



Document 10
Asset Category – Civils (Capex & Opex)
LPN

Asset Stewardship Report
2014

Helen Amare

Document History

Version	Date	Details	Originator	Revision Class	Section Update
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1.1	17/02/2014	Columns added to table 6 to include the RIGS tables and Rows corresponding to each line	H. Amare	Minor	7.2.1
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1.0 Executive Summary

1.1 Scope

Note: All expenditure and volumes described and justified in this document are based on the 19th February 2014 Strategy and Regulation NAMP

Non-load related expenditure (NLRE) of Civil assets refers to the investment in replacement of all substation building components and surrounds that has been assessed as poor condition requiring replacement, security-related improvements to Grid, Primary and Distribution substation sites in response to increasing levels of trespass, risk based flood protection (Refer to UK Power Network's RIIO-ED1 Flooding Protection document for more detail), oil containment works required by environmental legislation and essential cable bridge refurbishment, cable tunnel refurbishment and inspection and maintenance of these assets across the London Power Networks (LPN). The plan also includes Civil works driven by other plant replacements.

This plan details the capital expenditure (CAPEX) and operational expenditure (OPEX) of civil assets.

Replacement, refurbishment, inspection and maintenance costs for civil assets are held in the following locations in Ofgem and UK Power Networks investment planning documents. Listed below are the high level asset categories and their relevant NAMP line number.

Investment type		ED1 (£k)	NAMP line	RIGs
Replacement of building components and surrounds		27,379	1.47	CV6
Substation Security (including the expenditure for distribution substation locking replacement detailed in section 2.2. This is a one off programme with a total value of £6.9m)		9,547	1.08	CV8
Substation Flood Protection		3,730	1.47 and 1.47	CV11
Oil Containment		3,953	1.30	CV12
Cable Bridge	Refurbishment	2,331	1.47, 2.30,	CV6

	Inspection and maintenance		1,742	2.32	CV13
Cable Tunnel	Refurbishment		4,663	1.47	CV6
	Inspection and maintenance		13,868	2.30, 2.32, 2.33	CV13
	Other works (See section 7.2.5 for detail)	CAPEX	1,752	1.47	CV6
		OPEX	3,159	2.30, 2.32, 2.33	CV13
Safety			4,642	1.20	CV8
Inspection and maintenance			17,745	2.30, 2.32, 2.33, 2.34	CV13
Total Expenditure (Condition driven civil works)			94,511		
Project specific lines mapped to Civil asset replacement lines (CV6) as explained in section 7.6			18,200		CV6
Civil Expenditure associated with other asset replacement projects			14,245		CV6
Total Expenditure (Including civil works driven by other asset replacement and project specific lines mapped to CV6)			126,956		

Table 1: Investment areas

1.2 Investment Strategy

In the DPCR5 price control period levels of risk and dereliction have driven a level of investment significantly in excess of our regulatory allowances. Increasing level of defects and the deteriorated condition of civil assets has highlighted the need to increase the requirements for interventions.

The investment strategy in RIIO-ED1 is to:

- Replace civil assets that are in poor condition.
- Protect the environment from our equipment – oil bunding.

- Maintain good and affordable levels of service to customers by protecting critical equipment from environment – security and flood protection.
- Inspect and maintain civil assets so that we maintain the level of risk on the network and we can respond to urgent issues.

1.3 ED1 Proposal

The expenditure forecasts for civil assets have been developed based on condition data and historic work volumes. Key assumption made in developing the plan is historic work volumes, deteriorating conditions and age profile of the assets. This also shows assets are now at point where a large replacement work is required.

Forecast expenditure required for Civil assets in the LPN Licence area in ED1 is £127m.

The RIIO ED1 proposed expenditure profile is set to reflect the current DPCR5 spend.

Expenditure for some civil assets in ED1 has reduced while for some assets the expenditure has increased. If the cost of replacement of patent expired locks in ED1 is removed from the comparison, ED1 allowances for condition driven civil works are 11% less on a pro-rata basis than the actual DPCR5 expenditures. The availability of more extensive and more accurate in-house data has led to a better understanding of the condition of Civils assets which, in order to maintain the overall level of asset condition, has highlighted the need to increase in the requirement to refurbish, repair or replace the assets for some civil assets (refer to section 3 increasing number of assets requiring replacement). An in-house Health Indices model is being developed for civil assets to which will contribute to the achievement of continual improvement of data quality and works programming.

Licence	Total Costs (£k)
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Area	DR5 out turn Pro rata to 8 years (Condition driven civil works)	ED1 (condition driven civil works)	ED1 (including civil works driven by other asset replacement projects and project specific lines mapped to CV6)
LPN	100,248	94,511	126,956

Table 2 Forecast Expenditure

The RIIO ED1 proposed expenditure profile is set to reflect the current DR5 spend.

There has been investment in improving data quality during DPCR5. Better quality and completeness of data in recent years has led to identification of greater number of condition 3 and 4 assets requiring replacement or refurbishment. There is now more historical information and better asset information.

1.4 Innovation

UK Power networks are developing alternative designs of the traditional brick and block switch houses that are expected to reduce future maintenance and refurbishment costs.

UK Power Networks are also trialling a new product (Geo bund) to be used to bund existing and new transformers as a replacement to the traditional concrete bund. A trail of this product has been carried out and delivered at a Primary site in EPN. Initial cost estimates indicate a saving of 15% and shorter installation time; on site trials are currently being undertaken in order to validate these claims.

1.5 Risks and Opportunities

	Description of similarly likely opportunities or risks arising in ED1 period	Level of (efficiencies)/cost
Opportunity	Subject to results of trials UK Power Networks may consider wider use of geomembrane for bunding of existing transformers (15%)- applicable to approximately 50% of the transformers	Potentially 0.5% reduction of ED1 investment
Risk	Improved inspection regime high lights increased number of deteriorated assets	Potentially 10% increase of ED1 investment

Risk	Future modelling by the Environment Agency indicates increase flood levels which lead to increased height of flood protection design levels (5% of sites)	Potentially 0.5% increase of ED1 investment
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Table 3 Risks and opportunities

2 Description of Civil assets

This document details UK Power Network's non-load related expenditure (NLRE) proposals for replacement, refurbishment, inspection and maintenance of civil assets.

For the purpose of this plan the civil assets have been divided into 6 subheadings:

- Substation Building Components and Surrounds.
- Substation security.
- Substation Flood protection.
- Oil Containment.
- Cable Tunnels.
- Cable Bridges.

