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**Technical Support for TPCR4 Rollover.  
Assessment of Non-Load Related & Load  
Related Capex.  
Final report - SHETL**

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On behalf of Ofgem



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## EXECUTIVE SUMMARY

The current Transmission Price Control period (TPCR4) will be extended to include the additional year 2012/13, the Rollover year. This one year extension will apply to all 4 transmission owners (TOs): National Grid Electricity Transmission (NGET), Scottish Hydro Electric Transmission Limited (SHETL), Scottish Power Transmission Limited (SPTL) and National Grid Gas. KEMA was appointed by Ofgem to assess the additional one year forecast business plans with accompanying investment requirements as submitted by each TO for 2012/13.

This report focuses on the assessment of the Non-Load Related Expenditure (NLRE) and Load Related Expenditure (LRE) as forecast by SHETL for the Rollover year and makes recommendations regarding appropriate expenditure allowances for that year. A proportionate approach for the one year control has been adopted and the Capex analysis has focused on the most financially material issues. It is Ofgem's intention to perform a full efficiency review of historical Capex as part of RIIO-T1. Similar assessments for the other TOs are summarised in separate reports.

### Non-Load Related Expenditure

NLRE is driven by asset replacement and refurbishment requirements to ensure the transmission network continues to deliver the reliability, security and performance levels demanded. This review of SHETL's proposed NLRE for 2012/13 has determined that:

- SHETL's asset replacement modelling was comprehensively assessed during the TPCR4 price review. It was concluded that SHETL is collecting and recording sufficient condition data to support short and medium term Non Load Related asset replacement volumes and that the planning processes provide a robust platform for asset replacement planning.
- SHETL has stated that it has since developed its asset replacement modelling to incorporate a robust approach to assessing criticality and that this aligns with the Network Output Measures (NOM) methodology agreed between all TOs and Ofgem.

- Evidence that NLRE planning is substantiated by the NOM methodology was provided by SHETL indicating good correlation between asset condition and replacement priority modelling with respect to the schemes expected to incur expenditure in the Rollover year. The asset replacement planning is considered to be robust.
- An integral part of this review is the assessment of NLRE and LR schemes in more detail. Two schemes were examined (1 NLR and 1LR) and assessed by project need, design and cost. In both cases the need, design and costs of the schemes is considered to be valid.
- A summary of major asset unit costs indicates that switchgear costs appear to be reasonable and are aligned between the TO Average and KEMA cost comparators. However, the costs of the dominant transformers in SHETL, 132kV and 275kV, are considered high.
- When all Capex is considered, particularly the Transmission Investment Incentive (TII) schemes, SHETL is facing a substantial increase in demands on its delivery capability from an expenditure of £36m in 2009/10 to £583m in 2012/13; a 16-fold rise that incorporates, approximately, a 17-fold increase in overhead line expenditure. SHETL will shortly be re-negotiating, and appears to be highly reliant on, contractor framework agreements that extend beyond the Rollover period to assure contractor commitment. As many of the suppliers and contractors engaged by SHETL are global companies, SHETL believes this will mitigate the risks associated with potentially scarce or committed supplier resource in the UK. SHETL is also taking pro-active steps to attain additional internal resources from other large infrastructure industries such as oil and gas. It should also be recognised that the other electricity TOs are seeking to significantly increase Capex expenditure in the Rollover year and beyond which will inevitably exacerbate any supply chain delivery constraints further.

From a detailed analysis of SHETL's Capex plan and discussion of the main issues within this report KEMA has made an assessment of appropriate expenditure for each asset category in the Rollover year, 2012/13 as follows.

2012/13 Rollover Year (£m)	SHETL F'cast	KEMA Estimate	Comment
<b>NON-LOAD RELATED EXPENDITURE</b>			
Assets - replacement and refurbishment			
Transformers	4.2	3.6	unit costs high, reduced by 15%.
Reactors	0.0	0.0	no expenditure
Switchgear	4.1	4.1	two schemes, unit costs ok.
Overhead Lines	4.6	3.9	reduced in light of TPCR4 outturn as conductor condition better than anticipated.
Underground Cables	3.7	3.7	expenditure reasonable.
Protection & control	0.7	0.7	average unit cost ok.
Sub-station other	1.8	1.8	not assessed, in line with TPCR4 average.
Other NLRE			
Other TO	0.0	0.0	no expenditure.
Quasi capex			
Capitalised Overheads	1.7	1.7	not assessed
<b>TOTAL</b>	<b>20.8</b>	<b>19.5</b>	

### Load Related Expenditure

Load-related expenditure comprises all spend in relation to reinforcement of the transmission system, excluding TII, to accommodate new generation and demand connections or changes to existing customer requirements.

This review of SHETL's proposed LRE for 2012/13 has determined that:

- The most significant elements of LRE in 2012/13 are the 'Demand Connection-sole use' (£21.8m) and the 'Infrastructure – entry triggered' (£34.9m) categories, accounting for 76% of expenditure.
- Demand connection expenditure is driven by growth in demand, forecast by SHETL to be zero or very low, and the connection of embedded generators. There has been significantly higher growth in demand for expenditure in this category than originally envisaged in the TPCR4 FBPQ, driven by strong demand for embedded generation connections.
- An assessment of the Infrastructure-entry triggered developer generation projects and associated SHETL connection schemes based on factors such as; developer project consent status, contracted connection date, SHETL scheme consent status, SHETL scheme planning status and authorisation has been carried out to consider the likelihood of scheme expenditure in the Rollover year. The assessment of scheme



and expenditure uncertainty suggests a reduction of expenditure in 2012/13 of:  
Demand connection-sole use schemes to £15.2m and Infrastructure-entry triggered schemes to £24.4m.

- Inevitably there are some generation uncertainties which may impact 2012/13 and the associated expenditure. Some generation projects are themselves in the process of project development and may still face uncertainties over planning consents and project delivery timescales, which may lead to delays compared to that assumed in the generation background used to form this plan.
- The connect and manage regime has also introduced uncertainty with customers having more control over the timescales for their connection.
- Concerns on the deliverability of an increasing LRE expenditure with respect to the large rise forecast in total Capex expenditure are similar to those expressed for the NLRE.

From a detailed analysis of the largest elements of SHETL's load related Capex plan, the Demand connection-sole use and Infrastructure-entry triggered categories, and discussion of the main issues within this report KEMA has made an assessment of the appropriate expenditure for these categories in the Rollover year, 2012/13 as indicated below. The lower expenditure LRE categories listed were not reviewed.

