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DPCR4 – FBPQ ANALYSIS AND CAPEX PROJECTIONS

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LIST OF REVISIONS

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			REVISION HISTORY			
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Final	23/06/04	All	Adjustment following submission of final capital expenditure numbers.			
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Final	24/11/04	All	Revision of text referring to transfer of expenditure from Base Case to DNO Alternative Case and status of medium and high risk scenarios.			
Final	8/12/04	All	Revisions to text following receipt of EDF's comments dated 29 November 2004.			

CONTENTS

LIST OF ABBREVIATIONS

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
NAMP	Network Asset Management Plan
OHL	Overhead line
PB	Parsons Brinckerhoff
QoS	Quality of supply (reliability/interruption performance)
SSAP	Standard accountancy practice

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 as well as adjustments to the DPCR3 Projection and corrections to the DPCR4 forecast submitted by EDF at the end of October 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 EDF(LPN)'s DPCR3 adjusted projection, adjusted DPCR4 forecast , PB Power's modelling results and 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	230.0	356.3	343.9	272.0	Although the model indicates only a small reduction on EDF(LPN)'s forecast, we nevertheless consider that the forecast is based on insufficient scheme support and unjustified provisions. We therefore propose a level of expenditure similar to the expenditure in the current period.
Customer Contributions	(178.6)	(169.6)		(169.6)	
LRE Net	**51.4**	**186.7**		**102.4**	
Asset Replacement	207.4	436.7	294.6	294.6	The model projects lower expenditures for cables and switchgear than EDF(LPN)'s forecast. Nevertheless, the model includes some £105m of EHV cable replacement expenditure.
Other	108.1	121.0		121.0	£121.0m comprises SCADA (£1.1m), metering (£56.9m) and fault capex (£63m).
NLRE Total	**315.5**	**557.8**		**415.7**	
Non Operational	13.2	38.9		38.9	
DNO Total	**380.0**	**783.4**		**557.0**	
DNO Total				*398.2*	*As Ofgem Sep 04 paper, excl. meters, faults, non operational and ESQCR compliance*

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.

Adjustments have been made to the EDF(LPN) forecast in respect of gross market LRE expenditure, capitalised overhead and inter-company margin.

Our principal findings are summarised below.

Load related expenditure

A review of expenditure proposals shows that several of the proposed projects are not at all well defined and that there will be an opportunity for optimisation in terms of scope, phasing and utilisation of existing sites. In some cases, provision is simply made for unidentified schemes. The 11kV development proposals would appear to be based as much on performance improvement objectives as security of supply. EDF subsequently transferred expenditure associated with this from Base Case to DNO Alternative Case.

Non-load related expenditure

Substation asset replacement

Assessment against industry norms for EDF (LPN) shows significantly reduced expenditure below the LPN forecast in the substation replacement category.

Environment, health & safety

A significant increase in fluid filled cable replacement is proposed whereas the programme modelled in the Higher Risk Scenario would allow the high priority circuits to be addressed immediately and a be more manageable programme to be put in place for the future. EDF have stated that the high risk plan was a method of testing whether a continuation of DPCR3 investment levels was tenable. Cable replacement is included in the asset replacement modelling. However Ofgem is considering the requirement for replacing fluid filled cables as a specific financing issue.

We would also make the following general comments:

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

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

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

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

Ofgem scenario/sensitivity

- LPN networks are largely compliant with the 2020 targets and additional investment over and above that required to maintain current performance is not required.

DNO alternative case

- The DNO Alternative Scenario and the Base Case Submission are the same with the exception of performance improvement expenditure and the comments above on the Base Case Submission are equally applicable to the DNO Alternative Case. . EDF subsequently transferred the expenditure associated with some of the performance improvement expenditure from the base case to the DNO Alternative Scenario.

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

PB POWER VIEW ON LOAD RELATED AND NON LOAD RELATED EXPENDITURE ALLOWANCES

Load related expenditure

Although the model indicates only a small reduction on EDF(LPN)'s forecast, we nevertheless consider there will be opportunity for rescoping, optimising and deferring expending during DPCR4.. We therefore propose a level of gross expenditure lower than the forecast but significantly higher than expenditure in the current period.

Non-load related expenditure

The model projects lower expenditures for cables and switchgear than EDF(LPN)'s forecast. Nevertheless the model includes some £105m of EHV cable replacement.

Conclusion

The above considerations would indicate that a total capital expenditure, net of customer contribution, of £557m would be appropriate.

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 data learned in the 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.

In essence, 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 forecasts to give a bottom up view of the assumptions, risk assessments and justifications put forward by DNOs for their Base Case forecast, and at a high level review of the Ofgem and DNO scenarios.

b. For the Base Case load related expenditure a benchmarked comparison of the DNO forecast with a PB Power model and across all DNOs using a 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, inter-company margins and lane rentals. Where appropriate the load-related expenditure, as submitted has been grossed up to take the cost of all connections into account including where these may have been provided by third parties.

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

Adjustments to DPCR4 forecast

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

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

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

2. DNO SUBMISSIONS

2.1 Base case

EDF(LPN)'s approach to forecasting the Capex projections has been to define the DNO Alternative Case in the first instance and then to omit performance improvement expenditure from this to derive the Base Case. This is a different approach to the majority of the DNO's and it results in minimal difference between the DNO Alternative Case and the Base Case.

Although EDF(LPN)'s approach has been to comply with the request that the Base Case should maintain the current level of network performance/faults until 2020, the basis of the DNO Alternative Case and by its nature, the Base Case, is a broad based risk management approach and both longer term network risks and business risks have been addressed:

i. to reduce the current level of network risk associated with the number of substations that are currently operating above their firm capacity therefore requiring load transfers under fault conditions; and

ii. to reduce the risks associated with managing asset replacement in the future assuming that this need will materialise in accordance with EDF(LPN)'s current replacement age profiling expectations.

It is implicit in EDF(LPN)'s approach that they do not consider that either the level of network reinforcement proposed, or the level of asset replacement expenditure proposed over the next 2 regulatory periods would improve the level of network performance.

While these risk management objectives have been set for both the Base Case and the DNO Alternative Case, EDF have modelled in their NAMP what they refer to as a "Medium Risk" and "High Risk" approach for each scenario. The "High Risk" and "Medium Risk" Capex Projections associated with the DNO Alternative Case are reproduced from the EDF(LPN) NAMP below. EDF have stated that the high risk plan was a method of testing whether a continuation of DPCR3 investment levels was tenable.

Chart 2.1 - Medium and high expenditure scenarios

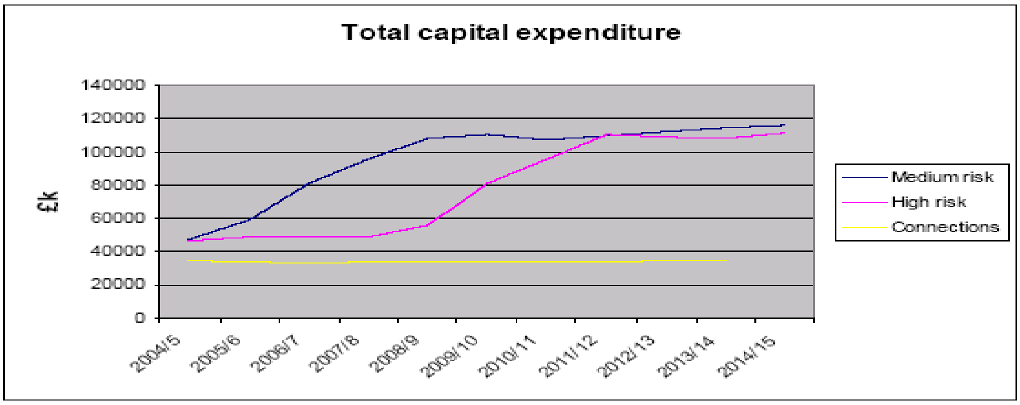


Figure 9-1 Total capital expenditure for medium and High Risk scenarios

Chart reproduced from EDF(LPN) Network Asset Management Plan – Direct Costs exclusive of overheads.