The plan also details the inspection and maintenance of the above civil assets.

2.1 Substation Building Components and Surrounds

There are 19,062 Distribution substation sites and 223 operational Grid and Primary sites in the LPN network.

There are 17,630 secondary buildings, 152 primary building and 63 grid substation buildings in LPN recorded in Ellipse. The civil replacement programme provides for the replacement of Grid, Primary and Distribution substation building components and surrounds that have been identified as condition 4 (refer to section 4.1 for condition grading of assets).

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects

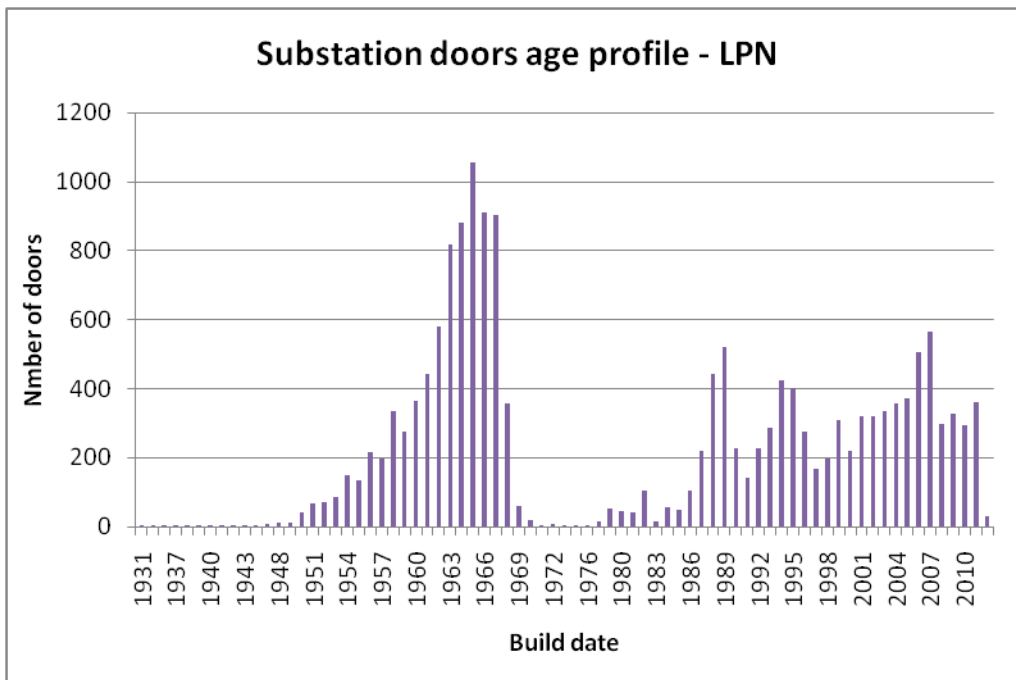
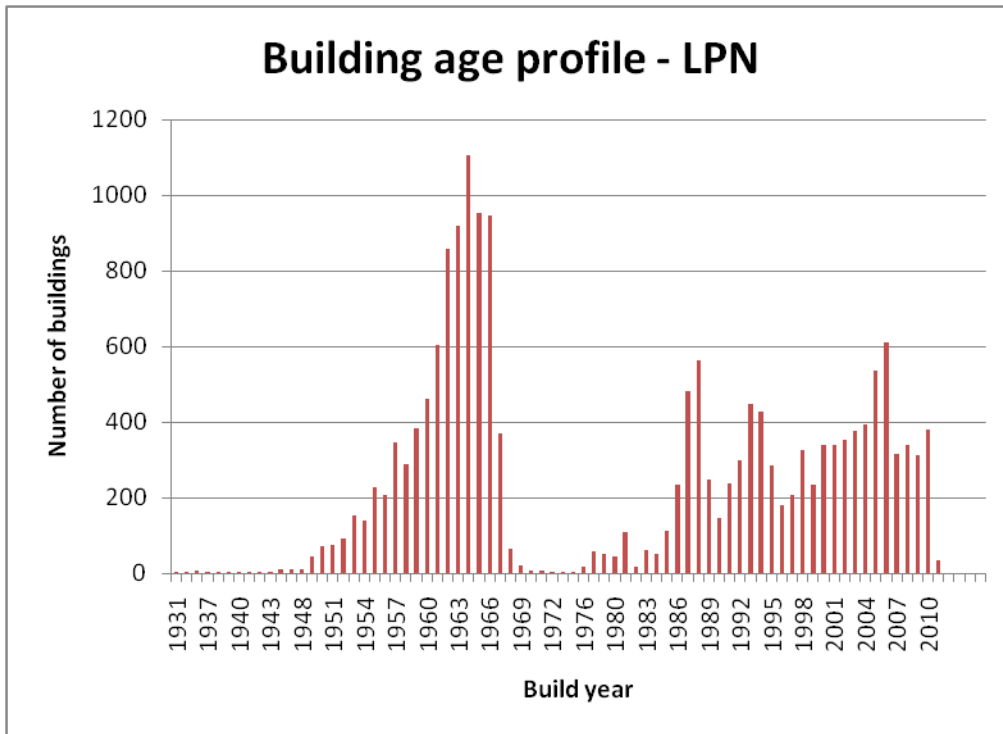


Figure 1 Typical civil assets age profiles

As shown on the graph above, due to most of the buildings being installed during the 1960s the age profile of the buildings is now at a point where targeted replacement

and improved inspection and maintenance are required and significant investment throughout ED1 and ED2 is necessary.

2.2 Substation Security

The security improvement programme allows for specific security-related improvements to Grid, Primary and Distribution substation sites in response to increasing levels of trespass. Security improvement works at Grid, Primary and Distribution substations include fitting new operational locks, fixing anti-scaling toppings to fence, installing new padlocks, fixing bollards to sites and fixing security grille to openings. Additional anti-climbing measures are applied to fences and buildings where there is a high risk of unauthorised entry and metal theft. This programme also includes lock upgrade installation at distribution substations. The total expenditure value of this programme in ED1 is £5.509m

2.3 Substation Flood Protection

A total of 53 Grid and Primary substation sites have been identified in LPN as being in potential flood risk areas as highlighted by existing Environment Agency flood maps.