2012/13 Rollover Year (£m)	SHETL F'cast	KEMA Estimate	Comment
<b>LOAD RELATED EXPENDITURE</b>			
Generation connection - sole-use	11.3	11.3	
Demand connection - sole-use	21.8	15.2	
Total LRE - sole-use	33.1	26.5	
Infrastructure - entry triggered	34.9	24.4	
Infrastructure - general reactive (excl TIRG /TSS)	0.0	0	no expenditure
Infrastructure - general non reactive (excl TIRG /TSS)	0.0	0	no expenditure
Infrastructure - exit triggered	1.0	1.0	not assessed
Infrastructure - TSS	2.0	2.0	not assessed
Total LRE - Infrastructure	37.9	27.4	
Capitalised Overheads	3.9	3.9	not assessed
<b>TOTAL</b>	<b>74.9</b>	<b>57.8</b>	

## 1 INTRODUCTION

The present transmission price control set by Ofgem in 2006 runs from 1 April 2007 to 31 March 2012. Following recommendations from the RPI-X@20 review the next full transmission price control review will be the first to reflect the new RIIO (Revenue = Incentives + Innovation + Outputs) regulatory model.

In 2010 Ofgem took the decision to extend the current price review period by one year to provide a transition period to the new RIIO-T1 model. A one year 'Adapted Rollover' of the current TPCR4 period for the financial year 2012/13 is to be applied and implementation of the new price control review of GB's gas and electricity transmission companies will take effect from 1 April 2013. The Adapted Rollover applies to all four transmission companies (TOs): National Grid Electricity Transmission (NGET), Scottish Hydro Electric Transmission Limited (SHETL), Scottish Power Transmission Limited (SPTL) and National Grid Gas - National Transmission System (NGG – NTS).

Ofgem appointed KEMA to provide technical support for the Transmission Price Control 4 (TPCR4) Rollover. As the Rollover review spans a short transitional period Ofgem adopted a proportionate approach to the one year control. The technical support comprising:

- a proportionate review of forecast capital expenditure, drawing on historical information where appropriate;
- a proportionate assessment of non-load related expenditure (NLRE) for 2012/13 (including asset replacement expenditure); and
- a proportionate assessment of forecast load related expenditure (LRE) in 2012/13.

The result of the review and KEMA evaluation is a recommendation on the appropriate non-load related (NLR) and load related (LR) capital expenditure allowances for the Rollover year 2012/13. The report excludes consideration of operational expenditure and non-network capital expenditure.



## 2 **APPROACH TO THIS ASSESSMENT**

KEMA has reviewed 's capital expenditure for the year 2009/10 provided in the Regulatory Reporting Pack (RRP) and the 2010 Forecast Business Planning Questionnaire and accompanying Detailed Narrative submitted to Ofgem in July and October 2010 respectively. The levels of expenditure with respect to NLRE and LRE have been assessed.

KEMA reviewed the total LR and NLR capital expenditure for SHETL, comparing outturn against allowances and projecting forecasts forward through the Rollover year (2012/2013) to 2014/15. Further analysis was performed on the NLRE to obtain a clear understanding of the levels of investment and volumes of assets installed, replaced or refurbished by major asset category.

KEMA reviewed the Rollover FB PQ submissions and accompanying narratives paying particular attention to;

- explanations from the TOs with regard to any revision to planning methodologies, asset management strategies and investment criteria since the previous TPCR4 submission;
- clarification of queries raised from the RRP analysis;
- consistency of the Rollover FB PQ expenditure forecast with the 2009/10 RRP forecast; and
- expenditure in the 2012/13 Rollover year.

Responses to requests for clarification arising from the FB PQ review and issued by Ofgem on 30 November 2010 were submitted by SHETL and have been taken into full consideration in this review. In addition, visits to SHETL by Ofgem and KEMA on 19 and 20 January 2011 provided further clarification and understanding of the information submitted.

Using all available information KEMA has made an assessment of:

- appropriate non-load related expenditure for the Rollover year 2012/13; and
- appropriate load-related expenditure for the Rollover year 2012/13.

### 3 NON-LOAD RELATED EXPENDITURE

#### 3.1 TPCR4 Expenditure to Date

Cumulative NLRE investment levels over the first three years of TPCR4 have been broadly in line with assumed allowances, outturning at £45.3m against allowances of £46.8m. The small underspend (3%) relative to allowance assumptions at the start of TPCR4 is largely attributable to reduced investment in switchgear and overhead line asset categories. SHETL is anticipating an overspend against assumed allowances during the final two years of the current price review to a forecast outturn of £7m (10%) above allowance assumptions.

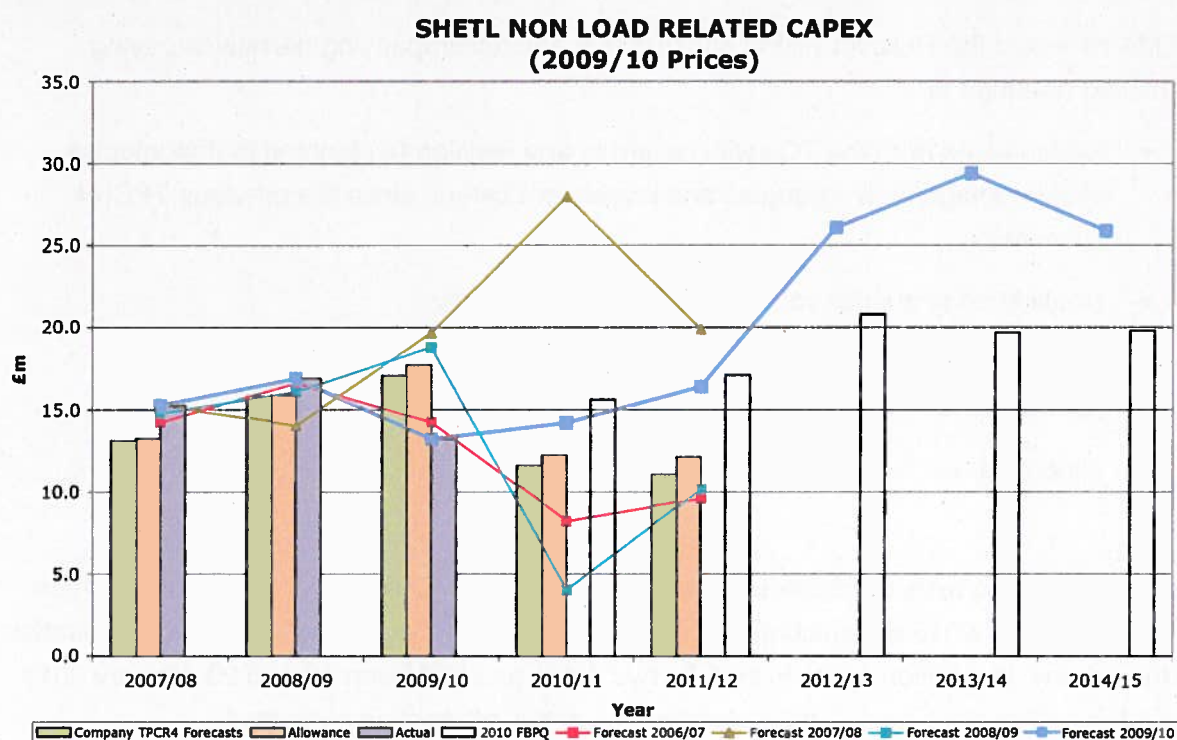


Figure 1: SHETL Non-Load Related capital expenditure.

