted towards those circuits that have a higher than normal fault risk and a large number of connected customers.

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

The proposed CI target for 2010 will improve from 75.9 to 74.4 under this scenario.

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 74.6. This is so close to the proposed target that only minimal investment will be needed to achieve it.

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

This scenario requires the company to achieve a CML performance of 64.2 by 2010. To meet this it is likely that the following investments will be required:

	Estimated investment (£m)	Estimate of benefits	
		CI	CML
Auto-sectionalisers	0.5	0.3	0.2
Intermediate CBs (urban circuits)	2.6	1.6	1.0
New generation of fault passage indicators	1.3	0.0	0.6
Remote control - rural	8.6	2.8	5.0
Remote control - urban	10.3	2.3	2.8
Triggered spark gaps	3.8	0.8	1.0
Total NEDL	27.1	7.8	10.6

NEDL has indicated that as performance targets are tightened so it becomes increasingly difficult and more expensive to achieve them. They have also stated that although urban customers are generally satisfied with their level of service the fact that urban performance makes up such a large part of the company's overall performance that the company appears incentivised to invest in this area in order to meet the company's overall targets.

The CML target for this scenario of 64.2 is only slightly less onerous than the 2020 target of 62.7 required in the Ofgem 2020 quality case scenario. As a consequence, the investment programme required to achieve this scenario is a slightly scaled down version of that given for the 2020 case.

The company has stated that this scenario has virtually exhausted all of the technology-based investment methods of improving performance. In that regard it is of the view that to move further will require the introduction of more fundamental changes to the distribution system. NEDL has considered that techniques such as the introduction of additional high-reliability sources, either new primary infeeds or firm busbars, and/or the rebuilding of overhead lines to more robust designs, possibly using insulated conductors, may be required. This by necessity is a long-term plan given the time needed to deliver any meaningful system change.

Each of these initiatives is described in more detail in our response to QoS improvement 1.

Note that all of the proposed investments involve the use of complex devices operating in a harsh environment. A higher than normal operating cost of this equipment is reflected in the appropriate table.

B.2 Overhead line upgrade

On network resilience and upgrading overhead lines NEDL's 20 kV network is already built to a reasonable specification and the cost would be of the order of £160 m overall for a 20 year programme. In response to this particular scenario, NEDL has proposed the rebuilding of 1450 km of HV light duty line at an estimated cost of £43.5 m up to year 2010.

NEDL has indicated that it would prefer to provide more primary substation infrastructure to address the objectives of this scenario. This approach is addressed in Appendix C.

B.3 Resilience undergrounding

NEDL forecasts £45 m for undergrounding but would favour selective under grounding in fringe urban areas.

B.4 Undergrounding overhead lines in national parks and areas of outstanding natural beauty (AONBs)

Over one third of the land in NEDL's distribution services area is either in a national park or an AONB. As a consequence the company has a high proportion of its overhead lines in such areas. Circuit lengths are:

Park	Circuit length (km)				
	132 kV	66 kV	33 kV	HV	LV
Northumberland coast AONB				106	31
Northumberland NP			14	337	98
Durham & Yorkshire Dales AONB & NP		2		1225	356
North York Moors NP & AONB		50		1142	331
Total NEDL	0	52	14	2810	816

NEDL has taken the view that the undergrounding exercise would require the whole system in the parks/AONBs to be either ground-mounted or underground, rather than not just the overhead lines. This is a very high-cost exercise.

The estimated cost of undergrounding these is just over £900 m. In simple terms, to support this level of investment. Use of system charges for all NEDL DUoS customers would have to double. NEDL expects this to be well above the level of investment that local customers would be willing to pay for.

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	1.6	0.4	0.3
Intermediate CBs (urban circuits)	0.0	0.0	0. 0
New generation of fault passage indicators	1.6	0 .0	0.6
Remote control – rural	11.7	2.9	5.3
Remote control – urban	0.0	0.0	0.0
Triggered spark gaps	3.8	0.7	1.0
20 kV primary infrastructure	23.0	0.0	0.0
Total NEDL	**42.8**	**4.2**	**7.4**

This programme is similar to that proposed for the central Ofgem QoS improvement scenario, but is more focused on rural customers. Thus, enhancements to urban circuits have been removed, with greater focus on the overhead system. NEDL's preferred scenario delivers slightly less on overall CI (4.2 against 4.9) and slightly more on overall CML (7.4 against 7.1), at significantly higher cost (£19.8 m against £11.7 m).