The shape of the above curves reflects that the 'ramp-up' of expenditure proposed under the 'medium risk' scenario has been delayed by 4 years under the 'high risk' scenario. Neither expenditure profile represents a minimum Capex projection required for the next regulatory period since both expenditure profiles are aimed at a reduced level of network risk below the current level. EDF quantify the level of risk as the number of substations overloaded above a certain percentage of time, 5% or 10%. Both scenarios tabled by EDF are intended to reduce or eliminate the number of substations that fall into one or other of the above categories. It may be that other substations will have higher loads than at present but they cannot go into the overload situation without impacting on the numbers that EDF say they are going to reduce and on this basis, the overall level of risk, as quantified and expressed by EDF will reduce.

The Base Case submission compared to DPCR3 forecast expenditure and allowance is set out in the Table below:

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	**210.6**	**230.0**	**357.6**	**-7.0**	**350.6**
Non Load Related	**340.5**	**315.5**	**591.7**	**-25.0**	**566.7**
Gross Capex less Non Op Capex	***551.1***	***545.4***	***949.3***	***-32.0***	***917.3***
Non Op Capex (Not Assessed)	16.8	13.2	38.9	0.0	38.9
Total Gross Capex	**567.8**	**558.6**	**988.2**	**-32.0**	**956.2**
Contributions	-104.0	-178.6	-168.9	9.6	-159.4
Net Load Related	**106.6**	**51.4**	**188.7**	**2.6**	**191.3**
Total Net Capex	**463.9**	**380.0**	**819.3**	**-22.5**	**796.9**
Non Load Related Summary					
Replacement			344.0	-25.0	319.0
ESQCR			0.6	0.0	0.6
Heath & Safety			6.6	0.0	6.6
Environment			120.8	0.0	120.8
Sub Total - Model Comparison	***0.0***	***207.4***	***472.0***	***-25.0***	***447.0***
Diversions		0.0	0.0	0.0	0.0
SCADA		3.3	1.2	0.0	1.2
Sub Total	***0.0***	***210.7***	***473.2***	***-25.0***	***448.2***
Metering (Not Assessed)		68.4	56.3	0.0	56.3
Sub Total	***340.5***	***279.1***	***529.5***	***-25.0***	***504.5***
Fault Capex (Not Assessed)		36.4	62.3	0.0	62.3
Non Load Related Total	**340.5**	**315.5**	**591.7**	**-25.0**	**566.7**

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.

The adjusted DPCR4 forecast is presented in the table below.

Table 2.2 – Adjusted DPCR4 Base Case Capex Projection[1] (£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	13.8	0.0	-12.3	4.2	0.0	**356.3**
Non Load Related		0.0	-15.7	6.8	0.0	**557.8**
Gross Capex less Non Op Capex	***13.8***	***0.0***	***-28.0***	***11.0***	***0.0***	**914.1**
Non Op Capex (Not Assessed)						**38.9**
Total Gross Capex	**13.8**	**0.0**	**-28.0**	**11.0**	**0.0**	**953.0**
Contributions	-13.8	0.0	5.5	-1.9	0.0	-169.6
Net Load Related	**0.0**	**0.0**	**-6.8**	**2.3**	**0.0**	**186.7**
Total Net Capex	**0.0**	**0.0**	**-22.5**	**9.1**	**0.0**	**783.4**
Non Load Related Summary						
Replacement		0.0	-11.2	3.8	0.0	311.6
ESQCR		0.0	0.0	0.0	0.0	0.6
Heath & Safety		0.0	-0.2	0.1	0.0	6.4
Environment		0.0	-4.2	1.4	0.0	118.0
Sub Total - Model Comparison		**0.0**	**-15.7**	**5.4**	**0.0**	***436.7***
Diversions		0.0	0.0	0.0	0.0	-
SCADA		0.0	0.0	0.0	0.0	1.1
Sub Total		***0.0***	***-15.7***	***5.4***	***0.0***	***437.8***
Metering (Not Assessed)		0.0	0.0	0.7	0.0	56.9
Sub Total		***0.0***	***-15.7***	***6.0***	***0.0***	***494.8***
Fault Capex (Not Assessed)		0.0	0.0	0.7	0.0	63.0
Non Load Related Total		**0.0**	**-15.7**	**6.8**	**0.0**	**557.8**
Total Adjustments	**13.8**	**0.0**	**-28.0**	**11.0**		**-3.2**

[1] The NLRE Environment forecast includes £113m relating to Fluid Filled Cables. £88m of this amount is the subject of further consideration and has not been included in the adjusted forecast in Ofgem's final proposal paper.

2.1.1 Projections of future load related capex

2.1.1.1 Network reinforcement

EHV reinforcement accounts for some 55% of the projected expenditure, 32% is allocated to 11 kV reinforcement and the remaining 13% to 11 kV and LV reinforcement. Details of work programmes and costs are provided in Appendix A.

Specific EHV reinforcement schemes have been included in the first 5 years of the NAMP (i.e. 2003/04 to 2008/09) and provision has been included for the later years. The expenditure on EHV substations increases to a significant peak in 2008/09 before reducing to 3 times the 2005/06 expenditure in 2009/10 and falling to a lower figure in subsequent regulatory periods. The EHV circuit expenditure reaches a peak in 2009/10. This expenditure is in addition to a large provision within the EHV substation replacement category that also provides a reinforcement contribution. In some cases an element of rationalisation and harmonisation is covered by the expenditure.

EDF(LPN) list some 33 substations that are expected to be out of firm capacity in 2003/04, a further 4 that are expected to be out of capacity by 2004/05 and 14 that are forecast to become out of capacity during DPCR4. In many cases, the degree of overload is marginal and load transfers are available to delay the need for reinforcement for a period, based on information supplied in the NAMP – e.g. Table 2.1 of LPN NAMP Development Plan and text – notably 11kV substations in the south east of London.

With the exception of a major project at Bankside there does not appear to be any carry over or continuity between scheme development in DPCR3 and DPCR4 and therefore little pre-commitment to the majority of the schemes listed in this category.

The total cost of the 11 kV reinforcement included amounts to £33 m made up largely of £11 m of unspecified schemes and £18.5 m for ‘other central area automation’. This expenditure is based on conceptual estimates for network rationalization and EDF subsequently transferred expenditure in this category from Base Case to DNO Alternative Case.

LV projected expenditure is an increased provision that is intended to be used to fund proactive schemes that will mitigate both the risk and the impact of a fault.

2.1.1.2 New connections forecast expenditure

EDF have examined the range of forecasts of new domestic customers from 2004 to 2010, ranging between 102 000 and 126 000 and have based their projections on a mid-range forecast of 111 600 or an annual increase of 17 700 rising to 19 400 in 2010. The increase in the number of domestic new connections is based on an assessment of regional development plans and government targets. Gross forecast expenditure of £217 m is included with anticipated contributions of £169 m, leaving net expenditure in this category of £48 m (before adjustments).

2.1.1.3 Load related scheme papers submitted

Since only approved papers for major schemes have been tabled, largely for investments in the shorter term, it has not been possible to review the efficacy of reinforcement schemes of any magnitude for the middle years or later years of DPCR4.

The South London Ring Paper submitted describes four options that were considered. The option selected has the lowest overall cost when NGC exit charges are excluded and has the second lowest cost/MVA of system capacity added by a small margin. While not being able to consider the efficacy of the scheme without further information on the network needs and configuration, there is no indication that this investment is less than efficient and the number of options considered tends to indicate that due consideration has been given to investment efficiency.

2.1.2 Comments and issues associated with the load related expenditure

i. Out of firm capacity considerations, i.e. substation loading considerations, do not appear to be a major investment driver.

ii. The expenditure profile submitted shows a very significant step increase; however:

  - there is no pre-commitment to many of the projects;
  - many of the projects described are very tenuous at this point in time;
  - the lower voltage expenditure is based on conceptual network improvement/development objectives; and
  - some additional load reinforcement benefit will be provided through the asset replacement expenditure.

iii. A further and significant factor is that the schemes at the embryonic stage that have been included in the investment plan will not have been subjected to optimisation considerations. As this process is regarded as one of the strengths of the NAMP process and one that has yielded savings in the past, it would be expected that future reductions in expenditure would also be achievable for the same reasons. It would be accepted that needs, assumptions and opportunities will all be refined and defined with the passage of time and when reviewed at the point of decision-making, an optimised scheme can be prepared.

iv. It is not at all clear that the 11 kV expenditure is driven exclusively by load growth requirements (resupply facilities following a fault) but would appear to deliver a combination of reinforcement benefit and network performance improvement. EDF have subsequently transferred expenditure against this to the DNO Alternative Case.

v. The above factors do not generate any confidence that the projected expenditure is the most efficient or, for a large tranche of the proposed expenditure, necessary or essential.