#### 3.1.1 Comparison of actual expenditure and allowances

Analysis of NLRE to date by major asset category (as reported in the FBPQ) is shown in Table 1 and indicates an underspend against TPCR4 allowance assumptions for switchgear,

overhead line and protection & control asset. No expenditure has been recorded against the Other TO category and no allowance assumptions were made against Substation other.

Asset Replacement	Expenditure £m	2007/08	2008/09	2009/10	Total	Act. minus B'line £m	Act. minus B'line %
Transformers	Ofgem Baseline						
	Actual						
Switchgear	Ofgem Baseline						
	Actual						
Overhead Line	Ofgem Baseline						
	Actual						
Underground cables	Ofgem Baseline						
	Actual						
Protection & control	Ofgem Baseline						
	Actual						
Sub-station other	Ofgem Baseline						
	Actual						
Other TO	Ofgem Baseline						
	Actual						
Total	Ofgem Baseline	13.2	15.9	17.7	46.8	-1.5	-3.1%
	Actual	15.2	16.9	13.2	45.3		

**Table 1: NLRE to date by major asset categories.**  
(NB Data Removed)

It should be noted that allowance assumptions by asset category are provided on an indicative basis and therefore not fixed. It is recognised that SHETL has significant scope to reprioritise investments across asset categories in response to changing circumstances and emerging asset management considerations. Consequently, expenditure by asset category should not necessarily be expected to align with TPCR4 allowance assumptions. However, correlations between allowance assumptions (per asset category) and expenditure should be apparent.

### Transformers

Transformer expenditure has been significantly above assumed allowances for the first three years of TPCR4 with a cumulative expenditure of £5.3m (57%) above the assumed allowance. However, transformer replacement programme delivery to date aligns with the original TPCR4 forecast and the annual volumes are commensurate with expenditure

patterns. SHETL noted that increasing costs to deliver asset replacements have impacted on transformer schemes in particular.

### **Switchgear**

Cumulative actual expenditure to date is 51% lower than allowance and has been consistently lower than allowance assumptions from the inception of the TPCR4 period with a significant expenditure reduction in 2009/10. SHETL has commented that reduced replacement volumes, from 37 original schemes to 24 schemes, and associated expenditure are mainly due to:

- Deferral of 275kV circuit breaker replacements at Beauly to align with outages for the Beauly-Denny reinforcement;
- Deferral of 132kV circuit breaker replacements at Dounreay to coordinate outages with substation reinforcement works; and
- Deferral of further replacement schemes following condition assessments.

### **Overhead Lines**

Overhead line expenditure in 2009/10 was broadly in line with allowance following two years of significant underspend resulting in a cumulative expenditure to date approximately 42% lower than allowance. Several reasons were provided by SHETL for the reduction in NLRE expenditure;

- On some circuits condition assessment of phase conductors revealed them to be in good condition and did not require replacement. The scope of work on affected schemes was therefore reduced;
- Some reconductoring has been deferred to avoid the potential of stranded assets should the circuit require reinforcement for new generation connections; and
- West coast circuit reconductoring has been deferred as SHETL has determined that significant rebuilding of light duty towers will be required to bring the circuits into line with current specifications. Significant additional design, environmental and consenting works are therefore required resulting in scheme deferral.

### **Underground Cables**

Cable installation costs are highly site specific and have lead to an expenditure considerably higher than the assumed allowances to date. SHETL has low volumes of cable installed in widely varying topologies and therefore installation costs also vary widely, with approximately 10km being installed during TPCR4.

### **Protection & Control**

Annual expenditure in this category is modest totalling approximately £0.7m to date.

### **Sub-station other**

This expenditure category encompasses three main work streams; circuit faults, plant faults and minor works. No allowance has been assigned against this category and expenditure is modest with a cumulative total of £3.3m to date.

### **Other TO**

No expenditure has been reported against this category.

## **3.2 Forecast Expenditure for 2012/13**

In the 2010 FBPQ submission SHETL has provided expenditure forecasts for the period 2010/11 to 2017/18 with an annual expenditure rising to £26.7m in 2017/18. The forecasts and accompanying detailed narrative have been considered in the assessment of:

- Updated forecast of the NLRE to the end of the current TPCR4 period;
- Forecast of the NLRE in the 2012/13 Rollover year; and
- Longer-term consideration of non-load related expenditure plans.

### **3.2.1 Application of Network Output Measures**

KEMA reviewed SHETL's long term (top down, age based) and short to medium term (bottom up, condition based) asset replacement modelling during the TPCR4 price review. It was concluded that SHETL is collecting and recording sufficient condition data to support

short and medium term Non Load Related asset replacement volumes and that the planning processes in place provide a robust platform for asset replacement.

During the TPCR4 price review it was suggested that SHETL's approach to system risk has scope for further improvement by adding substation and overhead line criticality to provide a combined "risk and criticality" model.

SHETL has stated that it has since developed its asset replacement modelling to incorporate a robust approach to assessing criticality and that this aligns with the Network Output Measures (NOM) methodology agreed between all TOs and Ofgem.

The asset risk management approach and condition focused replacement modelling adopted by SHETL during TPCR3 resulted in a better understanding of the equipment condition, enabling the deferment of a number of anticipated schemes. This means that the asset lives of a number of network components "evolved" between TPCR3 and TPCR4 and KEMA determined that there is evidence that demonstrates extended life expectancies for transformers, switchgear, overhead line conductor and towers in particular are being utilised.

Whilst SHETL has recently adopted the NOM risk and criticality based approach to asset replacement modelling it does not foresee any further revision to asset lives during the TPCR4 period.

Top down, age based, asset replacement modelling is carried out for the long term to provide a sense check on the proposed programme of works developed from the bottom up approach of condition assessment.