The arc suppression coils (ASCs) are the final eight installation that will complete the programme started in 1997. On completion of this programme 90 per cent of the company's HV overhead lines will be protected by this form of earthing. Note that the remaining ten per cent of overhead lines are spread over many, predominantly underground, primary systems. The company has advised that it is neither economic nor practical to convert these remaining systems to ASC earthing.

The company is currently installing remote control on its rural systems to cover main circuit breakers and key switching points. This programme is designed to address customer's issues with restoration time and, to a small extent reduce the impact of multiple interruptions and improve storm resilience.

The other programmes, auto-sectionalisers, new generation of fault passage indicators and triggered spark gaps are commented upon earlier.

Programme Details: 20 kV infrastructure

NEDL has an extensive rural 20 kV distribution system.

While the 20 kV system provides an extended circuit length, the lack of primary sources does lead to a poorer reliability for the customers when compared with similar areas supplied from 11 kV.

The rural remote control programme is currently addressing most of the large differences in headline performance. However, the complexities of operating and protecting the very long circuits that are characteristic of the present 20 kV system will always leave a significant difference for the customers supplied from it. In addition, although remote control does close the performance gap on CI and CML, it does nothing to improve the short interruption performance of the 20 kV network. The company has indicated that a status quo policy would result in performance for this customer group being three to four times worse than that seen on 11 kV networks. The company is fully aware of these issues and is committed to closing the performance gap between the two systems.

NEDL has already started a programme to improve the resilience of the sparse 20 kV network by introducing additional primary substations and remote busbars with duplicate 20 kV circuits. The company proposes to continue this programme during DPCR4. In total, a further 36 primaries or firm busbars will be required to improve the 20 kV system's performance to that of an equivalent 11 kV one for a total estimated investment of £80 m. This is a major undertaking and when considering that most of the required work will be in or adjacent to national parks and AONBs then timescales will be protracted. Investment will be initially slow while planning permissions, easements, land acquisition issues are cleared. It will then accelerate as main plant and circuits are installed and commissioned.

To achieve this goal, investments of £23 m are proposed in DPCR4. NEDL currently anticipates a further £57 m will be required over the subsequent five to ten years (dependent on the level of success with planning, wayleaves etc and funding). Note that this only includes for a small proportion of the required new EHV and HV circuits to be underground. Should planning and wayleave consents for new overhead lines not be forthcoming then costs, and timescales, could rise substantially.

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 DNO 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.

