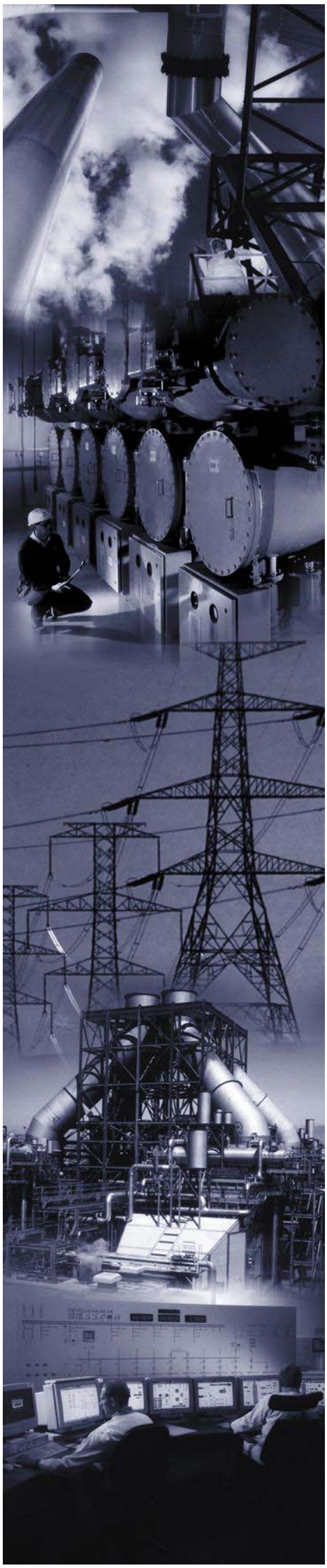

OFGEM

TECHNICAL EVALUATION OF PROPOSED CAPITAL EXPENDITURE PROGRAM FOR NGC'S 2006/07 PRICE CONTROL EXTENSION

DRAFT FINAL REPORT

JULY 2005

PB POWER

LIST OF REVISIONS

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0	27/05/05	All	First issue as 33.00/PP03.61465B – Interim Report			
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5	25/07/05	All	Issued as 33.00/PP03.61465B Rev. 5 in response to NGC comments.			
6	26/07/05	All	Issued as 33.00/PP03.61465B Rev. 6 in response to NGC comments.			

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APPENDICES

EXECUTIVE SUMMARY

General

PB Power was appointed by Ofgem to undertake a review of National Grid Company's (NGC's) investment proposals including:

- broad assessment of capital expenditure levels for 2000/01 to 2006/07;
- detailed assessment of load related expenditure (LRE) in 2005/06 and 2006/07;
- detailed assessment of asset replacement expenditure for 2005/06 to 2007/08; and
- high-level assessment of asset replacement expenditure plans from 2008/09 to 2011/12.

PB Power has reviewed NGC's capital proposals presented in the 2005 Business Plan, the pertinent details being summarised below:

- The actual expenditure for the Final Year of the Previous Price Control (2000/01) was £374m compared to a forecast of £398[1]m. The actual expenditure for the period first four years of the Present Price Control (2001/02 to 2004/05) was £1,467m compared to a forecast of £1,227m. The difference in actual expenditure to that forecast results largely from differences in generation background, demand and asset replacement requirements. From its high level assessment of actual expenditure (2000/01 to 2004/05), PB Power found no evidence to conclude that NGC's capital expenditure was not needed or inefficiently incurred;
- For the Final Year of the Present Price Control (2005/06) and the Extension to the Present Price Control (2006/07), NGC has forecast a spend of £465m and £614m respectively representing an increase in expenditure over the actual annual average expenditure known for the 5 years 2000/01 to 2004/05 of 26% and 67% respectively;
- For the year 2007/08, NGC has forecast a spend of £397m for non-load related expenditure (NLRE) representing an increase in expenditure over the actual annual average expenditure known for the 5 years 2000/01 to 2004/05 of 114%;
- PB Power's review of the forecast level of expenditure found the following:
    a. For the Final Year of the Present Price Control and the Extension to the Present Price Control, a spend of £392m in 2005/06 and £521m in 2006/07 is considered more appropriate. A detailed build-up of this expenditure is shown in Table 1 overleaf. This represents reduction of 16% in both 2005/06 and 2006/07 of the respective levels forecast by NGC.

[1] Net of customer contributions

b. For the year 2007/08, a spend of £373m was considered more appropriate in the NLRE category. This is also presented in Table 1 and represents a reduction of 6% of the level forecast by NGC.

c. For the years 2008/09 to 2011/12, PB Power's view is that the NLRE should be about £751m less than forecast by NGC, the principal reduction being in respect of switchgear.

Table 1 – PB Power's view of Expenditure in 2005/06 and 2007/08 compared to NGC's 2005 Business Plan

Categories	NGC 2005 Forecast			PB Power View		
(2004 prices)	2005/ 06 (£m)	2006/ 07 (£m)	2007/ 08 (£m)	2005/ 06 (£m)	2006/ 07 (£m)	2007/ 08 (£m)
LOAD RELATED EXPENDITURE						
Entry	0.0	0.0		0.0	0.0	
Supergrid system extension (infrastructure)excl TSS	124.8	174.6		101.0	153.4	
TSS	0.6			0.6	0.0	
Exit	87.1	101.4		74.0	76.0	
GT Factor						
Abatements	-10.0	0.0		-10.0	0.0	
Total Load Related	202.5	276.0		165.6	229.4	
NON-LOAD RELATED EXPENDITURE						
Asset Replacement:						
Transformers	13.2	19.5	29.2	13.2	19.5	29.2
Switchgear	25.9	35.8	88.0	25.9	35.8	88.0
Sub-station other	9.1	16.9	14.9	9.1	16.9	14.9
Overhead Lines	119.3	140.8	116.7	83.8	94.6	92.6
Underground Cables	30.3	55.2	72.3	30.3	55.2	72.3
Protection						
Telecontrol / SCADA / Energy Mgt						
Protection & Control	28.9	32.7	28.2	28.9	32.7	28.2
Abatements	0.0	0.0	0.0	0.0	0.0	0.0
Diversions: non-rechargeable						
Other TO	35.3	37.3	37.5	35.3	37.3	37.5
SO excl BETTA	12.1	14.0	10.5	12.1	14.0	10.5
Total Non-Load Related	274.1	352.2	397.3	238.6	306.0	373.2
Customer Contributions (enter as negative)	-11.8	-14.1		-11.8	-14.1	
TOTAL CAPITAL EXPENDITURE	464.8	614.1		392.4	521.3	

All prices, unless otherwise stated, are expressed in constant 2004 prices. The main issues associated with the main expenditure categories are as follows:

- PB Power's review also found that there were a number of areas where there was uncertainty in the level of expenditure that would be incurred by NGC. This included the assumed generation background, number and location of new customer connections to the transmission network and increases in electricity demand of existing customers requiring network augmentation; uncertainty in NGC policy in prioritising asset replacement schemes; and the sanctioning process. Given this uncertainty, Table 2 below presents a range of expenditure that could be incurred by NGC in 2005/06 and 2006/07 that is compared to PB Power's view (as presented in Table 1) and the average

expenditure incurred in the previous 5 years 2000/01 to 2004/05 for which the actual annual average expenditure is known.

Table 2 – PB Power's view of the potential range of Expenditure in 2005/06 and 2006/07 given uncertainty

Categories	Actual	2005/06			2006/07		
(2004 prices)	5 year average[2] (£m)	PB Power view (£m)	Low scenario (£m)	High scenario (£m)	PB Power view (£m)	Low scenario (£m)	High scenario (£m)
LOAD RELATED EXPENDITURE							
Entry	10.0	0.0	0.0	0.0	0.0	0.0	0.0
Supergrid system extension (infrastructure)excl TSS	112.4	101.0	101.0	124.8	153.4	115.1	174.6
TSS	8.8	0.6	0.6	0.6	0.0	0.0	0.0
Exit	64.5	74.0	64.5	87.1	76.0	64.5	101.4
GT Factor							
Abatements		-10.0	-10.0	-10.0	0.0	0.0	0.0
Total Load Related	193.9	165.6	156.1	202.5	229.4	179.6	276.0
NON-LOAD RELATED EXPENDITURE							
Asset Replacement:							
Transformers	6.6	13.2	10.6	13.2	19.5	15.6	19.5
Switchgear	19.0	25.9	20.7	25.9	35.8	28.6	35.8
Sub-station other	7.6	9.1	7.3	9.1	16.9	13.5	16.9
Overhead Lines	41.6	83.8	67.0	83.8	94.6	75.7	94.6
Underground Cables	25.1	30.3	24.2	30.3	55.2	44.2	55.2
Protection							
Telecontrol / SCADA / Energy Mgt							
Protection & Control	32.5	28.9	23.1	28.9	32.7	26.2	32.7
Abatements		0.0		0.0	0.0		0.0
Diversions: non-rechargeable							
Other TO	38.2	35.3	35.3	35.3	37.3	37.3	37.3
SO excl BETTA	14.4	12.1	12.1	12.1	14.0	14.0	14.0
Total Non-Load Related	184.9	238.6	200.4	238.6	306.0	255.1	306.0
Customer Contributions (enter as negative)	-10.8	-11.8	-11.8	-11.8	-14.1	-14.1	-14.1
TOTAL CAPITAL EXPENDITURE	368.1	392.4	344.6	429.3	521.3	420.6	567.9

Load related expenditure

For 2005/06 PB Power considers that, given the timescales to deliver transmission projects, some unsanctioned schemes would not be delivered suggesting a LRE level of £166m to be more appropriate. For 2006/07, given supplementary activity presented by NGC following the 4th distribution price control settlement NGC could be required to spend its forecast £276m, however, with the likelihood of certain Entry and Exit schemes not coming to fruition or being deferred, a LRE level of £229m is considered to be more appropriate. Given the uncertainty of customer related schemes LRE could however flex between £156m and £203m in 2005/06 and between £180m and £276m in 2006/07.

Non-load related expenditure

Asset replacement expenditure, forming a large part of NGC's NLRE has been reviewed through asset replacement modelling and there is a fair degree of correlation between PB

[2] This is the average expenditure occurring over the 5-year period 2000/01 to 2004/05, i.e. the last 5 years for which actuals are known.

Power's model and the forecast asset replacement spend by NGC. A reduction of £106m is indicated in respect of overhead lines for the years 2005/06 to 2007/08. Given that modelling results tend to be optimistic in forecasting requirements for NLRE (an operator may take the opportunity to rationalise and so replace at lower cost, for example), the NLRE expenditure levels could flex downwards to £200m in 2005/06 and £255m in 2006/07 (i.e. network related asset expenditure reduced by 20 per cent).

Issues for further consideration

In going forward there remain a number of issues that require to be addressed. These are summarised below:

- **Historic expenditure:** Further examination would be required to provide a detailed view of expenditure over the period 2001/02 to 2004/05.

- **Power factor:** The power factor at Grid Supply Points (GSPs) is forecast by NGC to continue to decline. Ofgem should give consideration to introducing incentives to manage power factor where it is economic to do so.

- **Reactive compensation:** Beyond the Extension to the Price Control, the postulated transfers on the interconnector with France, in particular, appear to have a bearing on levels of compensation. The appropriateness of the assumptions on transfers with France will need to be considered when reviewing NGC's expenditure plans for the Next Price Control.

- **Asset replacement:** Scheme listings are an integral part of the review. In future they should be amplified to include all expenditure on a particular scheme including that before and after the review years in question. A yearly account of the quantities of asset replacement additions and disposals, by scheme and by asset category should be included for each year. Further consideration may be required to relate lives of groups of assets to condition and importantly to the recording of the actual ages at which assets are replaced and the reasons why.

- **Scheme papers:** Certain of the scheme papers presented by NGC, sometimes for substantial amounts of expenditure have been based on Project Definition Documents or without apparent substantiation. NGC should be encouraged to improve these to avoid the need for substantial supplementary questioning and presumably to satisfy its own internal sanctioning process.

- **Sanctioning process:** Further clarity should be provided in this area, in particular the process whereby unsanctioned schemes enter into NGC's 2005 Business Plan, and further distinction should be provided between schemes that are sanctioned (but are not yet started and hence may be deferred or cancelled) and those which are actually committed (contracts placed and either manufacture or construction work underway).

- **Divergence from Business Plan:** It may be appropriate for Ofgem to instigate a form of annual regulatory reporting whereby divergence from previously allowed expenditure can be monitored and, where necessary, agreed.

1. INTRODUCTION

1.1 General

The present transmission price control, set by Ofgem in 2000, runs from 1 April 2001 to 31 March 2006 (the Present Price Control). In 2004 Ofgem consulted on extending the National Grid Company's (NGC's) Transmission Asset Price Control for 2006/07[3] (the Extension to the Present Price Control) to permit alignment of electricity and gas transmission price controls in Great Britain. Early in 2005 Ofgem appointed PB Power to undertake a technical evaluation to extend NGC's main transmission price control for 2006/07 (the mini-review), the technical evaluation comprising a:

- broad assessment of capital expenditure levels for 2000/01 to 2006/07;
- detailed assessment of load-related expenditure in 2005/06 and 2006/07;
- detailed assessment of asset replacement expenditure for 2005/06 to 2007/08; and
- high-level assessment of asset replacement expenditure plans from 2008/09 to 2011/12.

The report has considered (operational) capital expenditure resulting from changes in load demand, the connection of new generating plant, the retirement of old generating plant, the replacement of existing 'life expired' assets, and other provisions such as those for network related IT expenditure, safety and environmental aspects. The report excludes consideration of operational expenditure and non-network capital expenditure.

The report is structured as follows. An overview of NGC's historic and forecast capital expenditure is presented in Section 2. A review of capital expenditure incurred for the period (2000/01 to 2004/05) is presented in Section 3. The review of NGC's capital expenditure forecast for the remaining year of the Present Price Control and the Extension to the Present Price Control, together with a longer view of asset replacement requirement to 2011/012 is detailed in Section 4. The report concludes in Section 5.

1.2 Background

Historically, operational capital expenditure has been treated in two parts, Load Related and Non-Load Related. Load Related Expenditure (LRE) is associated with the connection (or disconnection) of generation plant and customers directly connected to the transmission system, reinforcements to the existing system to accommodate revised connections and also general load growth. LRE generally comprises the following scheme categories:

Entry schemes may be defined as those schemes required to enable a generator, namely a power station, to be connected to the transmission system.

[3] Ofgem: Extending the National Grid Company's Transmission Asset Price Control for 2006/07, Initial Consultation, May 2004, Document No. 102/04.

Infrastructure schemes may be defined as those schemes required for reinforcement of the transmission system in order to meet the planning standards to fulfil the company's obligations to the transmission licence.

TSS Schemes are transmission system support schemes such as those needed to reduce reliance on balancing mechanism services.

Exit schemes may be defined as those schemes required to meet increases or changes in the power demand of grid supply points and other directly connected customers as a result of load growth, load transfer or closure of embedded generation.

Non-Load Related Expenditure (NLRE) relates principally to the replacement of 'life expired' assets, expenditure on network control and information gathering facilities, diversions, expenditure related to the environment and measures to enhance network performance. NLRE generally comprises the following scheme categories:

Replacement schemes may be defined as those schemes necessary for the replacement of existing 'life expired' assets. Replacement schemes include the following main sub-categories:

- Transformers
- Switchgear
- Sub-station other (including auxiliary supplies)
- Overhead Lines
- Underground Cables and
- Protection and Control

Diversions: Non-rechargeable schemes may be defined as those schemes for the diversion principally of overhead lines, say as a result of a wayleave termination.

Other Transmission Operator (TO) schemes comprise miscellaneous items including environmental oil containment schemes, site security, and asset management IT systems.

System Operator (SO) excluding BETTA schemes comprise system control schemes including those relating to the operation of the balancing services.

The LRE and NLRE may be combined to obtain the gross expenditure requirements. Part of this expenditure does however presently not form part of NGC's regulated capital expenditure allowances. This excluded expenditure is largely associated with new connections and upgraded or revised connections associated with generator or demand customers. In these instances, when a generator or a demand customer is connected to the network or wishes to upgrade or revise its connection, a capital contribution or annual connection charge is received. The Price Control is set on the basis of funding capital expenditure net of all capital contributions.

1.3 Approach to review

NGC's capital expenditure for the Final Year of the Previous Price Control, the Present Price Control period and the Extension for 2006/07 has been reviewed with respect to the overall level of spend, with respect to LRE and NLRE making up the overall spend, and with respect to the categories within LRE and NLRE.

To establish the appropriateness of the level of spend Ofgem issued a capital expenditure questionnaire on 28 February 2005. NGC submitted its substantive Response to Capital Information Request on 11 April 2005. A meeting was held between representatives of Ofgem, NGC and PB Power on 27 April 2005 followed by a further meeting between NGC and PB Power on 27 June 2005. In addition NGC provided responses to some 100 requests for clarifications submitted by PB Power. A summary of project correspondence and documentation is included as Appendix A to this report.

Using this information, PB Power has taken a view as to:

- The actual expenditure compared with that expenditure allowed by Ofgem in 2000, including such differences as exist between the expenditures;
- A review of the forecasting processes including NGC's policy statements, modelling processes, application of condition monitoring and resulting variances in respect of asset replacement expenditure;
- Appropriate load-related expenditure for 2005/06 and 2006/07;
- Appropriate asset replacement expenditure for 2005/06 to 2007/08; and
- High-level asset replacement expenditure from 2008/09 to 2011/12.

1.4 Changes to circumstances during the present Price Control

It may be appropriate to note in passing certain changes to circumstances during the Present Price Control:

- NGC has closed the Technology Division and laboratory at Leatherhead and the project office at Guilford as well as having moved the head office to Warwick; there have as a consequence been changes among staff undertaking asset management;
- The "PLUGS" method of applying connection charges has been introduced with connection assets being treated as being more shallow than before;
- Suppliers, particularly major manufacturers, have consolidated and less manufacture of transmission plant and equipment is being undertaken in the United Kingdom;
- Introduction of NETA in April 2001 and BETTA in April 2005; and
- Introduction of the electricity transmission network reliability incentive scheme, with effect from 1 January 2005.