The Flood defences would be a combination of reinforced concrete bund walls, concrete block walls, concrete slabs and protective waterproof membranes. There is a clearly defined UK Power Network's flooding programme in place for the remainder of DPCR5 which is being closely monitored together with a clearly defined programme for ED1. Refer to sections 3.3 and 7.2.3 for more detail. A flooding strategy document is also available for more detail.



Figure 2 Example of flooded UK Power Network Substation

2.4 Oil Containment

Accidental leakage or spillage of significant quantities of oil in a substation can pose a risk to the environment. Increasingly soils contaminated with oil are being classified as 'hazardous waste' and incurring waste disposal fees of £100-£150/tonne. This programme deals with bund refurbishment and retro-bunding of existing transformers on sites where the risk to the environment is highest.

Over time significant amounts of oil from leaking plant can build up within the ground strata. This programme also includes cleaning of oil contaminated site to prevent external pollution.

All Grid and Primary Substations have been assessed and prioritised based on their potential risk to Ground Water sources, Surface Water (e.g. rivers and streams) and the sites proximity to an environmentally sensitive area. There is a clearly defined UK Power Network's works programme in place for the remainder of DPCR5 which is

being closely monitored together with a clearly defined programme for ED1. Refer to sections 3.4 and 7.2.4 for more detail.

2.5 Cable Tunnels

Cable tunnels are a series of underground structures comprising of shafts, tunnel sections and ancillary equipment used to install 132/33/11kV cables. Access is typically through shaft head houses and the tunnel complex is reached through a series of steps or ladders. Tunnels are typically located under major roads throughout the LPN region.

The construction types used on UK Power Networks tunnel are:

- Bolted cast concrete segments circular section.
- Bolted cast iron segments circular section.
- Wedge concrete segments circular section (no bolts).
- Square section poured concrete.
- Brick built construction circular or square section.

There are 27 cable tunnels in LPN listed in the Table below; their total length is 36,341m with additional 12,500m being commissioned and brought into service midway through the ED1 period. Refer to sections 3.5 and 7.2.5 for more detail.

Site / Route	Tunnel Length (m)
Barking River Tunnel	771.4
Battersea A River Tunnel	583.2
Battersea B Rivr+Side Tunnel	1007
City Road - Backhill (Colct)	2195
City Road - Beech Street	1087
City Road - Seacoal Lane	3467.5
Coram Street	114.4
Deptford - Stowage	200
Deptford Grid - 22kv	124
Deptford Power Station (132kv)	236.3
Deptford River Tunnel (To Westferry Road)	579
Duke St - Carnaby St - Leicester Sq	2194
Holloway - Islington	260

Lodge Rd B 66kv (Tunnel A)	64
Lodge Road 66kv Lodge Road B (Tunnel B)	56.5
Lodge Road Tunnel C	226.7
New Cross/Vacoe Rd (2 Shafts Only)	124.5
Roding River Tunnel	165
Seacoal (New From Mss) Lane	12
Sinclair Rd/Russel Rd (Olympia)	174
St Johns Wood-Longfordst-Backhill	5154
Wallis Road	78
Wandsworth - Moreton St	3726.1
Westferry Road (Millwall Dock)	133
Westham-Brunswick-Millanium	1832.5
Willesden Grid - Fulham Palace Road	6015.4
Wimbledon - Wandsworth	5760.5

2.6 Cable Bridges

Where circuits cross railway lines, rivers, roads etc. structures are constructed to support and protect the cables; these are generically known as Cable Bridges.

There are 57 cable bridges in LPN listed on the Table below.

List of Cable Bridges in LPN	
Woodford Green High Road	Causeway Box Girder Bridge
Rail Bridge Over Taylors Lane	Chelsea Harbour Drive Over Chelsea Creek
Trackside Under Craven Park	Shepherdleas Wood Railway Embankment
Rail Bridge Over Acton Lane	Crossness Marshes
North Circular Adj. Neasden Rail Depot	Thames Road Over River Cray
Hackney Grid Cable Bridge	Frasers & Chalmers Now 11kv
River Lee Nature Reserve Xing	Queens Road / Bexley Road
Lea Road Bridge	South Road Opp Watts Bridge Road
Lee Navigation Hackney Cut Xing	Causway Narrow Girder Bridge
Cockerall Road	Causeway Broad Girder Bridge
Willesden Grid Canal Crossing No 4	Plough Lane Over Wandle (Small)
Willesden Grid Canal Crossing No 3	By Wimbledon Grid Over River Wandle
Willesden Grid Canal Crossing No 2	Mitcham Ln Over River Gravney/Roe Bridge
Willesden Grid Canal Crossing No 1	Crayford High Street Over River Cray
Rail Bridge Ne Of Willesden Grid	Priory Road Over River Darent

White City	Access Into Churchfields Over Brook
Hampstead Road	Amberley Road
Delancy Street	By Carpenters Rd/River Lee Br Property
By St Johns Wood On Canal	Plough Lane Over Wandle (Large)
River Roding By Luxborough Lane	Causeway Lattice Bridge
Bow Creek Lock Bridge	Lower Lea Crossing
Bow Creek Concrete Bridge	East India Dock Crossing
Iron Rail Bridge Over Bow Creek	Violet Road 11kv
Twelvetrees Crescent Lea Crossing	Near Barbers Shop Over River Lee
Bromley Bridge Over River Lee	Ben Johnson Rd Victory Br Ovr Regent Cnl
Void Under A13 Bow Creek	Forest Road
Violet Road 66kv	Wandsworth Grid Bell Lane Creek
Gunmakers Arms Bridge No 1 (22kv)	Causeway Box Girder Bridge
Gunmakers Arms Bridge No 2 (132kv)	

Failure to secure and protect cable bridges can lead to the need for more costly refurbishment expenditure.

All identified cable bridges have been surveyed and where appropriate mitigations are in place. Refer to sections 3.6 and 7.2.6.

2.7 Safety

This programme addresses activities associated with the identification and removal of asbestos from substations. Asbestos removal or encapsulation is considered where periodic inspection reveals a situation where a previously sealed or encapsulated asbestos containing material has become exposed, and has deteriorated to the extent where release of fibres is possible. In this situation encapsulation or removal shall be considered.

3 Investment Drivers

3.1 Substation Building Components and Surrounds

The failure of civil assets can lead to environmental and safety issues affect quality of supply, compromise the security of the system and in worst cases result in a large

number of supply interruptions. The main investment driver is therefore the condition of the asset.