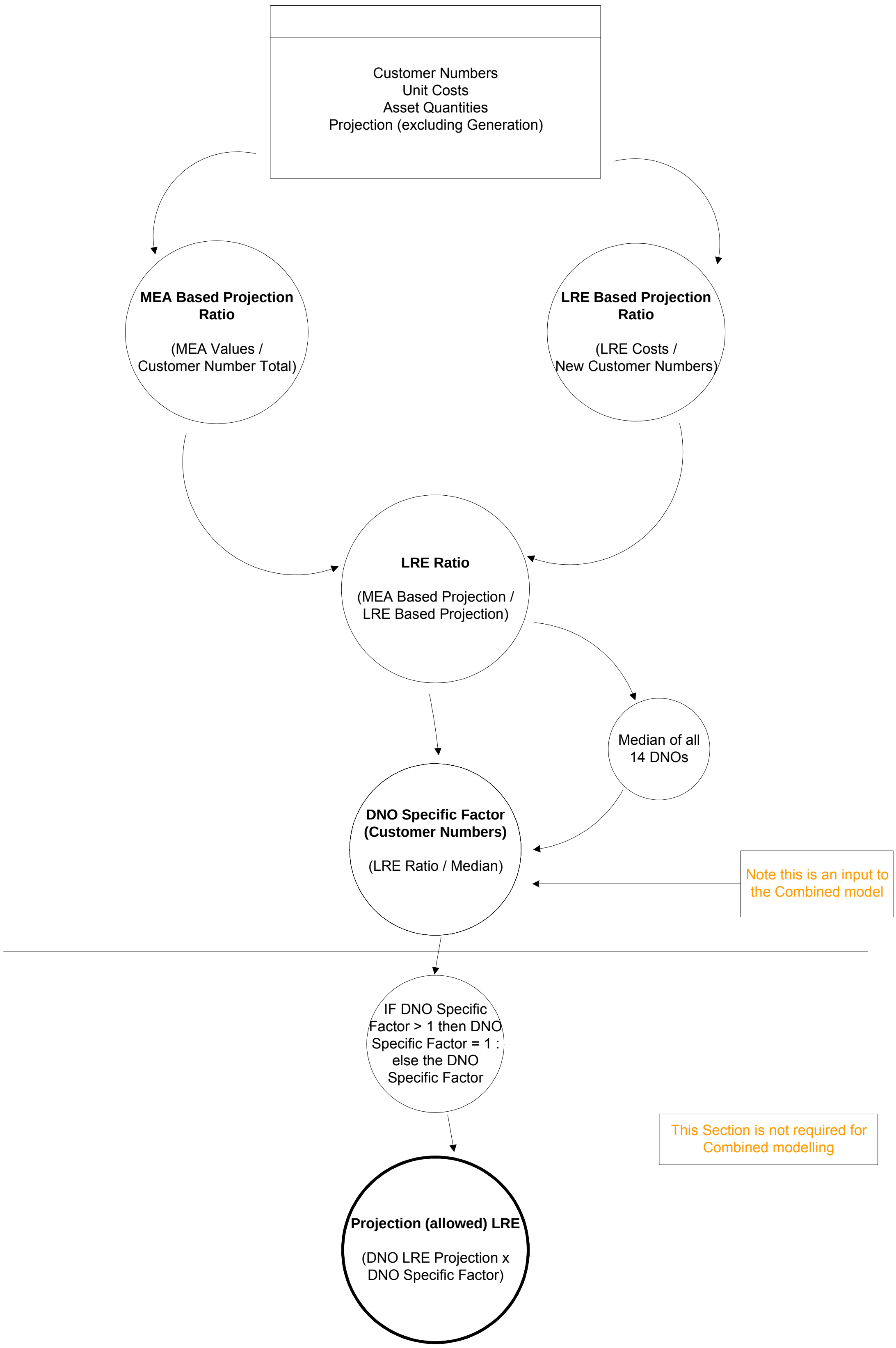
Being benchmarked on a median rather than on an average implies that extremes do not affect the adopted benchmarking position. It also means that the LRE of each company is compared relative to its cost base against the Industry Trend and not in absolute cost terms. This approach recognises therefore 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