### **3.2.2 Trends in expenditure**

#### **Transformers**

The chart in Figure 2 shows actual and forecast transformer expenditure and assumed TPCR4 allowances.

**[REMOVED]**

**Figure 2: Actual and forecast transformer expenditure with assumed TPCR4 allowances.**



Transformer expenditure rises to an unprecedented peak of approximately £6m in 2010/11 prior to reducing year on year to a forecast of £4.2m in the Rollover year and continued annual reductions into RIIO-T1.

This expenditure profile aligns with the transformer replacement programme submitted in the TPCR4 FBPQ. Expenditure levels are forecast to be significantly higher than initial estimates due to higher transformer costs and the increased cost in delivering transformer asset replacement schemes in particular. There is potential scope to reduce transformer costs to better align with the TO Average and it is suggested this forecast expenditure be reduced by 15% to £3.6m. Transformer scheme assessments indicate a high degree of correlation between condition, criticality and replacement priority.

### **Switchgear**

The chart in Figure 3 shows actual and forecast switchgear expenditure and assumed TPCR4 allowances.

[REMOVED]

**Figure 3: Actual and forecast switchgear expenditure with assumed TPCR4 allowances.**

As outlined in Section 3.1 there has been significant underspend relative to assumed allowances throughout TPCR4 to date and this trend is forecast to stabilise over the last two years with forecast outturn (£2.3m) in alignment with assumed allowance. The significant increase in expenditure in the Rollover year is primarily due to two 132kV switchgear replacement schemes already undergoing detailed design. This expenditure is highly scheme dependent, aligns with replacement priority assessment and is considered reasonable.

### **Overhead Lines**

The chart in Figure 4 shows actual and forecast overhead line expenditure and assumed TPCR4 allowances.

[REMOVED]

**Figure 4: Actual and forecast overhead line expenditure with assumed TPCR4 allowances.**

Overhead line expenditure exhibits a year on year increase during the end of TPCR4 and out to a peak of £7.3m in 2013/14. SHETL stated that refurbishment schemes requiring phase conductor replacement are now becoming more prevalent than the partial refurbishment schemes, fittings and fixtures only, previously carried out. However, the type of refurbishment performed will be driven by the appropriate condition assessments.

During TPCR4 the good condition of phase conductors, better than anticipated, has been cited as a contributor to a reduction in incurred expenditure which is forecast to outturn at £15m (83%) against an assumed allowance of approximately £18m. It is suggested that a similar reduction be applied to forecast overhead line expenditure in the Rollover year to £3.9m to accommodate a similar eventuality.

There is also some concern over the deliverability of overhead line schemes in the Rollover year as TIRG and TII related overhead works increase significantly to approximately [REDACTED], and are likely to place considerable pressures on the supply chain.

### **Underground Cables**

The chart in Figure 5 shows actual and forecast underground cable expenditure and assumed TPCR4 allowances.

[REMOVED]

**Figure 5: Actual and forecast underground cable expenditure with assumed TPCR4 allowances.**

Underground cable expenditure is inconsistent due to the low volumes of cable deployed in SHETL and the dependence on specific scheme and site related factors. Expenditure in the Rollover year is associated with ongoing TPCR4 works to replace 132kV gas compression cables in Aberdeen and Dundee. The expenditure is considered to be reasonable.

### 3.2.3 Scheme condition and priority assessment

Subsequent to the TPCR4 review SHETL has incorporated system criticality assessment into its asset condition modelling to determine asset replacement priorities.

SHETL stresses that the asset condition is the leading factor used to determine asset replacement volumes and strongly assert that asset replacements are not determined by age profiles.

The medium term modelling performed provides a five-year look ahead, based on the condition of the assets and prioritised by an objective scoring mechanism. Effectively the medium-term modelling provides scheme plans for the next two years (short term plan) and forms the medium term plan for the 3 to 5 year period.

The integrated medium and short term modelling is considered robust, taking into account the size of SHETL's asset base. All proposed NLRE schemes in the FBPQ are identified by the short term modelling (replacement within two years) and based on the condition scores and equipment risk identification. In general SHETL's NLRE schemes are supported by sufficient detailed risk identification.

SHETL has provided a summarised output of its asset condition and replacement priority modelling with respect to the schemes expected to incur expenditure in the Rollover year, Figure 6.

**[Table Removed]**

**Figure 6: summarised asset condition and replacement priority report for 2012/13 schemes.**

Overall there is good correlation in all major asset categories between remaining useful life, criticality and replacement priority. Where an asset replacement scheme is proposed to incur expenditure in 2012/13 that does not have a very high or high replacement priority additional justification has been provided for its inclusion.

### 3.2.4 Comparison of unit costs

Installed unit costs have been provided by all TOs and averaged to provide a basis for comparison. Further comparison against KEMA unit cost data has also been performed and Table 2 summarises these comparisons by asset category.

(Table Removed)

**Table 2: Comparison of unit costs.**

### **Transformers**

SHET's unit costs for all transformers are significantly higher than both the TO Average and KEMA comparators. The [REDACTED]

[REDACTED]  
[REDACTED].

### **Switchgear**

SHETL's [REDACTED]  
[REDACTED]  
[REDACTED]

### **Overhead lines**

It is not evident that the TO costs submitted have been done so on the same basis and any direct comparison with the TO Average is not considered valid. Overhead line costs for the Scottish TOs are [REDACTED]  
[REDACTED]

### **Underground cable**

SHETL's [REDACTED]  
[REDACTED].

It should be noted that cable installation costs can vary significantly from scheme to scheme and are sensitive to local topology and obstacles that may require specialist installation techniques.

In summary, whilst switchgear costs appear to be reasonable and are aligned between the TO Average and KEMA comparators, the costs of the dominant transformers in SHETL 132kV and 275kV are considered high.

### 3.2.5 Assessment of replacement volumes

The asset addition volumes provided in Table 3 are sourced from the 2010 FBPQ Table 4.15.

**(Table Removed)**

**Table 3: Major asset category replacement volumes**

From Table 3 it can be observed that:

- NLR transformer additions are generally consistent apart from a peak in 2008/09. In the rollover year, 2012/13, replacement volumes are below the average annual TPCR4 addition rate;
- Subsequent to high replacement numbers at the start of TPCR4 switchgear additions are relatively consistent and are below the average annual addition rate in the Rollover year;
- Overhead conductor additions reported by SHETL in Table 4.15 are load related only with no additions recorded against NLRE where only minor refurbishment was performed; and
- Cable additions are highly scheme dependent and are well above the TPCR4 average and related to the Aberdeen and Dundee 132kV cable replacement projects.

