ANNEX 22: LONG TERM STRATEGY

Electricity North West Limited
Registered Office:
304 Bridgewater Place,
Birchwood Park,
Warrington,
Cheshire.
WA3 6XG.
Registered no: 2366949 (England)

Contents

1. Background

In forming our plans for RIIO-ED1, we have been careful to take account of the longer term context in which those plans will be delivered.

To help us do this, we have explored the potential longer term impact of moves to a low carbon economy with our stakeholders and also considered the requirements of the existing network over the next few decades. For the last three years, we have published annual Strategic Direction Statements which outline our current thinking in these areas and the future impacts we expect.

The overall backdrop is provided by government-instigated moves towards de-carbonisation of the energy sector as part of the plan to achieve legally-binding national reductions to overall carbon emissions by 2050. This is likely to result in a significant increase (potentially 60%) in electricity demand due to the decarbonisation of the transport and heat sectors. In addition to this, we will have to take account of the needs of an extensive and ageing existing asset base and ensure that we continue to comply with all our current obligations.

Long-term forecasting is always fraught with uncertainty, particularly where the future may hold a very different pattern of energy usage from that of today. However we have constructed a range of plausible forecasts rooted in currently available information and analysis of our current network.

We have broken down our longer-term forecasts into four key areas;

- Asset Renewal;
- Other Non Load investment;
- Low Carbon Reinforcement; and
- General reinforcement.

In addition, we have included consideration of a particular issue in terms of the proposed construction of a new nuclear power station at Moorside on the west coast of Cumbria in the period to 2023.

2. Approach

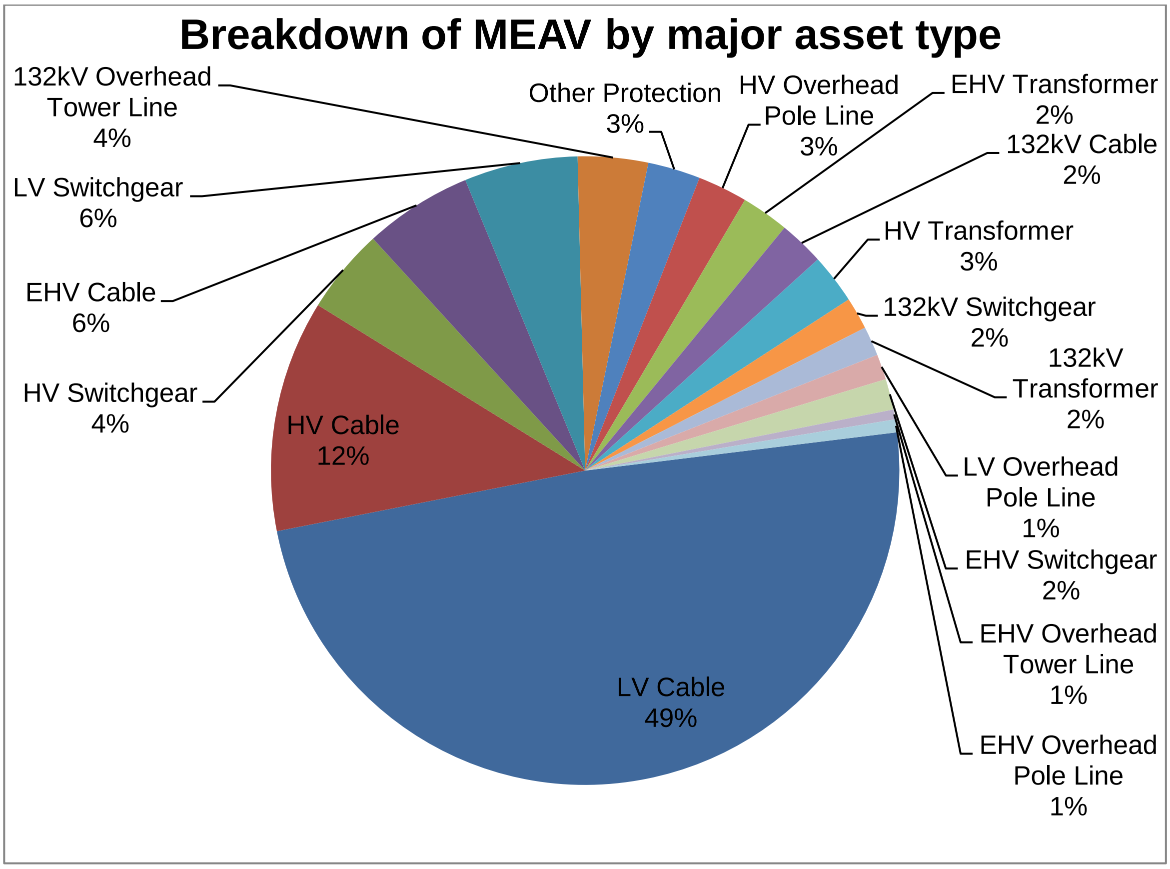
Detailed forecasting models become increasingly unreliable as their time horizon is extended so for longer-term planning we have used a more strategic approach for each area as set out below. In each case, the results are presented in terms of the total forecast for a RIIO price control period (eight years). These costs relate to the forecast direct construction costs of the work. We have not included ongoing maintenance costs or the indirect costs of running our business over the forecast period in these projections.