2.1.3 Projections of future non-load related capex

Non-load related capital expenditure is addressed against:

- Performance based asset replacement;
- Environment, Health and Safety; and
- Asset Replacement.

These programmes of work with forecast costs are described in Appendix 1.

Fluid filled cable replacement is the major expenditure item proposed and the rate of proposed would result in some 26% of the asset base (230 km) being replaced by 2015.

EDF explain in the NAMP Philosophy and Strategy document that the asset replacement programme of work is intended to address condition, safety, environmental, quality of supply performance and future age profile concerns by a risk-managed approach to targeting, prioritising, and optimisation of timing of replacement. In their Base Case submission, EDF(LPN) state that:

> "…..A calculation has also been made as to which assets might need replacing in the period not due to the risk of failure, but to avoid creating problems for future periods where all the assets could start to fail over a relatively short period of time. This is done through a combination of assessing early indications of deterioration, life expectancy of the assets and the failure modes and impact of failure. If a large population of assets will require replacing in future price control periods, but the volumes that would need to be replaced are not feasible, then some have been brought forward into the DPCR4 period."

EDF have subsequently confirmed that the replacement of assets within the DPCR4 period will be driven by condition/operational risk/reliability and not some concept of a 'cliff face'.

EDF(LPN) also advise that Regulations, Quality of Supply, Reinforcement and Resilience considerations when taken together, may produce different asset replacement numbers from those projected by their Asset Replacement Model.

The sum included also has a substantial provision (£10 m) for unspecified 66 kV switchgear replacement.

2.1.4 Comments and issues associated with the non-load related expenditure

- The most significant issue arises as a result of the approach taken to forecast asset replacement volumes. EDF consider that the replacement programmes that would be forecast by age profile/survivor curve modelling would be unmanageable unless the programmes are commenced as soon as possible. No benefits in terms of network performance or reduced operating costs are generally attributable to this approach by EDF(LPN) other than a more manageable programme of asset replacement into the future. A comparison of asset lives shows that EDF's average asset lives are not significantly older than those of other companies but no other company is proposing to ramp up the rate of asset replacement on the same basis as EDF.

- Very high expenditure is set against Fluid Filled Cable Replacement and even if this expenditure were considered essential, the execution of a programme of the magnitude proposed would be problematical. The percentage of the asset proposed to be replaced within a 10-year period appears high. Considerations such as these have caused EDF to delay the proactive replacement of LV cable replacement until a more innovative approach is found and although the level of risk associated with the two assets, fluid filled cables and LV cables, are different, it is not at all clear that LPN could in fact deliver the replacement programme for the fluid filled cables at the pace proposed.

- EDF(LPN) have included Performance Based Asset Replacement Expenditure in the Base Case and this expenditure is intended to 'stabilise CI and CML performance against a deteriorating network and increasing fault trends in the underground 11 kV cable network'. Some of this expenditure was subsequently transferred to the DNO Alternative Case.

- The specific amount included for performance based asset replacement has not been identified separately from the general asset replacement expenditure.

- It is not clear that the approach taken by EDF(LPN) in setting out discreet work programmes in the NAMP adequately addresses the interaction of the various programme elements in generic type programmes or the mutual benefits from the various categories. In particular, the expenditure both in the load related and non-load related categories is so high, and the volume of assets being replaced is also so high, that it would be anticipated that fault rates would be affected and network performance improvement gains realised. The approach to 'Health Indices' modelling that EDF intend to adopt particularly relates fault rates for all asset classes to age and against this analysis forecasts the replacement volumes necessary to maintain fault rates or control them at a higher or lower level. Other companies who have already adopted 'Health indices' modelling are forecasting lower volumes of asset replacement requirements to those like EDF using survivor curve models.

2.2 Ofgem scenario/sensitivity analysis

2.2.1 Network performance improvements

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

Table 2.3 - Network performance improvement targets

02/03 actual		01/02 & 02/03 ave		2010 Scenario		2020 Scenario		(ave/2010)%	
CI	CML	CI	CML	CI	CML	CI	CML	CI	CML
35.1	40.1	36.2	39.7	41.2	39.4	41.2	38.9	88%	101%

It can be seen from the above Table that the LPN networks are largely compliant with the 2020 targets and that additional investment over and above that required to maintain current performance is not required.

2.2.2 Comments and Issues associated with the quality of supply scenarios

Since the quality of supply targets are within reach and no additional expenditure is required, there are no issues arising.

2.3 DNO alternative case

As described previously, EDF(LPN)'s approach to developing the 3 submissions was to establish its alternative scenario based on its NAMP process and to extract the network performance improvement expenditure and work programmes from this to establish the Base Case Scenario.

The initial financial difference between the Base Case Scenario and the DNO Alternative totals £5.5 m.

2.3.1 Comments on DNO alternative scenario

Since the DNO alternative scenario and the Base Case submission are essentially identical prior to subsequent transfers with the exception of the minor network performance improvement expenditure identified, the comments set out in response to the Base Case submission are equally applicable to the DNO alternative scenario.

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.

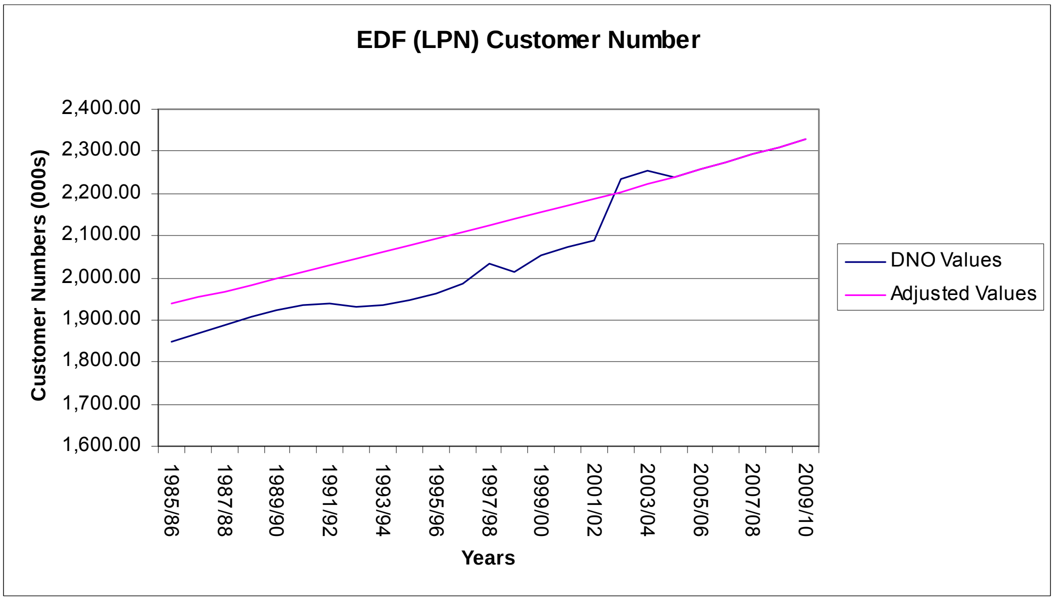
Detailed descriptions of the models are provided in Appendices D, E and F and the following sections discuss the validation and adjustment of the input variables and the model outputs.

3.2 Load related expenditure

3.2.1 Model inputs

The customer numbers supplied by LPN have a step change increase between 2001/02 and 2004/05. This step has been removed by PB Power by applying an average growth rate of 0.75% working back from 2005/06. The average growth rate has been calculated over the 1985/86 to 2000/01.