### 3.2.6 Programme delivery

NLRE expenditure is forecast to increase significantly from the £13.2m incurred in 2009/10 to a level of £20.8m in 2012/13 that may place some strain on supply chain delivery. However, this increase is modest in comparison to the total forecast capital expenditure (ex customer

contributions) in the Rollover year (£620m) and SHETL's approach to meeting this challenge is discussed in Section 5 of this report.

## 4 LOAD RELATED EXPENDITURE

For the avoidance of doubt, expenditure associated with TIRG and TII related projects is not included in this LRE assessment.

### 4.1 TPCR4 Expenditure to Date

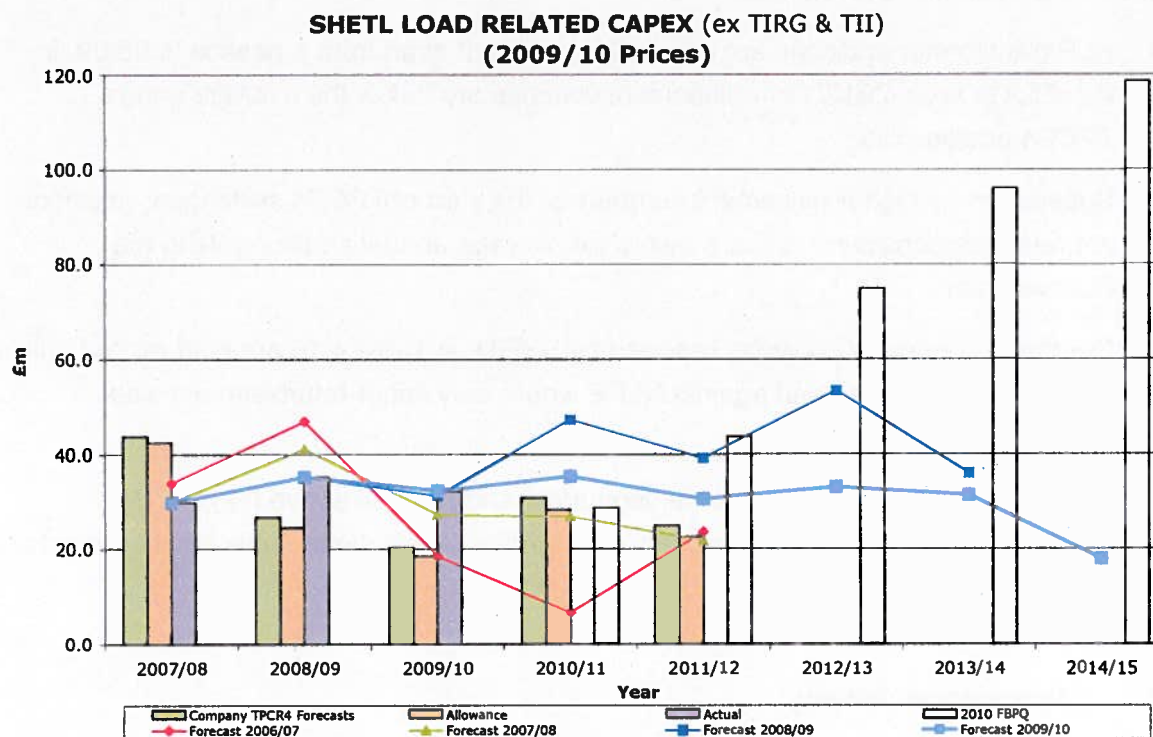


Figure 7: SHETL Load related capital expenditure



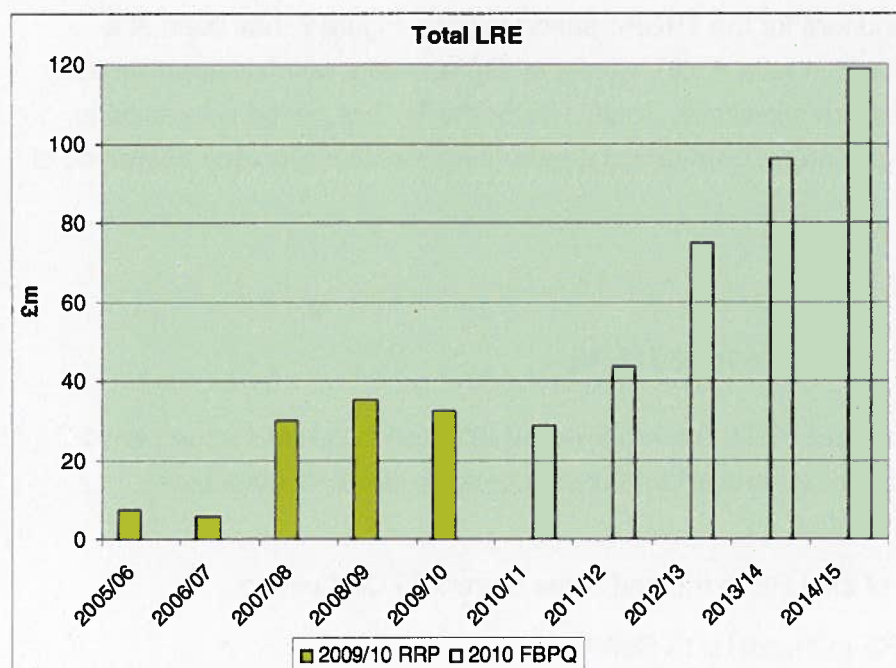
Annual load related expenditure for the TPCR4 period to date, Figure 7, has been at a generally consistent level with a total of £97.4m expenditure to date which is approximately 14% greater than the assumed allowance. Total LRE for the TPCR4 period is forecast to outturn at £169.8m, approximately £34m (25%) greater than the total assumed allowance of £136.4m.

#### **4.2 Forecast Expenditure for 2012/13**

In the 2010 FBPQ submission SHETL has provided expenditure forecasts for the period 2010/11 to 2017/18. The forecasts and accompanying detailed narrative have been considered in the assessment of:

- Updated forecast of the LRE to the end of the current TPCR4 period;
- Forecast of the LRE in the 2012/13 Rollover year; and
- Longer-term consideration of all load related expenditure plans, including TIRG and TII.

Actual LRE to 2009/10, and forecast LRE from 2010/11, for the period 2005-2015 is shown in Figure 8. The expenditure in each year comprises all expenditure needed to accommodate new generation and demand connections or changes for existing connections.