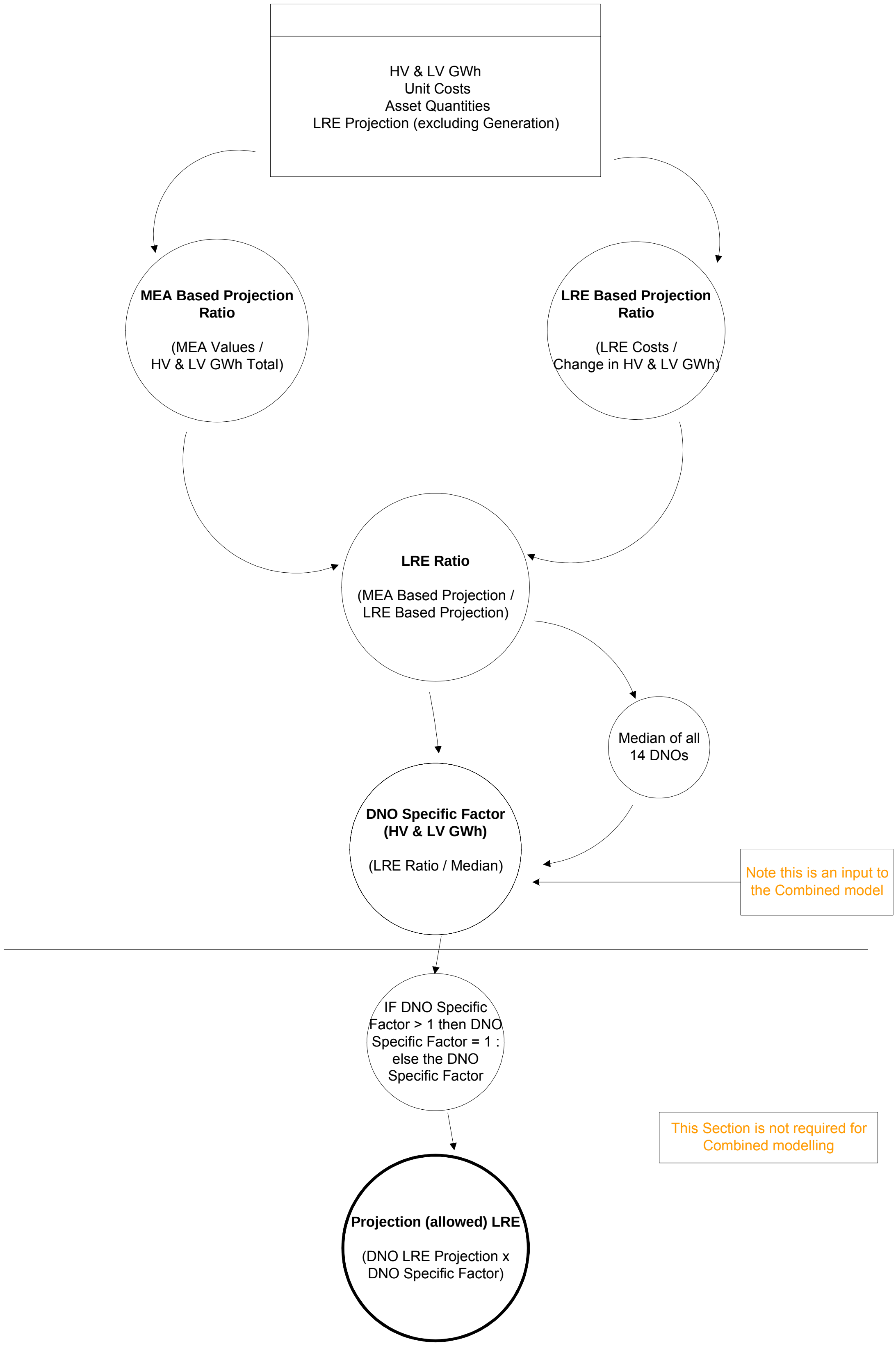
Although each DNO's network is comprised of a large number of smaller networks and that it would be expected that these would have a range of spare capacities depending on local load growth and when individual networks were last reinforced, it is possible that a larger number of the smaller networks 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.

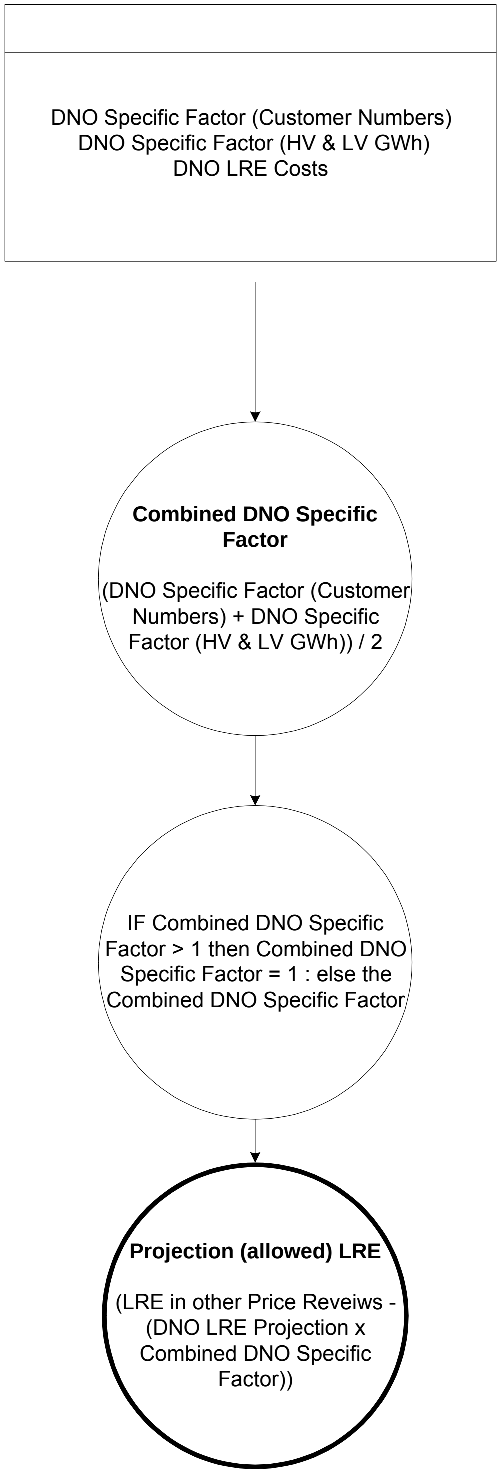
Combined Load Related Expenditure Modelling (Phase 1A Customer Numbers)