Figure 3.1 - Adjustment to customer numbers



No adjustments were considered necessary to the GWh forecast growth.

As the connection market is changing, EDF have submitted their Load Related Expenditure net of 3rd party connections. After questioning EDF on this matter the follow amendments have been made.

Table 3.1 - Adjustment to forecast LRE to reinstate competition reduction

	05/06	06/07	07/08	08/09	09/10
% Increase to EDF LRE	6%	8%	10%	12%	14%

3.2.2 Model outputs

The following table sets out the model output compared to DPCR 2 & 3 expenditure and DPCR4 submission. The DPCR4 submission for LRE has been increased to reinstate the reduction incorporated for competition in connections. The DPCR4 LRE figure has not been adjusted for expenditure that is considered unnecessary.

Table 3.2 – Load-related capex model outputs[1]

LRE DPCR2 (excluding generation)	**LRE DPCR3 (excluding generation)**	**Submitted LRE Gross DPCR4 (excluding generation)**	**Model Output LRE for DPCR4**
(£m)	(£m)	(£m)	(£m)
190	229	363	**344**

3.2.3 Load related expenditure modelling comments

The model shows the LPN network to be an outlier possibly due to it being an exclusively cable network or possibly some network components are sized on fault level considerations rather than thermal or voltage constraints. Although the model indicates only a small reduction on EDF(LPN)'s forecast, we nevertheless consider that the forecast is based on insufficient scheme support and unjustified provisions and that there will be opportunity to rescope, optimise and defer projects during the period.. We therefore propose a level of expenditure lower than the EDF forecast but higher than the DPCR3 expenditure.

3.3 Non load related expenditure

3.3.1 Model inputs

No specific model input adjustments were made for EDF(LPN), other than that for EDF(LPN) only the unit costs of cables, HV ring main units and HV ground mounted transformers are

[1] The DPCR3 projection was adjusted and the DPCR4 forecast was corrected at the end of October 2004, after the completion of the modelling the results of which were reported in Ofgem's Update Paper dated September 2004. The data, model output and PB Power opinion as stated in Tables 3.2 and 3.3 remain as prior to the October 2004 changes and are as the PB Power view reflected in the Update Paper. (The effect of re-running both the models would have been to indicate outputs slightly lower than hitherto.)

While the Executive Summary, Tables 2.1, 2.2 and 3.4 have been amended to reflect the October 2004 changes, the PB Power opinion on load and non-load related expenditure within these tables has remained unaltered.

the DNO's own new build (LRE) unit costs reflecting the costs of construction in central London.

With minor exceptions, assets were modelled on an age based replacement profile basis.

3.3.2 Model outputs

Table 3.3 below provides a comparison between the DNO submission and the model outputs for the main asset classes.

Table 3.3 - Comparison of NLRE Model Outputs with DNO Submission

Submission	FBPQ Table 26	Adjusted submission	Combined	Adjusted submission	Model output	Bench-marked output	PB Power Opinion
Lines	1.8	1.8	Lines & services	16.4	4.9	5.3	
Cables	187.5	184.1	Cables & services	188.5	172.1	144.1	
Transformers	32.9	32.3	Substations	258.7	167.3	145.2	
Switchgear	180.1	176.9	Part Submission Total	463.6	344.3	294.6	
Services and Lines	19.3	19.0					
SMC	0.0	0.0					
Other Substations	50.4	49.5					
Other Not Modeled	0.0	0.0	Other Not Modeled	0.0		0.0	
Total	472.0	463.6	Total	463.6		294.6	294.6

3.3.3 Non load related expenditure modelling comments

Before the application of benchmarking, the model is predicting lower expenditure than EDF(LPN)'s forecast in respect of cables, switchgear (appreciably) and services and lines. It is noted that replacement of fluid filled cables forms an appreciable part of EDF(LPN)'s forecast. (The benchmarked model output includes some £105m of EHV cable replacement expenditure.) It is also noted that the EDF companies are high compared to the rest of the industry submission to model value for EHV cable. For transformers the EDF(LPN) forecast and the model output are however about the same. The effect of benchmarking is to reduce the model outputs still further as the submission/model ratios for EDF(LPN) are high, reflecting that the forecast is high.

In PB Power's opinion, the allowed non-load related expenditure corresponding to the model output should be £294.6m. This amount excludes ESQCR expenditure, diversions, metering and fault capital expenditure. Furthermore ESQCR expenditure has been excluded from the overall total as this matter is being considered separately.

3.4 PB Power's opinion of allowances

Our findings are summarised in the table below.

Table 3.4 – PB Power's Opinion of Allowances (£m)

Item	Adjusted DPCR 3 Projection	Adjusted DPCR4 Forecast	Model Output, benchmarked	PB Power Opinion
Gross Load Related	**230.0**	**356.3**	**344**	**272.0**
Non Load Related	**315.5**	**557.8**		**415.7**
Gross Capex less Non Op Capex	**545.4**	**914.1**		**687.7**
Non Op Capex (Not Assessed)	13.2	38.9		38.9
Total Gross Capex	**558.6**	**953.0**		**726.6**
Contributions	-178.6	-169.6		-169.6
Net Load Related	**51.4**	**186.7**		**102.4**
Total Net Capex	**380.0**	**783.4**		**557.0**
Non Load Related Summary				
Replacement		311.6		
ESQCR		0.6		
Heath & Safety		6.4		
Environment		118.0		
Sub Total - Model Comparison	***207.4***	***436.7***	**294.6**	***294.6***
Diversions	0.0	-		0.0
SCADA	3.3	1.1		1.1
Sub Total	***210.7***	***437.8***		***295.7***
Metering (Not Assessed)	68.4	56.9		56.9
Sub Total	**279.1**	***494.8***		**352.7**
Fault Capex (Not Assessed)	36.4	63.0		63.0
Non Load Related Total	**315.5**	**557.8**		**415.7**

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 asset replacement 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 – LOAD RELATED EXPENDITURE

APPENDIX A - BASE CASE SUBMISSION

Actual and forecast capital expenditure projection for DPCR3

In the table below we present the actual and forecast capital expenditure projection for DPCR3. The net load related expenditure for the period is £72.5 m and overall gross capital expenditure £631.3 m.

Table A.1 - Actual and forecast expenditure projection for DPCR3

£M @ 2003/2004 prices	**Actual**		**Forecast**			
	2001/02	**2002/03**	**2003/04**	**2004/05**	**2005/06**	**Total**
Capital Expenditure						
Load Related	41.2	42.5	59.0	68.6	67.1	278.4
Capital Contributions	(27.9)	(49.8)	(38.2)	(47.0)	(43.0)	(205.9)
Non Load Related	64.5	67.0	67.0	69.9	71.3	339.6
Non-operational capex	1.2	0.0	1.9	5.5	4.6	13.2
Total Capital Expenditure	79.1	59.6	89.7	97.0	100.0	425.4

The above figures are presented without normalisation.

Base Case capital expenditure forecast for DPCR4

The Base Case capital expenditure forecast for DPCR4 is as summarised as follows:

Table A.2 - Base case capital expenditure forecast for DPCR4

£M @ 2002/03 prices	**2005/06**	**2006/07**	**250.9**	**223.1**	**200.9**	**Total**
Capital Expenditure						
LRE	65.6	70.4	73.5	74.3	73.9	357.6
Contributions	(35.4)	(34.5)	(33.8)	(32.8)	(32.4)	(168.9)
NLRE	80.8	107.7	123.1	138.5	141.6	591.7
Non-Operational capex	7.8	6.8	8.7	8.0	7.6	38.9
Total Capital Expenditure	**118.7**	**150.4**	**171.5**	**188.0**	**190.7**	**819.4**

The above figures are presented without normalisation.