Replacement of poor condition substation buildings and enclosures will reduce the deterioration of substations and reduce the risk of trespass. It will also increase the number of sites that comply with the requirements of the ESQC Regulations 2002 *“Enclose the substation where necessary to prevent, as far as reasonably practicable, danger or unauthorised access”*.

Assets are replaced once they reach Condition 4. Due to most of the network being installed during the 1960s and the deteriorating conditions of the assets, the age profile of buildings and building components a large replacement programme will continue to be required throughout ED1.

It is anticipated that the ongoing inspection process will find new replacement works due to degradation. The following charts show that condition 4 of building components raised by year is increasing.

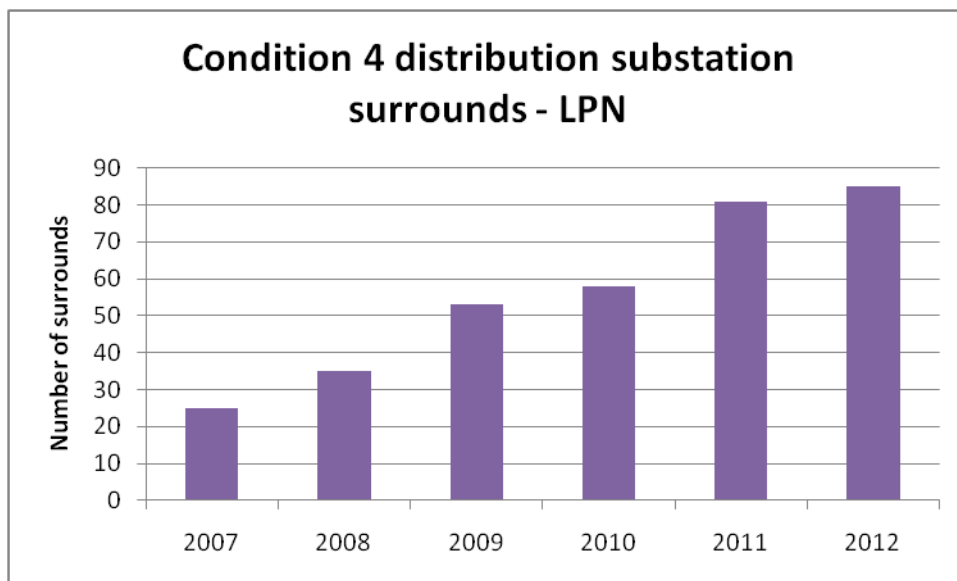


Figure 3 – Condition 4 distribution substation surrounds raised by year

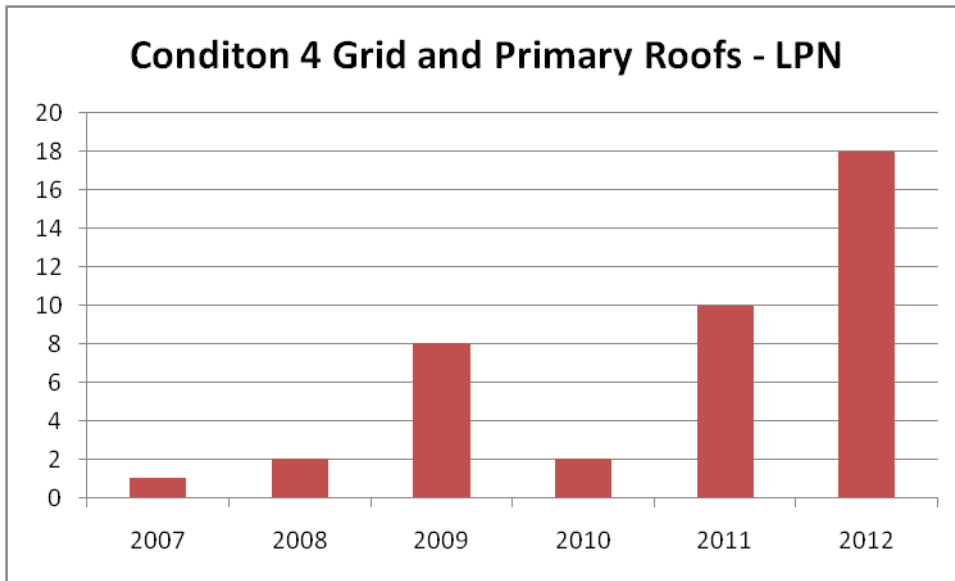


Figure 4 Condition Grid and primary roofs raised by year

The increase in reported Condition 4 assets is primarily due to more detailed and targeted inspections being undertaken.. This is leading to a better understanding of asset risk and is allowing more efficient interventions which are more closely focused on the building components and structures which are becoming unserviceable.

3.2 Substation Security

UK Power Networks is experiencing high levels of metal theft where unauthorised intruders have entered operational sites and removed earthing conductors.

The numbers of metal thefts had recently created a greater need for enhanced sub-station security.

Metal Theft Report (volumes)				
Year	2009	2010	2011	2012
LPN	42	60	102	146

Table 3- Metal theft report

Levels of metal theft has in the past been very closely linked to the price of scrap metals, which at present are near their record highs again and are expected to stay high for the foreseeable future.

UK Power networks is undertaking mitigation to enhance security at sites identified as being vulnerable to unauthorised access by installation of alarms/CCTV and the application of anti-vandal paint to exposed earthing.

UK Power Networks is undertaking different substation security enhancement works in order to:

- Reduce the risk of theft and associated damage to buildings and equipment
- Provide safety to the general public and children in particular.
- Provide a safe working environment for those authorised to be working in them.
- Maintain compliance with legal requirements including those arising from non-compliance with the ESQC regulations 2002.
- Prevent loss of supply of electricity to customer due to vandalism or theft and
- Achieve a reduction in costs which invariably result from rectifying the consequences of site incursion.

3.3 Substation Flood protection

Flooding events across England and Wales have highlighted the vulnerability of electricity substations to major flood incidents and called into question existing levels of flood protection. More general concerns over global warming and rising sea levels also brings into question whether historic levels of protection from flooding will be adequate in the future.

Combined with flooding as a result of water mains failures and concerns over climate change and predicted rises in sea level the Minister of Energy, via the Department for Business Enterprise and Regulatory Reform (BERR), called for a review. The

resulting review document, The Pitt Review released in June 2009, considered the causes, societal and economic impacts of a major flood event and made a number of recommendations regarding the protection of public and private assets and Critical National Infrastructure.

In order to implement the Pitt Review recommendations and reduce the risk risks associated with a flood event it is essential that UK Power Networks addresses the issue of flooding through protecting its existing highest risk sites, through its designs for new substations and during modifications/reinforcement of existing substation sites.