3. Asset Renewal

Historically, the major component of our network investment programme has been the replacement and refurbishment of our existing electrical and civil assets as they reach the end of their useful life. Much of the asset base was installed in the 1950s and 1960s and hence renewal rates have been relatively low over recent decades as the overwhelming majority of the assets have been within their design lives. However, we have already seen the start of an increase in renewal requirements in DPCR5 as a large number of assets start to approach the end of their useful lives.

Modern asset management and condition monitoring techniques assist in effectively prioritising replacement requirements and identifying where additional asset life can be achieved. This can help constrain investment from the levels that would otherwise be required; however the background pattern of investment in this area is that of an inexorable rise over the next few decades.

We do not believe that the future increase in investment will replicate the originally-installed profile, but will be much more incremental over time. The pattern will also differ significantly by major asset type. The chart below shows the composition of the current network Modern Equivalent Asset Value (MEAV), ie the current cost of replacing the whole network;



The valuation is dominated by the LV and HV underground cable networks (including services). These assets have been extremely reliable historically and there are no current indications that overall performance levels are worsening. These assets are however very difficult to inspect and condition assess hence it is difficult to build predictive models. Assumptions on the future replacement rates of these cable networks are the biggest variable in long-term renewal projections.

For the other asset types, it is possible to undertake condition assessments which can be used to inform future replacement requirements. We utilise a suite of Condition-Based Risk Management (CBRM) models to enable us to identify these requirements. Annex 2 gives further details on the development of this approach and details the results for the RIIO-ED1 period.

For the longer-term projections, we have reviewed the overall replacement percentages in RIIO-ED1 and used these as a baseline for assessing future periods, taking into account the deterioration trends suggested by the CBRM models.

The results by major asset type are set out below with further details in Appendix 1;

		RIIO-ED1		**RIIO-ED2**	**RIIO-ED3**	**RIIO-ED4**	**RIIO-ED5**	**Total by 2055**
	Total Number	Volumes	% replaced					
Transformers	34,475	1,784	5%	12%	10%	10%	10%	**47%**
Switchgear	85,729	11,076	13%	11%	10%	10%	9%	**53%**
Overhead Lines	12,923	620	5%	10%	11%	11%	11%	**48%**
Underground Cables	44,193	542	1%	2%	3%	4%	4%	**15%**

This shows that, even with planned increases over future periods, around half of the current switchgear, transformer and overhead line assets will still be in service in 40 years' time. In terms of the cable network, it is likely that around 85% of the current inventory will still be in use. Increased use of refurbishment and life extension techniques, together with the replacement of assets due to other investment drivers will contribute to these being credible projections; however they are likely to be towards the bottom of the potential range of future renewal investment.