Forecast of future load related Capex for DPCR4

EDF (LPN)'s load related capital expenditure projections for the Base Case scenario are as set out in the following table:

Table A.3 - Load related expenditure forecast

LOAD RELATED CAPITAL EXPENDITURE - £M	2005/06	2006/07	2007/08	2008/09	2009/10
Reinforcement	20.4	26.2	30.0	31.8	31.8
New Connections	45.1	44.2	43.5	42.5	42.1
LRE Total Gross	65.5	70.4	73.5	74.3	73.9
Customer Contributions	-35.4	-34.5	-33.8	-32.8	-32.4
LRE Total Net	**30.1**	**35.9**	**39.7**	**41.5**	**41.5**

Network reinforcement

When extracted from the Network Asset Management Plan (NAMP) (DNO Alternative Scenario – Table 17.6) the breakdown of Reinforcement Expenditure pre the allocation of overheads is as shown below. EHV reinforcement accounts for some 55% of the projected expenditure, 32% is allocated to 11 kV reinforcement and the remaining 13% to 11 kV and LV reinforcement.

Table A.4 - Reinforcement expenditure forecast

Reinforcement - £k	2005/06	2006/07	2007/08	2008/09	2009/10
EHV Substations	3163	6575	8706	11294	9375
HV Switchgear	125	500	375	0	0
EHV Circuits	3100	2850	3200	2500	4000
11kV	6563	6763	6725	6500	6500
LV	1000	1200	1800	1975	2525
Connections	1000	1000	1000	1000	1000
Total	**14951**	**18888**	**21806**	**23269**	**23400**

Without interrogation of the NAMP on a line-by-line basis, it is not clear if any of the expenditure removed from the DNO Alternative Scenario to form the Base Case was included in the reinforcement category but if so, it is not expected to be significant.

Specific EHV reinforcement schemes have been included in the first 5 years of the NAMP (i.e. 2003/04 to 2008/09) and provision has been included for the later years. It can be seen from the above table that expenditure on EHV substations increases to a significant peak in 2008/09 before reducing to 3 times the 2005/06 expenditure in 2009/10 and falling to a lower figure in subsequent regulatory periods. The EHV circuit expenditure reaches a peak in 2009/10. This expenditure is in addition to a large provision within the EHV Substation replacement category that also provides a significant reinforcement contribution. In some cases a significant element of rationalisation and harmonisation is included. The annual expenditure in this class in 2003/04 is planned to be less than £2 m compared to an average of almost £6 m per annum forecast throughout DPCR4 and projected by EDF to continue at this level throughout the following DPCR5 period.

EDF(LPN) list some 33 substations that are expected to be out of firm capacity in 2003/04, a further 4 that are expected to be out of capacity by 2004/05 and 14 that are forecast to be out of capacity during DPCR4. In many cases, the degree of overload is marginal and load transfers are available to delay the need for reinforcement for a period.

Some of the schemes in the forecast appear to be very tentative and are not required in the near future with the exception of two projects estimated at £850,000 and £700,000.

The total cost of the 11 kV reinforcement included amounts to £33 m made up of largely of £11 m of unspecified schemes and £18.5 m for ‘other central area automation’. This expenditure is based on conceptual estimates for network rationalization.

LV projected expenditure is an increased provision that is intended to be used to fund proactive schemes that will mitigate both the risk and the impact of a fault.

New connections forecast expenditure

New connections expenditure and customer contributions are forecast as follows:

Table A.5 - New connections expenditure

£M	2005/06	2006/07	2007/08	2008/09	2009/10
New Connections	45.1	44.2	43.5	42.5	42.1
Customer Contributions	-35.4	-34.5	-33.8	-32.8	-32.4
New Connections - Net	9.7	9.7	9.7	9.7	9.7

EDF have examined the range of forecasts of new domestic customers from 2004 to 2010, ranging between 102 000 and 126 000 and have based their projections on a mid-range forecast of 111 600 or an annual increase of 17 700 rising to 19 400 in 2010. This compares with increases varying from 14 280 in 2001/02 to 18 400 in 2003.

Projections of future non-load related Capex

The amount of non-load related expenditure projected by EDF (LPN) for the Base Case scenario is as follows:

Table A.6 - Non load related expenditure forecast

Non-Load Related - £m	2005/06	2006/07	2007/08	2008/09	2009/10
Asset Replacement, QoS, Env, Health & Safety	56.7	84.0	99.4	114.9	118.0
Fault Capitalisation	12.5	12.5	12.5	12.5	12.5
Metering	11.6	11.2	11.2	11.1	11.1
Total Non-Load Related Expenditure	80.8	107.7	123.1	138.5	141.6

Environment, health and safety expenditure

The following table sets out the programmes of work and expenditure included in the environment, health and safety category. The expenditure tabled is pre the allocation of overheads.

Table A.7 - Environment, health and safety forecast expenditure – medium risk scenario

£k	2005/06	2006/07	2007/08	2008/09	2009/10
Noise Reduction	12	12	12	12	12
ESQCR	118	50	50	50	50
Cut out Replacement	750	550	400	363	250
Safety - operations	705	390	375	356	300
FF Cable Replacement	3 875	6 750	15 875	27 750	28 500
Oil Containment - Pmy /Stns	498	498	498	498	498
FF Cable Refurbishment	743	743	743	743	743
Civil Replacement	1 949	2 716	2 716	2 841	3 216
Total	**8 650**	**11 709**	**20 669**	**32 613**	**33 569**

The above expenditure is considered to be the 'Medium Risk' scenario and totals £107 m during the period (pre overheads) but the 'High Risk' scenario tables a significant lower expenditure in this category totalling £35 m although this is still considerably higher than historic expenditure. EDF have stated that the high risk plan was a method of testing whether a continuation of DPCR3 investment levels was tenable.

Table A.8 - Environment, health and safety forecast expenditure – high risk scenario

£k	2005/06	2006/07	2007/08	2008/09	2009/10
Noise Reduction	12	12	12	12	12
ESQCR	118	50	50	50	50
Cut out Replacement	750	550	400	363	250
Safety - operations	705	390	375	358	300
FF Cable Replacement	2 125	1 000	1 000	2 000	7 250
Oil Containment - Pmy /Stns	498	498	498	498	498
FF Cable Refurbishment	543	543	543	593	743
Civil Replacement	1 699	1 716	1 716	2 341	4 216
Total	**6 450**	**4 759**	**4 594**	**6 215**	**13 319**

The Fluid Filled Cable Replacement is the major expenditure item proposed and the rate of proposed would result in some 26% of the asset base (230 km) being replaced by 2015.

Asset replacement

The following table sets out the programmes of work and expenditure included in the asset replacement expenditure category. The expenditure tabled is pre the allocation of overheads.

Table A.9 - Asset replacement programmes of work

£k	2005/06	2006/07	2007/08	2008/09	2009/10
Battery Replacement	356	435	477	390	347
Tower Line Refurbishment	469	0	63	313	500
EHV Cable Replacement	1 700	3 463	3 288	3 575	5 000
Substation Security	25	10	10	10	10
Protection of Assets	350	350	350	350	350
HV/LV Cable Replacement	2 500	4 375	5 875	7 000	7 250
Misc HV/LV Asset Replacement	3 765	3 623	3 599	3 739	4 375
Diagnostic Inspection Equipment	50	45	30	25	10
Defect Rectification	163	113	50	50	50
Protection Asset Replacement	1 318	979	943	855	1 009
Service Replacement	90	90	90	90	90
EHV Switchgear Change	7 014	13 703	13 748	12 550	13 350
11kV Switchgear Change	4 020	4 666	5 716	5 716	5 619
Replace 11kV Switchboards	1 682	6 247	6 875	7 625	6 500
EHV Transformer change	4 655	4 355	2 355	1 685	2 625
EHV Substation Replacement	863	4 025	5 688	4 875	3 000
Misc EHV Repl	612	12	12	13	15
UHF Band Reversal	694	0	0	0	0
Provision of 18% NRSWA	486	481	483	500	500
Total	**30 812**	**46 972**	**49 652**	**49 361**	**50 600**

Forecasting methodology

EDF explain in the NAMP Philosophy and Strategy document that the asset replacement programme of work is intended to address condition, safety, environmental, quality of supply performance and future age profile concerns by a risk-managed approach to targeting, prioritising, and optimisation of timing of replacement. In their Base Case submission, EDF (LPN) state that:

> "…..A calculation has also been made as to which assets might need replacing in the period not due to the risk of failure, but to avoid creating problems for future periods where all the assets could start to fail over a relatively short period of time. This is done through a combination of assessing early indications of deterioration, life expectancy of the assets and the failure modes and impact of failure. If a large population of assets will require replacing in future price control periods, but the volumes that would need to be replaced are not feasible, then some have been brought forward into the DPCR4 period."