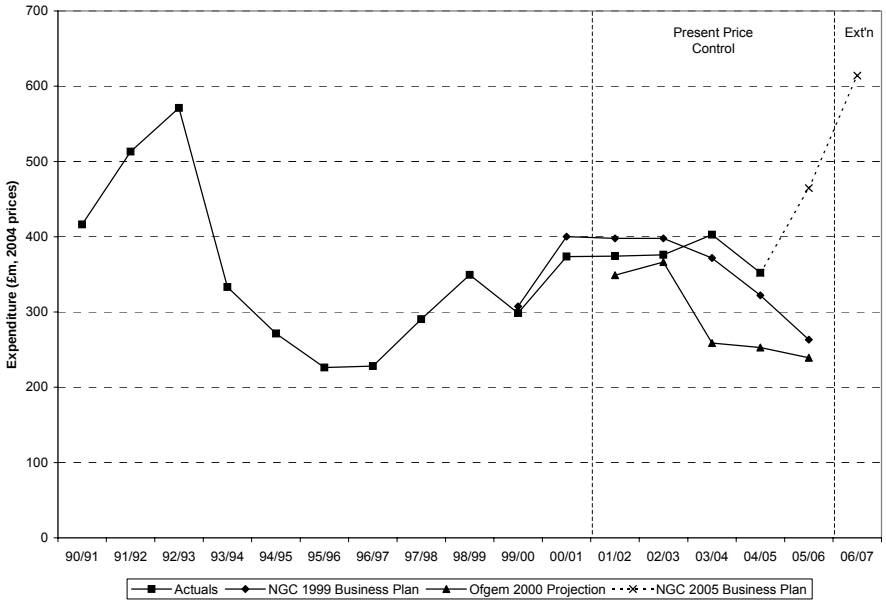
1.5 BETTA, other interconnectors and the Olympic Bid.

Expenditure relating to BETTA and transmission investment for renewable generation is excluded from this review. The network expenditure reviewed relates only to the England and Wales transmission networks and excludes interconnectors. The potential effects of the Olympic Bid were excluded.

2. OVERVIEW

In 1999 NGC submitted a capital expenditure business plan covering the period of the Present Price Control (2001/02 to 2005/06) (NGC 1999 Business Plan). Ofgem made projections which were set out in the Price Control Proposals (Ofgem 2000 Projection). As part of the present review, NGC submitted actual figures for expenditure and updated forecasts for the remaining Final Year of the Present Price Control and the Extension to the Present Price Control (NGC 2005 Business Plan), a copy of the annual actual and forecast expenditures being included as Appendix B to this report. These are shown in Figure 2.1 along with actual figures for expenditure known to date.

Figure 2.1 – NGC's annual capital expenditure



In presenting Figure 2.1, it is of note that:

- about £280m of expenditure between 2000/01 and 2004/05 was associated with major reinforcement schemes in Yorkshire and London (Exceptional Schemes) that have increased variances between actual and forecast expenditure due to the phasing of these projects.

- the balance of the variances is largely associated with differences in generation background, demand and asset replacement expenditure to those forecast ahead of the Present Price Control.

NGC is forecasting substantial increases in capital expenditure, not only in the Final Year of the Present Price Control and the Extension to the Present Price Control, but also in the longer term. This requirement is largely driven by NGC's view of the need for increasing asset replacement in its aging network and substantial customer driven demand related activity.

The actual and forecast expenditure is reviewed in more detail in the following sections.

3. ACTUAL EXPENDITURE FOR THE PERIOD 2000/01 TO 2004/05

3.1 General

Table 3.1 presents a comparison between the capital expenditure allowed by Ofgem for revenue purposes for the Price Control and the actual expenditure[4]. Table 3.1 comprises two tables with Table 3.1.a focusing on the Final Year of the Previous Price Control while Table 3.1.b provides comparisons for the period 2001/02 to 2004/05 (first four years of the Present Price Control) for which actual expenditure is known.

Table 3.1.a – Comparison of Allowed and Actual capital expenditures 2000/01 (£m at 2004 prices)[5]

	Allowed Expenditure	Actual Expenditure	Actual – Allowed Expenditure	(Actual - Allowed) Allowed Expenditure
LOAD RELATED EXPENDITURE				
Entry	17.0	15.9	-1.1	-6.2%
Supergrid system extension (infrastructure) excl TSS	166.2	97.1	-69.0	-41.5%
TSS				
Exit	57.7	57.9	0.2	0.4%
Gt Factor				
Abatements	-12.4	0.0	12.4	
Total Load Related	228.4	170.9	-57.5	-25.2%
NON-LOAD RELATED EXPENDITURE				
Asset Replacement:				
Transformers	9.0	3.5	-5.5	-61.3%
Switchgear	17.0	18.4	1.4	8.5%
Sub-station other	37.3	12.2	-25.1	-67.3%
Overhead Lines	33.9	36.7	2.8	8.2%
Underground Cables	13.6	10.5	-3.1	-22.6%
Protection				
Telecontrol / SCADA / Energy Mgt				
Protection & Control	30.5	46.2	15.7	51.4%
Abatements		0.0	0.0	
Diversions: non-rechargeable				
Other TO	38.4	50.1	11.7	30.3%
SO excl BETTA	0.0	27.7	27.7	
Total Non-Load Related	170.7	205.3	34.6	20.3%
Customer Contributions (enter as negative)	0.0	-2.5	-2.5	
TOTAL CAPITAL EXPENDITURE	397.9	373.7	-24.2	-6.1%

[4] Abatements have been applied pro rata to the asset replacement equipments concerned.

[5] NGC appear to have assumed that the revised forecast presented in its 1999 Business Plan as the allowance. The allowance made by OFFER in 1996 was £266m (2004 prices).

Table 3.1.b – Comparison of Allowed and Actual capital expenditures 2001/02 to 2004/05 (£m at 2004 prices)

	Allowed Expenditure	Actual Expenditure	Actual – Allowed Expenditure	(Actual - Allowed) Allowed Expenditure
LOAD RELATED EXPENDITURE				
Entry	66.7	33.9	-32.8	-49.2%
Supergrid system extension (infrastructure) excl TSS	385.6	464.9	79.3	20.6%
TSS	22.9	35.2	12.3	53.5%
Exit	126.4	264.7	138.3	109.4%
Gt Factor	-41.0	0.0	41.0	
Abatements	0.0	0.0	0.0	
Total Load Related	560.7	798.8	238.1	42.5%
NON-LOAD RELATED EXPENDITURE				
Asset Replacement:				
Transformers	24.2	29.4	5.2	21.5%
Switchgear	100.5	76.8	-23.7	-23.6%
Sub-station other	57.7	25.9	-31.8	-55.1%
Overhead Lines	103.2	171.4	68.2	66.1%
Underground Cables	143.0	114.8	-28.2	-19.7%
Protection				
Telecontrol / SCADA / Energy Mgt				
Protection & Control	102.3	116.1	13.8	13.5%
Abatements		0.0	0.0	
Diversions: non-rechargeable				
Other TO	94.0	140.9	46.9	49.9%
SO excl BETTA	41.9	44.1	2.2	5.1%
Total Non-Load Related	666.7	719.4	52.7	7.9%
Customer Contributions (enter as negative)	0.0	-51.5	-51.5	
TOTAL CAPITAL EXPENDITURE	1,227.4	1,466.7	239.3	19.5%

While LRE was lower than the allowed expenditure for 2000/01, NLRE was higher than the allowed expenditure. Both the actual LRE and NLRE are higher than the corresponding allowed expenditures for the period 2001/02 to 2004/05. PB Power comments on LRE and NLRE below, however, it should be noted that although it is appropriate to maintain a distinction between LRE and NLRE, in some cases the investment drivers will be a combination of the above factors, with network rationalisation, the replacement of ageing assets and improved network performance often being provided as part of a reinforcement scheme required by increasing electricity demand. Consequently the allocation of expenditure to LRE or NLRE may be somewhat arbitrary.

The following sections present a high level examination of LRE and NLRE given the context of a mini-review. Further detailed examination will be required to provide a robust view of expenditure over the period 2001/02 to 2004/05.

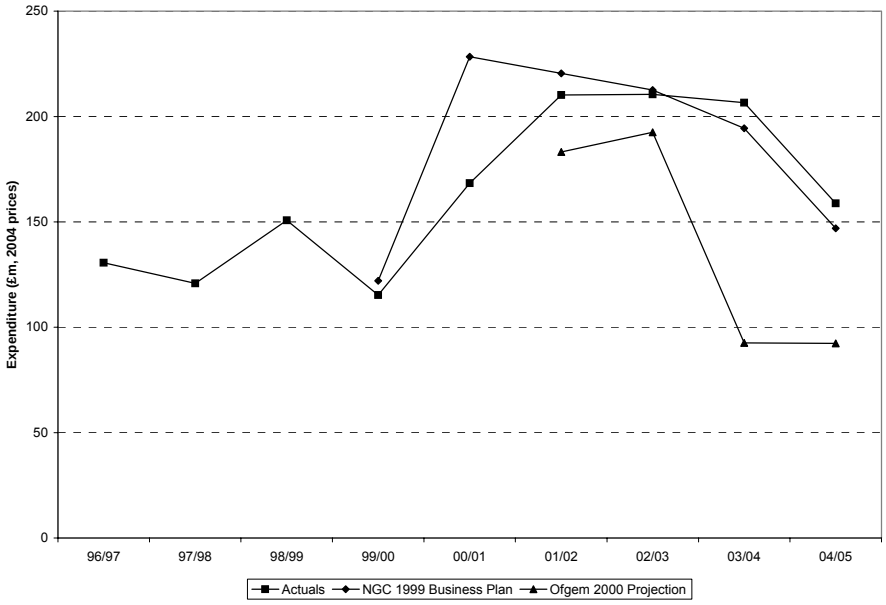
In undertaking the review it is of note that the investment programme delivered by NGC is different to that presented in the NGC 1999 Business Plan and that subsequently agreed with Ofgem, following a review. It may be expected that there would be certain departures resulting from the influence of customer-driven LRE and the need for innovation/efficiency

but there are departures, particularly in NLRE category, beyond what might be expected of a company delivering an agreed Business Plan. It may be therefore appropriate for Ofgem to instigate a form of annual regulatory reporting whereby divergence from previously allowed expenditure can be monitored and, where necessary, agreed.

3.2 LRE

Figure 3.1 shows the NGC 1999 Business Plan and the Ofgem 2000 Projection compared to the Actual.

Figure 3.1 – Trend in LRE, 1996/97 to 2004/05



LRE may be expected to vary from forecasts as new power station and customer connections, power station closures, and increases in electricity demands of existing customers are largely outside the direct control of the transmission business. The transmission business is however expected to be able to provide informed views on likely levels of expected expenditure. The reasons for variances between the NGC 1999 Forecast and Actual are discussed below:

a. **Entry Expenditure (£16m in 2000/01, £34m in period 2001/02 to 2004/05)** – In 2000/01 expenditure incurred in this category was dominated by the Baglan Bay and Staythorpe CCGT connections with expenditure being in accordance with the allowance.

   Over the Present Price Control period 2.7GW of new generation is expected to connect compared to NGC's forecast of 11.3GW and the Ofgem allowance based on 5GW. The actual expenditure for the period 2001/02 to 2004/05 is £33m less than the Ofgem 2000 Projection of £67m. This is in accordance with expectation given the status of the market.

b. **Exit Expenditure (£58m in 2000/01, £265m in period 2001/02 to 2004/05)** – In 2000/01 expenditure incurred in this category was in accordance with the allowance.

For the Present Price Control, NGC has stated in its 2005 Business Plan that whilst its forecast for gross demand ahead of the control was broadly accurate the level of demand taken from the transmission system has increased by 2.9GW (5.5%) higher than forecast. Capital expenditure for demand schemes has therefore been £181.1m higher than the NGC 1999 Business Plan and the Ofgem 2000 Projection. The additional requirements for capital expenditure in this category have resulted largely from a combination of Distribution Network Operator (DNO) schemes and customer demand schemes such as Network Rail. This has influenced expenditure in the period 2001/02 to 2004/05 such that there has been an overspend of £138m (109%).

c. **Infrastructure Expenditure (£97m in 2000/01, £465m in period 2001/02 to 2004/05) and revenue adjustment factor (not applicable in 2000/01, £61m in period 2001/02 to 2004/05)** – During 2000/01 and the period 2001/02 to 2004/05 period the London Infrastructure Project (£140m of which £6m remains to be incurred) and the Second Yorkshire Line Project (£146m of which less than £1m remains to be incurred) have largely been undertaken and are now largely complete. The phasing and magnitude of actual costs for these Exceptional Schemes have influenced actual costs occurring in 2000/01 and the period 2001/02 to 2004/05 in real terms. In 2000/01 this is the main cause for expenditure in this category being £69m (42%) less than the allowance.

Both generation openings and closures have been less than forecast by NGC ahead of the Present Price Control although demand has been greater than forecast. When the revenue adjustment factor (Gt) is taken into account to reflect the reduced level of generation connection activity, NGC was allowed expenditure of £345m compared to actual expenditure of £465m in the period 2001/02 to 2004/05. The capital expenditure for infrastructure schemes has therefore been £120m higher than the allowance in the period 2001/02 to 2004/05.

The underlying investment in LRE when the two Exceptional Schemes (London Infrastructure Project and the Second Yorkshire Line Project) are excluded from the capital expenditure are shown in Figure 3.2 below.

Figure 3.2 – Trend in LRE excluding Exceptional Schemes, 1996/97 to 2004/05

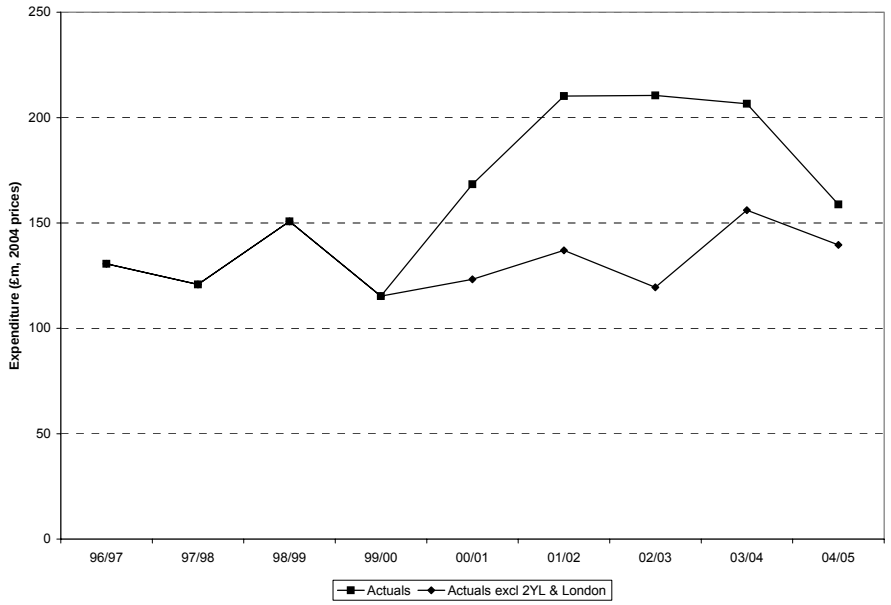


Figure 3.2 shows that, despite higher than forecast system demand together with changes in generation openings and closings during the period 2001/02 to 2004/05, the average annual LRE remains at about the same level of £135m year on year.

d. **TSS (£0m in 2000/01, £35m in period 2001/02 to 2004/05)** – No expenditure was known to be incurred in this category in 2000/01[6]. In the period 2001/01 to 2004/05, expenditure has been higher than that allowed by Ofgem in 2000 by £9m. NGC have stated that this resulted from the need to advance or enhance schemes to reduce reliance on balancing mechanisms services.

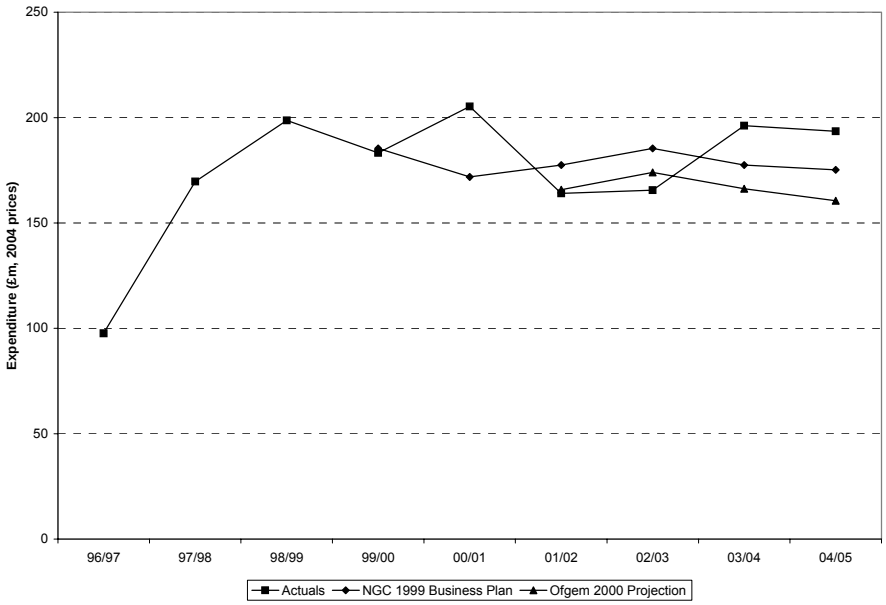
3.3 NLRE

3.3.1 Expenditure trends

Figure 3.3 shows the trend in NLRE, particularly the reduced level of expenditure during the period 2001/02 to 2002/03 and the marked increase in 2000/01 and the period 2003/04 and 2004/05, the latter being mostly due to increases in overhead line and "other TO" expenditures. ("Other TO" expenditure comprises miscellaneous items including environmental oil containment measures, data capture devices and site security measures.)

[6] PB Power was not involved in formulating views on TSS ahead of the Present Price Control with Ofgem.

Figure 3.3 – Trend in NLRE, 1996/97 to 2004/05



In reviewing the level of NLRE it is of note that, in the short to medium term, the levels of investment are largely considered to be within the company's discretion, other than with respect to the relatively small proportion of expenditure associated with safety and environmental measures.

3.3.2 Policy for asset replacement and refurbishment

NGC's policy for managing asset replacement and refurbishment is stated in Policy Statement EPS 12.0 – Equipment Replacement and Refurbishment which has been updated in 2005 from an earlier version produced in 1999. EPS 12.0 is the general document covering some ten equipment specific policy statements for NGC's range of assets. Importantly EPS 12.0 and the equipment specific policy statements EPS 12.1 to EPS 12.10 contain NGC's classification and assessments of asset lives as used for long-term planning purposes.

NGC's policy, as stated in EPS 12.0, is to consider assets for replacement or refurbishment before performance becomes unacceptable. Investment planning is largely based on the assessment of the condition of assets and not their performance as such. The system used by NGC to classify the condition of the main groups of assets varies however, partly because the assets themselves differ and also because the availability of condition data may also vary. NGC has therefore not adopted a system of universal condition scoring. Condition data is generally considered to have a validity for planning purposes of up to about five years.

For most asset types EPS 12.0 contains a list of criteria for priority ranking of asset replacement candidates and/or a summary of life limiting processes. For overhead lines (EPS 12.4), underground cables (EPS 12.5), and circuit breakers (EPS 12.6) the plant concerned is sub-divided in some detail either according to asset type and/or working environment. In the cases of underground cables (EPS 12.5) and transformers (EPS 12.7),

criteria are stated of prioritising or ranking replacement according to the condition of the asset concerned.