**Figure 8: Actual and forecast load related expenditure**

Forecast LRE increases significantly year on year from the TPCR4 minimum expenditure of approximately £29m in 2010/11 to £119m in 2014/15. The Rollover year is forecast to incur £74.9m expenditure, more than double that delivered in 2009/10.

The most significant elements of the increased expenditure in 2012/13 are the 'Demand Connection-sole use' (£21.8m) and the 'Infrastructure – entry triggered' (£34.9m) categories, accounting for 76% of expenditure and illustrated in Figure 9 and Figure 10 respectively.

#### 4.2.1 Review of proposed programme

##### Generation connection sole use

Forecast expenditure in this category for the Rollover year totals [REDACTED] and is attributed to two schemes, [REDACTED] and [REDACTED], Table 4. Both these schemes, although consented, have experienced significant slippage in their connection dates although it is understood that Gordonbush is now under construction.

**(Table Removed)**

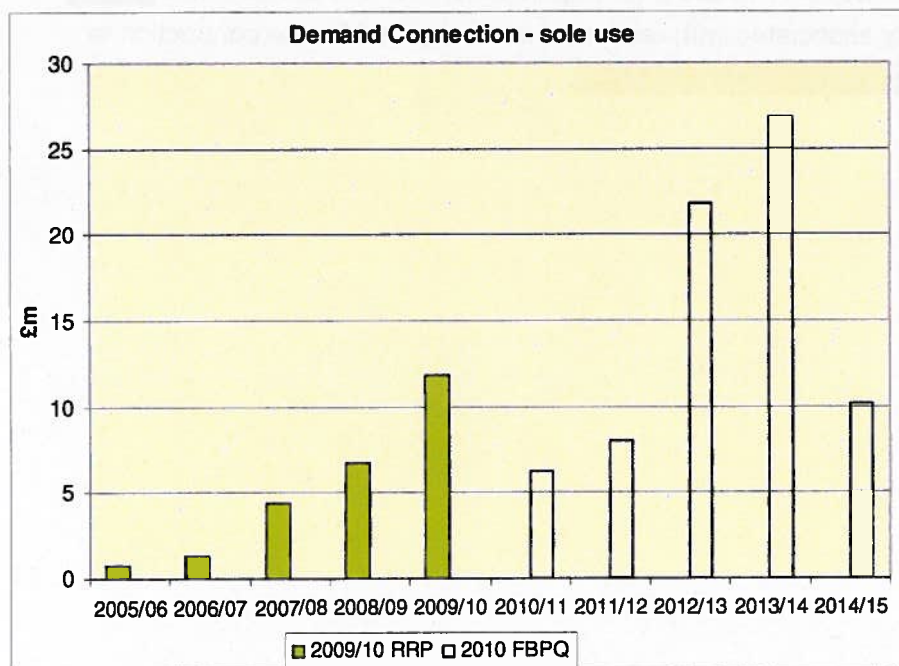
**Table 4: Generation connection sole use expenditure in 2012/13.**

Evidence of construction progress at [REDACTED] has not been apparent but, as it is consented, it is assumed likely that the scheme will be ready for connection in 2012/13, it is suggested that the proposed expenditure be unchanged.

#### **Demand connection sole use**

This expenditure is driven by growth in demand, forecast by SHETL to be zero or very low, and the connection of embedded generators (both large single and aggregated smaller embedded generators) and therefore largely based on forecasts obtained from DNOs and directly connected customers.

There has been significantly higher growth in demand for expenditure in this category than originally envisaged in the TPCR4 FBPQ, driven by strong demand for embedded generation connections. Cumulative expenditure to date is [REDACTED] against an original 2005 FBPQ forecast of [REDACTED] (2009/10 cost base). SHETL is anticipating a reduction in expenditure during the last two years of TPCR4 followed by a large step change in expenditure to [REDACTED] in the Rollover year, Figure 9.

**Figure 9: Actual and forecast demand connection sole use capital expenditure**

There are seven consented schemes forecast to incur expenditure of [REDACTED] in the Rollover year, Table 5, representing an unprecedented level of expenditure in this category.

**(Table Removed)**

**Table 5: Consented demand connection sole use schemes.**

SHETL is progressing with the design and consent process for the infrastructure projects associated with four of these demand schemes [REDACTED] and it is assumed there is a high degree of certainty that these schemes will proceed. It is understood that windfarm construction has now commenced at [REDACTED] and there is also a high degree of certainty of connection and expenditure in the Rollover year. [REDACTED]

[REDACTED]

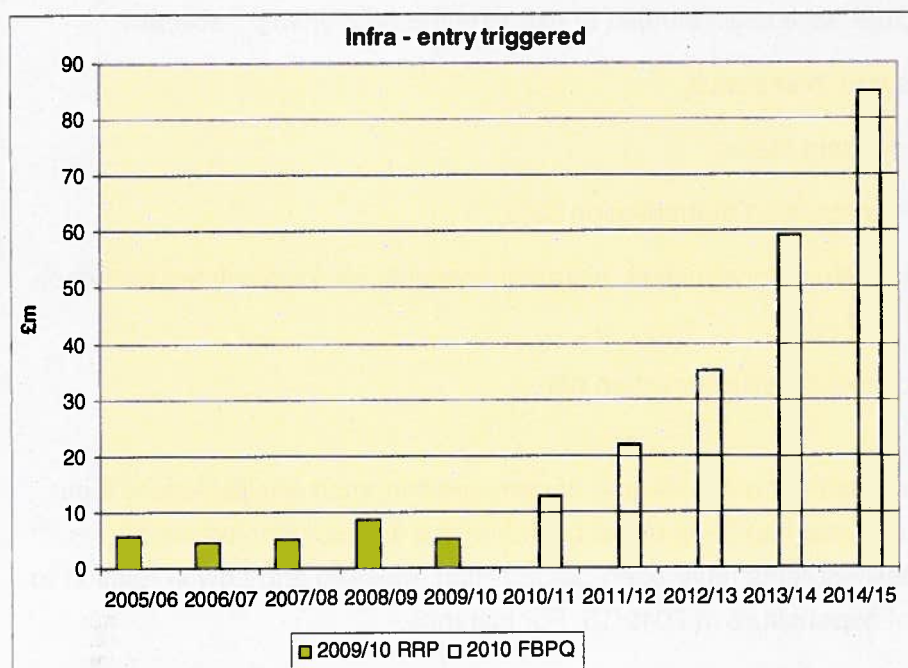
[REDACTED]

[REDACTED]

[REDACTED]

#### **Infrastructure entry triggered**

Entry-triggered infrastructure investment is indicating a significant and increasing step change year on year from 2010/11 to 2014/15. Expenditure over this period totals [REDACTED] and appears to be largely associated with reinforcements required for the connection of approximately [REDACTED].