Department of Energy and Climate Change (DECC) recommended DNOs should consider all forms of flooding and as a result, UK Power Networks have investigated and developing a programme of works to protect substation assets from surface water flooding.

The benefits of protecting major substation assets from known flood risks are :

- Protect plant from damage due to flooding and reduce repair/replacement costs and timescales for repair as well as the need to commit resources. This ultimately leads to improved responses in re-establishing Network supplies to flood affected areas and customers.
- Facilitates the continuity of supplies to customers, particularly to critical infrastructure dependent on supplies to re-house others affected by floods (e.g. emergency rest centres, command centres, Accident and Emergency or Specialist hospitals etc).
- Promotes positive media and government focus.

Failure to protect major substations from flood leads to loss of supply to customers and damage to plant with subsequent replacement and repair costs. The cost of replacing the plant/equipment on a grid site would be £2.5 million. It should be noted

that from the Pitt report (itself a response to the devastating floods in 2007), 40% of the recommendations focused on ensuring continuity and protection of electricity supply infrastructure in the event of flooding.

3.4 Oil Containment

SHE 01 006 “Storage and Handling of Oils and Polluting Liquids” and DEFRA Control of Pollution (Oil Storage) (England) Regulations 2001 state that bunding should be carried out on existing transformers containing more than 200 litres of oil where these pose “significant risk” i.e. less than 10m away from any inland freshwater or coastal waters, or less than 50m away from a from a well or borehole otherwise known as a Source Protection Zones (SPZ).

While transformers are not classified as oil storage containers whilst in operation leaking transformers can pose a significant risk to ground strata, ground water and watercourses. Furthermore oil bunding is becoming more necessary as greater volumes of very old critical infrastructure are in operation. During ED1 oil leaks are examples of defects which indicated equipment may be nearing its end of life. For the reasons set out below it is necessary to consider all Grid and Primary transformers with a potential to contaminate, not just those in SPZ’s, for assessment, retrospective decontamination and bunding works.

The Water Resources Act 1991, The Environment Act 1995 and Environmental Protection Act 1990 state that it is an offence to cause or knowingly permit the discharge of poisonous, noxious or polluting matter into relevant waters or into any underground strata. For this reason all existing non-bunded Grid and Primary transformers have been assessed with regards to the risk of pollution to ground and surface water systems, the ground strata in general and to 3rd party land including SSSI’s (Site of Special Scientific Interest) and AONB’s (Area of Outstanding Natural

Beauty). It is expected that all outstanding non-bunded transformers will be addressed during the RIIO ED1 period; this is detailed further in Section 7.2.4.

Over time significant amounts of oil from leaking plant can build up within the ground strata. Bunding or replacing a leaking transformer may prevent further oil contamination but it does not remove or control the oil already present in the ground which may, over time, still migrate to watercourses or ground water systems beyond the distances quoted in DEFRA Control of Pollution (Oil Storage) (England) Regulations 2001 or adjacent third party land. As part of the overall pollution control strategy it is proposed to extend the transformer pollution assessment to include identifying contaminated ground strata beyond the area of the transformer and to develop additional mitigation works where appropriate as part of any bunding project.

3.5 Cable Tunnels

UK Power Networks aim to maintain tunnels in a satisfactory and serviceable condition and to address structural and ancillary issues before significant works are required to stabilise the asset as defined in UK Power Networks standard document EDS 10-7004–Cable Tunnel Inspection and Maintenance. The consequence of failure to the network, the environment and the public is considered to be considerably higher than other civil assets, it is therefore important frequent maintenance is undertaken.

The maintenance of a tunnel includes all the operations necessary to maintain it in a serviceable condition indefinitely, including:

- condition assessment (inspections, testing and monitoring, structural assessments).
- routine maintenance (typically involving like-for-like replacement of the tunnel fabric to maintain efficient functioning and preserve condition. e.g. ventilation maintenance to avoid thermal runaway).

- interventions (to carry out vital repairs to and modification of the structure in response to deterioration and loss of performance, or adaptations to meet new requirements, e.g. for higher loadings, health and safety or control equipment).
- emergency actions (e.g. in response to unforeseen incidents, flooding, structural collapse).

3.6 Cable Bridges

Cable bridges and more particularly the cable circuits on/in the cable bridges are vulnerable to third party interferences.

Inspection, maintenance and refurbishment of cable bridges in accordance with UK Power Networks document EDS 10-7003 Cable Bridge Inspection and Maintenance reduces the risk of structural failure and damage to cables and EHV fluid filled cables.

There was an incident in 2009 where vandals/cable thieves set fire to a group of 132kV cables in a cable bridge supplying Dartford Grid. This resulted in supplies being interrupted to approximately 90,000 customers with several thousand customers in the environs of Dartford being without electricity supply for several days.

As a result UK Power Networks is undertaking programme of refurbishment and enhanced maintenance works of Cable Bridges so as to provide secure housing for UK Power Networks' electrical equipment and apparatus, meet the requirements of The Electricity Safety, Quality and Continuity (ESQC) Regulations 2002 and of the licence and other regulatory provisions. Specifically:

- To protect the public and employees from danger.
- To maintain security and prevent unauthorised access.
- To ensure continuity of supply.
- Reduce structural failure and damage to cables.

3.7 Safety

Sites at all voltages have the potential to contain asbestos. Under the Control of Asbestos Regulations 2006, UK Power Networks has a duty of care to identify asbestos containing materials within its operational sites and to protect its staff from harm which could be caused by such materials.

Where Asbestos Containment Measures (ACM) are suspected or confirmed an effective strategy is put in place to safely deal with the materials: this includes either removing the ACM or leaving it in place undisturbed with a safe plan to do this.

The requirements of Asbestos containing materials are:

- Good condition: The material is monitored at regular interval and labelled where practical.
- Poor condition/ Disturbed: It is removed by a specialist contractor.
- Minor damage: The material is repaired or encapsulated and labelled and monitored at regular intervals.
- Major project works are expected to carry out demolition and refurbishment surveys and assessments prior to any works being carried out on assets suspected of containing asbestos containing materials.

This is discussed further in section 7.2.7.

4 Asset Assessment

4.1 Condition

Inspections of civil assets (Grid and Primary) are carried out every six months and in accordance with EMS 10-0002 (Inspection and Maintenance frequency Schedule).