The probability distributions (replacement profiles or retirement fractions) used to model long-term replacement requirements are specified for each equipment type in EPS 12.0 and its sub-sections in terms of the criteria defined in Table 3.2.

Table 3.2 – Probability distribution function definitions

Definition	Threshold
Earliest onset of significant unreliability (EOSU)	2.5% of the equipment has reached a state where it requires replacement
Anticipated life	50% (median) of the equipment population has reached a state where it requires replacement
Latest onset of significant unreliability (LOSU)	97.5% of the equipment has reached a state where it requires replacement

Assuming a normal distribution of percentage replacement against age, the 2.5% and 97.5% markers represent points at +/- two standard deviations from the stated anticipated life. (NGC points out that not all the retirement profiles form a normal distribution and that some may be skewed). The implication is that some replacement may be modelled as being required before the "earliest onset of significant unreliability", including that which is not necessarily age related.

Priority ranking criteria are created for each equipment type to facilitate the development of an optimised replacement plan. Related processes are:

- NSPM204 Asset Health Review.
- NSPM111 Long Term Replacement.

Changes to asset lives since the first issue of EPS12.0 in 1999 are summarised in the table below.

Particular revisions principally concern overhead lines and switchgear and we address their impact on the actual and forecast expenditures later in the report.

NGC has provided a comparison of its asset technical lives since vesting in 1990 and in general these are now longer than initially assumed in 1990. The lives of NGC's substation assets also tend to be longer than those of other international transmission companies as stated in the Cigré report "Ageing of the System – Impact on Planning" dated November 2000. This latter comparison may be in part due to the robustness of plant and equipment originally purchased by NGC's predecessor, the CEGB, that NGC's assets may be older

than those of international comparators and that arguably NGC may therefore have greater experience of assessing ageing plant.

Table 3.3 – Changes to asset lives in EPS 12.0

EPS	Description	Equipment	Anticipated Asset lives
12.1	Substations	Compressed air plant	Lives reduced
12.2	Civil works	Fencing. Oil containment tanks.	Items added
12.3	Reactive compensation	MSCs and SVCs. SVC control systems	Lives increased. Item added.
12.4	Overhead lines	GZTACSR 'Gap Type' conductor. Tower structures (painted/not painted to policy). Overhead line insulators. Overhead line spacers and vibration dampers.	Item added. Item added. Item added. Item added.
12.5	Cables (being re-written)		
12.6	Switchgear	Circuit breakers. SF6 high duty circuit breakers. Current transformers, oil/paper. Surge arrestors.	Asset classes amplified. Item added. Lives increased. Item added.
12.7	Transformers	All	No change to asset lives but updated to include definitions of end of asset life.
12.8	Protection, Control and Automation Systems	All reclassified - more asset classes.	Lives of some older protection types increased, but those of digital/numerical equipments and software/database driven systems reduced.
12.9	Measurements	All reclassified - more asset classes.	Lives increased in general.
12.10	Telecommunications	All	Asset lives generally unchanged.

3.3.3 NGC's modelling of long-term asset replacement

NGC uses the Algorithmic Equipment Reliability Tool (ALERT) to provide its long-term probabilistic planning forecast over a 20-year scenario. NGC describes ALERT as a Monte Carlo model used to forecast uncertainty in future asset replacement volumes and thereby the possible range of long-term capital requirements. The inputs to the model are asset lives and asset population data. In general NGC uses a 50% confidence level at which it is 50% confident that it would not have to replace more than that level of assets in any one year.

In assessing the outputs from ALERT, consideration is given to the spread of results at various levels of confidence to understand the uncertainty in the future asset replacement volumes and hence the possible range of long-term capital requirements.

Certain asset types (batteries, towers, metering and telecommunications equipment are not modelled using ALERT as they are either not lead assets or data (towers) is not available.

3.3.4 Application of condition based monitoring

Transformers. NGC's policy for monitoring the condition of transformers is described in EPS 12.7 and includes criteria for assessing end-of-life. A technical replacement priority is assigned according to a four-point scale reflecting the condition information obtained.

Switchgear. NGC's replacement and refurbishment strategies as well as criteria for end-of-life are stated in EPS 12.6.

Overhead lines. NGC's policy for refurbishment and replacement of overhead lines as set out in EPS12.4 (Issue 3, May 2005) is described in more detail, with examples, in scheme paper PSC 368 dated March 2004 and entitled "Overhead Line Asset Management and Capital Replacement Strategy". In particular Appendix 4 of PSC 368 describes the decision process for choice of work options for each overhead line route. A key driver is whether system requirements (capacity reinforcement) would entail a conductor upgrade in the next five years. Another driver is whether the conductors would last another ten to fifteen years (i.e. for ACSR conductors whether the conductors are core-only or fully greased). These considerations determine the work option where condition indicates that work is required. The costs of replacement with upgraded capacity conductors, like-for-like capacity conductors or fittings-only differ, as discussed later in the report.

Condition assessments of overhead lines are classified as:

- Asset Health Review (review of issues affecting the performance and condition of lines)
- Foot patrol (ground level visual inspection carried out at minimum intervals of two years)
- Level 1 (internally via tower climbing and helicopter surveys)
- Level 2 (more detailed condition assessment including design solution, undertaken by contractors) otherwise termed Pre-Sanction Engineering (PSE)

- Equipment modification instruction (EMI) – a one-off corrective action to restore transmission equipment to a serviceable condition

Scheme papers are supported by an appendix entitled “condition snapshot” which summarises the data status, the type of conductor (core only/fully greased) and the percentages of components (fittings, insulators, spacers, conductor, towers) in poor condition. An assessment of system risk and criticality is undertaken, principally considering safety and reliability and system resilience under adverse weather conditions. Appendix 1 to PSC 368 states that under storm conditions some 63% of overhead line routes have operating restrictions to prevent manual reclosure in the event that automatic delayed auto-reclose (DAR) action fails, lest there be a conductor breakage and down on the ground. The number of temporary repair sleeves is taken as an indication of conductor in poor condition.

NGC has commented that for overhead line fittings the age profile, ad-hoc maintenance changes and huge volume of fittings installed on the system have made recording and maintaining fitting information difficult. NGC expects that the current Work and Asset Management (WAM) initiatives would improve both the accuracy, level of detail and allow for data to be stored electronically.

Towers. Although NGC has provided asset lives for towers depending on environmental exposure and whether historically they were or were not painted according to company policy (the latter is a change since the last price preview), neither sufficient environmental or painting history is presently available to provide corresponding asset age profiles. Instead NGC bases investment decisions on current tower condition determined from foot patrols carried out every two years. Towers suspected of being in the poorest condition are subject to climbing assessments that have been completed for 25% of the towers including all schemes in the 2005 Business Plan. Prioritised routes are then subject to detailed assessments designated as Pre-Sanction Engineering (PSE) works, generally scheduled to be available 18 months before start of the actual refurbishment/replacement work. NGC expects that its data and modelling processes for towers will improve over time.

Underground cables. EPS 12.5, policy statement on cable replacement, is being re-written. The fundamental life-limiting processes for lead sheath cables are reinforcing tape corrosion (pre-1973 BICC and AEI) and inter-crystalline lead sheath cracking (older 132kV and 275kV Pirelli). Both degradation mechanisms can result in oil-leaks, deterioration of the cable and reduced availability. NGC has also cited the introduction of further environmental legislation since the last price review as contributing to the scope of work.

3.3.5 Cost estimating

NGC has for a number of years now compiled a report entitled “TR3, Electricity Transmission Plant Cost Estimating Data”. The latest issue is Issue 16 for 2005/06. NGC has also recently introduced a systematic procedure, Project Definition Document (PDD) for estimating schemes using its cost database and taking account of assessments of complexity and engineering costs. Later in this report we comment on unit costs as used in our modelling of asset replacement expenditure.

3.3.6 Comparison of NGC 1999 Business Plan and NGC's 2005 Business Plan submission

In 2000 Ofgem accepted PB Power's recommendation that the allowed asset replacement expenditure be some £43m less than that in the NGC 1999 Business Plan (at 1999/2000 prices). Table 3.1 presents a comparison of actual against allowed expenditure and shows major increases for overhead line and "other TO" expenditures, with an increase overall.

In Appendix C to the 2005 Business Plan submission the various schemes are summarised, by NGC's spending categories, in a schedule entitled "NGC Capital Schemes Listing". In Appendix D NGC provided a selection of scheme papers describing individual projects in some detail, including their history as timings and costs have changed.

An analysis of the variances between the expenditure allowed for 2000/01 and the period 2001/02 to 2004/05 and the actual expenditure shows overspends of 20% and 8% respectively. From our comparison of the schemes in the NGC 1999 Business Plan (99 BP) with those in the 2005 Business Plan submission we find that the main reason for the increase is the introduction of new schemes in the period 2000/01 to 2004/05 that were not in the NGC 1999 Business Plan. Another (lesser but appreciable) reason is overall cost increase of the schemes in the NGC 1999 Business Plan. Some schemes originally in the NGC 1999 Business Plan have been delayed to beyond 2004/05. The main NLRE categories are discussed below:

a. **Transformers (£4m in 2000/01, £29m in period 2001/02 to 2004/05)** – The actual and forecast expenditure is £6m (61%) lower and £5m (22%) higher than that allowed for 2000/01 and the period 2001/02 to 2004/05 respectively. NGC comments that the median age of its transformer base is 36 years and that the majority of transformers have not yet reached the paper ageing (i.e. a principal) age-of-life criterion.

   A comparison of schemes shows virtually all unsanctioned schemes from NGC 1999 Business Plan as being postponed beyond 2004/05. Instead expenditure has been incurred in new schemes. Some of this apparent variance may be attributed to original bulk provisions being assigned to generic schemes.

b. **Switchgear (£18m in 2000/01, £77m in period 2001/02 to 2004/05)** – In 2000/01 actual expenditure was in accordance with the allowance.

   The actual expenditure for the period 2001/02 to 2004/05 is some £24m (24%) less than the corresponding allowed expenditure, the main reason being that unsanctioned schemes in NGC 1999 Business Plan have been postponed until after 2004/05. (These schemes relate to switchgear at voltages other than 400kV.) The reduction in spend associated with not taking forward unsanctioned schemes is slightly offset by newly introduced schemes.

The volume of replacements is less than we modelled in 2000. NGC has explained that instead of replacement it has introduced a policy of refurbishing type OBR60 275kV air blast circuit breakers, enabling it to defer some costs[7].

c. **Overhead lines (£37m in 2000/01, £171m in period 2001/02 to 2004/05)** – In 2000/01 and the period 2001/02 to 2004/05 overhead line expenditure has been higher than the allowance by £3m (8%) and £68m (66%) respectively. As overhead lines comprise a major part of the asset replacement expenditure and as NGC's processes in respect of overhead lines have undergone changes since the last price review, we have carried out an analysis in some depth of the reasons behind the variances in expenditure.

NGC has developed and extended its condition monitoring processes during the Present Price Control and changes are ongoing and so these processes may not in our view be not yet complete or mature. There remain important areas where data is incomplete, such as towers (painting and fittings). Furthermore NGC's historic records do not contain complete details of the level of greasing of conductors and so NGC presently relies on sample testing of conductors to confirm this key aspect.

NGC categorises its overhead line expenditure under the following headings:

QFI	Quad (conductor) fittings (only) replacement
QFU	Quad full replacement
TFI	Twin fittings replacement
TFU	Twin full replacement
ST	Steelwork replacement
OT	Other miscellaneous
EMI	Engineering Modification Instruction

The largest categories in terms of expenditure are QFU and TFU. QFU schemes typically comprise replacing quad 400mm² ACSR conductors with triple 700mm² AAAC conductors which provide improved fatigue performance, less susceptibility to corrosion and higher capacity. The first two such QFU schemes have been completed and others are presently being implemented. The costs of a number of major schemes either completed or underway (Dungeness – Ninfield, Chickerell – Mannington, Keadby – West Burton - Walpole) are appreciably higher than forecast in NGC 1999 Business Plan. The reasons for the variances appear to be mainly a combination of more work being required and contractor costs being higher than initially budgeted although NGC has also incurred overhead line expenditure in South Wales as a result of the change in generation background.

NGC has also embarked on a policy of replacing fittings only where this is required from condition monitoring, where (fully greased ACSR) conductors are

[7] This figure is presumably before application of abatements and is compared with NGC's 1999 Business Plan, before the reduction in allowed expenditure on switchgear.

not suffering from corrosion and where system considerations do not require an increase in capacity.

EMI schemes are a short duration measure to address public safety risks (replacement of fittings on sections of line crossing major roads).

By comparing the schemes in the NGC 1999 Business Plan (99 BP) with those in the present 2005 Business Plan submission we find that the main reason for the increase is new schemes introduced in the period 2000/01 to 2004/05 that were not in the NGC 1999 Business Plan. Another (lesser but appreciable) factor is cost increase although some schemes originally in the NGC 1999 Business Plan have been delayed to beyond 2004/05.

Our initial conclusion is that there has been considerable movement since NGC 1999 Business Plan, that the present processes of condition monitoring and assessment, though improved, have some way to go and that this will reflect on the view that we take of NGC's forecast for expenditure for 2005/06 and beyond. However, based on the status of asset management techniques at the time of incurring the expenditure in the period 2000/01 to 2004/05 there is no evidence to suggest that expenditure was not justified or inefficient.

d. **Underground Cables (£11m in 2000/01, £115m in period 2001/02 to 2004/05)** – The actual expenditure is some £3m (23%) and £28m (20%) lower than the allowance for 2000/01 and the period 2001/02 to 2004/05 respectively. The variance includes net cost increases, an increase for new schemes introduced (many concerning cable accessories or auxiliary systems) and a deferrals beyond the Present Price Control.

These swings underlie major programme changes, in part reflecting that individual cable schemes may incur appreciable expenditure and also that the work carried out is different to that originally forecast. NGC is tending to adopt a policy of installing cables in tunnels in urban areas and as a result and after a strategy review has identified cables requiring replacement in tunnels. This review has resulted in a different investment profile. Accessories are also an issue and, for example, NGC states that it has undertaken significant increase in tank replacement over the current period.

The Dartford Tunnel cable replacement scheme, and the only significant replacement of cable as such to be undertaken during the Present Price Control, incurred additional expenditure of £24m in the period 2001/02 to 2004/05, as a new tunnel was required instead of laying the replacement cables on the original route in a road tunnel.

The replacement of the Beddington – Rowdown 275kV cables that are suffering corrosion of reinforcement tapes has been delayed until the matter of resiting an en-route water abstraction point can be resolved. As a consequence expenditure on this project during the period 2001/02 to 2004/05 is some £68m lower than the corresponding allowed expenditure.

The replacement of the Stalybridge – Thorpe Marsh and Macclesfield – Stocksbridge 400kV cables in the 'old' Woodhead tunnel by new cables in the 'new' Woodhead tunnel has been delayed while refurbishment of the existing tunnel has been carried out to extend its life and reduce risk. Some £24m of allowed expenditure has therefore not been incurred in the period 2001/02 to 2004/05. This scheme is unsanctioned and the cables are currently planned to be installed in 2008 and 2015 in the 'new' tunnel, which was purchased from Railtrack in 1993.

From these examples we would however expect that the pattern of variances encountered in the period 2000/01 to 2004/05 in respect of cable expenditure could be repeated in the future.

e. **Substation Other and Protection and Control (£58m in 2000/01, £142m in period 2001/02 to 2004/05)** – As there appear to have been changes in which these assets have been allocated in NGC's Capital Schemes Listings and in the summary tables of capital expenditure between NGC 1999 Business Plan and submission for the 2006/07 extension, we have addressed Substation Other and Protection and Control as a combined group for the purpose of variance analysis.

Overall the actual expenditure is some £9m and £18m less than the allowed expenditure for 2000/01 and the period 2001/02 to 2004/05 respectively. This results from cost decreases or delays to in projects identified in the NGC 1999 Business Plan. Furthermore some £20m worth of expenditure forecast in 2000 has either been postponed beyond 2004/05 or cancelled. These reductions in expenditure (within the price control) are offset by new schemes being introduced and cost increases to schemes in the NGC 1999 Business Plan.

The major contributors to the cost decrease (over the current price control) are two protection and control schemes which were identified as virtual blanket provisions in NGC 1999 Business Plan and under which much less expenditure has been incurred during the period 2001/02 to 2004/05. The two schemes in particular are:

- Scheme 08981B (renumbered as 10055 under NGC's current reporting system PIER), Asset Replacement – Substation Control Systems infrastructure stages 3 & 4 – incurring some £35m less expenditure in the period 2001/02 to 2004/05 than forecast in 2000; this scheme is sanctioned and further expenditure is projected until 2007/08.

- Scheme NR0063 (renumbered as 10163 under NGC's current reporting system PIER), Protection Refurbishment stage 7, incurring some £13m less expenditure than allowed in the period 2001/02 to 2004/05; this scheme is sanctioned and further expenditure is projected until 2007/08.

The new schemes introduced include replacement of a tertiary connected reactor and a number of small schemes to replace substation auxiliaries under Substation Other.

f. **Other TO and SO excluding BETTA (£185m in 2000/01, £78m in period 2001/02 to 2004/05)** – Similarly we have also addressed the variances of "Other TO" and "SO excluding BETTA" expenditures together as a combined group.

Overall the actual and forecast expenditure was £39m and £49m in excess of the allowed expenditure for 2000/01 and the period 2001/02 to 2004/05 respectively. New schemes introduced between 2001/02 and 2004/05 and cost increase account for an increase in expenditure to those in NGC 1999 Business Plan. Cost decreases are accounted for by cost decreases on forecast schemes, schemes in the NGC 1999 Business Plan being closed without incurring much expenditure and forecast schemes postponed. Much of the apparent swings may be due to the same schemes being re-titled and renumbered since the NGC 1999 Business Plan was compiled e.g. in the detail there are changes to scheme numbers and titles of schemes relating to environmental oil containment measures. Other instances of schemes closed relate to global capital provisions made in the NGC 1999 Business Plan but not expended as such to-date in the Present Price Control.

Year on year the principal variances occur in 2003/04 which may be a reflection on the ability to forecast ahead expenditure of this diverse nature.

Two major "Other TO" schemes introduced between 2001/02 and 2004/05 relate to IT systems for asset management purposes (schemes ISC417, Work and Asset Management (WAM) Wave 1, and ISC317, Office in the Hand (OITH) Rel1, totalling some £34m). Both schemes are sanctioned. Other projects include enhancements to cable trench covers (£7m).

Under "SO and BETTA" expenditure the major project, the Integrated Energy Management System (IEMS) was completed but with a cost increase during the period 2001/02 to 2004/05 of some £4m. A further £8m of expenditure not in the NGC 1999 Business Plan related to One-hour gate closure.

4. FORECAST EXPENDITURE FOR THE PERIOD 2005/06 TO 2011/12

4.1 General

As part of the present review, NGC has provided forecasts for the period 2005/06 to 2011/12 to permit consideration of:

- Updated forecasts of LRE and NLRE for the Final Year of the Present Price Control (2005/06)
- Forecasts of LRE and NLRE for the Extension to the Present Price Control (2006/07)
- Longer-term consideration of asset replacement expenditure plans to 2011/12.