EDF have subsequently confirmed that the replacement of assets within the DPCR4 period will be driven by condition/operational risk/reliability and not some concept of a 'cliff face'.

EDF (LPN) also advise that Regulations, Quality of Supply, Reinforcement and Resilience considerations when taken together, may produce different asset replacement numbers from those projected by their Asset Replacement Model.

Key assets are considered to be:

- 132 kV and EHV Switchgear;
- 11 kV Switchboards and Distribution Switchgear;
- Pressurised and Fluid Filled Cables;
- HV and LV Cable Replacement.

Work programmes

Significant expenditure is set against replacement of gas-filled cables where a number are considered to be in poor condition. A number of specific routes have been identified for replacement.

It is anticipated that the ability to predict the probability of faults on HV cables will improve and an increased provision has been allowed to finance the proactive cable replacement of fault prone cables during the period.

The 'Misc HV/LV Asset Replacement' category includes distribution transformers replaced under fault conditions and various small items of asset.

As a result of significant incidents on the network, it is considered that a range of replacement are required capable of being put into service at short and EDF (LPN) are examining the options for the development and procurement of these strategic spares starting with initial outline proposals for the following:

- 33/11 kV self-contained mobile substation;

- Strategic spare grid and primary transformers;
- 33 kV self-contained mobile switchboard;
- 11 kV self-contained mobile switchboard;
- Temporary EHV overhead line;
- Temporary surface-laid cable system.

A budget provision has been included in 2005 for the purchase of transformers and cable.

With respect to EHV switchgear replacement, NGT is planning a refurbishment programme for sites shared with EDF Energy as follows:

- Acton Lane, 2006 (EDF 2006);
- Barking C 132, 2010/11 (EDF 2010/11);
- Littlebrook 132 kV (2006/07);
- Willesden 66 kV (2007).

The sum included also has a substantial provision (£10 m) for unspecified 66 kV switchgear replacement. One of the major schemes would appear to be at a particular site and is currently under way.

The full delivery of the Base Case scenario would result in the following changes to the London network by 2010:

- 12% of EHV cables replaced (rising to 30% by 2015, 66% by 2025);
- 35% of 132 kV switchgear replaced (rising to 66% by 2015);
- 70% of 66 kV switchgear replaced (rising to 91% by 2015);
- 6% of 33 kV switchgear replaced (rising to 17% by 2015, 86% by 2025);
- 28% of 11 kV and 6.6 kV switchgear replaced (rising to 45% by 2015); and
- 50% of interconnected network rearranged to simple radial with automation.

APPENDIX B
QUALITY OF SUPPLY SCENARIO

APPENDIX B – QUALITY OF SUPPLY SCENARIO

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

Table B.1 - Network performance targets

02/03 actual		**01/02 & 02/03 ave**		**2010 Scenario**		**2020 Scenario**		**(ave/2010)%**	
CI	CML	CI	CML	CI	CML	CI	CML	CI	CML
35.1	40.1	36.2	39.7	41.2	39.4	41.2	38.9	88%	101%

It can be seen from the above Table that the LPN networks are largely compliant with the 2020 targets and that additional investment over and above that required to maintain current performance is not required.

APPENDIX C
DNO ALTERNATIVE SCENARIO

APPENDIX C – DNO ALTERNATIVE SCENARIO

As described previously, EDF (LPN)'s approach to developing the 3 submissions was to establish its alternative scenario based on its NAMP process and to extract the network performance improvement expenditure and work programmes from this to establish the Base Case scenario.

The financial difference between the Base Case scenario and the DNO alternative is set out as follows and totals £5.5 m.

Table C.1 - Financial difference between Base Case and DNO case

Programme	2005/06	2006/07	2007/08	2008/09	2009/10
	£m	£m	£m	£m	£m
Network performance enhancement programmes	0.8	0.8	0.7	0.6	0.7
Network security programmes	0.5	0	0	0	0
UHF radio systems	0.8	0	0	0	0
Seacoal – Bankside tunnel adjustment to budget	0.6				
Total	2.7	0.8	0.7	0.6	0.7

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.

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.

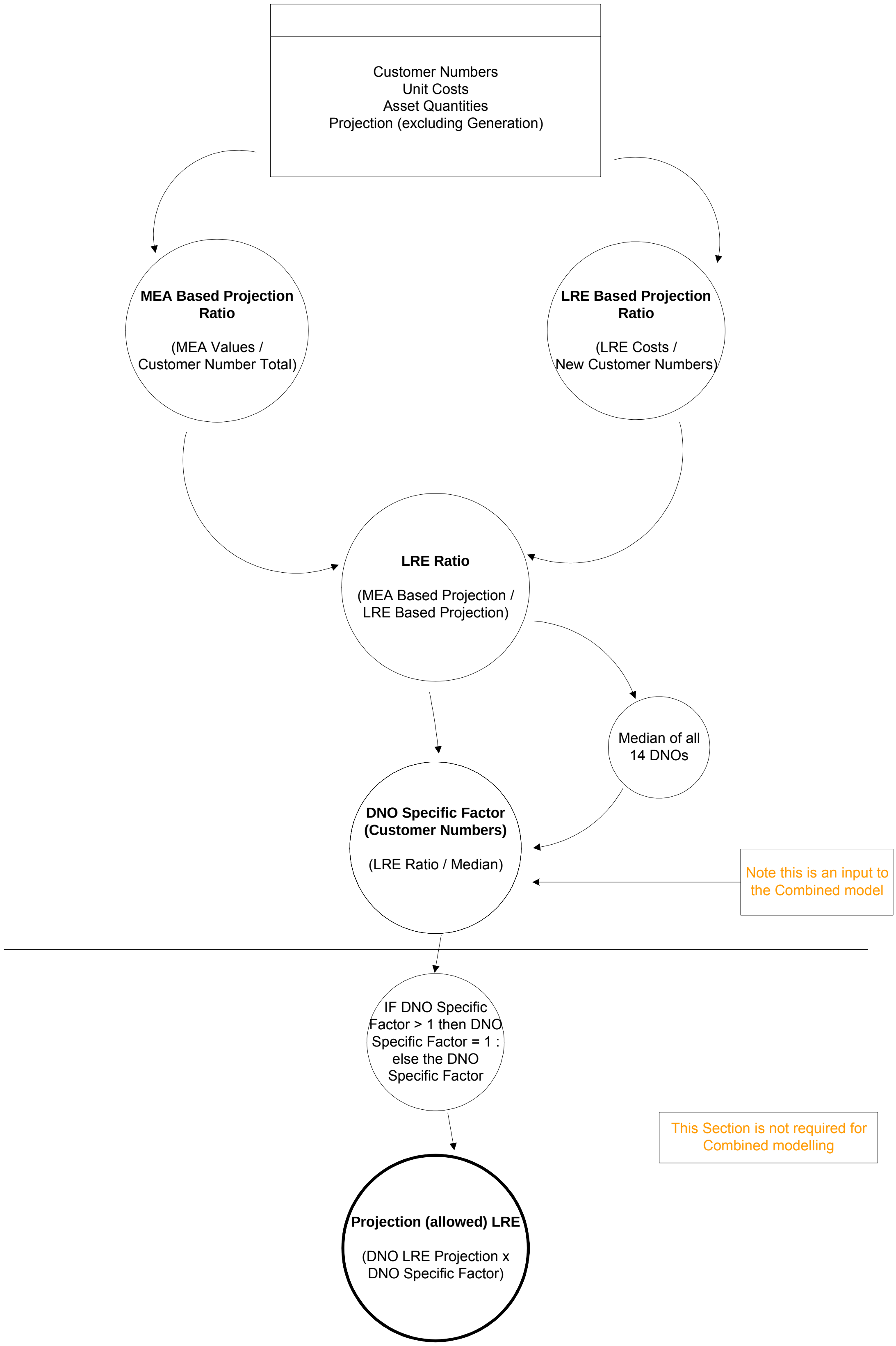
Being benchmarked on a median rather than on an average implies that extremes do not affect the adopted benchmarking position. It also means that the LRE of each company is compared relative to its cost base against the Industry Trend and not in absolute cost terms. This approach recognises therefore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