During Inspections or Maintenance the appropriate condition measurements civil structures and buildings on Grid, Primary or distribution substation site are recorded and entered into Ellipse. This enables the condition of equipment to be recorded and analysed. The majority of condition monitoring activities is performed by field staff using a mobile device.

The condition of the Civils assets are recorded in the asset register. These indicators are usually unique to each condition point being measured but the following general theme applies across all condition indicators.

- **Condition 1** The condition is as new or very good.
- **Condition 2** The condition is satisfactory or serviceable.
- **Condition 3** An indication that either minor work is required or the condition indicates that future repair or replacement is required.
- **Condition 4** This category indicates that significant/urgent repair or replacement is required.

The key replacement criteria is identifying all Civil assets as having either an overall condition rating of 3 or 4 or containing associated assets with either of these ratings and improve the asset to condition 1 or 2. Replacement improves the asset into condition 1 while refurbishment improves the asset into condition 2. Refurbishment is deployed to reduce the risk and extend the asset life. Minor repairs are undertaken at condition 3 to

reduce the need for major work required to recover condition 4 situations. The refurbish/replacement decision is made on a cost benefit basis- which delivers the more positive net present value over time Issues are re-inspected by Network Operations Project Manager as part of works scoping and work order process.

During the replacement of electrical plant it is sometimes necessary to replace or refurbish the Civil asset in order to support the long term health of the installation. Only a small proportion of our electrical plant assets will experience any refurbishment or replacement interventions in ED1 and an even smaller proportion of these interventions will require associated civil refurbishment or re-building work. Accordingly this expenditure forecast is for essential civil asset replacements which are independent of plant replacement.

Deteriorating age, frequent use and hostile environment which these assets are exposed to are partly responsible for the increasing number of condition 4 recorded assets. However this increase in numbers is primarily happening due to a greater number of targeted inspections. This is leading to a better understanding of asset risk and is allowing more efficient interventions which are more closely focused on the building components and structures which are becoming unserviceable.

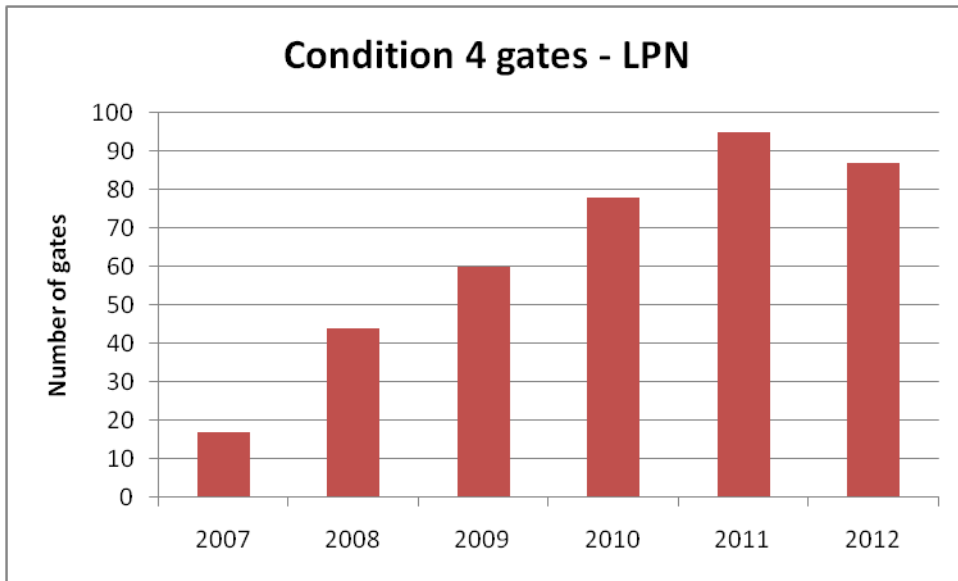


Figure 5 Condition 4 gates raised by year

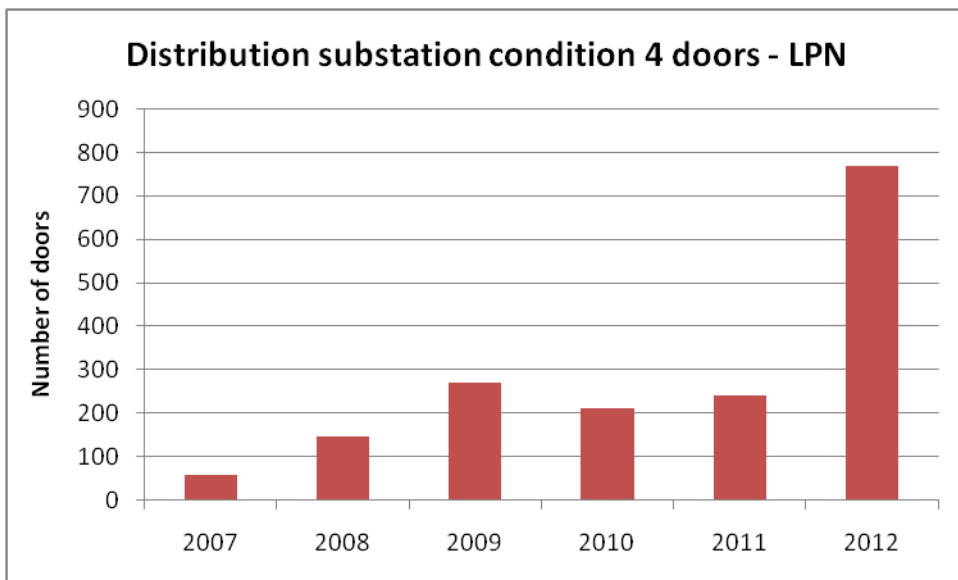
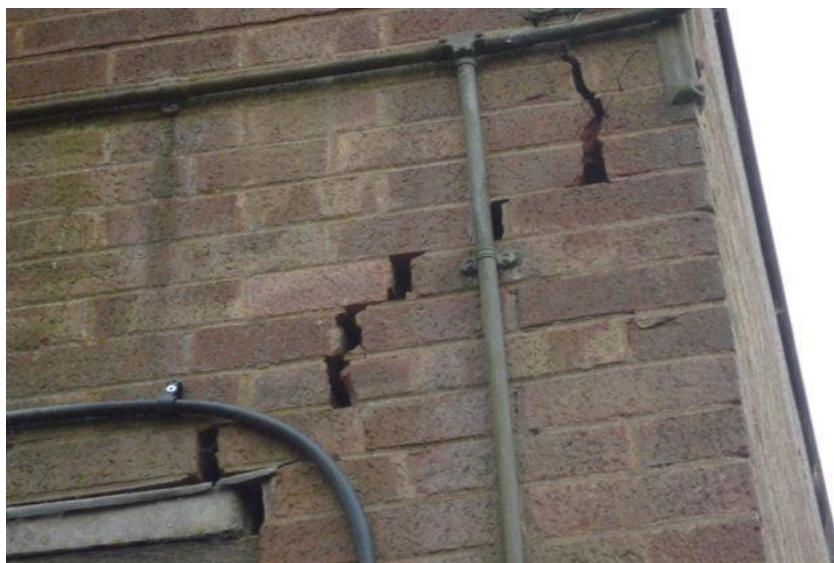


Figure 6 Condition 4 distribution substation roofs raised by year

The following pictures show typical failures of civil assets across the network.