As indicated in Figure 2.1 increases in capital expenditure are forecast by NGC for the Final Year of the Present Price Control and the Extension to the Present Price Control, when compared to the average annual expenditure in the preceding 5 years excluding Exceptional Schemes. NGC's forecast for the Final Year of the Present Price Control and the Extension to the Present Price Control indicate that it will spend £89m (24%) and £220m (56%) more than the average annual spend for the preceding 5 years. When these levels are further considered in the context of allowances for accommodating renewable sources of generation in Scotland, that have been dealt with separately, the increase in expenditure over historic levels becomes more pronounced.

4.2 Scheme authorisation and control

Transmission business capital expenditure is largely driven by relatively few, large-scale investments to meet the requirements of generators, interconnectors, distributors, customers and also the replacement of life-expired assets. Consequently capital expenditure for NGC has been reviewed, so far as practicable, on a project-by-project basis.

All schemes involving expenditure of greater than £100,000 are required to follow the principles and guidelines laid out in NGC's Investment Scheme Procedure (ISP). The ISP also summarises the minimum authority levels for transmission scheme approvals. For all schemes where the total cost is over £1m, approval is sought from the Transmission Project Sanctioning Committee (TPSC), a sub-committee of the Transmission Executive Committee. For schemes where the total cost is over £30m, approval is sought from the NGT Executive.

Accordingly schemes are categorised as:

- Unsanctioned (UNS) – scheme papers were not available for unsanctioned schemes
- Sanctioned (SAN) – generally for construction to start in the forthcoming year
- Completed/Closed (CLO)

NGC has stated that, excluding abatements and capital contributions, the following sanction proportions could be derived[8].

	2005/6	**2006/7**
% of value sanctioned	86%	50%

PB Power has found that particular care needs to be taken in understanding how schemes are classified in terms of authorisation status and what these classifications (closed/sanctioned/unsanctioned) mean. For future Price Controls, we are of the view that further clarity should be provided in this area, in particular:

- the process whereby unsanctioned schemes enter into NGC's Business Plan and
- further distinction between schemes that are sanctioned (but are not yet started and hence may be deferred or cancelled) and those which are actually committed (contracts placed and either manufacture or construction work underway).

We comment elsewhere that while a few PDDs were provided as examples, scheme papers were not available for unsanctioned schemes. The PDDs, while providing a estimate of costs, do not by themselves provide any support or justification for the related unsanctioned schemes and so the supporting documentation for such schemes remains unclear to us.

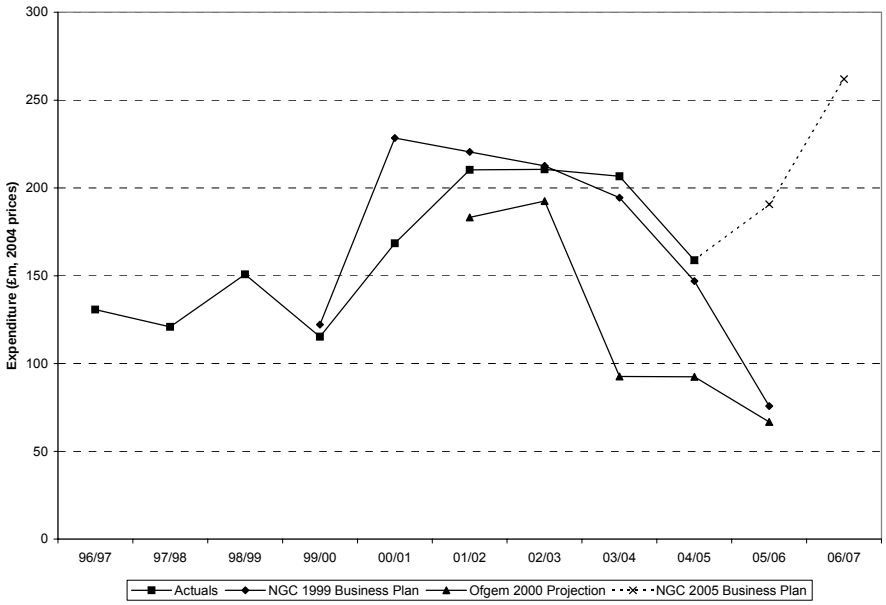
4.3 LRE

4.3.1 Review of proposals

Figure 4.1 shows the NGC 2005 Business Plan relative to the NGC 1999 Business Plan, the Ofgem 2000 Projection and Actual expenditure.

[8] This was the position on 3 May 2005.

Figure 4.1 – LRE, 1996/97 to 2006/07



To forecast the level of LRE, NGC establishes a "best view" network development scenario based upon a number of drivers including generation openings, generation closures, demand forecasts, market intelligence and customer knowledge. NGC supports the "best view" forecast level of capital expenditure through a planning process that enables an assessment of the sensitivity of the level of capital expenditure to uncertainties such as those associated with the generation market.

NGC plans its network in accordance with the Security and Quality of Supply Standard (SQSS). The standard includes a deterministic set of criteria to provide a minimum level of security of supply and allows for an economic test to justify investment over and above the requirements identified by the deterministic criteria. It is of interest that certain jurisdictions are moving towards (or have already adopted) a “grid benefits test” investment justification that could result in a security of supply above or below those required by deterministic criteria.

The LRE programme is based on a number of assumptions including:

- System demand rising.
- The potential effects of the Olympic bid were excluded.

We would note that whilst:

- the generation and demand forecasting methodologies appear comprehensive, there is very little detail on the precise assumptions used; and
- the generation openings and closures appear reasonable, historically these have been difficult to forecast as evidenced in comments made on Entry expenditure in Section 3.1.

NGC have also indicated that there has been little uptake on initiatives on demand side management. Further, of relevance to those areas that would benefit from constraint management, say to reduce requirements for reactive compensation, there has also been little or no generation to provide alternatives to those proposed by NGC.

NGC's 2005 Forecast for LRE is expected to increase relative to the outturn for the previous five years. PB Power's views with respect to NGC's forecast LRE program are as follows:

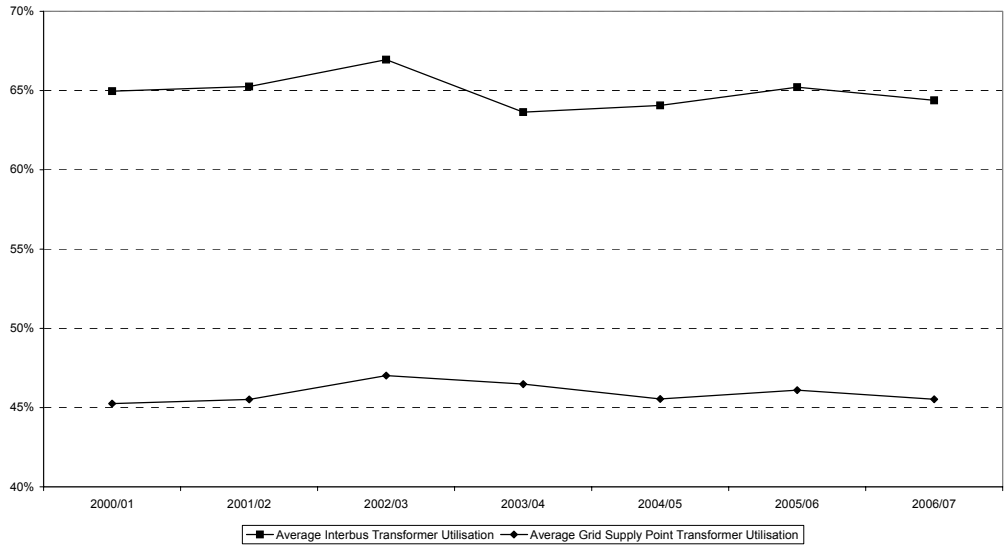
a. **Entry Expenditure (£0m in both 2005/06 and 2006/07)** – NGC considers that there will be no requirements for entry expenditure in 2006/07 and PB Power has no reason to disagree with that view.

b. **Exit Expenditure (£87m in 2005/06, £101m in 2006/07)** – In general terms, the drivers of Exit Expenditure, namely the number and location of new customer connections and increases in electricity demands of existing customers are outside the direct control of NGC. The NGC 2005 Business Plan should therefore reflect customer requirement and NGC indicates that all the demand connection schemes are either the subject of connection offers or are being progressed at the formal interface meetings with the relevant DNOs. The NGC 2005 Business Plan forecasts of expenditure in this category are however (£22m) 35% and (£37m) 57% greater than the average annual actual expenditure reported for the previous 5 years (on average £65m / annum). This forecast level of spend, this could either suggest:

- NGC's forecast level of spend is consistent with demand and security of supply drivers; or
- NGC has under or over-forecast the requirements for expenditure.

In order to obtain a high-level view of Exit expenditure, a review of the average utilisation of installed transformer capacity is shown in Figure 4.2.

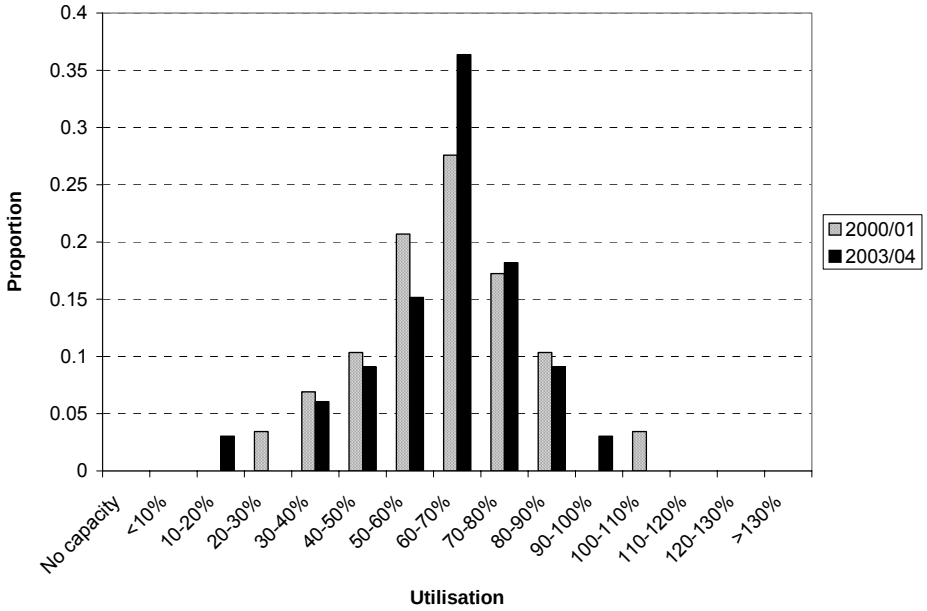
Figure 4.2 – Average transformer utilisation



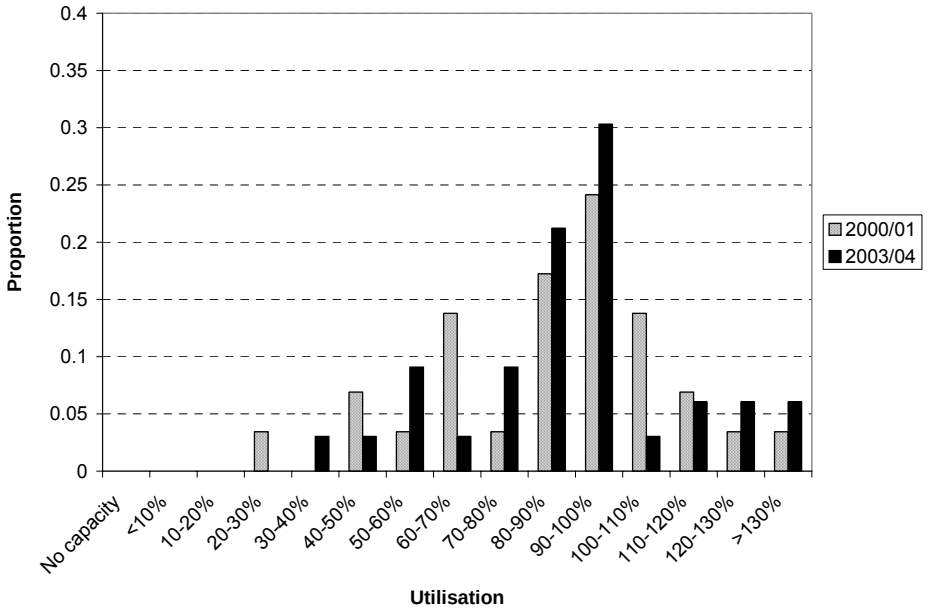
While PB Power acknowledges that Figure 4.2 provides a high level indicator that does not necessarily take into account regional variations in increases in demand or specific triggers for increasing transformer capacity, the corresponding forecast levels of utilisation in 2005/06 and 2006/07 do not support NGC's view of sustained high level activity in this category. Further, analysis focusing on those areas where the reinforcements occur is shown in Figure 4.3.

Figure 4.3 – Change in utilisation of Grid Supply Point (GSP) transformers at which NGC is forecasting expenditure

(a) Intact system



(b) First circuit outage



The analysis presented in Figure 4.3 is not conclusive in supporting NGC's view of increased requirements for capital expenditure in this category although in reviewing Figure 4.3b it is of note that an increasing number of sites are operating at greater than the name-plate rating of transformers such that, dependent on the characteristics of the daily load cycle, one could expect a requirement for reinforcement. Reasons presented by NGC for requirements for reinforcement at sites with relatively low utilisation include:

- expected large increase in demand;
- increase in demand over 300MW threshold SQSS requiring additional reinforcement; and
- where utilisation appears to have decreased since 2001 (mitigating actions by DNO, but reinforcement still required).

NGC has also stated that it believes the principal driver for the increased number of applications has been most strongly influenced by the P2/5 investigation and the DNO price control outcome citing, in particular a number of sites that have had high utilisation since 2000/01 but have only recently been the subject of applications from the respective companies. PB Power concurs with NGC that the level of activity in this category is very much dependent on responding to customer driven requirements although the question remains as to:

- whether the customer chooses to take the scheme forward; and
- the timing of the scheme.

Unlike Entry Expenditure, there is therefore less uncertainty in Exit Expenditure that relates to DNOs largely as a result of the joint working that is undertaken in identifying the optimum solution before the DNO makes a formal application.

The DNO submissions for the 4th Distribution Price Control were also reviewed to establish if there was consistency between the transmission and distribution licensees at the connection boundaries between the parties. However, with the focus of the Distribution Review being different, there was insufficient detail available to draw any conclusions.

Taking the above into consideration:

- for 2005/06 PB Power considers that given the timescales to deliver transmission projects that unsanctioned schemes will not be delivered suggesting an expenditure level of £74m to be more appropriate.
- for 2006/07, given supplementary activity presented by NGC following the 4th Distribution Price Control settlement NGC could be required to spend its forecast £270m. However, with the likelihood of certain Exit schemes not coming to fruition or being deferred PB Power considers an allowance of £76m to be more appropriate.
- **Sensitivity:** as suggested above, there is uncertainty in the level of expenditure that would be incurred by NGC in this category largely due to the dependence of NGC on customers taking forward their applications. Expected high and low scenarios are as follows:

  i. *High scenario:* Subsequent to the submission of NGC's 2005 Business Plan submission, NGC has indicated that it has received

further applications that in their view make the forecast low. Combined expenditure for exit works and exit related infrastructure has been indicated to be £46m higher than the 2005 Business Plan submission. On the basis that certain of these will fall away for reasons outlined above, a high expenditure scenario could be expected to be of the order of that indicated in NGC 2005 Business Plan submission, i.e. £87m in 2005/06 and £101m in 2006/07.

ii. *Low scenario:* Should historical levels of exit related expenditure continue into 2005/06 and 2006/07 then expenditure in this category could be as low as £65m / annum. Given the recent settlement of the Distribution Price Control this is considered unlikely.

It is of note that:

- while NGC has obligations under its Licence to connect applicants, the level of activity is about double that occurring historically. When taken together with NGC's proposed infrastructure and non-load related expenditure proposals, consideration needs to be given to NGC's ability to resource and deliver the proposals. This is discussed later in this report.

- while NGC has indicated it undertakes extensive joint working with the DNOs, subsequent to the submission of NGC's 2005 Business Plan submission, NGC has indicated that it has received further applications that in their view make the forecast low.

- NGC has indicated that the power factor at exit points is declining as there appears to be little incentive on DNOs to managing this. Ofgem should give consideration to introducing incentives to manage power factor where it is economic to do so.

c. **Infrastructure Expenditure (£126m in 2005/06, £175m in 2006/07)** – The infrastructure expenditure includes expenditure driven largely by new generation connections and demand.

About 35% (20% entry and 15% exit) of the total expenditure forecast in this category for 2005/06 and 2006/07 is associated with the provision of infrastructure associated with connections. A large proportion of this expenditure has already been sanctioned but in respect of infrastructure for entry connections (£9m in 2005/06 and £58m in 2006/07), it is of note that the generation openings will occur beyond the period associated with Extension to the Present Price Control.

About 20% of the total expenditure forecast in this category for 2005/06 and 2006/07 is associated with the provision of reactive compensation. NGC

justifies the need for this expenditure based on modelled scenario analysis that takes into account expected increases in demand, and changes on generation openings and closures rather than having any operational experience suggesting deterioration of network voltage performance in accordance with SQSS criteria. PB Power has found it difficult to assess the requirements for this spend based on presented scheme papers and associated underpinning reports but following a presentation by NGC for spend in this area required in 2005/06 and 2006/07 considers NGC's plans and underpinning assumptions, to be valid. It is however of note that a review of the status of the schemes making up the reactive power schemes shows about 33% and 80% of the schemes for 2005/06 and 2006/07 remain to be sanctioned. Given the time to implement transmission schemes, the unsanctioned schemes in 2005/06 are unlikely to come to fruition in the indicated timescales resulting in a deferral to 2006/07. However, given the delays expected in connecting certain of the exit schemes in 2006/07 and uncertainty in developments in generation background coupled with NGC's ability to resource its expenditure proposals, is also expected to defer compensation schemes such that the level of spend in 2006/07 does not increase above levels projected by NGC.

PB Power therefore considers that certain of the suggested levels of capital investment in reactive compensation would be deferred out of the Present Price Control and Extension to the Present Price Control. This amounts to £21m less than that forecast by NGC.

Beyond the Extension to the Price Control postulated transfers on the interconnector with France, in particular, appear to have a bearing on levels of compensation and these will need to be considered when NGC's expenditure plans for the Next Price Control.

The balance of the expenditure in the infrastructure category is associated with miscellaneous infrastructure schemes that it is difficult to take a view on without considerable analysis.