One key conclusion from this is that much of the additional functionality required of the network in a 'smart' world will have to be enabled by retrofitting technology to pre-existing assets.

4. Other Non-load Investment

In addition to asset replacement, there are a range of additional drivers which result in the replacement of existing assets, whether due to legislative drivers or responding to demands for increased resilience of and performance from the network.

Predicting future requirements in this area is difficult as such changes are often made in reaction to unforeseen or extreme events. The table below sets out our forecast spend in these areas, together with the outline assumption for each. In general terms, we have not included speculative provision for currently unknown requirements and hence the forecast shows a decrease over future periods as areas of current concern are addressed.

2012-13 prices	2016-2023	2024-2031	2032-2039	2040-2047	2048-2055	Assumptions
	RIIO-ED1	RIIO-ED2	RIIO-ED3	RIIO-ED4	RIIO-ED5	
Diversions	27.2	30.0	30.0	30.0	30.0	No new requirements
Legal & Safety	43.0	25.0	20.0	20.0	20.0	Current security & safe climbing programmes complete. Continuation of mitigation measures only thereafter
Resilience	20.7	15.0	25.0	15.0	25.0	No material new requirements following CNI & Black Start implementation in ED1. 10 year battery replacement cycle
Rising & Lateral Mains	14.5	30.0	20.0	5.0	5.0	Resolution phased over ED1, 2 & 3. Provision thereafter
Losses & Environmental	16.2	20.0	5.0	5.0	5.0	Implementation of new transformer spec over ED1 & 2. Residual provision thereafter
Other Non-Load	**121.6**	**120.0**	**100.0**	**75.0**	**85.0**	

5. Low Carbon Reinforcement

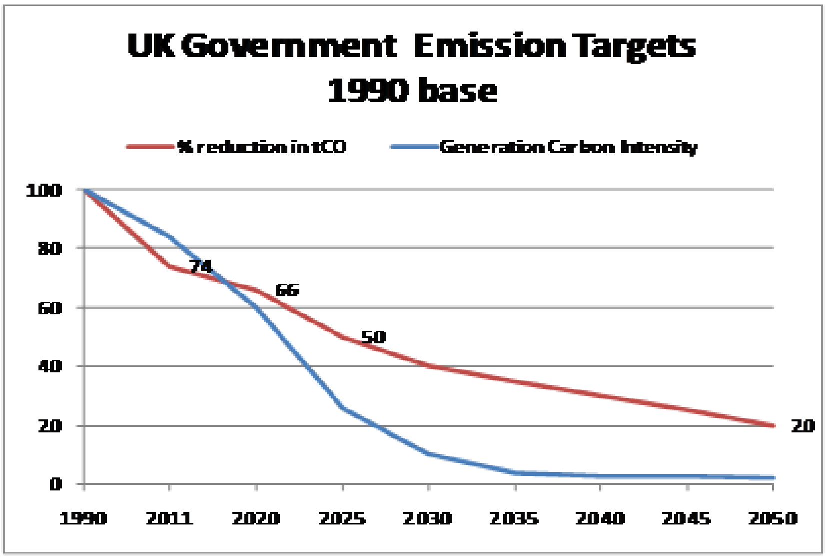
One of the most uncertain future factors to consider in long-term planning is the future network implications of the wide scale adoption of Low Carbon Technologies (LCT) such as Electric Vehicles, Heat Pumps and domestic PV generation.

These are particularly important as their demand patterns are completely different in scale and character to existing domestic level loads and this has the potential to render much of the current lower voltage network unable to connect such devices.

In order to make a meaningful forecast, we have to a) consider the likely network impact of varying scales of LCT penetration and b) consider the likely timeframe for the roll out of these devices.

In terms of assessing the network impact, we have used the Transform model developed collectively with the industry and third party experts. This looks at the ability of different types of network to accommodate LCTs and selects from a range of potential solutions when it considers the network's ability to have been exceeded. Using this approach means we can model the potential implications in a consistent way across the industry.