Bromley Grid 33kV – significant crack on building representing a Condition 4 building. Serious structural failure leads to more costly structural refurbishment expenditure.





Streatham Hill

Figure 7 Typical structural failures of buildings and structures across the network representing a Condition 4 building. Serious structural failure leads to more costly structural refurbishment expenditure.

4.2 Inspection and Maintenance

UK Power Networks is responsible for the inspection and maintenance of substation sites, buildings, cable tunnels, cable bridges and the equipment housed within them.

Assets are inspected and maintained to provide secure housing for the electrical equipment and meet the requirement of the ESQC regulations 2002 and other regulatory provisions. Inspection procedures will identify and quantify remedial works and /or asset and element replacement.

4.2.1 Substation Building Components and Surrounds

This programme covers major and minor Grid and Primary site inspections and maintenance. The inspection and maintenance requirements of civil assets are detailed in the UK Power Networks document EMS 10-6501 Maintenance and Inspection Policy for Civil Assets.

Grid and Primary sites are inspected on a cyclic basis to assess the condition of buildings and other associated civil structures. The inspection frequency of substation buildings is being changed from four month to six month during DPCR5; however the inspection is now more detailed and comprises more assets (greater focus in shorter life assets) giving better value and efficiency from substation inspections and visits. This programme also allows for fire suppression system inspection and testing and water quality testing at Grid and Primary substations. The inspection includes procedures to identify defects that might eventually lead to failure of an item of the civil structure or the civil structure itself.

Maintenance of buildings and other civil structures are carried out to rectify defects following surveys and restore assets to a defined condition for continued safe and reliable service. The major activities in the civil maintenance programme are graffiti removal, vegetation clearance and maintenance of sites (Grid, Primary, and Secondary) and buildings.

This programme also addresses repairs of urgent defects and fly-tipping clearance. It also takes into account remedial works following asbestos survey, water testing, and fire risk assessment.

The main source of condition data and defects for civil assets is from substation inspectors. Inspections are carried out as per UK Power Networks inspection and maintenance policy (EMS 10-0002 Inspection and Maintenance Frequency Schedule). During inspection, defects and condition data on civil assets are collected using a Hand Held Device (HHD) and held in the Asset Register. In order to ensure that a good quality data is captured, inspectors are provided with training on assessment and collection of civil asset data on a frequent basis.

The Asset Register gives each defect a criticality rating of P1-P5 and this rating signifies the timeframe in which the defect must be rectified.

Defect Criticality	Definition	Time to fix the Defect
P5	Critical	< 3 months
P4	Urgent	3 - 12 months
P3	Required	12 - 24 months
P2	Medium	24 - 48 months
P1	Low	during next maintenance, next visit

Figure 6 shows the number of building components and surrounds defects reported since 2007. It shows that the number of defects being reported has risen by 500% since 2007. However in recent years substation building defects have stopped rising. Increased levels of defect reflect better surveys and greater focus on individual Civils assets leading to efficiencies detailed in Section 7.2.8.

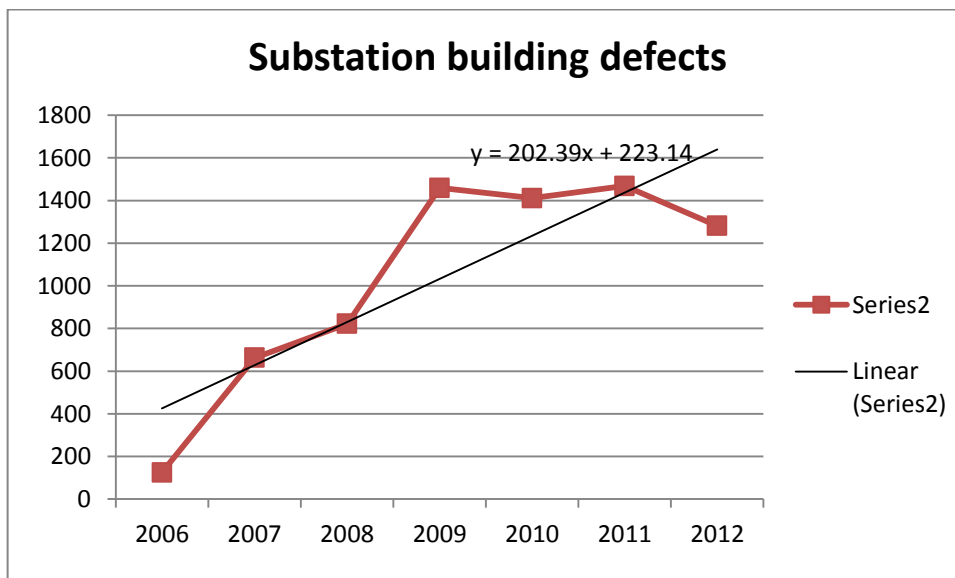


Figure 8 Volumes of building defects raised by year

Typical defect repairs covered in this programme of work are:

- **Building defects** - Labels, heating, wiring & lighting, padlocks, disused syringes, rubbish, redundant materials, vermin, redundant plant, graffiti, guttering and downpipes, access flap, ladders, CO₂ systems, flood detectors, ventilation, sump pump, cable trench covers, water ingress, trip hazards, falling materials, vegetation, asbestos, access problems.
- **Site enclosure defects** Blocked drains, Oil interceptors, Cesspit/septic tanks, rubbish, lighting, sharps, redundant materials, open excavations, cable trench covers, trip hazards.
- **Site security defects** - Labels, third party interference, padlocks.