D.1.4 Period of analysis

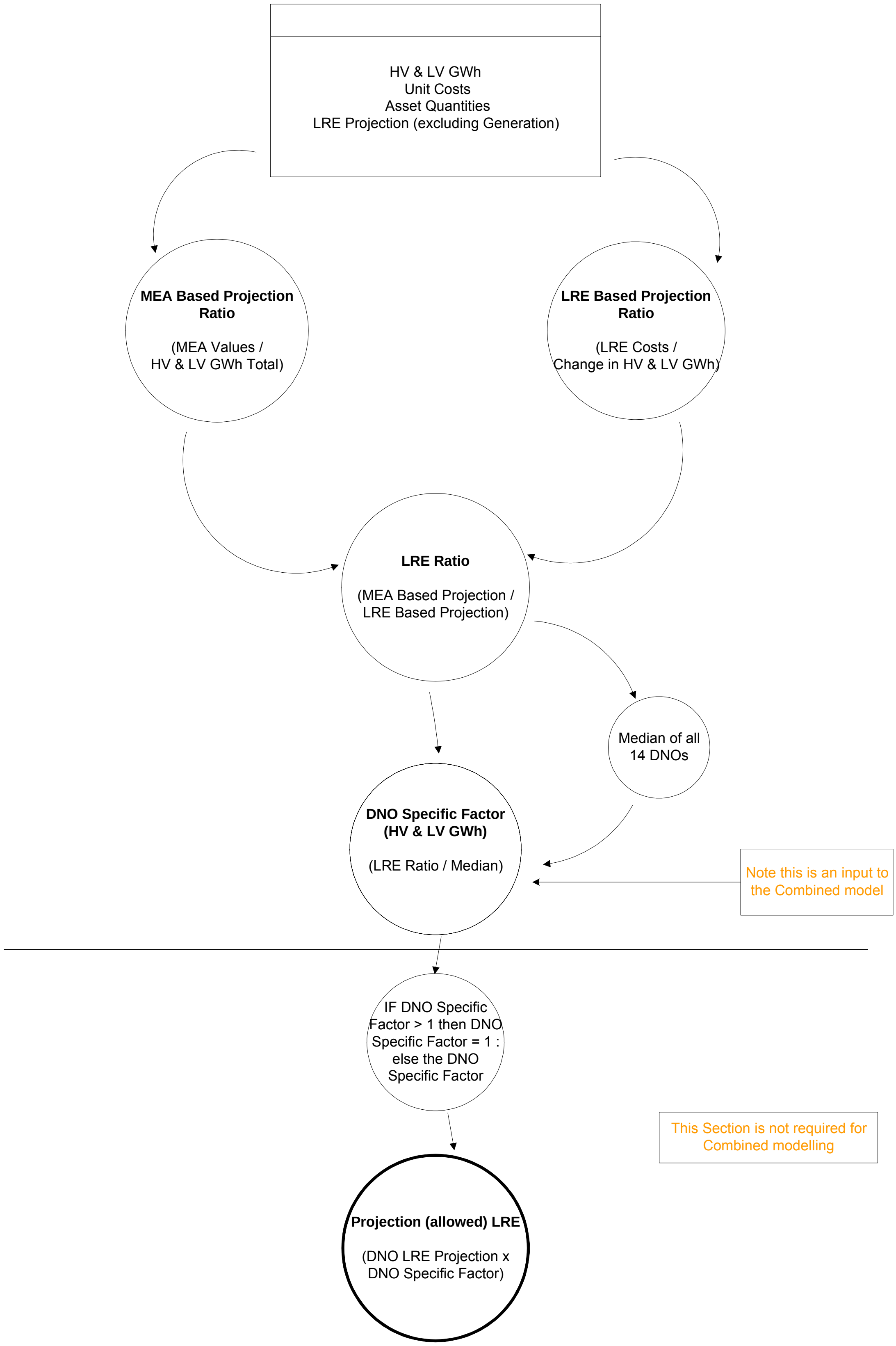
Although each DNO's network is comprised of a large number of smaller networks and that it would be expected that these would have a range of spare capacities depending on local load growth and when individual networks were last reinforced, it is possible that a larger number of the smaller networks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

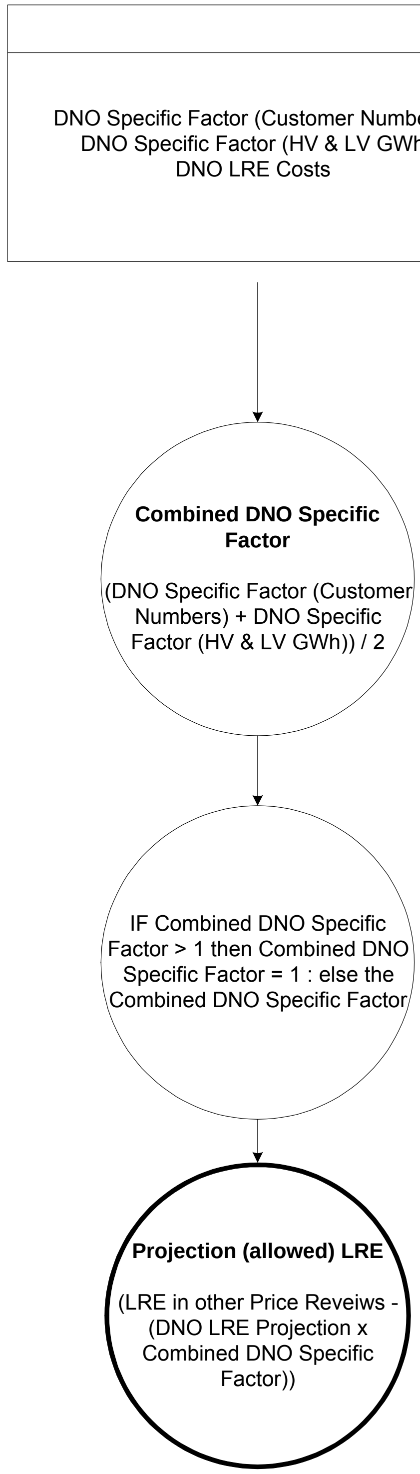
Combined Load Related Expenditure Modelling
(Phase 1A Customer Numbers)



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]

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

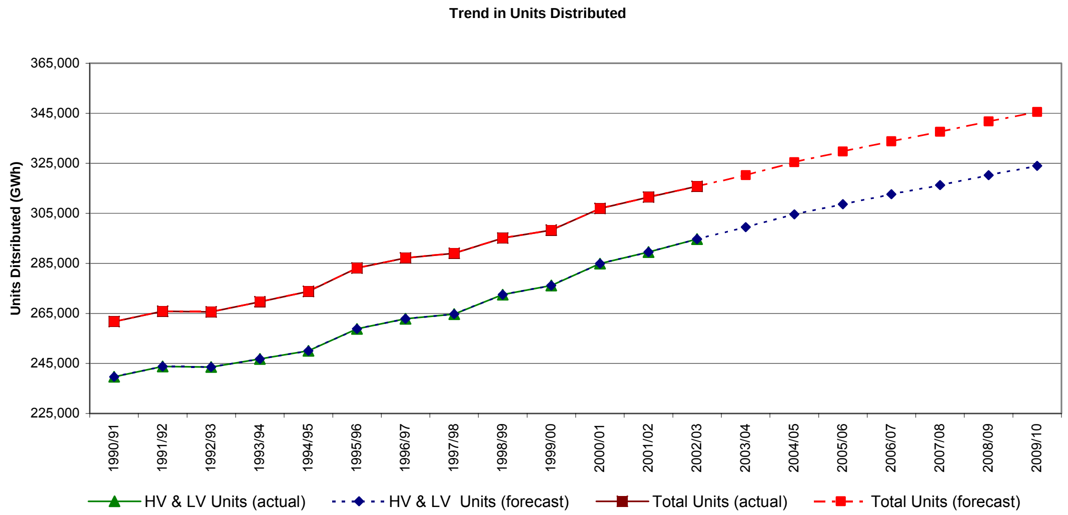
only. Statistics are published by geographical region in accordance with the Nomenclature of Units for Territorial Statistics (NUTS) classification. NUTS1 covers regions, NUTS2 covers sub-regions and NUTS3 covers unitary authorities or districts. At present NUTS2 data is available for the years 1995 to 2001 and NUTS3 data for 1993 to 1998 only.