**Figure 10: Actual and forecast entry-triggered capital expenditure**

The forecast expenditure of [REDACTED] in 2012/13 represents [REDACTED] of total LRE and appears to be allocated as follows:

- [REDACTED] to consented developer projects;
- [REDACTED] to developer projects at the scoping stage;
- [REDACTED] to TII project pre-construction works; and
- [REDACTED] to the engineering design of eight reinforcement schemes.

In keeping with the proportionality approach adopted by Ofgem for the Rollover price review a high level analysis has been performed on the entry-triggered infrastructure schemes forecast to incur expenditure in the Rollover year and listed in Figure 11.

**(Table Removed)**

**Figure 11: Infrastructure-entry triggered schemes with forecast expenditure in 2012/13.**

Several assessment factors have been studied to examine the relationship between:

- SHETL schemes and their status;
- SHETL scheme consent status;
- SHETL forecast construction authorisation date;
- Developer project status (construction, planning consents etc.) associated with each SHETL scheme; and
- Developer project contracted connection dates.

A scheme by scheme assessment of the degree of certainty that each one is likely to incur expenditure in the Rollover year has been made based on the assessment factors above. Results of the scheme assessments have been graded High, Medium and Low in relation to the perceived certainty of expenditure in 2012/13. For instance;

- High has been awarded where there is a high degree of correlation between all the factors above and therefore the need and timing of the scheme is clear;
- Medium has been awarded where there is a moderate degree of correlation (e.g. there may be uncertainty in the consent process in relation to the contracted connection date) but there remains reasonable certainty of the need and timing of the scheme; and
- Low has been awarded where there is a lower degree of correlation between the assessment factors (e.g. developer schemes may be in the scoping phase or have a long history of delay) and therefore the need and timing of scheme expenditure in the Rollover year is not clear.

From the high level scheme analysis it can be concluded that:

- There is a high degree of certainty that four of the projects will incur expenditure in 2012/13 as there are developer consents and generally robust levels of underwriting commitment in place and the associated SHETL schemes are at the design stage with appropriate consents being sought and construction authorisation imminent. These high certainty schemes are; [REDACTED];
- Four schemes, [REDACTED] have been assessed with a Medium degree of certainty that they are likely to incur expenditure in



the Rollover year as there are developer consents in place and generally developer commitment is indicated by a degree of financial underwriting; and

- Assessment of the remaining six schemes has resulted in a Low expectation of significant expenditure in 2012/13. None of these schemes have developer consents in place and have generally long connection dates with [REDACTED] and [REDACTED] dates moving further out from those indicated above to 2015/16 as shown in Table 5.1.2 in the SHETL detailed FBPQ Rollover narrative.

In cognisance of the above review it is suggested that the forecast expenditure of [REDACTED] for the Low certainty schemes is deferred from 2012/13 to give a revised total scheme expenditure of [REDACTED]. This suggested reduction is dominated by the potential deferral of [REDACTED] associated with the single [REDACTED] scheme.

SHETL has also included other elements of expenditure in the infrastructure-entry triggered category:

- Pre-construction works for the TII schemes totalling [REDACTED] in 2012/13 have been incorporated and no reduction is suggested for this figure.
- There is engineering design expenditure proposed for eight reinforcement schemes that totals [REDACTED] in the Rollover year, with [REDACTED] of this allocated across four schemes. This appears to be a high level of expenditure for design activities on a small number of schemes and it is suggested that this be reduced to [REDACTED] based on an average of [REDACTED] per site.

## 5 TOTAL CAPEX PROGRAMME DELIVERY

The total Capex forecast by SHETL in the four main categories of Load Related, Non-Load Related, TIRG and TII is presented in Figure 12.

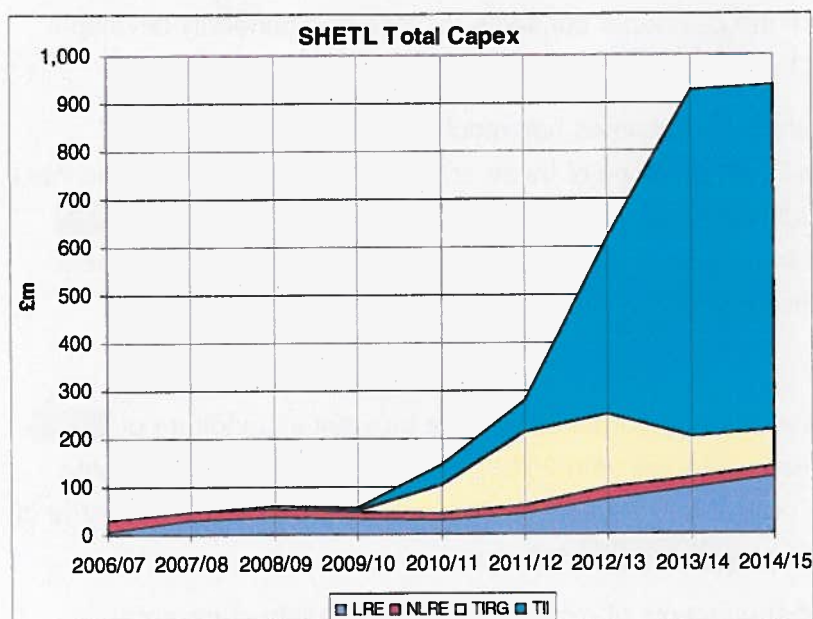


Figure 12: Total SHETL Capex forecast

Total capital expenditure delivered in 2009/10 was approximately £58m of which the traditional LR and NLR elements represented 79% (£45.5m) of activity. By 2012/13 this figure is forecast to increase to £620m of which traditional expenditure accounts for £95.7m (15%) of activity.

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

<sup>1</sup> TII HVDC forecast expenditure estimated from Table 4.23 of the 2010 FBPQ.

<sup>2</sup> TII overhead line contribution estimated from Table 4.23 of the 2010 FBPQ.

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

16010832

[REDACTED]  
[REDACTED]  
[REDACTED]

[REDACTED]  
[REDACTED]  
[REDACTED]

[REDACTED]  
[REDACTED]  
[REDACTED]

## 6 SCHEME ASSESSMENTS

KEMA identified 2 schemes for detailed investigation, taken from the Business Plan Questionnaire. These schemes consisted of:-

- 1 Load related, 1 Non-load related:
  - 1 transformer scheme; and
  - 1 windfarm connection scheme.