In terms of the likely roll-out timeframe for LCTs, our forecasts for RIIO-ED1 have been based on one of four scenarios articulated by DECC. Our 'Best View' aligns with the 'Low' scenario. We have continued this projection over future periods and calibrated it by RIIO period using the target rate of CO_2 reduction (see chart below).

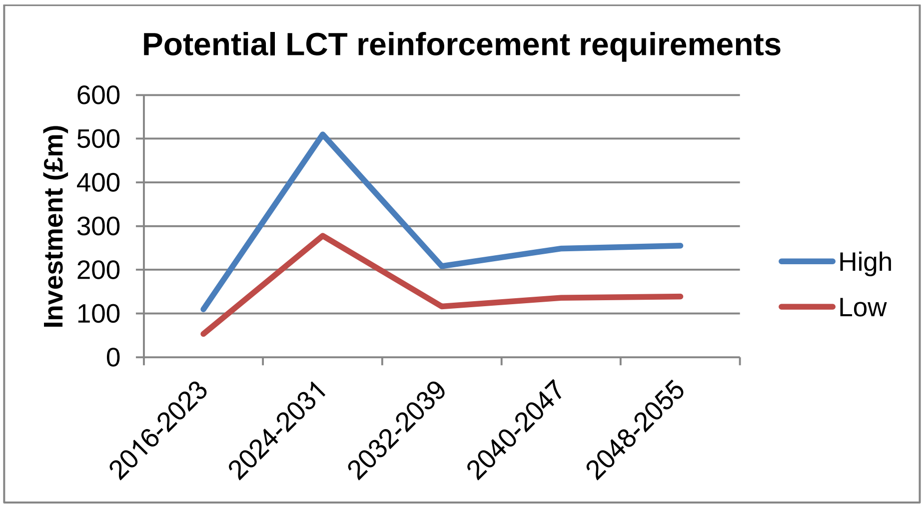


This results in a significant increase in the RIIO-ED2 period as that is when the rate of decarbonisation will be at its most rapid.

We have taken two further factors into account in constructing the forecast. Firstly, we consider that the current research effort and technology trials will reveal new and cheaper solutions to the emergent demand issues. We do not currently know what these will be, but we have discounted our projections by 25% in each period on the assumption that new technologies make these reductions possible.

Secondly, as the scale of investment grows, so does the potential overlap with other programmes of work, particularly the asset renewal programme. We will not know the specific locations where this overlap occurs (and hence where multiple needs can be solved by a single project) until the detailed planning phase of the programmes but we have assumed a further 20% discount on the costs of responding to decarbonisation due to the likely overlap with other work.

For comparison, we have also looked at the potential impact of LCT technology take-up if the future resembled the 'High' DECC scenario for our region. We believe that this is less likely, but it gives an illustration as to the range of investment that might be required in this area.



6. General Reinforcement

Every year, we undertake reinforcement of the existing network to accommodate increases in demand. This may require the upsizing of assets that were otherwise still serviceable, or the re-configuration of part of the network (eg through installing new cables interconnecting circuits) to enable us to manage load more flexibly.

Patterns of demand growth are not consistent through time and across our region. They do however generally follow economic activity and it is possible to make near-term projections of the impact of this at quite a detailed level. As such, our RIIO-ED1 forecast is comprised of projects at specific sites for the higher voltage networks, together with overall forecasts at the lower voltages based on trend analysis.

The recent economic recession has resulted in a drop in overall demand, however in our region, we experience localised load growth ranging from 4%-5% per annum in central Manchester through to sustained decline in a number of former mill towns. Even if overall demand is falling, we will still need to respond to these localised needs.

Our long-term forecast is that economic growth will slowly return to pre-recession levels resulting in an enduring demand growth of 1%-2% per annum (similar to the last 20 years). Continuation at this rate will result in a doubling of demand by 2050. As a result, our forecasts for general reinforcement show an incremental period-on-period rise out to RIIO-ED5.