Sensitivity: The forecast level of spend will be influenced by changes to the demand and generation background. Expected high and low scenarios are as follows:

- *High scenario:* In the short timescales to 2006/07, NGC have indicated that there would be little scope to implement additional schemes to accommodate changes, say in generation background. As such, in the high scenario case, NGC is not expected to incur more than it has proposed in its 2005 Business Plan submission. This includes, for example, increasing transfers from Scotland that would increase requirements for reactive compensation in the West Midlands and North London area.

d. **TSS (£0.6m in 2005/06 and £0 in 2006/07)** – Expenditure in this category is small and no consideration has been given to its appropriateness given the sensitivity to changes in TSS would be within rounding errors of expenditure levels provided.

4.3.2 Summary

The findings of the review of LRE are summarised in Table 4.1.

Table 4.1 – PB Power's view of LRE in 2005/06 and 2006/07 and possible ranges in expenditure given uncertainty

Categories (2004 prices)	Actual 5 year average (£m)	2005/06 PB Power view (£m)	2005/06 Low scenario (£m)	2005/06 High scenario (£m)	2006/07 PB Power view (£m)	2006/07 Low scenario (£m)	2006/07 High scenario (£m)
LOAD RELATED EXPENDITURE							
Entry	10.0	0.0	0.0	0.0	0.0	0.0	0.0
Supergrid system extension (infrastructure) excl TSS	112.4	101.0	101.0	124.8	153.4	115.1	174.6
TSS	8.8	0.6	0.6	0.6	0.0	0.0	0.0
Exit	64.5	74.0	64.5	87.1	76.0	64.5	101.4
GT Factor							
Abatements		-10.0	-10.0	-10.0	0.0	0.0	0.0
Total Load Related	193.9	165.6	156.1	202.5	229.4	179.6	276.0

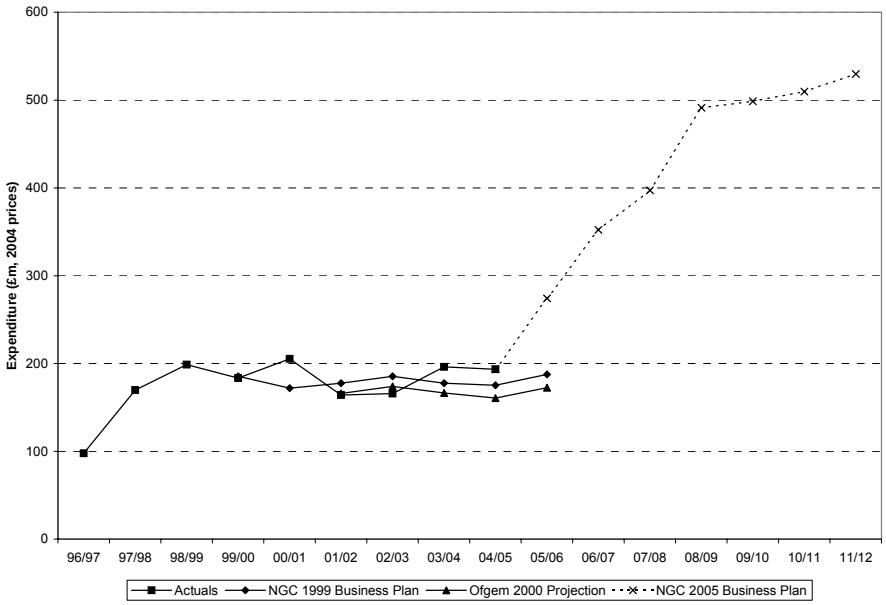
The table presents PB Power's view of levels of LRE for 2005/06 and 2006/07. For illustrative purposes, the table also shows how this compares to the average expenditure incurred in the previous 5 years for which the actual annual average expenditure is known. Given uncertainty in the assumed generation background, the number and location of new customer connections to the transmission network and increases in electricity demand of existing customers requiring network augmentation; and the sanctioning process, Table 4.1 also presents a range of expenditure that could be incurred by NGC in 2005/06 and 2006/07.

4.4 NLRE

4.4.1 General

Figure 4.4 shows the NGC 2005 Business Plan relative to the NGC 1999 Business Plan, the Ofgem 2000 Projection and Actual.

Figure 4.4 – NLRE, 1996/97 to 2006/07



4.4.2 Process

To assess NLRE PB Power has modelled the long-term replacement of the following asset "families" using the "replacement profile" technique used in the previous Transmission and Distribution Price Control Reviews:

- Transformers;
- Switchgear;
- overhead lines (with conductors and towers modelled separately);
- underground cables;
- protection and control (including metering and telecommunications) equipments; and
- substation other (including batteries, diesel generators and LVAC auxiliary systems).

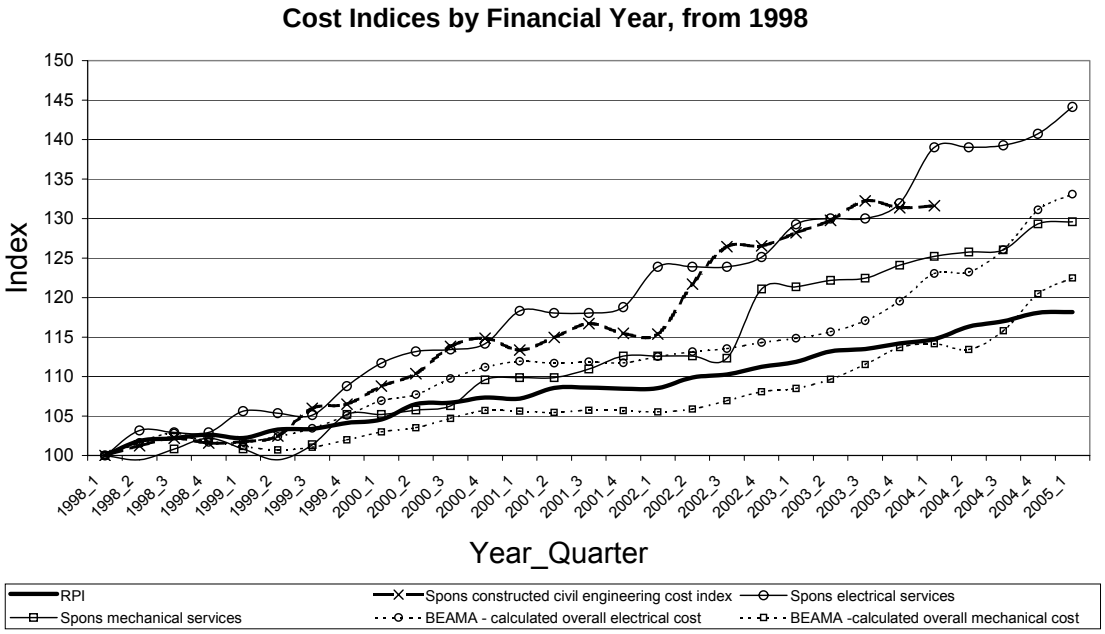
We have used the age profiles, replacement profiles and unit costs for the various "families" of assets as provided by NGC. The age profiles provided were compared with EPS 12 asset lives, and with those used in the 2000 review. The unit costs provided by NGC have been compared with those provided in TR3, those used in the 2000 review and PB Power's own cost database.

The other remaining items of capital expenditure, including those relating to system operation, site security and "other" miscellaneous expenditure, whilst appreciable, are not amenable to the asset replacement modelling technique used.

4.4.3 Comparison of unit costs

NGC has stated that its unit costs provided for the 2000 Transmission Price Control Review (TPCR) failed to identify a number of developing trends that in some cases lead to substantial increases in project cost. Figure 4.5 shows the cost indices relating to the transmission business. This figure shows the increase in mechanical and electrical services, and most notably civil engineering costs to be higher than the Retail Price Index (RPI).

Figure 4.5 – Trends in cost indices



In response to these inaccuracies NGC developed and implemented the PDD process that is intended to be a more holistic approach to cost forecasting. The PDD incorporates site-specific conditions and based on this information increases or decreases the unit costs for each scheme. The unit costs supplied by NGC for this review are based on the outputs of the PDD process, as well as the actual costs of projects already carried out.

We have compared the unit replacement costs from:

- Unit replacement costs provided by NGC (from Table 2.7 of the 2005 Business Plan submission, as well as the response to our subsequent query on unit costs);
- analysis of a number of specific scheme papers provided by NGC;
- NGC Technical Report TR3 (Issue 16), Electricity Transmission Plant Cost Estimating Data for 2005/6; and
- replacement costs used in the 2000 TPCR.

In Table 2.7 NGC has provided a breakdown of unit costs by:

- supply and installation of materials;

- project management and engineering (10 per cent throughout of the supply and installation of materials costs); and

- "Other expenditure" (18 per cent of the supply and installation of materials costs for major items of plant and equipment only).

The text below describes the results of the unit costs comparison for each asset "family", and indicates the costs applied in the modelling process.

Overhead Lines. The average asset replacement unit cost for overhead lines (using 700mm^2 AAAC conductor) provided in the 2005 Business Plan submission is significantly higher than that in Technical Report TR3 and the costs used in the 2000 review. NGC lists the general increasing trend in OHL contractor prices and additional safety and environmental measures now applied as being the major factors responsible for the increase in cost. Analysis has been carried out on the scheme papers provided which shows that the higher costs provided by NGC in the 2005 Business Plan submission align with those of the actual schemes, and we have therefore used them in the asset replacement model.

Underground cables. The unit replacement costs quoted in NGC's 2005 Business Plan submission are low in comparison with both the "new build" costs in TR3 and the costs applied in the 2000 review. As the 2005 Business Plan submission Table 2.7 costs are based on actual work carried out by NGC we have used these costs in the model, and adjusted the model output expenditure to allow for the cost of replacement and refurbishment of ancillaries such as tunnels, joints and terminations.

Switchgear. The average unit costs provided in NGC's 2005 Business Plan submission represent the cost of switchgear unit replacement, defined by the equipment voltage level. We note NGC's statement that the cost of air insulated switchgear (AIS) and gas insulated switchgear (GIS) replacement schemes are comparable because the higher material costs of GIS are offset by the higher construction costs associated with replacing existing AIS in-situ on a one for one basis. We also note that the introduction of new 132kV switchgear (with higher ratings to accommodate increased network fault levels) may require the structures housing the equipment to be reconstructed and the replacement of ancillary equipment (e.g. current and voltage transformers).

Accordingly NGC has stated that the unit costs for switchgear as provided in Table 2.7 of its 2005 Business Plan submission are weighted as one-third GIS costs and two-thirds AIS costs. This weighting reflects a view expressed by NGC that:

- in a number of instances it is preferable, for economic and safety reasons, to replace a complete switchbay and not just individual plant items such as circuit breaker piecemeal;

- other items such as instrument transformers and busbars may be in poor condition;

- there are fault level inadequacies at 132kV;

- rebuilding of a new substation, GIS, “off-line” at an adjacent site may be preferable and may be undertaken more quickly;

- suppliers are reluctant to undertake in-situ replacement of AIS but that an “off-line” replacement policy may not apply everywhere (e.g. indoor AIS substations)

We would comment that, particularly in view of the complexity and changes associated with integrated protection and control systems, there might be merit in NGC’s approach. However, no detailed substantiation has been provided by NGC nor any accounting of benefits due to land being released thereby.

For the purposes of modelling, we have used NGC’s weighted unit costs for switchgear. Later in the report we describe a sensitivity analysis in which we differentiate between AIS and GIS.

A comparison between the “as new” costs of open terminal switchgear as stated in TR3 (Issue 16, 2005/6) and the standardised average replacement costs from NGC’s 2005 Business Plan submission is presented in Table 4.2.

Table 4.2 – Comparison of switchgear costs

Item	Costs used in TPCR 2000*, (excl. protection)	TR3 new build (full infrastructure) cost, inc. protection but excluding engineering	PB costs (Ofgem budget cost database), inc. protection but excl. engineering and contingencies	NGC BPQ costs (Table 2.7), supply & installation of materials only, excl. project management & engineering and "other expenditure"	NGC BPQ costs (Table 2.7), including project management & engineering and "other expenditure"	Comment
400 kV switchgear	£1,396,049	£1,547,200	£1,617,205	£1,350,000	£1,728,000	TR3 cost is as Schedule 2A, feeder bay
275kV switchgear	£953,372	£1,268,700	£1,175,127	£1,290,000	£1,651,200	TR3 cost is as Schedule 2G, feeder bay
132kV switchgear	£437,102	£423,700	£487,680	£560,000	£716,800	TR3 cost is as Schedule 2J, feeder bay

* amounts have been adjusted to represent 2004/05 price levels.

It should also be noted that the TR3 costs in the table above include the cost of protection equipment. The costs supplied by NGC represent the unit replacement costs as well as the cost of civil and structural work that is sometimes required as part of the refurbishment of the switch bay (or the rebuild of a bay in an adjacent site). The costs supplied in NGC’s 2005 Business Plan submission were used in our model.

Transformers and reactors. The unit replacement costs are generally in accordance with TR3 and our cost database. The costs provided in the 2005 Business Plan submission were therefore used in the model.

4.4.4 Comparison of asset lives

We have compared the average asset lives from the:

- average lives as calculated from the asset replacement profiles provided by NGC in the current 2005 Business Plan submission
- anticipated asset lives (NGC Engineering Policy Statement EPS 12 - Equipment Replacement and Refurbishment, Issue 3, 2005)
- average asset lives from and retirement curves used during the TPCR in 2000; and
- responses to our subsequent queries on retirement profiles for towers, and transformers

Since the 2000 Price Review, NGC has re-assessed the lives of its assets as generally remaining unaltered, with some exceptions and additions that are listed below:

Transformers and reactors. The replacement profile associated with transformers of type T_4_IB_AEI750 has been altered to reflect random failure rates that are higher than for the general transformer population. This effectively means that for this specific family of transformers, the mean life expectancy has shifted from 45 to 26 years. However, only 4 of these transformers currently remain on the NGC system.

Switchgear. The retirement profile associated with the 300kV conventional refurbished air-blast circuit breakers (not pressurised head) has been altered to reflect the extension of the asset lives brought about with the refurbishment of type OBR60 circuit breakers. This refurbishment programme extends the mean life of the equipment by 5 years (i.e. to 55 years) and has allowed the replacement of the switchgear to be safely deferred.

Overhead Lines. Individual asset replacement profiles have been added for All Aluminium Alloy Conductor (AAAC), Aluminium Conductor Alloy Reinforced (ACAR) and GAP overhead line conductors. The only GAP (high temperature low sag) conductors on the system were installed in 2004, and hence the replacement of this family does not fall within the time frame associated with this review. The average age of AAAC/ACAR conductors on the NGC system is thirteen years and with the assigned profiles exhibiting mean lives of 60 years, the replacement of these conductors does not impact on the forecast for the years considered in this review.

Towers. NGC does not include the modelling of tower asset lives in the ALERT forecast analysis. Tower lives have been revised by NGC, based on condition assessment and variances in historic painting regimes. The existing tower population have not been categorised into these new groups (according to historic painting policy) as NGC's investment decisions are based upon the current condition of individual towers. We have therefore utilized the same replacement profiles as used in the 2000 review which were

based on the profile for towers presented in EPS12 (Issue 1, 1999) and fall in the mid range of the new asset lives presented in EPS 12.4 (Issue 3, 2005).

Underground cables. Retirement profiles have been added for XLPE insulated cables, which have been installed since the 2000 review (a change of procurement policy from fluid filled cables). The mean life for this cable family is estimated to be 40 years, with an EOSU of 25 years.

Protection, telecommunications, metering and control. A number of new asset retirement profiles have been added for these asset groups, and the number of equipment groups has expanded to incorporate control, telecommunications and metering plant.. The previous review categorised these equipments as solid state or electro-mechanical, with 25 years life expectancy being assigned to the solid state and 35 years for the electro-mechanical units.

Some of the new profiles have significantly shorter anticipated asset lives (anticipated lives for certain software driven systems as low as 10 years), which reflect the real life expectancy of modern numeric models based on manufacturers advice and experience. NGC's investment strategy incorporates a combined 'one-hit' replacement approach wherever possible, with the provision of an integrated standard bay solution. This process inevitably leads to the replacement of protection and control equipment before it becomes scheduled for age/condition related asset replacement in some cases in order to maximise the efficient delivery of overall transmission requirements.

4.4.5 Unit quantities

The declared unit quantities supplied for this review have been compared with the quantities supplied for the review carried out in 2000. In most cases the declared unit quantities are comparable, with the exception of the following asset "families".

Transformers. The declared "pre-2000" unit quantities have increased since the previous review. This is due to the addition into the asset base of transformers and reactors connected at voltage levels below 132kV, as well as quad boosters which were omitted from the asset age profiles provided by NGC in 2000. These additional units have resulted in an average increase in forecast non-load related expenditure of approximately £6m per year from 2005/06 to 2011/12.

Switchgear. As for transformers above, switchgear units related to sub-132kV voltage levels have also been included in the NGC asset base for this review as well as units utilised as strategic spares. The addition of these units has resulted in an average increase in the forecast non-load related expenditure of approximately £2m per year from 2005/06 to 2011/12.

Protection, telecommunications, metering and control. In previous reviews only protection equipment was included in the modelling part of the review. For this review we have included control, telecommunications and metering equipment as well as protection relay units. The inclusion of this additional plant into the model has resulted in an increased forecast expenditure of approximately £22m per year from 2005/06 to 20011/12 to the

forecast (the inclusion of control equipment accounts for the majority of this additional spend, approximately £19m per annum).

4.4.6 Comparison of forecast and model output

In Table 4.3 and 4.4 we summarise the comparison of NGC's forecast and our model predictions for asset replacement, using the costs and replacement profiles discussed in the previous sections with the age profiles declared in the 2005 Business Plan submission.

It should be noted that this review considers a three-year period, with the NGC budget being built up from separate identified schemes, a few of which contain generic provisions. Inevitably there may be some mismatches between the NGC's 2005 Business Plan forecast and the output of our model, which differences we would expect to be proportionately less were the review to be carried out over a longer period. We also note that the compilation of a table of quantities of assets disposed of and added (Table 2.4 of the response) does not necessarily form part of NGC's planning process. Furthermore the medium to long term modelling that NGC undertakes is to provide an indication of likely replacement quantities whereas NGC states that its budget is composed of schemes based on asset condition.

We have analysed the load related scheme listings and find that there are no readily identifiable schemes incorporating the replacement of assets that would otherwise be classed as non-load related expenditure. No adjustments have thus been made to our non-load related forecast to cater for load related schemes.

Transformers (excluding reactors). The NGC Capital Schemes Listing includes the replacement of series and shunt reactors under the 'Substation Other' group of assets. We have thus moved the reactors from the 'Transformer' group of assets (where they were in the 2000 review), to the 'Substation Other' group.

Our model predicts a higher replacement of transformers than forecast by NGC. As transformer replacement is driven predominantly by the condition of the transformers, two main factors decide whether to replace a transformer:

- high dissolved gas analysis content generally indicating winding faults or poor core bolt or winding bolt insulation; and
- high content of furfurans in transformer oil indicating deterioration of paper insulation (low degree of polymerisation, and hence electrical strength, of paper insulation).