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)

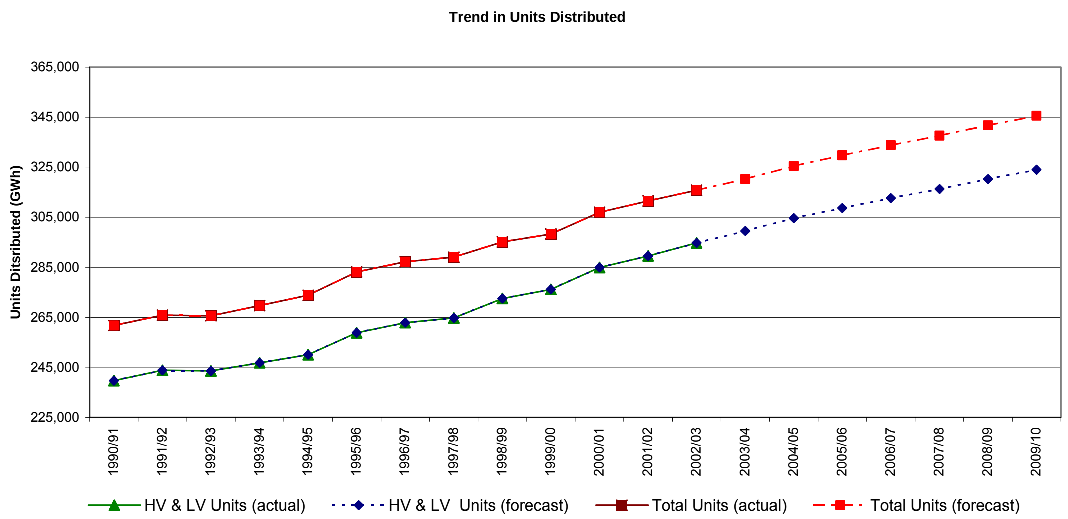
For the purposes of this review, GVA is treated as being synonymous with gross domestic product (GDP). Furthermore Regional Accounts are currently published in terms of GVA[1] only. Statistics are published by geographical region in accordance with the Nomenclature of Units for Territorial Statistics (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.



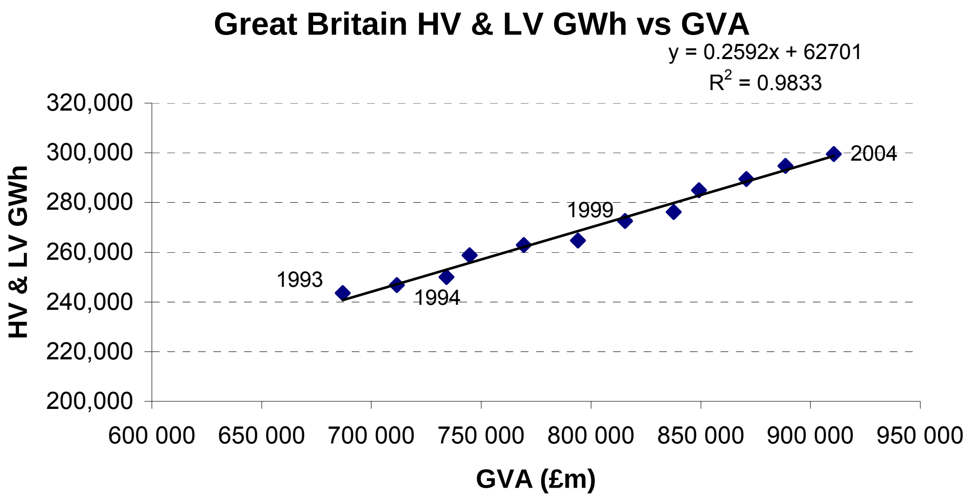
The total regulated units are HV and LV units and the total regulated units include EHV units. Up to and including 2003/03, the units distributed are actual units whereas from 2003/04 onwards these are forecast.