7. Cumbria Nuclear

NuGen has applied to National Grid Electricity Transmission for the connection of a 3.6GW nuclear power station, at Moorside near Sellafield. To enable this connection National Grid will need to provide 4 x 400kV transmission circuits. At present, no firm commitments on the timing of the connection works or the route for the transmission circuits have been made.

National Grid has considered six options for this connection. One of these has a significant impact on our 132kV distribution network, whereby National Grid's proposals would mean displacing our existing lines to establish a 400kV overhead line double circuit around the west coast of Cumbria.

We have included a total estimate for this work within the RIIO-ED1 period. We do not expect our customers to meet any part of National Grid's costs or the consequential costs of accommodating their chosen route. It is likely though, that we will have to upgrade or replace some of our assets as a result. Our current estimate is that around 45% of the £207m estimated cost will be funded by our customers, with the remainder being recharged to National Grid.

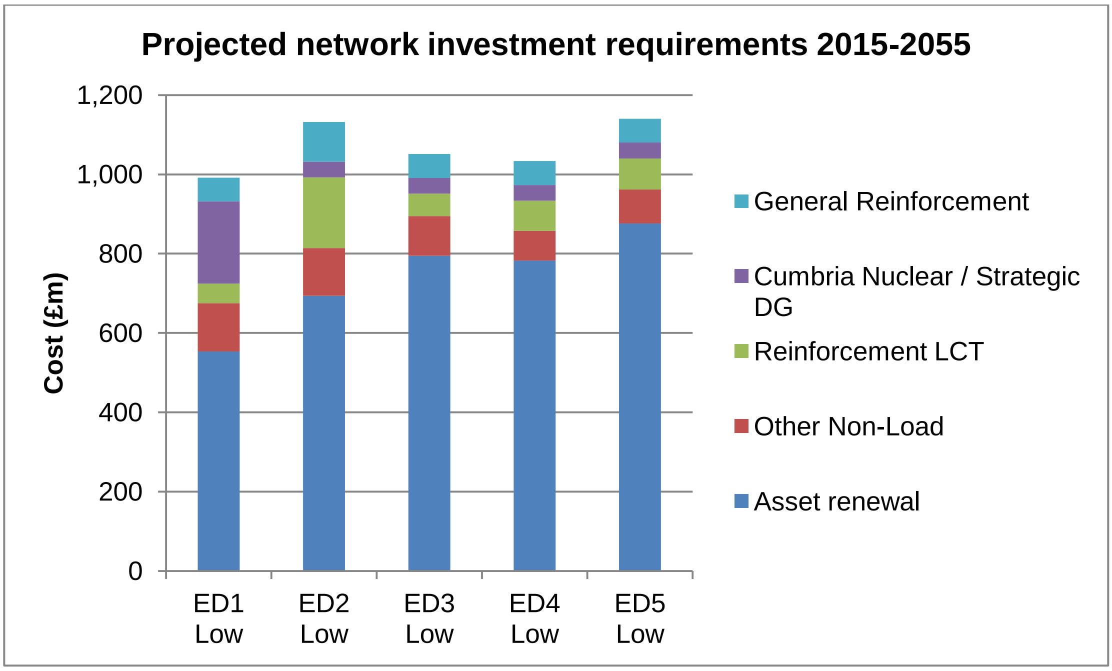
8. Strategic Reinforcement

As the pattern of future demand requirements becomes clear, it is likely that it will be economically advantageous to undertake a small number of strategic network reinforcement projects where this is more efficient that responding to issues on a piecemeal basis. At the moment, it is impossible to identify where these may be required but our previous experience of areas such as South Manchester is that it can be possible to solve multiple emerging issues with a single wider-scale reinforcement project.

As such, we have included an assumption for future such works in our forecast.