As either condition would require a re-wind in a factory, such units are considered as being beyond economic repair and therefore candidates for replacement. NGC reported that 37 transformers currently have active internal faults. The 23 transformers scheduled for replacement by NGC during this review period seems reasonable considering the three-year duration of this review. The quantities of transformers to be replaced may not all have been included in Table 2.4 of the NGC response, as the unsanctioned schemes 00Z103 (Transformer deployment replenishment) and 015497 (Condition driven SGT replacement) do not seem to have specific transformers associated with them, although the corresponding expenditure totals £26m over the review period.

As NGC's forecast expenditure is lower than that predicted by our model and the annual levels of replacement is similar to that incurred in the present Price Control period, we would therefore accept NGC's forecast for expenditure on transformers.

Table 4.3 – Comparison of quantities in NGC's Forecast and PB Power's Model predictions - 2005/06 to 2007/08

	Quantities 2005/06-2007/08				Comments
	Unit	NGC's forecast for asset replacement (2005 Business Plan submission Table 2.4)		PB Power Model	
		Disposals	Additions		
Transformers (excluding reactors)	each	23	23	33	Quantities in NGC's 2005 Business Plan submission (Table 2.4) may not include all units to be replaced.
Switchgear	each	106	96	237	NGC's forecast may not fully reflect the quantities of 132kV circuit breakers to be replaced, as indicated by modelling; NGC's forecast omits switchgear at 66kV and below.
Overhead lines	circuit-km	979	979	811	Full refurbishment.
Cables	circuit-km	57	15	44	28.8km of 132kV cable to be disposed of without replacement. The 2 x 275kV, 10km, Beddington - Rowdown circuits are to be replaced with a single 400kV circuit, but the replacement is to occur outside the years in question.
Protection, control, metering and telecommunications	each	800	831	1741	Quantities from NGC's 2005 Business Plan submission (Table 2.4) do not reflect the actual quantities to be replaced
Substation other (including reactors)	each	557	557	1412	Quantities from NGC's 2005 Business Plan submission (Table 2.4) do not reflect the actual quantities to be replaced

Table 4.4 – Comparison of expenditures in NGC's Forecast and PB Power's Model predictions - 2005/06 to 2007/08

	Expenditure (£m)			Comments
	3 x NGC's average annual spend	NGC's forecast	PB Power model adjusted	
	(2000/1-2004/5)	2005/06-2007/08		
Transformers (excluding reactors)	19.7	61.9	62.7	Similar levels of expenditure forecast.
Switchgear	57.1	149.7	174.6	Model forecast is higher than NGC's forecast mainly due to 132kV and 66kV switchgear expenditure apparently being deferred. (See detailed explanation below.) It should be noted that NGC's forecast expenditure for switchgear increases sharply following this review period.
Overhead lines	124.9	376.8	271.0	74% of the NGC schemes listing expenditure is unsanctioned. The model's forecast for this group has been adjusted to allow for expenditure not included in the model
Cables	75.2	157.8	157.2	Similar levels of expenditure forecast, despite differences in quantities. A detailed reconciliation accounting for expenditure not modelled, schemes of long duration and schemes completed in the years in question is presented in the text.
Protection, control, metering and telecommunications	97.4	89.8	122.2	NGC forecast levels of expenditure similar to historical levels
Substation other (including reactors)	22.9	40.9	50.2	The model's forecast for this group has been adjusted to allow for expenditure not included in the model. Replacement of reactors was not included in this asset group in the past
Other TO	114.6	110.1	*110.1*	
SO excl BETTA	43.1	36.6	*36.6*	
Total	554.8	1023.6	984.7	

Switchgear. In past reviews, NGC has included only switchgear at and above 132kV in its declared age profiles. For this review, switchgear at 66kV and 33kV levels has been declared and so included in our model.

Our model predicts a substantially higher replacement of switchgear quantities than forecast by NGC[9]. The model forecasts a higher level of replacement of switchgear units at 132kV and below (199 units) than the quantities declared in the NGC submission (70 units) over the three years considered for this review. NGC has indicated that its priority is to replace or refurbish air blast circuit breakers despite age-based modelling showing oil circuit breakers (275kV and 132kV) as well as significant quantities of other switchgear at 132kV and below becoming candidates for replacement. Furthermore NGC predicts a sharp increase in expenditure for 2008/09 and beyond.

Table 4.5 presents a comparison of quantities and expenditure between NGC's 2005 Business Plan submission and our modelling.

Table 4.5 – Comparison of switchgear quantities and expenditure

	Unit	Not Related To Voltage	66kV & below	132kV	275kV	400kV	Total
Comparison of quantities							
NGC 2005 Business Plan submission, Table 2.4, disposals	#	N/A	0	70	34	2	106
NGC 2005 Business Plan submission, Table 2.4, additions	#	N/A	0	68	23	5	96
PB Power model, disposals	#	N/A	54	145	36	2	237
Comparison of expenditure							
Switchgear, schemes listing, unabated	£m	42.6	1.2	53.1	53.3	0.8	151.0
Switchgear, schemes listing, abated	£m	42.3	1.2	52.7	52.8	0.8	149.7
PB Power model, disposals	£m		7.2	104.1	59.3	4.0	174.6

In making the comparison between NGC's 2005 Business Plan submission we would observe the following:

- the quantities in 2005 Business Plan submission Table 2.4 (and NGC's medium to long term modelling) do not drive NGC's budget directly which instead is composed of a number of individual schemes; the compilation of a schedule similar to Table 2.4 does not appear to be part of NGC's planning process and so the data as submitted may lack precision

- Scheme 015498 is entitled "Policy Driven CB replacement" at some £39m in 2007/08; this is an unsanctioned scheme and so no scheme paper or other information or justification was forthcoming

- NGC includes switchgear at </= 13kV, mainly controlling reactive plant connected to transformer tertiary windings, with the associated plant

[9] In the review, quantities of circuit breakers are used as a proxy for the entire switchgear associated with a primary circuit; in detail however a switchgear expenditure scheme may relate to non-circuit breaker items such as bushings.

- in respect of switchgear at 66kV and below, NGC has explained that the costs (2007/08) are for pre-engineering prior to actual replacement of assets and hence no asset replacement quantity is shown at this point; although our modelling shows a substantial quantity of assets due for replacement, the unit costs are small as is the corresponding expenditure difference

- for 132kV switchgear the model quantities and expenditures are higher than indicated by NGC, but if Scheme 015498 was attributed to 132kV switchgear the expenditures would be similar

- comparing 132kV switchgear quantities in detail, the model predicts replacement quantities of some 54 oil circuit breakers (OCBs) (NGC, 14), 1 outdoor GIS circuit breaker (NGC, nil), no ground circuit breakers (NGC, 4) and 90 conventional air blast circuit breakers, not refurbished (NGC, 52); it would appear that NGC may not have fully reflected the quantities of 132kV circuit breakers to be replaced e.g. we understand that NGC assigns replacement of OCBs with a lower priority than replacement or refurbishment of air-blast circuit breakers and hence OCB replacement may be deferred and

- we would regard the relative differences in quantities and expenditures of 275kV and 400kV switchgear as small.

A further observation is that an inspection of the assets declared by NGC for this review show that almost 3% of switchgear (70 units) is beyond the “latest onset of significant unreliability” as defined by their associated age profiles but are presumably still performing an acceptable level of service.

As NGC’s forecast is lower than that predicted by our model, we would accept NGC's forecast for expenditure on switchgear.

Overhead lines. The forecast increase in expenditure of some £51m on overhead lines in 2005/06 over the 2004/05 expenditure is due mainly to a number of major refurbishment projects either running up to a full work level or starting; these schemes have been subject to pre-sanction engineering and are sanctioned:

- Keadby – West Burton – Walpole (full refurbishment)

- Pembroke – Swansea – Cilfynydd (fittings)

- 4YV Line (Pembroke) (fittings)

- Chesterfield – High Marnham (full refurbishment)

The overhead line expenditure for 2005/06 comprises £18m unsanctioned and £107m sanctioned expenditure, totalling £125m. The unsanctioned expenditure however includes £10m expenditure in 2006/06 for the Burwell – Walpole scheme which could therefore be incurred in a later year.

The levels of expenditure forecast by NGC are higher than those predicted by our model. We have adjusted the model output to include those 'non-model related' schemes in the scheme listing provided by NGC. These 'non-model related' schemes included diversions and EMI work for the years 2005/06 to 2007/08.

Our model utilises the data, notably asset categories, provided by NGC in Tables 2.4 to 2.7 of its 2005 Business Plan and identifies quantities and expenditures of conductor systems and towers for replacement and/or refurbishment. The 811 circuit-km of conductor systems modelled for replacement and/or refurbishment comprises:

		Circuit-km
Zebra	Fully greased	54
Lynx	Fully greased	127
Zebra	Core only greased	542
Lynx	Core only greased	88
TOTAL		811

The same unit cost (£281,900 per circuit-km as stated in Table 2.7 of NGC's 2005 Business Plan) has been used for each conductor category and reflects a fully refurbished cost. The data provided in Tables 2.4 to 2.7 of NGC's 2005 Business Plan does not permit further segregation into full and fittings only refurbishments as being implemented in practice by NGC.

(If an allowance was to be made for fittings only refurbishment and considering that the latter would be applied to fully greased conductors, the proposed expenditure allowed below would be reduced.)

Table 4.6 outlines the expenditure that we believe is appropriate for overhead lines from 2005/06 to 2007/08.

Table 4.6 – Table of expenditure breakdown for overhead lines – PB Power's view

Expenditure	Quantity Circuit-km	Unit cost (£k)	Total Cost (£m) (2005/06 - 2007/08)	Annual cost breakdown (£m)		
				2005/06	2006/07	2007/08
Model forecast for OHL replacement	811	281.9	228.6	66.0	76.2	86.5
Model forecast for tower refurbishment	782	19.5	15.3	4.4	5.1	5.8
EMI and diversions (from scheme listing)			27.1	13.4	13.3	0.4
PB View for overhead lines			**270.9**	**83.8**	**94.6**	**92.6**

Accordingly we consider that an expenditure on overhead lines of approximately £270m would be appropriate. This would represent an increase of 189% in expenditure over that allowed for the five years covered by the 2000 review.

Underground cables. Similarly the output of our model has been modified to include cable related expenditure not included in the model (sourced from the scheme listing provided by NGC, including the cost of replacement and refurbishment of ancillaries such as tunnels, joints and terminations). When comparing the cable replacement unit quantities in Table 4.3, it is clear that the "asset replacement additions" column does not correspond with the "disposals" or with the "PB Power view". This is because of the non-like-for-like replacement that is underway in this asset category. One example of which is the replacement of the two 275kV, 10km, Beddington – Rowdown cable circuits, which are to be replaced with one circuit only of 400kV cable (scheme 9416). According to paper PSC 224 dated 7 May 2003, the actual replacement would not be completed before 2010/11 and hence would be outside the years in which the above comparison is made. However appreciable expenditure on this project is being incurred in the meantime.

At 132kV some 28.8km of cable from Mill Hill to St John's Wood are planned for disposal by NGC, to be replaced by the proposed "Hendon" infrastructure scheme which is at an early planning stage.

In reconciling expenditures we would observe that NGC's forecast expenditure for 2005/06 to 2007/08 includes for some:

- £32m of expenditure on accessories and general cable refurbishment, not modelled but added the adjusted output to form PB Power's view
- £25m of expenditure on the replacement of the Woodhead Tunnels cables (scheme 11055), 2 x 4.7km, with overall scheme cost of £41m and due for completion in 2009/10 (i.e. expenditure is forecast but without the corresponding quantity being added in the years in question)

- £27m of expenditure on the Beddington – Rowdown cable (scheme 9416), 10km, overall scheme cost £76m and due for completion in 2010/11 (i.e. expenditure is forecast but without the corresponding quantity being added in the years in question)

The 15km of replacement cable addition (NGC Table 2.4) would, using NGC's unit costs, correspond to an expenditure of about £55m and may be attributed to two other schemes:

- Kirkby – Lister Drive No 1 (scheme 11053), 8.6km, £38m and
- Bramley – Didcot 1 and 2 (scheme 11454), 2 x 2.85km, £22m.

There are however a number of other smaller schemes (e.g. Elstree – Mill Hill SGT and cable 2 replacement – scheme NR0054), but not necessarily addition of asset replacement cable as such, which make up the balance of expenditure of £13m.

It will be appreciated that expenditure on some major cable replacement schemes is incurred over a relatively long period of time (Beddington-Rowdown commenced in 2001/02 and the final expenditure is expected in 2010/11) which complicates the comparison of forecast and modelled expenditures.

As our model predicts almost the same expenditure as forecast by NGC. We would therefore accept NGC's forecast for expenditure on underground cables.

Protection, telecommunications, metering and control. In previous reviews, only protection and control equipment have been included in the model. For this review telecommunications and metering equipment has been added to the model.

The model shows a greater number of plant due for replacement than specified in the NGC submission. For example, the model forecasts the replacement of 410 units over the three-year period for the asset group "Busbar protection - Double Bus Electronic static simple". NGC declared that it will replace 73 of these units over the three years. Similarly the model forecasts the replacement of 155 units for the group "Control Bay Semi Distributed 1st Gen SCS" over the three year period, with the NGC submission declaring the replacement of 37 units. Clearly there are inaccuracies in either the replacement unit quantities provided by NGC, or the retirement profiles provided by NGC of this asset category. We conclude that the unit quantities in the NGC submission do not reflect the actual unit quantities that will be replaced.

The levels of expenditure and actual unit replacement forecast by NGC are below those forecast by the model, and hence we would accept NGC's forecast for expenditure for protection, telecommunications, metering and control.

An inspection of the assets declared by NGC for this review shows that approximately 5% of protection and control equipments (486 units) are beyond the "latest onset of significant unreliability" as defined by their associated age profiles but are presumably still performing an acceptable level of service. Some 426 of these 486 protection and control equipments are of the type of equipment entitled "Control Bays - Electromechanical Attracted Armature Frequent Use" of which 260 are planned to be replaced by NGC by the end of 2007/08. The

asset replacement profile assigned to this particular category of control equipment would therefore appear to be inconsistent with the declared population and forecast replacement and so may need reviewing.

Substation other. As mentioned in the preceding text, series and shunt reactors have been included in the 'Substation Other' asset grouping for this review period (having fallen into the 'Transformer' asset group in the previous review). The replacement unit quantities forecast by PB Power do not agree with the quantities provided by NGC. The "asset replacement" and "disposals" quantities in the NGC submission are also inconsistent over the years considered and are not comparable with the quantities replaced in 2004/05 (367 units). There are also two shunt reactors (one 275kV unit and one 400kV unit) included in the 2005 Business Plan submission for 2007/08 under "asset replacement additions" and "disposals", which are not clearly identifiable in the schemes listing. We conclude that the unit quantities in the NGC submission do not reflect the actual unit quantities that may be replaced.

NGC has also indicated to us that it does not model quantities of auxiliary diesel generators or low voltage ac systems at substations and hence has not provided quantities of disposals and additions of these assets.

The model has also been modified to include expenditure associated with the schemes in the schemes listing provided by NGC which would not form part of the equipment included in the model. With these modifications in place, the levels of expenditure and actual unit replacement forecast by NGC are below those forecast by the model, and hence we would accept NGC's forecast for expenditure for substation other.

"Other TO" and "SO excluding BETTA". Expenditures for 2006/07 and 2007/08 are forecast at levels similar to those in the Present Price Control. "Other TO" expenditure includes £10m for the continued work on environmental oil containment measures. A major scheme in "SO excluding BETTA" relates to Balancing Systems Replacement at £10m.

4.4.7 PB Power's view of non-load related expenditure 2005/06 to 2007/08

Table 4.7 presents PB Power's view of non-load related expenditure for the years 2005/06 to 2007/08, taking account of the proposed reduction in overhead line expenditure from NGC's forecast.

Table 4.7 – PB Power's view of non-load related expenditure 2005/06 to 2007/08

Categories	NGC 2005 Forecast			PB Power View		
	2005/ 06	2006/ 07	2007/ 08	2005/ 06	2006/ 07	2007/ 08
(2004 prices)	(£m)	(£m)	(£m)	(£m)	(£m)	(£m)
NON-LOAD RELATED EXPENDITURE						
Asset Replacement:						
Transformers	13.2	19.5	29.2	13.2	19.5	29.2
Switchgear	25.9	35.8	88.0	25.9	35.8	88.0
Sub-station other	9.1	16.9	14.9	9.1	16.9	14.9
Overhead Lines	119.3	140.8	116.7	83.8	94.6	92.6
Underground Cables	30.3	55.2	72.3	30.3	55.2	72.3
Protection						
Telecontrol / SCADA / Energy Mgt						
Protection & Control	28.9	32.7	28.2	28.9	32.7	28.2
Abatements	0.0	0.0	0.0	0.0	0.0	0.0
Diversions: non-rechargeable						
Other TO	35.3	37.3	37.5	35.3	37.3	37.5
SO excl BETTA	12.1	14.0	10.5	12.1	14.0	10.5
TOTAL NON-LOAD RELATED	274.1	352.2	397.3	238.6	306.0	373.2

4.4.8 Sensitivity Analysis – unit costs

The sensitivity of PB Power's view to changes in unit costs has been considered. In the case of overhead line costs, those presented in scheme papers are consistent with those presented in Table 2.7 of the 2005 Business Plan submission and our own in-house database. In the case of cable costs, the nature of NGC's cable schemes are such that they are very scheme specific making any analysis difficult. We have therefore compared the unit costs for transformers and switchgear only from

- Table 2.7 of NGC's BPQ response
- NGC Technical Report TR3 (Issue 16), Electricity Transmission Plant Cost Estimating Data for 2005/6, and
- PB Power Cost Databook[10]

In the case of TR3 costs, we have added 10% for project management and engineering as this is a typical amount from the sample of PDD papers provided. We have seen one example of a total cost from a PDD paper (i.e. TR3 based costs) being repeated directly in the schemes listing – Woodhead Tunnel Cable Replacement, Scheme no 11055 – and hence have not ascribed any overheads to TR3 based costs.

[10] Budget Cost Data for Electrical Transmission and Distribution Plant and Equipment, prepared for Ofgem in August 2002.

The PB Power costs have been derived from our Cost Databook including an allowance for engineering and contingencies. For switchgear at 132kV and below, the PB Power costs are as per our DPCR4 analysis.