Table 6 summarises these schemes, their status and details of the associated expenditure.

**(Table Removed)**

**Table 6: schemes selected for detailed analysis.**

Subsequent to receipt of additional information from SHETL with regard to the Ardmore project costs no specific issues were identified in either project review.

Table 7 summarises the issues for each SHETL scheme considered. Each scheme has been assessed under the following three headings:

- Need (i.e. has the TO provided a reasonable justification for the work?);
- Design (i.e. has the TO provided the optimum design?); and
- Cost (i.e. are the costs reasonable?).

and for each issue a bullet "colour-coding" scheme has been used, where:

- Green indicates concurrence;
- Amber indicates that there are uncertainties regarding aspects of the scheme; and
- Red indicates there are unjustified aspects of the scheme.

(Table Removed)

**Table 7: Summary of scheme assessments.**

## **7 CONCLUSIONS**

KEMA has reviewed the total NLR and LR capital expenditure for SHETL, comparing outturn against allowances and projecting forecasts forward through the Rollover year (2012/2013) to 2014/15. Further analysis was performed on the NLRE to obtain a clear understanding of the levels of investment and volumes of assets installed, replaced or refurbished by major asset category.

In conclusion:

- Transformers; Replacement volumes are low but the transformer unit costs are considered high in relation to KEMA and TO Average comparators. The replacement schemes proposed do correlate well with SHETL's replacement priority assessment. An adjustment of [REDACTED] to the forecast expenditure has been made to compensate for the unit costs.
- Switchgear; Two 132kV switchgear replacement schemes are proposed for the Rollover year and forecast expenditure appears to be reasonable.
- Overhead lines; The scope of overhead line refurbishment, largely whether conductor replacement is necessary or not, is determined by conductor condition that is not always easy to determine in advance. SHETL is forecasting reduced expenditure against assumed TPCR4 allowances largely due to a reduced scope of work as conductor has been in better condition than anticipated. It is suggested that the forecast 2012/13 expenditure also be reduced to account for a similar situation.
- Underground cables; SHETL replaces very low volumes of cable and the expenditure proposed is highly scheme and site specific and is considered to be reasonable.
- Protection and control; SHETL provided a range of unit costs that align with cost comparator expectation and the expenditure is considered reasonable.



- Substation other: This expenditure category encompasses three main work streams; circuit faults, plant faults and minor works. Forecast 2012/13 expenditure aligns with the TPCR4 annual average and is considered to be reasonable.
- Scheme assessments: Two schemes were examined in detail (1 NLR and 1LR) and assessed by project need, design and cost. In both cases the need, design and costs of the schemes is considered to be valid.

- [REDACTED]

Adopting the proportionate approach encouraged by Ofgem for this review KEMA has made an assessment of appropriate expenditure for each NLRE asset category in the Rollover year, 2012/13. This assessment is presented below.

2012/13 Rollover Year (£m)	SHETL F'cast	KEMA Estimate	Comment
<b>NON-LOAD RELATED EXPENDITURE</b>			
Assets - replacement and refurbishment			
Transformers	4.2	3.6	unit costs high, reduced by 15%.
Reactors	0.0	0.0	no expenditure
Switchgear	4.1	4.1	two schemes, unit costs ok.
Overhead Lines	4.6	3.9	reduced in light of TPCR4 outturn as conductor condition better than anticipated.
Underground Cables	3.7	3.7	expenditure reasonable.
Protection & control	0.7	0.7	average unit cost ok.
Sub-station other	1.8	1.8	not assessed, in line with TPCR4 average.
Other NLRE			
Other TO	0.0	0.0	no expenditure.
Quasi capex			
Capitalised Overheads	1.7	1.7	not assessed
<b>TOTAL</b>	<b>20.8</b>	<b>19.5</b>	

#### Load Related Expenditure

A proportionate approach to the LRE category analysis has also been adopted by reviewing the largest expenditure categories, encompassing approximately 76% of total expenditure, 'Demand Connection-sole use' and 'Infrastructure – entry triggered'.

**In conclusion:**

- The Rollover year is forecast to incur £74.9m expenditure, more than double that delivered in 2009/10.
- It has been assumed that the two Generation-sole use schemes will incur the forecast expenditure as one is currently under construction and the other has been granted planning consent.
- There has been significantly higher growth in demand for expenditure in the Demand connection –sole use category than originally envisaged in the TPCR4 FB PQ, driven by strong demand for embedded generation connections. However, two of the 7 consented schemes exhibit a degree of uncertainty associated with expenditure in the Rollover year and that deferral of expenditure beyond 2012/13 is possible. It is suggested that forecast expenditure in this category be reduced to [REDACTED] to account for potential deferrals.
- An assessment of the Infrastructure-entry triggered developer generation projects and associated SHETL connection schemes based on factors such as; developer project consent status, contracted connection date, SHETL scheme consent status, SHETL scheme planning status and authorisation has been carried out to consider the likelihood of scheme expenditure in the Rollover year. Each scheme assessment was categorised with a high, medium or low certainty of incurring expenditure in 2012/13 and it is suggested it may be possible to defer expenditure of the low category schemes beyond 2012/13. This assessment results in the reduction of expenditure in 2012/13 of: Demand connection-sole use schemes to [REDACTED] and Infrastructure-entry triggered schemes to [REDACTED].

From a detailed analysis of the largest elements of SHETL's load related Capex plan, the Demand connection-sole use and Infrastructure-entry triggered categories, and discussion of the main issues within this report KEMA has made an assessment of the appropriate expenditure for these categories in the Rollover year, 2012/13 as indicated below. The low expenditure LRE categories listed were not reviewed.

2012/13 Rollover Year (£m)	SHETL F'cast	KEMA Estimate	Comment
<b>LOAD RELATED EXPENDITURE</b>			
Generation connection - sole-use	11.3	11.3	
Demand connection - sole-use	21.8	15.2	
Total LRE - sole-use	33.1	26.5	
Infrastructure - entry triggered	34.9	24.4	
Infrastructure - general reactive (excl TIRG /TSS)	0.0	0	no expenditure
Infrastructure - general non reactive (excl TIRG /TSS)	0.0	0	no expenditure
Infrastructure - exit triggered	1.0	1.0	not assessed
Infrastructure - TSS	2.0	2.0	not assessed
Total LRE - Infrastructure	37.9	27.4	
Capitalised Overheads	3.9	3.9	not assessed
<b>TOTAL</b>	<b>74.9</b>	<b>57.8</b>	

## APPENDIX A - DETAILED SCHEME ASSESSMENTS

Appendix Removed