9. Overall Summary

The total forecast network investment requirements over the next forty years as a result of the drivers noted above is as follows;



10. Implications

This analysis has a number of important implications for our RIIO-ED1 plan. These fall broadly into three separate categories, namely:

- The level of reinforcement investment that can be brought forward into RIIO-ED1
- The resource capability development that can commence in RIIO-ED1
- Ensuring the appropriate contracting strategy

11. Level of reinforcement investment that can be brought forward into RIIO-ED1

Our stakeholders place a higher priority on ensuring affordability of customers' bills than they do on facilitating the move to a low carbon future. We have been very conscious of this in developing our plan. The scale of the potential increase in reinforcement expenditure that we forecast for RIIO-ED2 and RIIO-ED3 is such that we have considered very carefully whether we should bring forward some of this work into RIIO-ED1. If it were possible to do so we could mitigate the cost pressures that outage congestion and competition for contractor resources will inevitably bring. These benefits would potentially have a positive impact on customer prices over the long-term; however we need to remain mindful of the risk of building assets that are not utilised in the near term.

The need for the reinforcement levels we have predicted will only arise if there is a significant change in the current package of Government stimulus to the heat pump and electric vehicle markets. Beyond the implementation of the revised Renewable Heat Incentive, at the current time we are not aware of any evidence that Government are contemplating further revisions to their stimulus package within the RIIO-ED1 period. Our stakeholders also tell us that they do not expect changes in this period.

In five years' time we may have much more information and the picture may be much clearer. If this is the case, we anticipate that the Government will enact the necessary legislative changes to introduce new stimulus packages or we will be asked to provide additional, specific Outputs to support the move to a low carbon future. These occurrences may trigger the need for a mid-point review of the remainder of RIIO-ED1.

We are very conscious that to ensure maximum efficiency we must avoid the risk of unnecessary investment wherever possible. Our key dilemma in assessing reinforcement expenditure targeted at supporting the growth in Low Carbon Technologies (LCTs) is determining the precise location for this reinforcement. Given this we have included a relatively modest plan in addressing low carbon-driven reinforcement during RIIO-ED1, but one that can ramp-up quickly when required in RIIO-ED2.

11.1 EHV and 132kV networks

On our EHV and 132kV networks, we see a continually shifting pattern of peak demands. Overall demand has been falling, but at localised hot spots we have significant reinforcement requirements. The overall impact of LCTs on this network is hard to predict without good data on the likely clustering of their adopters and an accurate forecast of when the technologies will be adopted in significant numbers.

We do not believe that the increase in reinforcement needs we have forecast for the RIIO-ED2 period will occur at the end of RIIO-ED1 and is more likely to be needed from the middle of the period onwards. Therefore, during RIIO-ED1 we have focussed on addressing the most heavily overloaded demand groups and separately those demand groups with limited alternative feeds.

11.2 HV and LV networks

The urban conurbations within our operating area have HV networks operating predominately at 6.6kV. A proportion of the switchgear in these areas is fault rated below our design standard of 21.9kA. Although the standing fault level may not exceed this rating, it often represents a significant barrier for significant load or generation increases, such as LCTs or urban DG. It is proposed to remove this sub standard switchgear from the network over two price control periods to coincide with increased penetration of LCT which may otherwise be constrained or unacceptably delayed. The volumes for intervention in RIIO-ED1 are forecast to cost some £14m with the remainder of the switchgear to be changed in RIIO-ED2. The fault level on the primary HV busbar coupled with the rating of the primary HV switchgear is used to prioritise intervention. This strategy allows us to certify that the whole network emanating from a particular primary substation will not have fault level issues that would impede the connection of LCTs.

The electrical nature of LCT connections will increase harmonic levels on the distribution system. This is of particular concern to the LV network as the penetration of photovoltaic generation, heat pumps and electric vehicle chargers increases. Using analysis we commissioned from Parsons Brinckerhoff, we will commence a programme of fitting LV harmonic filters to substations identified as having harmonic issues during RIIO-ED1, ramping up into RIIO-ED2.

Our work on looped services shows that these are not compatible with persistent LCT loads such as heat pumps due to thermal heating effects and voltage drop. We therefore propose to address looped services that constrain the connection of LCT to the network. In RIIO-ED1 we will also remove all looped services where we have another driver to work on these assets.