Table 4.8 – Transformer and switchgear unit costs for sensitivity study

Equipment category	Table 2.7 costs (2005 Business Plan Submission) £ 000's	TR3 costs £ 000's	PB Power costs £ 000's
Transformers			
400/275kV, 1000MVA	2,163	2,139	2,232
400/275kV, 500MVA	2,163	1,796	1,623
400/132kV, 240MVA	1,984	1,596	1,995
275/132kV, 240MVA	1,766	1,353	1,704
Switchgear, excluding protection			
400kV GIS	1,728	2,633	2,475
400kV Airblast CB	1,728	1,528	1,502
275kV GIS	1,651	2,458	1,929
275kV Oil CB	1,651	1,203	1,005
275kV Airblast CB	1,651	1,203	1,005
132kV Indoor GIS	717	614	1,013
132kV Oil CB	717	457	520
132kV Airblast CB	717	457	520

Table 4.9 – Comparison of NGC's forecast with PB Power's model considering different unit costs for transformers and switchgear.
(Figures shown are cumulative expenditure over the years 2005/06 to 2007/08)

Equipment type	NGC's forecast £m	Model output with adjustments		
		NGC's Table 2.7 unit costs £m	NGC TR3 unit costs £m	PB Power costs £m
Transformers (excl. reactors)	61.9	62.7	51.0	60.0
Switchgear	149.7	174.6	122.3	124.2

Transformers (excluding reactors)

Approximately 60% of the expenditure relating to transformers is associated with the replacement of 275/132kV grid supply transformers. The TR3 costs for this category are at least 20% lower than either the costs supplied in Table 2.7 of NGC's 2005 Business Plan Submission or the PB Power costs and may reflect non like-for like replacement (i.e. betterment). The impact of the lower TR3 cost is shown in Table 4.9 above where the

cumulative expenditure over the years in question would indicate transformer expenditure being less by about £10m.

Switchgear

As commented earlier, NGC's weighted costs (⅓ GIS: ⅔ AIS) in Table 2.7 are higher than the corresponding AIS costs. As our model predicts one-for-one replacement of AIS, a lower overall cost is obtained. NGC's weighted cost arguably reflects betterment, although NGC claims that for a number of cases consideration of the overall costs tend to bring AIS costs up to the GIS level. As NGC has not provided further substantiation of this claim, we would consider that the switchgear costs could be some £27m less than NGC's forecast, i.e. £122.3m.

These differences contribute to our consideration of the range of expenditure (low scenarios) that follows.

4.4.9 Range of NLRE capex

In Appendix D we present an analysis the variances between allowed and actual non-load related expenditures for 2001/02 to 2005/06. Whilst the overall variance is an increase of £154m (18 per cent of the expenditure allowed in 2000), the principal contributors have been overhead line expenditure (change in asset condition assessment) and in Other TO and SO expenditure (reflecting purchase of IT systems). Given the restrictions on resources referred to later, we consider that non-load related expenditure for 2005/06 to 2006/07 is unlikely to be higher than that forecast. Furthermore in consideration that

- unsanctioned schemes not proceeding amounted to some 26 per cent of allowed expenditure in the Present Price Control
- the unit costs underlying the transformer and switchgear forecast expenditures appear to reflect betterment which may not necessarily happen and
- the major influence on variances appears to be company policy on prioritising schemes and not necessarily determined by factors that could be modelled as part of a sensitivity analysis

we would consider that a lower bound of 20 per cent on the expenditure on the network related assets would be appropriate. The resulting high and low scenarios are presented in the table below.

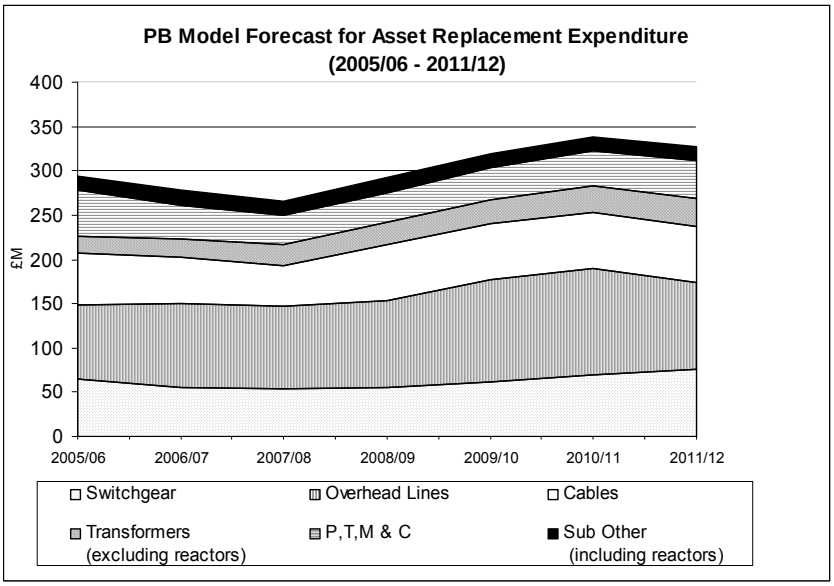
Table 4.10 – PB Power's view of the potential range of non-load related expenditure in 2005/06 and 2006/07 given uncertainty

Categories (2004 prices)	Actual 5 year average (£m)	2005/06 PB Power view (£m)	2005/06 Low scenario (£m)	2005/06 High scenario (£m)	2006/07 PB Power view (£m)	2006/07 Low scenario (£m)	2006/07 High scenario (£m)
NON-LOAD RELATED EXPENDITURE							
Asset Replacement:							
Transformers	6.6	13.2	10.6	13.2	19.5	15.6	19.5
Switchgear	19.0	25.9	20.7	25.9	35.8	28.6	35.8
Sub-station other	7.6	9.1	7.3	9.1	16.9	13.5	16.9
Overhead Lines	41.6	83.8	67.0	83.8	94.6	75.7	94.6
Underground Cables	25.1	30.3	24.2	30.3	55.2	44.2	55.2
Protection							
Telecontrol / SCADA / Energy Mgt							
Protection & Control	32.5	28.9	23.1	28.9	32.7	26.2	32.7
Abatements		0.0		0.0	0.0		0.0
Diversions: non-rechargeable							
Other TO	38.2	35.3	35.3	35.3	37.3	37.3	37.3
SO excl BETTA	14.4	12.1	12.1	12.1	14.0	14.0	14.0
TOTAL NON-LOAD RELATED	184.9	238.6	200.4	238.6	306.0	255.1	306.0

4.4.10 Look ahead beyond 2006/7

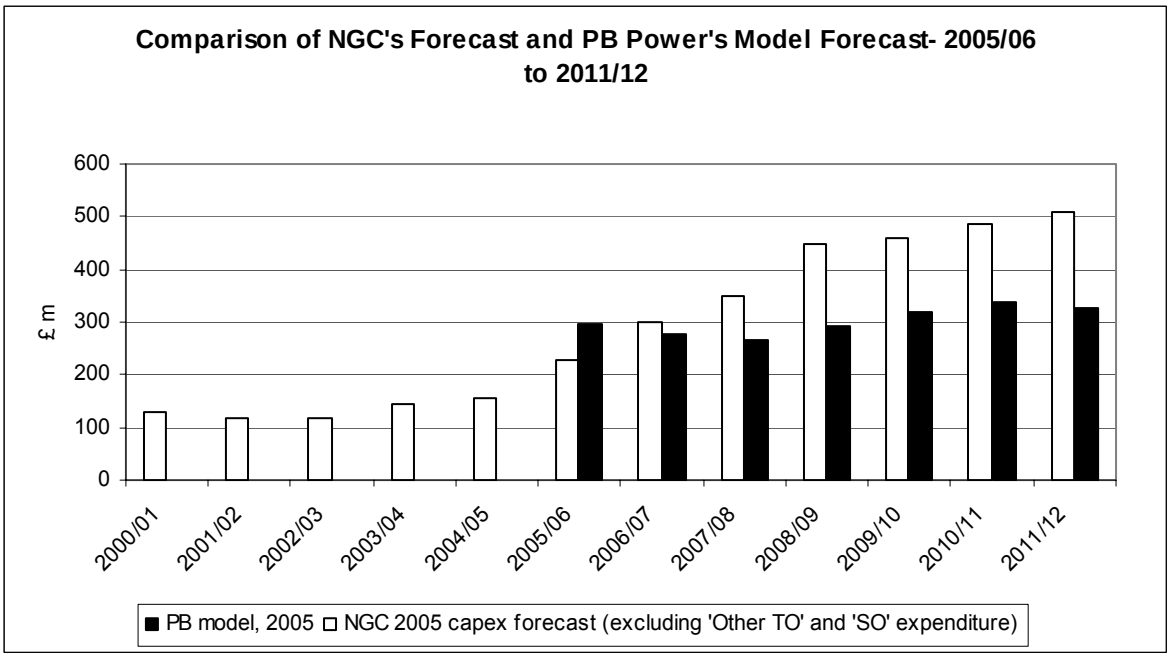
Figure 4.6 below shows the adjusted model forecast for asset replacement expenditure for the years from 2005/06 to 2011/12. The figure has been split to represent the various asset groups, as categorised by NGC in the current 2005 Business Plan submission. It should be noted that Figure 4.6 includes only those asset categories included in our model. Adjustments have been made to the model outputs for the 'Cables', 'Overhead Lines' and 'Sub Other' asset categories for the years 2008/09 to 20011/12 to compensate for the non-model related expenditure.

Figure 4.6 – PB Power model of asset replacement expenditure



NGC's total asset replacement expenditure forecast can be seen in Figure 4.7, along with the PB Power model presented above. Whereas the average yearly spend from 2005/6 to 2007/08 matches the NGC forecast expenditure, for the years following 2007/08 NGC's forecast is higher than the PB Power view.

Figure 4.7 – Comparison between NGC's Forecast and PB Power's model



4.4.11 PB Power's view of asset replacement expenditure to 2011/12

For each year from 2008/09 to 2011/12 and, for each asset category modelled, the adjusted output of the model has been compared with NGC's forecast. In each case the lesser of the two has been taken as PB Power's view. The resulting overall view is presented in Table 4.11. The adjusted model output for overhead lines has been adopted throughout from 2005/06 to 2011/12 and for switchgear and cables from 2008/09 to 2011/12.

Table 4.11 – PB Power's view of asset replacement expenditure to 2011/12

Year	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	Total
NON-LOAD RELATED EXPENDITURE								2005/06 to 2011/12
Asset Replacement:	**(£m)**	**(£m)**	**(£m)**	**(£m)**	**(£m)**	**(£m)**	**(£m)**	**(£m)**
Transformers	13.2	19.5	29.2	30.4	21.6	22.4	30.3	166.6
Switchgear	25.9	35.8	88.0	*55.6*	*61.5*	*68.9*	*76.2*	*412.0*
Sub-station other	9.1	16.9	14.9	14.4	15.3	17.8	11.7	100.1
Overhead Lines	*83.8*	*94.6*	*92.6*	*98.3*	*115.2*	*120.7*	*97.8*	*703.0*
Underground Cables	30.3	55.2	72.3	*63.4*	*63.8*	*63.9*	*63.7*	*412.6*
Protection Telecontrol / SCADA / Energy Mgt								
Protection & Control	28.9	32.7	28.2	34.8	41.3	32.9	37.1	235.9
Abatements	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diversions: non-rechargeable								
Other TO	35.3	37.3	37.5	33.3	29.6	23.4	21.5	217.9
SO excl BETTA	12.1	14.0	10.5	8.4	8.3	0.0	0.0	53.3
TOTAL NON-LOAD RELATED	238.6	306.0	373.2	338.6	356.6	350.1	338.3	2301.4

For the years 2008/09 to 2011/12 and where PB Power's view differs from (is less than) NGC's forecast, a comparison is presented below. The most marked difference is in the switchgear expenditure.

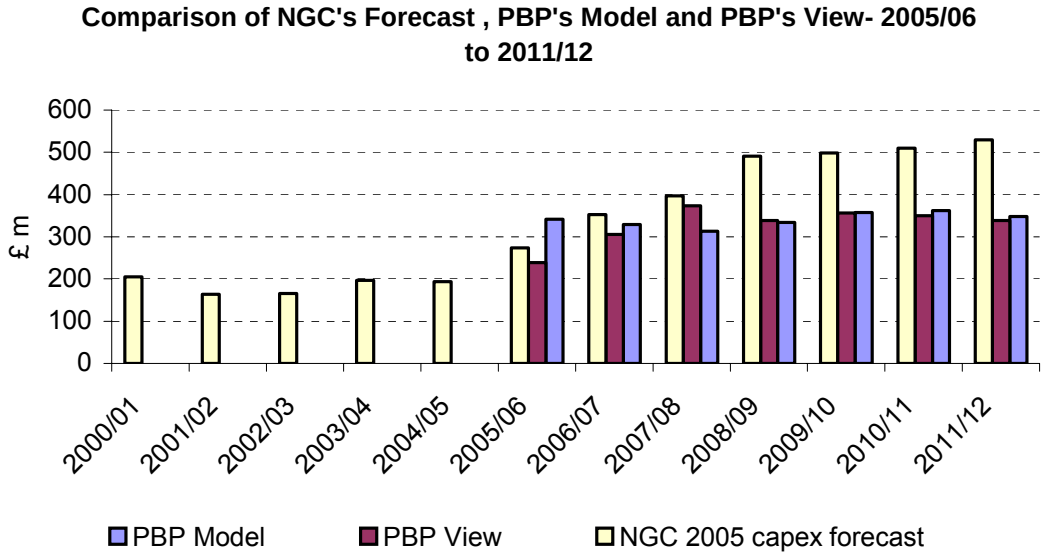
Table 4.12 – Differences between NGC's Forecast and PB Power's View

(£m)

	NGC's forecast	PB Power's View
Switchgear	723.6	262.3
Overhead lines	508.0	432.0
Underground cables	362.9	254.8

A comparison between NGC's Forecast, PB Power's Model and PB Power's View is presented in the chart below.

Figure 4.8 – Comparison of NGC's Forecast, PB Power's Model and PB Power's View, 2005/06 to 2011/12



4.5 Potential constraints to NGC's forecast & programme

To deliver the capital programme NGC indicated that it embarked on a drive to increase its own and its supplier resource capability. The table below presents a comparison of NGC's forecast capital expenditure and numbers of full time employees (FTEs) available as project engineers/managers, site engineers, commissioning engineers, senior authorised personnel, locally based regional/field engineers including agency staff. The increase trend of future staff requirements as indicated is against a general background of staff reductions since Vesting as well as a reduction of the number of electrical power engineering courses at universities in the United Kingdom.

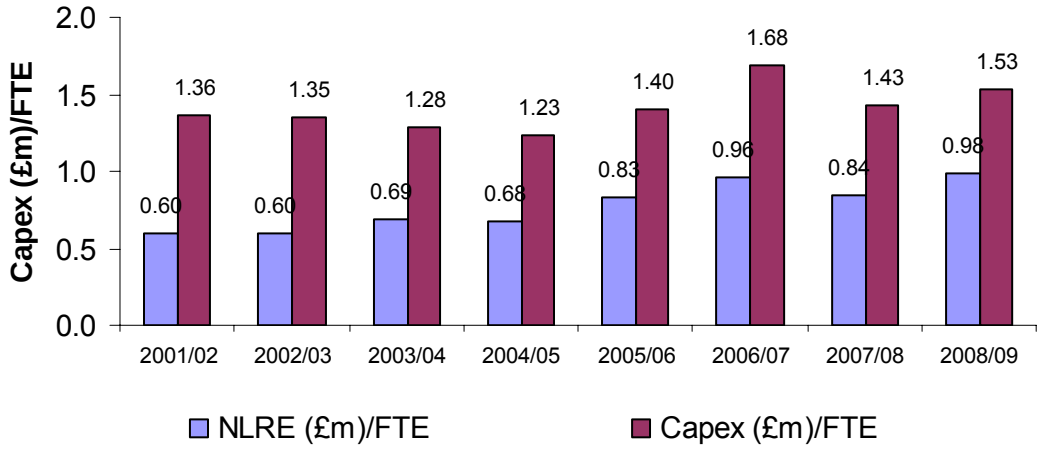
Table 4.13 – Comparison of NGC's forecast capital expenditure and full time employees

	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
Capex (£m)	374.3	376.1	364.0	352.3	464.8	614.1	673.3[11]	767.3
NLRE (£m)	164.1	165.6	196.2	193.5	274.1	352.2	397.3	491.3
FTEs	275.0	278.0	284.0	286.0	332.0	365.0	471.0	500.0
Capex (£m)/FTE	1.36	1.35	1.28	1.23	1.40	1.68	1.43	1.53
NLRE (£m)/FTE	0.60	0.60	0.69	0.68	0.83	0.96	0.84	0.98

[11] Load-related expenditure for 2007/8 and 2008/9 assumed to be as for 2006/7 for this illustration only.

The results in terms of capex per FTE are presented in Figure 4.9 below and show a marked increase in 2005/06 and 2006/07 above present levels.

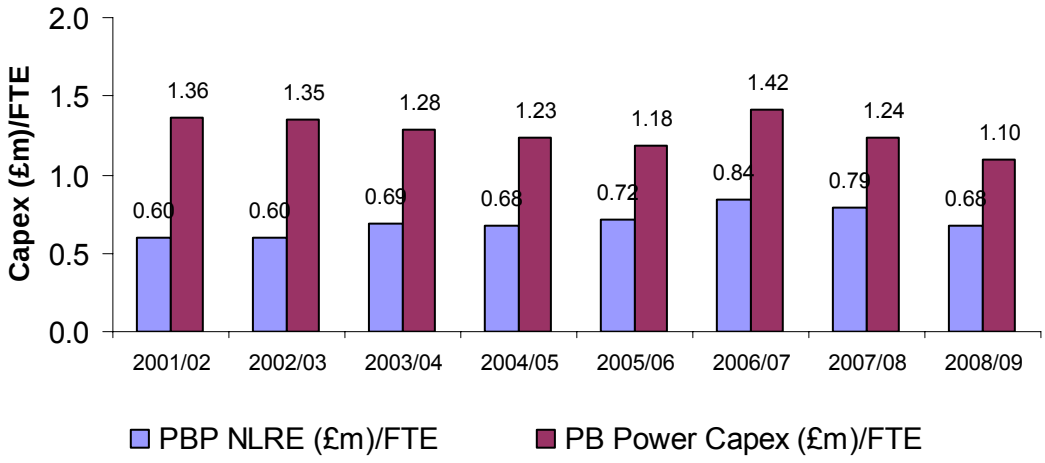
Figure 4.9 – Trends in Capex per FTE



The increases in 2005/06 and 2006/07 would raise doubts as to NGC's capacity to manage and engineer the forecast levels of capital expenditure.

The corresponding analysis based on PB Power's view of expenditure is indicated in Figure 4.10 and, in our view, is a more attainable level of expenditure than that based on NGC's forecast.

Figure 4.10 – PB Power's View capex per FTE



5. CONCLUSIONS

PB Power was appointed by Ofgem to undertake a review of NGC's investment proposals including:

- broad assessment of capital expenditure levels for 2000/01 to 2006/07;
- detailed assessment of load-related expenditure in 2005/06 and 2006/07;
- detailed assessment of asset replacement expenditure for 2005/06 to 2007/08; and
- high-level assessment of asset replacement expenditure plans from 2008/09 to 2011/12.