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

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

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

Trend of energy distributed against time.

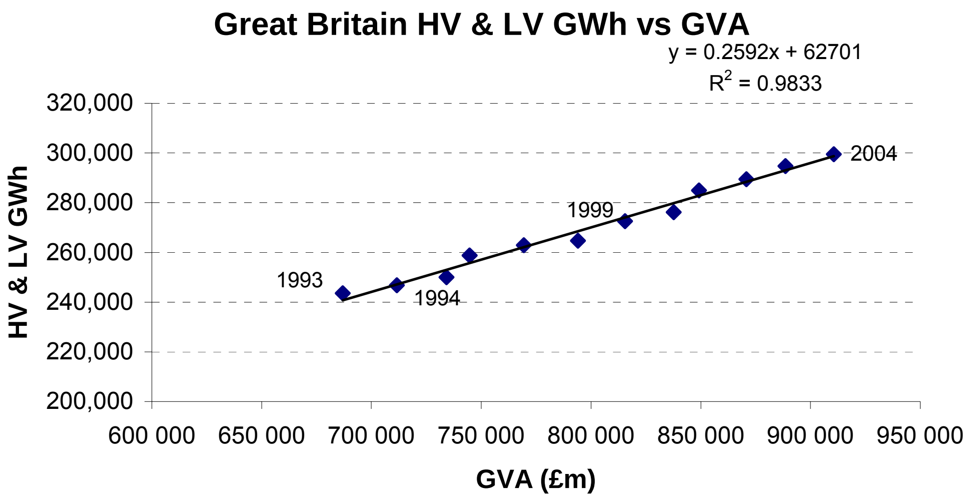


The total regulated units are HV and LV units and the total regulated units include EHV units. Up to and including 2003/03, the units distributed are actual units whereas from 2003/04 onwards these are forecast.

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

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.

[2] To align GVA and GWh data, ONS data for 2001 was treated as corresponding to the review year 2001/02 and so on.
[3] www.hm-treasury.gov.uk/media//E7910/ACF11CB.pdf, "Forecasts for the UK Economy", February 2004.

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

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

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

E.1.5 Derivation of GVA-based load forecasts

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

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

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

APPENDIX F

NON-LOAD RELATED CAPEX MODELLING

APPENDIX F – NON-LOAD RELATED CAPEX MODELLING

F.1.1 NLRE asset replacement modelling for DPCR4

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

F.1.1.1 Age-based replacement

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

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

i. age profile

ii. retirement profile and

iii. unit cost.

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

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

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

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

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

F.1.1.2 Cyclic refurbishment / replacement

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

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

F.1.1.3 Assumptions

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

F.1.1.3.1 Overhead lines

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

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

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

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

F.1.1.3.2 Underground cables

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

F.1.1.3.3 Submarine cable

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

F.1.1.3.4 Benchmarking of DNO forecasts

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

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

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

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

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

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

- lines and services
- cables and services and
- substations

The model output is initially modified so that for each of the asset groups the overall industry (14 DNOs') expenditure predicted by the model is the same as that forecast by the DNOs. (The differences had in any case been small.) For each asset group, benchmark factors of

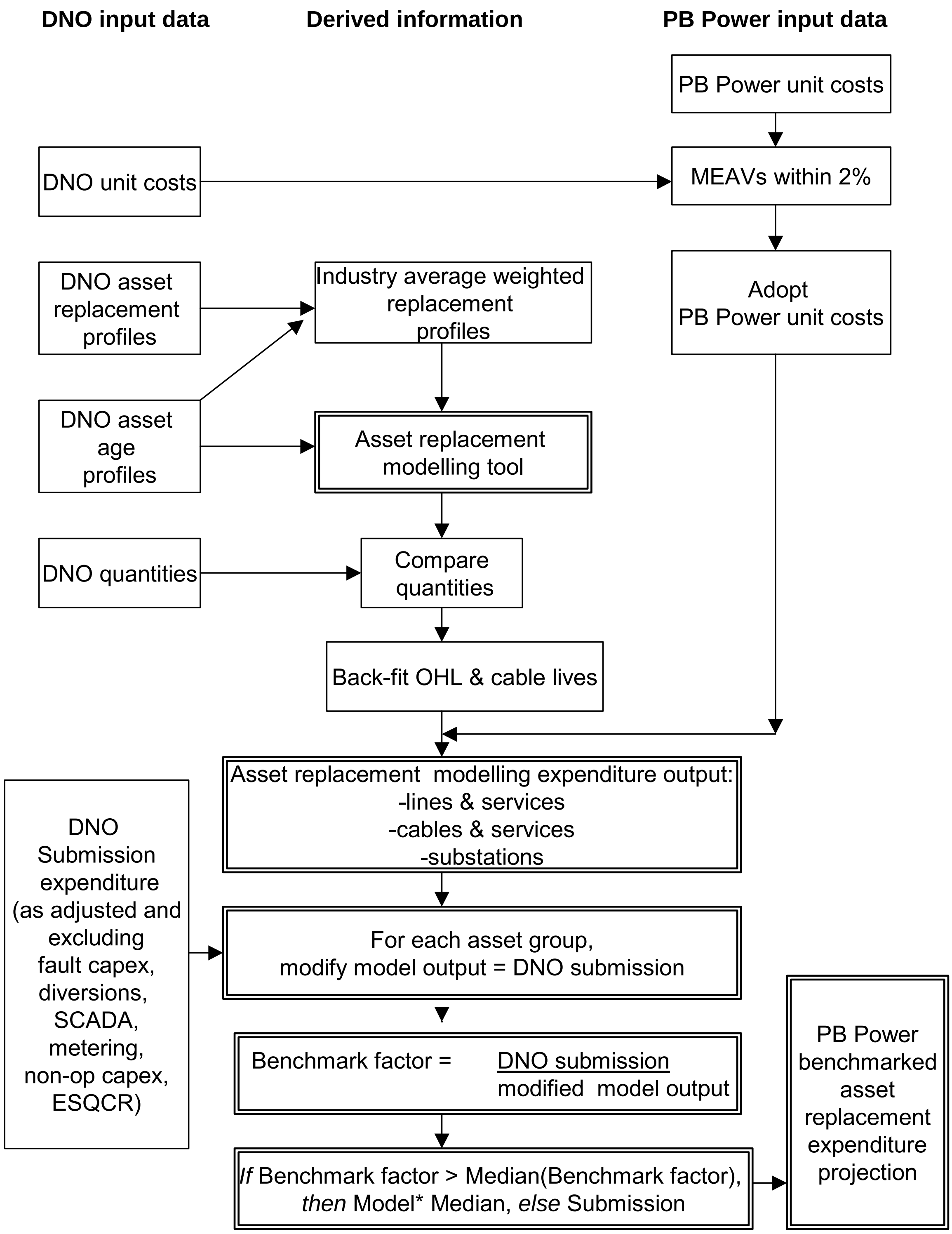
DNO submission/model output are calculated and medians (about unity) obtained. Where the benchmark factor exceeds the median (submission exceeds model output), the resulting benchmarked output is the model output multiplied by the median. Otherwise the benchmarked output is the submission itself. Minor miscellaneous amounts not specifically included within asset groups in the FBPQ submission have been treated as pass-through with minor adjustments.

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

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

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

ASSET REPLACEMENT BENCHMARKING FLOWCHART



APPENDIX G

UNIT COSTS AND MODERN EQUIVALENT ASSET VALUE

APPENDIX G – UNIT COSTS AND MODERN EQUIVALENT ASSET VALUE

PB POWER – SCHEDULE OF UNIT COSTS

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

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

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

MODERN EQUIVALENT ASSET VALUE (MEAV)

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

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