12. Resource capability development that can commence in RIIO-ED1

Our delivery strategy is to use a blend of direct labour and contractor resources. We are developing the future capability and capacity of both of these resource pools in anticipation of the growing investment programme our long-term strategy sets out.

In designing our delivery model for our business plan we have been mindful of the need to be able to flex resources in the event that LCT adoption rates are higher than anticipated. Our delivery plan shows how we will be able to increase our contract resources and flex our less time-critical investments to accommodate any reasonably foreseeable level of LCT adoption up to and including the highest of the DECC scenarios.

We also note that much of the RIIO-ED2 and RIIO-ED3 reinforcement will require considerable cable-laying activity which presents fewer delivery challenges in terms of available market capacity than, for example, overhead lines work.

12.1 Work Force Renewal

Our Work Force Renewal (WFR) recruitment and training strategy is a key element of our resource capability and is based on a strategic view of the workforce requirements we will have over the next 15 years. During this period, the demographic profile of our workforce will change dramatically, presenting challenges in terms of replacing an aging workforce, developing our delivery capacity and developing a new range of skills.

We are meeting the challenges by recruiting apprentices, A level, HNC and graduate trainees; this will be further supplemented by an upskilling/re-skilling programme for existing employees.

As a result of our long-term network planning, we have used our strategic resource model during DPCR5 to determine our requirements for RIIO-ED1 and beyond. Our strategy is aligned to, and we are working very closely with National Skills Academy for Power (NSAP) and the other DNOs on utilising a WFR Planning Model.

Our new training academy was opened during 2013 and provides the infrastructure necessary to cater for the increase in recruitment and training. Our A level, HNC and graduate programmes have recently received IET accreditation and improvements to our craft apprentice programme were introduced in September 2012.

12.2 Contracting Strategy

Our delivery model is based on retaining a core of direct labour for reactive customer work and tree cutting with flexibility provided by contractors for other investment areas. This ensures security of fault response, retains key skills within our business and provides efficient cost delivery whilst maintaining flexibility for the business.

The balance of work will be completed by external contractors, procured through either framework arrangements or, for larger projects, via a formalised tender process. The approach of undertaking the additional volume by utilising external contractors is appropriate as we anticipate there will be sufficient flexibility in the market to accommodate the increasing work programme at an efficient cost and without the risk of building a stranded workforce.

We have assessed the potential increase in activities and volumes required when moving from a ‘Low’ to a ’Medium’, or even to a ‘High’ carbon reduction scenario. The difference in scenario outputs has been assessed using our resource analysis tool and the inbuilt flexibility within the delivery strategy can cope with these additional demands and changes should they be encountered during the course of RIIO-ED1.

Our only area of concern is that some specialist resources become limited in a stretched market and as a consequence command a premium price. It is therefore essential that early indicators are monitored regularly to determine the scenario developing.

We are already building closer links and exploring partnering arrangements with some of our contractors and supply chain to secure the future resources needed.

		Total Asset Length	RIIO-ED1 Volumes	%age replaced - RIIO-ED1	RIIO-ED2	RIIO-ED3	RIIO-ED4	RIIO-ED5	By 2056	Assumptions
LV	Overhead Pole Line	2,224	188	8.5%	15.0%	15.0%	15.0%	15.0%	68%	ED1 reduction due to ESQCR programme in DPCR5. Flat thereafter
LV	Cable	28,529	201	0.7%	1.5%	2.0%	3.0%	4.0%	11%	Gradually increasing to reflect age of asset base
LV	Services (OH, UG, RLM)	1,965,377	24,910	1.3%	11.0%	12.0%	13.0%	14.0%	51%	Replacements driven by a mix of condition and increased loading due to LCT take up for heat pumps, EVs etc.
HV	Overhead Pole Line	7,746	238	3.1%	10.0%	12.0%	12.0%	12.0%	49%	ED1 reduction due to ESQCR programme in DPCR5. Pick up thereafter
HV	Cable	13,105	249	1.9%	3.0%	4.0%	4.0%	5.0%	18%	Gradually increasing to reflect age of asset base
EHV	Overhead Pole Line	1,015	101	9.9%	8.0%	8.0%	8.0%	8.0%	42%	Reduction from ED1 programme
EHV	Overhead Tower Line	338	3	0.9%	2.0%	3.0%	9.0%	12.0%	27%	Very low volumes of activity in RIIO 1 - 3 will result in a large number of lines being very dilapidated toward the middle of the century, hence requiring increase in investment as lines will require total replacement.
EHV	Cable	2,207	108	4.9%	10.0%	15.0%	8.0%	8.0%	46%	Reflects planned phase out of assisted cable over medium term
132kV	Overhead Pole Line	4	-	0.0%	0.0%	0.0%	100.0%	0.0%	100%	This equates to approximately 40 structures which for the sake of completeness should be considered for replacement/refurbishment within the next 20 - 25 years.