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

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.

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 2004[3] 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:

a. age profile;

b. retirement profile and;

c. 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 33 kV 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 33 kV 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 (ie 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 33 kV 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.

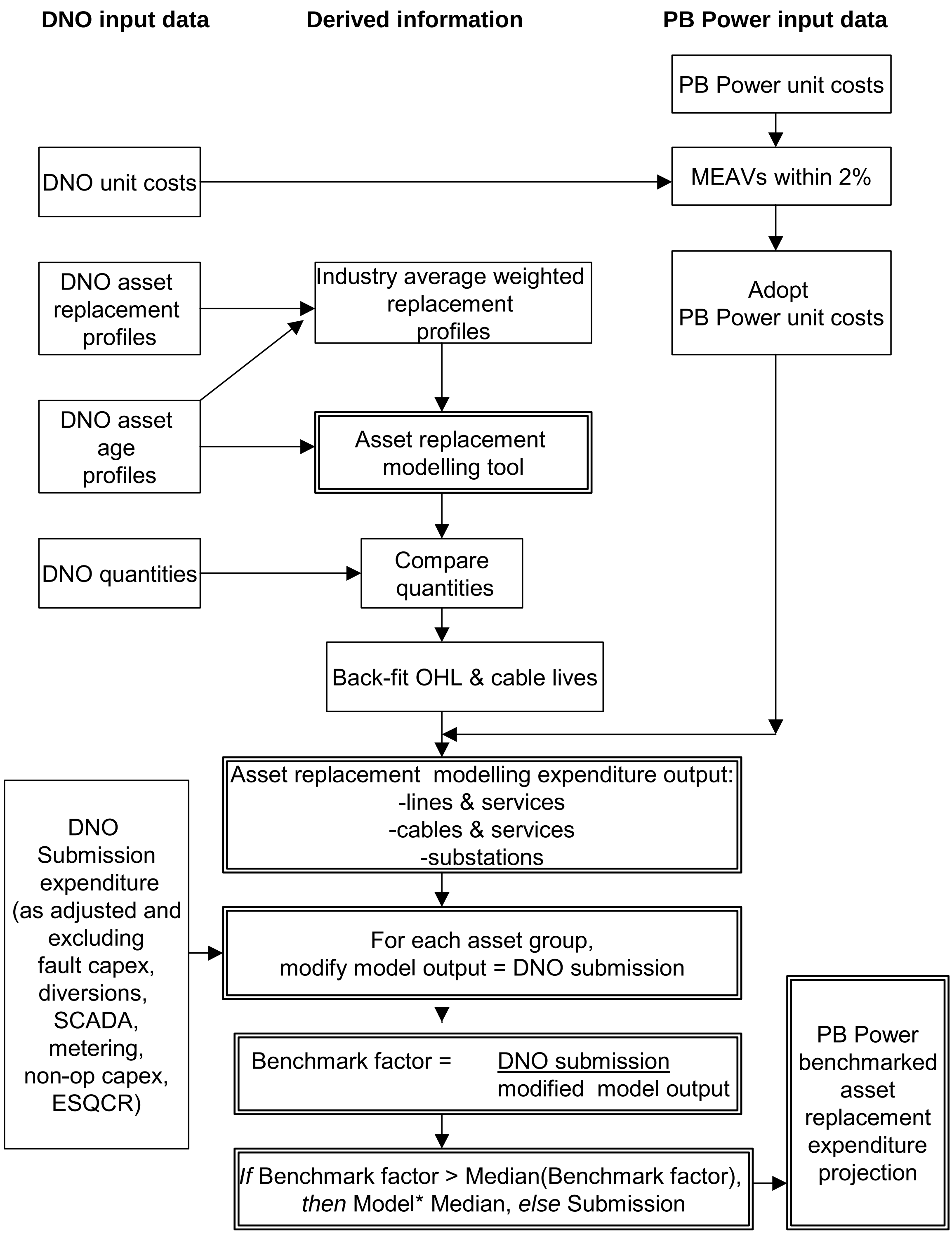
The model output is initially modified so that for each of the asset groups the overall industry (14 DNOs') expenditure predicted by the model is the same as that forecast by the DNOs. (The differences had in any case been small.) For each asset group, benchmark factors of DNO submission/model output 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		
- 33 kV Single Circuit length	46	11
- 33 kV Double Circuit length	69	8
- 66 kV Single Circuit length - Towers	46	8
- 66 kV Single Circuit length - Poles	55	8
- 66 kV Double Circuit length	13	8
132 kV		
- 132 kV Single Circuit length	66	9
- 132 kV 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 & 11 kV	85	12
- 20 kV	103	16
EHV cables		
- 33 kV	76	10
- 66 kV	77	11
- 132 kV	61	9