PB Power has reviewed National Grid Company's (NGC's) capital proposals, the pertinent details being summarised below:

Historic expenditure

- The actual expenditure for the Final Year of the Previous Price Control (2000/01) was £374m compared to a forecast of £398 m. The actual expenditure for the period 2001/02 to 2004/05 was £1,467m compared to a forecast of £1,227m. From its high level assessment of actual expenditure (2000/01 to 2004/05), PB Power found no evidence to conclude that NGC's capital expenditure was not needed or inefficiently incurred.

PB Power's view of expenditure for 2005/06 to 2007/08

- For the Final Year of the Present Price Control (2005/06) and the Extension to the Present Price Control (2006/07), NGC has forecast a spend of £465m and £614m respectively representing an increase in expenditure over the actual annual average expenditure known for the 5 years 2000/01 to 2004/05 of 26% and 67% respectively;
- For the year 2007/08, NGC has forecast a spend of £397m for non-load related expenditure (NLRE) representing an increase in expenditure over the actual annual average expenditure known for the 5 years 2000/01 to 2004/05 of 114%;
- PB Power's review of the level of expenditure found the following:

    a. For the Final Year of the Present Price Control and the Extension to the Present Price Control, a spend of £392m in 2005/06 and £518m in 2006/07 is considered more appropriate. A detailed build-up of this expenditure is shown in Table 5.1 overleaf. This represents reduction of 16% in both 2005/06 and 2006/07 of the respective levels forecast by NGC.

    b. For the year 2007/08, a spend of £373m was considered more appropriate in the NLRE category. This is also presented in Table 1 and represents a reduction of 6% of the level forecast by NGC.

Table 5.1 – PB Power's view of expenditure in 2005/06 and 2006/07 compared to NGC's 2005 Business Plan

Categories	NGC 2005 Forecast			PB Power View		
(2004 prices)	2005/ 06 (£m)	2006/ 07 (£m)	2007/ 08 (£m)	2005/ 06 (£m)	2006/ 07 (£m)	2007/ 08 (£m)
LOAD RELATED EXPENDITURE						
Entry	0.0	0.0		0.0	0.0	
Supergrid system extension (infrastructure)excl TSS	124.8	174.6		101.0	153.4	
TSS	0.6			0.6	0.0	
Exit	87.1	101.4		74.0	76.0	
GT Factor						
Abatements	-10.0	0.0		-10.0	0.0	
Total Load Related	202.5	276.0		165.6	229.4	
NON-LOAD RELATED EXPENDITURE						
Asset Replacement:						
Transformers	13.2	19.5	29.2	13.2	19.5	29.2
Switchgear	25.9	35.8	88.0	25.9	35.8	88.0
Sub-station other	9.1	16.9	14.9	9.1	16.9	14.9
Overhead Lines	119.3	140.8	116.7	83.8	94.6	92.6
Underground Cables	30.3	55.2	72.3	30.3	55.2	72.3
Protection						
Telecontrol / SCADA / Energy Mgt						
Protection & Control	28.9	32.7	28.2	28.9	32.7	28.2
Abatements	0.0	0.0	0.0	0.0	0.0	0.0
Diversions: non-rechargeable						
Other TO	35.3	37.3	37.5	35.3	37.3	37.5
SO excl BETTA	12.1	14.0	10.5	12.1	14.0	10.5
Total Non-Load Related	274.1	352.2	397.3	238.6	306.0	373.2
Customer Contributions (enter as negative)	-11.8	-14.1		-11.8	-14.1	
TOTAL CAPITAL EXPENDITURE	464.8	614.1		392.4	521.3	

All prices, unless otherwise stated, are expressed in constant 2004 prices. The main issues associated with the main expenditure categories are as follows:

PB Power's view of appropriate expenditure for 2005/06 and 2006/07

Load related expenditure: For 2005/06 PB Power considers that, given the timescales to deliver transmission projects, some unsanctioned schemes would not be delivered suggesting a LRE level of £166m to be more appropriate. For 2006/07, given supplementary activity presented by NGC following the 4th distribution price control settlement NGC could be required to spend its forecast £276m, however, with the likelihood of certain Entry and Exit schemes not coming to fruition or being deferred, a LRE level of £226m is considered to be more appropriate. Given the uncertainty of customer related schemes LRE could however flex between £156m and £203m in 2005/06 and between £176m and £276m in 2006/07.

Non-load related expenditure: Asset replacement expenditure, forming a large part of NGC's NLRE has been reviewed through asset replacement modelling and there is a fair degree of correlation between PB Power's model and the forecast asset replacement spend by NGC. A reduction of £105.8m is indicated in respect of overhead lines for the years 2005/06 to 2007/08. Given that modelling results tend to be optimistic in forecasting

requirements for NLRE (an operator may take the opportunity to rationalise and so replace at lower cost, for example), the NLRE expenditure levels could flex downwards to £200m in 2005/06 and £255m in 2006/07 (i.e. network related asset expenditure reduced by 20 per cent).

PB Power's view is further supported by an analysis of resources to deliver the capital programme.

PB Power's view of appropriate NLRE to 2011/12

Table 5.2 presents PB Power's view of the appropriate non-load related expenditure for the years to 2011/12 and where the model output has been adopted instead of the NGC forecast.

Table 5.2 - PB Power's view of appropriate NLRE to 2011/12

(£m)

Year	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	Total 2005/06 to 2011/12
NGC's Forecast Capex 2005	205.3	164.1	165.6	196.2	193.5	274.1	352.2	397.3	491.3	498.6	509.5	529.6	3052.6
Model based output					198.4	341.8	329.3	313.6	333.6	357.2	361.9	348.3	2385.7
PB Power View						238.6	306.0	373.2	338.6	356.6	350.1	338.3	2301.4
Model output instead of forecast						ohl	ohl	ohl	ohl, swgr, cables	ohl, swgr, cables	ohl, swgr, cables	ohl, swgr, cables	

APPENDIX A

PROJECT DOCUMENT REGISTER

APPENDIX A - PROJECT DOCUMENT REGISTER

Table A1 Document register

No.	Date	Reference	Title	Source
1	08/03/05	Via e-mail	Asset life modelling PowerPoint presentation.	NGC
2	01/04/05	Via e-mail	Summary 2005 Business Plan submission.	NGC
3	11/04/05	Via e-mail	Full NGC 2005 Business Plan submission.	NGC via Ofgem
4	21/04/05	Via post	NGC Scheme Papers.	NGC via Ofgem
5	27/04/05	Hand carried	NGC presentations.	NGC
6	27/04/05	Hand carried	CD containing NSPM204 and NSPM111.	NGC
7	17/06/05	Via e-mail	NGT Capex Presentation to Ofgem	NGC

Table A2 Supplementary question response register

No.	Date	Reference	Title	Source
1	22/04/05	Via e-mail	Response to initial supplementary questions to NGC on Summary 2005 Business Plan submission (1001, 1002, 1003, 1004, 1005, 1006, 1007)	NGC
2	28/04/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1017, 1022, 1024, 1026, 1034, 1038, 1039, 1041, 1042)	NGC
3	03/05/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1023, 1028, 1029, 1033, 1035)	NGC
4	06/05/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1009, 1014, 1021, 1025, 1027, 1031, 1036, 1040, 1051)	NGC

Table A2 Supplementary question response register cont…

No.	Date	Reference	Title	Source
5	09/05/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1008, 1010, 1012, 1013, 1016, 1018, 1020, 1032, 1037, 1045, 1047, 1049)	NGC
6	10/05/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1043, 1044, 1046, 1050)	NGC
7	11/05/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1011, 1015, 1019, 1030, 1048, 1054)	NGC
8	13/05/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1058)	NGC
9	16/05/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1052, 1053, 1059, 1060, Q&A log)	NGC
10	17/05/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1055, 1057, 1064, 1065)	NGC
11	18/05/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1056)	NGC
12	19/05/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1062)	NGC
13	20/05/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1066, 1067, 1069)	NGC
14	24/05/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1063)	NGC
15	24/05/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1070)	NGC
16	25/05/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1061)	NGC
17	25/05/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1056)	NGC
18	02/06/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1068)	NGC
19	14/06/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1071, 1075, 1076, 1078, 1080, 1082, 1083, 1086, 1087)	NGC

Table A2 Supplementary question response register cont…

No.	Date	Reference	Title	Source
20	22/06/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1088, 1089, 1090)	NGC
21	23/06/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1085)	NGC
22	23/06/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1073, 1074, 1077, 1079, 1081, 1084, 1091)	NGC
23	29/06/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1095)	NGC
24	30/06/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1093, 1094, 1096, 1099, 1100, 1101, 1102)	NGC
25	30/06/05	Via e-mail	Supplementary questions to NGC on Full 2005 Business Plan submission (1097, 1098)	NGC
26	01/07/05	Via e-mail	GSP Utilisation Graph	NGC
27	05/07/05	Via e-mail	Revised table for 1096	NGC

APPENDIX B

NGC BUSINESS PLAN SUBMISSION TABLE 2.1

APPENDIX B – NGC BUSINESS PLAN SUBMISSION TABLE 2.1

SECTION 3: CAPITAL EXPENDITURE **ALLOWED, ACTUAL AND FORECAST CAPITAL EXPENDITURE 2000/01 T0 2011/12**

	Allowed Expenditure (2004 prices)						Actual Expenditure (2004 prices)					Forecast expenditure (2004 prices)						
Categories	2000/01 (£m)	2001/02 (£m)	2002/03 (£m)	2003/04 (£m)	2004/05 (£m)	2005/06 (£m)	2000/01 (£m)	2001/02 (£m)	2002/03 (£m)	2003/04 (£m)	2004/05 (£m)	2005/06 (£m)	2006/07 (£m)	2007/08 (£m)	2008/09 (£m)	2009/10 (£m)	20010/11 (£m)	2011/12 (£m)
LOAD RELATED EXPENDITURE																		
Entry		4.2	17.2	33.6	11.8	8.4	15.9	13.4	15.8	4.6	0.1	0.0	0.0					
Supergrid system extension (infrastructure)excl TSS		133.9	117.5	90.4	43.9	29.7	97.1	118.8	130.2	125.9	90.0	124.8	174.6					
TSS		3.5	1.9	8.0	9.5	3.8		5.0	17.1	12.0	1.1	0.6						
Exit		42.2	22.8	9.8	51.6	44.3	57.9	81.4	55.8	64.1	63.5	87.1	101.4					
GT Factor		-0.6	33.1	-49.2	-24.3	-19.5												
Abatements												-10.0	0.0					
Total Load Related		183.2	192.6	92.6	92.4	66.8	170.9	218.6	218.9	206.6	154.7	202.5	276.0					
NON-LOAD RELATED EXPENDITURE																		
Asset Replacement:																		
Transformers		6.2	6.1	5.0	6.9	12.4	3.5	3.0	8.5	7.6	10.3	13.2	19.5	29.2	30.4	21.6	22.4	30.3
Switchgear		17.2	21.0	27.1	35.2	34.2	18.4	19.9	16.0	20.3	20.6	25.9	35.8	88.0	130.6	171.0	215.0	207.0
Sub-station other		13.5	17.2	12.8	14.2	14.6	12.2	8.3	6.1	5.5	6.0	9.1	16.9	14.9	14.4	15.3	17.8	11.7
Overhead Lines		25.5	16.8	23.9	37.0	40.4	36.7	33.7	28.5	40.5	68.7	119.3	140.8	116.7	148.1	134.5	116.8	108.6
Underground Cables		39.2	44.8	43.2	15.7	22.1	10.5	19.2	25.2	39.7	30.7	30.3	55.2	72.3	91.3	77.0	81.2	113.4
Protection		11.3	11.3	11.3	11.3	11.3												
Telecontrol / SCADA / Energy Mgt		2.9	13.2	19.8	21.1	16.9												
Protection & Control							46.2	35.0	32.1	29.6	19.4	28.9	32.7	28.2	34.8	41.3	32.9	37.1
Abatements												0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diversions: non-rechargeable																		
Other TO		32.2	28.2	18.0	15.6	14.6	50.1	29.9	36.1	40.4	34.5	35.3	37.3	37.5	33.3	29.6	23.4	21.5
SO excl BETTA		17.7	15.4	5.3	3.5	6.1	27.7	15.1	13.1	12.6	3.3	12.1	14.0	10.5	8.4	8.3	0.0	0.0
Total Non-Load Related		165.8	174.0	166.3	160.6	172.5	205.3	164.1	165.6	196.2	193.5	274.1	352.2	397.3	491.3	498.6	509.5	529.6
Customer Contributions (enter as negative)		0.0	0.0	0.0	0.0	0.0	-2.5	-8.4	-8.4	-38.8	4.1	-11.8	-14.1					
TOTAL CAPITAL EXPENDITURE	397.9	349.0	366.5	258.9	253.0	239.3	373.7	374.3	376.1	364.0	352.3	464.8	614.1					

APPENDIX C

ASSET REPLACMENT MODELLING

APPENDIX C - ASSET REPLACEMENT MODELLING

NLRE Asset Replacement Modelling for TPCR Mini-Review
20/05/2005

The NLRE asset replacement modelling procedure and associated assumptions adopted for the TPCR mini-review are described in the following text.

Age-Based Replacement

This technique has been employed for all of the following equipment asset types:

- Switchgear
- Transformers (includes shunt reactors)
- underground cable
- protection, control, telecommunications and metering equipment
- overhead line and towers, and
- "other" substation equipment (includes batteries, diesel generators, LVAC auxiliary systems

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 these 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 expected to be retired in each year over a given number of years of operation. For this review most of the retirement profiles have been based on those supplied by NGC. Where NGC did not supply the profiles, Gaussian distributions defined according to the standard deviation[12] and average life of the asset types represented were used in the model.

[12] The 2.5% (earliest onset of significant unreliability) and 97.5% (latest onset of significant unreliability) markers supplied by NGC represent points at ± two standard deviations from the stated anticipated life.

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 asset replacement calculation essentially 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.

From the above description it will be clear to many that this technique is equivalent to the well known “survivor” type analysis used for TPCR 2000, DPCR3 and DPCR4.

The modelling process used in this review has been refined so that the replacement of deferred assets (these are the assets remaining on the system, whose ages are greater than their specified life expectancy) can be spread over a defined number of years in the immediate future.

APPENDIX D

VARIANCE ANALYSIS

Comparison of NGC's 2000 Forecast and NGC's 2005 Business Plan submission

In the table below we provide an analysis of the variances between the expenditure allowed for the present price control and the actual expenditure. (The comparison includes the year 2005/06 which is, of course, forecast expenditure.) From our comparison of the schemes in the NGC 2000 Forecast (99 BP) with those in the 2005 Business Plan submission we find that the main reason for the increase is the introduction of new schemes in the period 2001/02 to 2005/06 that were not in the NGC 2000 Forecast. Another (lesser but appreciable) reason is overall cost increase of the schemes in the 2000 Forecast. Some schemes originally in the NGC 2000 forecast have been delayed to beyond 2005/06 and therefore appear as a negative variance.

Of the overall variance of about +18% (of allowed expenditure), the net effect of cost increases was about +11% and that of scheme changes about +7%. Within the latter figure there are marked variances. The reduction in expenditure on unsanctioned schemes was about 26% (of allowed expenditure), offset by increases in sanctioned expenditure of about 32% and of closed expenditure of about 12%.

Variances - Comparison of Allowed and Actual NLRE

Updated status (App. C)	PB Power's classification of Variance	Variance (+ve is over-spend) (£m)							
		2001/02 to 2005/06							
		Trans-formers	Switch-gear	Over-head Lines	Under-ground cables	Sub-station Other, Pro-tection & Control	Other TO_SO	Total	(of overall total variance)
		(£m)	(£m)	(£m)	(£m)	(£m)	(£m)	(£m)	
All	Cost decrease	-0.2	-5.1	-0.7	-8.9	-53.6	-4.6	-73.1	-47.4%
	Cost increase	5	23	64.0	43.7	14.8	15.6	166.1	107.7%
	Scheme closed (with little actual expenditure)	-0.3	-2.4	-3.9	-1.3	-1.1	-50.8	-59.8	-38.8%
	(New) scheme introduced 01/02 to 05/06	29	37.7	137.9	40.4	37.4	172.7	455.1	295.1%
	99 BP scheme postponed (mainly to after 05/06)	-23.4	-85.1	-49.4	-101.8	-20.1	-57.1	-336.9	-218.4%
	Miscellaneous	-4.2	0	-0.9	7.9	0.0	0.0	2.8	1.8%
	TOTAL	5.9	-31.9	147.0	-20.0	-22.6	75.8	154.2	100.0%
UNS	Cost decrease	0	-0.1		-1.1	0.0	0.0	-1.2	
	Cost increase	0	0	1.6	0.0	0.3	0.0	1.9	1.2%
	Scheme closed (with little actual expenditure)	0	0		0.0	0.0	0.0	0.0	
	(New) scheme introduced 01/02 to 05/06	0.6	1.9	12.4	3.4	9.0	19.4	46.7	30.3%
	99 BP scheme postponed (mainly to after 05/06)	-22.3	-79.1	-58.5	-48.3	-19.0	-39.6	-266.8	-173.0%
	Miscellaneous	0	0		0.0	0.0	0.0	0.0	0.0%
	TOTAL	-21.7	-77.3	-44.5	-46.0	-9.7	-20.2	-219.4	-142.3%
SAN	Cost decrease	0	-5.1	-0.7	-1.8	-53.3	0.0	-60.9	-39.5%
	Cost increase	5	14.4	38.6	38.1	6.8	9.8	112.7	73.1%
	Scheme closed (with little actual expenditure)	0	0		0.0	0.0	-0.9	-0.9	
	(New) scheme introduced 01/02 to 05/06	22.3	28.2	100.2	23.7	13.8	108.3	296.5	192.2%
	99 BP scheme postponed (mainly to after 05/06)	-1.1	-6		-53.5	-1.1	-17.6	-79.3	
	Miscellaneous	0	0	-0.9	0.0	0.0	0.0	-0.9	-0.6%
	TOTAL	26.2	31.5	137.2	6.5	-33.8	99.6	267.2	173.3%
CLO	Cost decrease	-0.2	0		-6.0	-0.3	-4.6	-11.1	
	Cost increase	0	8.5	23.9	5.6	7.7	5.7	51.4	33.3%
	Scheme closed (with little actual expenditure)	-0.3	-2.4	-3.9	-1.3	-1.1	-49.9	-58.9	-38.2%
	(New) scheme introduced 01/02 to 05/06	6.1	7.7	25.2	13.4	14.6	45.0	112.0	72.6%
	99 BP scheme postponed (mainly to after 05/06)	0	0	9.2	0.0	0.0	0.0	9.2	6.0%
	Miscellaneous	0	0		0.0	0.0	0.0	0.0	
	TOTAL	5.6	13.8	54.4	11.7	20.9	-3.8	102.6	66.5%