132kV	Overhead Tower Line	1,595	90	5.6%	5.0%	5.0%	5.0%	5.0%	26%	Likely to be fundamentally based on ongoing refurb rather than replace
132kV	Cable	352	12	3.3%	10.0%	25.0%	1.0%	1.0%	40%	Reflects planned phase out of assisted cable over medium term
Total		**2,022,493**	**26,099**	**1.3%**						
HV	Transformers	33,602	1,680	5.0%	12.0%	10.0%	10.0%	10.0%	47%	Age profile suggests near term increase in replacement
EHV	Transformers	715	87	12.2%	10.0%	10.0%	11.0%	11.0%	54%	Reports show that newer transformers will fail more rapidly than older units hence need to continue with high levels of asset intervention, also LCN will result in increased loadings hence reducing life expectancy of existing fleet.
132kV	Transformers	158	17	10.8%	8.0%	8.0%	10.0%	10.0%	47%	Reports show that newer transformers will fail more rapidly than older units hence need to continue with high levels of asset intervention, also LCTs will result in increased loadings hence reducing life expectancy of existing fleet.
Total		**34,475**	**1,784**	**5.2%**						
LV	Switchgear - Cut Outs	1,965,377	40,497	2.1%	5.0%	5.0%	5.0%	5.0%	22%	Estimated run rate post Smart Meter roll-out
LV	Switchgear - ex. Cut Outs	37,049	3,624	9.8%	10.0%	10.0%	10.0%	10.0%	50%	Carry on at existing levels
HV	Switchgear	45,644	7,338	16.1%	12.0%	10.0%	10.0%	8.0%	56%	Reduction from planned ED1 peak in activity
EHV	Switchgear	1,917	69	3.6%	5.0%	9.0%	10.0%	8.0%	35%	Rise anticipated in ED3 due to longevity of current plant mix as many units will be approaching 100 years old.

132kV	Switchgear	1,119	45	4.0%	3.0%	5.0%	8.0%	10.0%	29%	Significant ramp up to reflect age profile and current low level of activity
Total		**2,051,106**	**51,573**	**2.5%**						
HV	Protection	3,176	1,776	55.9%	25.0%	20.0%	20.0%	20.0%	122%	Assumed near term major replacement programme then lower levels
EHV	Protection	816	648	79.4%	25.0%	20.0%	25.0%	30.0%	100%	The general assumption is that electro- mechanical relays will need replacement because their bearings will be too old to operate correctly, and then the replacement micro processor relays will only last between 20 and 25 years so population replacement rates will rise markedly over the period.
132kV	Protection	192	177	92.2%	25.0%	20.0%	25.0%	30.0%	100%	The general assumption is that electro- mechanical relays will need replacement because their bearings will be too old to operate correctly, and then the replacement micro processor relays will only last between 20 and 25 years so population replacement rates will rise markedly over the period.
Other	Protection	5,589	113	2.0%	5.0%	5.0%	5.0%	5.0%	22%	Provision for replacement of pilots etc.
Total		**9,773**	**2,714**	**27.8%**						