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

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

ASSET REPLACEMENT BENCHMARKING FLOWCHART



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 66 kV and 132 kV 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
- 20 kV Single circuit	km	34.9	34.9
EHV Lines			
- 33 kV Single Circuit length	km	38.2	38.2
- 33 kV Double Circuit length	route km	60.0	60.0
- 66 kV Single Circuit length - Towers	km	130.4	71.7
- 66 kV Single Circuit length - Poles	km	85.1	46.8
- 66 kV Double Circuit length	km	204.9	112.7
132 kV			
- 132 kV Single Circuit length	route km	168.4	92.6
- 132 kV 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 & 11 kV	km	88.7	88.7
- 20 kV	km	127.6	127.6
EHV cables			
- 33 kV	km	195.8	195.8
- 66 kV	km	826.9	826.9
- 132 kV	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 & 11 kV	km	105.8	105.8
EHV cables			
- 33 kV	km	496.1	496.1
- 132 kV	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 & 11 kV switches (excluding RMU & CB)	each	7.3	7.3
- 6.6 & 11 kV RMU	each	11.3	11.3
- 6.6 & 11 kV CB	each	27.8	27.8
- 6.6 & 11 kV A/RC & Sect, urban automation	each	11.0	11.0
EHV network			
- 33 kV CB (I/D)	each	76.8	76.8
- 33 kV CB (O/D)	each	54.0	54.0
- 33 kV Isol (I/D)	each	7.6	7.6
- 33 kV Isol (O/D)	each	7.6	7.6
- 66 kV CB (GIS) (I/D)	each	311.7	311.7
- 66 kV CB (GIS) (O/D)	each	311.7	311.7
- 66 kV CB - other (I/D)	each	311.7	311.7
- 66 kV CB - other (O/D)	each	311.7	311.7
- 66 kV Isol (I/D)	each	8.0	8.0
- 66 kV Isol (O/D)	each	8.0	8.0
- 132 kV CB (GIS) (I/D)	each	1,012.5	1012.5
- 132 kV CB (GIS) (O/D)	each	519.6	519.6
- 132 kV CB - other (I/D)	each	519.6	519.6
- 132 kV CB - other (O/D)	each	519.6	519.6
- 132 kV Isol (I/D)	each	13.5	13.5
- 132 kV 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			
- 6.6 kV PMT	each	3.0	3.0
- 6.6 kV GMT	each	10.5	10.5
- 11 kV PMT	each	3.0	3.0
- 11 kV GMT	each	10.5	10.5
- 20 kV PMT	each	3.7	3.7
- 20 kV GMT	each	15.7	15.7
EHV network			
- 33 kV PMT	each	4.3	4.3
- 33 kV GMT	each	317.5	317.5
- 66 kV	each	337.8	337.8
- 132 kV	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					
		Transformers	**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%