Allowance is made for a number of miscellaneous operational responsibilities, including demolishing abandoned/unsafe buildings.

It is difficult to predict the volume of works for defect repairs and maintenance of civil assets. As such activity in this area has been predicted on historical work volumes.

4.2.2 Cable Tunnels

Tunnels are visually inspected twice a year and fully surveyed and inspected annually. The inspection and maintenance requirements of cable tunnels are detailed in the UK Power Networks standard document EDS 10-7004.

Periodic maintenance of tunnels include: periodic testing of lighting, ventilation and alarm installations in the tunnel, six monthly exchange of sump pumps to prevent clogging and failures, cleaning out of sumps and drainage channels, removal of debris and litter from tunnels, upkeep and lubrication of access points (doors, hatches, compressed strut assisted pavement covers etc.).

The inspection will also include minor maintenance of steel ladders, handrails and landings and cable support steelwork where appropriate.

4.2.3 Cable Bridges

The inspection and maintenance requirements of cable bridges are detailed in the UK Power Networks standard document EDS 10-7003.

Maintenance of cable bridges includes re-painting surfaces, improvements to security and other maintenance works as the condition surveys and inspections deem necessary to provide continued adequate protection to the structure given the location and atmospheric conditions.

4.3 Asset Age Profile

Black & Veatch (B&V) were appointed to undertake age analysis of all civil assets within Ellipse.

In order to review the age aspects associated with the replacement of civil assets the extent of the age data within the Ellipse system was assessed. Where there were gaps a proxy age was generated based upon the methodology in appendix 1. The age analysis showed that a substantial number of assets were older than the design life proposed, yet still in good condition. The analysis also showed that a significant number of assets were in poor condition but had not exceeded the proposed asset life. Therefore age alone could not be used as an indicator for replacement strategy. History and current work rates have also been used to forecast the volumes for some civil assets. The detail of the analysis is presented in appendix 1.

5 Intervention policies

5.1 Interventions: Description of intervention options evaluated

The interventions considered for civil assets are: replacement, refurbishment, maintenance and repairs.

Civil asset replacement strategies optimise expenditure plans by maximising asset life, reducing whole life costs, improving reliability and reducing short-term expenditure requirements.

	Intervention	Application	Net benefit	Typical Cost of intervention	Typical cost of asset failure
Capex	Like for like replacement	Condition 4 Roofs, gates, doors, heating, fences	New asset	10-25k (roof)	250k Damage / replacement of switchgear, outages, structural damage, health & safety risk, exposure to asbestos
	Replace with higher spec asset	Replacement of existing locking by an intelligent locking system	New asset – extend life	£500-1000/site	5-10k/site – reduction in theft from and unauthorised entry to substation sites
	Refurbish	Cable bridges, cable tunnels, buildings	Reduce replacement	£30-40k/ cable bridge	150-200k – collapse and replacement of asset, loss of supply, health & safety risks from removal and replacement
	Security enhancement	Grid, primary and distribution substations	Reduce theft and damage from unauthorised entry	Refer to section 7.2	Refer to section 7.2
Opex	Routine maintenance	Graffiti removal, vegetation clearance	Improved amenity Reduce further maintenance	2-5k	No financial benefit but societal benefit is reflected in reducing the potential for customer complaints and local authority notices
	Enhanced maintenance	Buildings e.g. underpinning	Reduce replacement costs	40k	150k – replacement of building

Table 4 Interventions

Typical intervention examples of civil assets are shown below.



Figure 9 Replacement roof at Willington Road



Figure 10 Graffiti Removal at Lenthall Road



Figure 11 Surround Replacement at Rochester Avenue



Figure 12 Door Refurbishment at Rossland Close

6 Innovation

6.1 Alternative Switch House Design

Changes to switch house design are being developed to design an alternative 11kV and 33kV switch house that have higher operational safety, lower environment impact, lower maintenance requirement and higher availability & reliability. The switch house will also be elevated to prevent risk of flooding.

This will reduce future maintenance and refurbishment costs. It will also improve resilience to environmental impacts by reducing CML's and CI's.

To date the alternative switch-house design has been trialled at 3 sites located in the SPN and EPN licensed areas and early reviews of the projects have shown a cost saving of 10-20% and, in conjunction with the build process construction and "dry-trade" material, construction times shortened.

6.2 Geotextile Membrane Bunding

A new polymer technology is being trialled as an alternative to the conventional concrete bund. This new technology can easily be retrofitted to existing sites and although new to the UK is proven technology in over 9,000 installations across the globe including the USA and Australia.

The alternative approach utilises the implementation of new technology as a selectively permeable membrane (hydrocarbon (oil) filter). The geotextile membrane is impregnated with a hydrocarbon absorbent polymer which allows water to pass through whilst retaining the hydrocarbon within its structure. This removes the requirement for oil discriminating pumps as well as interceptors for some of our sites; a requirement with the more traditional approach of concrete bunds. The removal of these also reduces the ongoing maintenance costs associated with our sites.

A trial of this system has been carried out and delivered at a site in the EPN area. A review of the performance of the product and the potential for efficiencies is due to be undertaken

by the end of March 2014. If all conforms to the UK Power Networks standards and good practice, this system will be incorporated in to the standards.

7 ED1 Expenditure requirements for Civil Assets

7.1 Methodology

The volumes and costs used to forecast the Civil Replacement expenditure in ED1 have come from:

- Condition based assessment has been applied to different types of civil assets within Ellipse to estimate the number of civil assets in poor condition.
- Historic volumes of interventions were averaged for the last four years and the same level of activity assumed for future years.
- This approach has been applied to forecast volumes and expenditure of inspection and maintenance of civil assets.
- Where a new driver of investment or replacement has been identified a new programme of work has been drawn up. For example replacement of locks, major structure (external support structure) replacement and asbestos surveys.

A combination of condition based assessment and historic volume approach has been used to forecast the volumes and expenditure of substation building components and surrounds.

A combination of risk assessment, surveys and historic volumes of interventions has been used to forecast volumes and expenditures for security, oil containment, cable tunnels, and cable bridges.

Figure 13 shows an overview of the method used to construct the RIIO-ED1 NLRE investment plans.

This approach does not take into consideration external environmental impacts e.g. greater deterioration of assets in coastal areas which leads to an increase expenditure in rectifying conditions and defects of buildings, cable bridges and cable tunnels., increased an authorised access in high crime areas requiring additional

measures to be provided which in turn increases the expenditure for substation security.

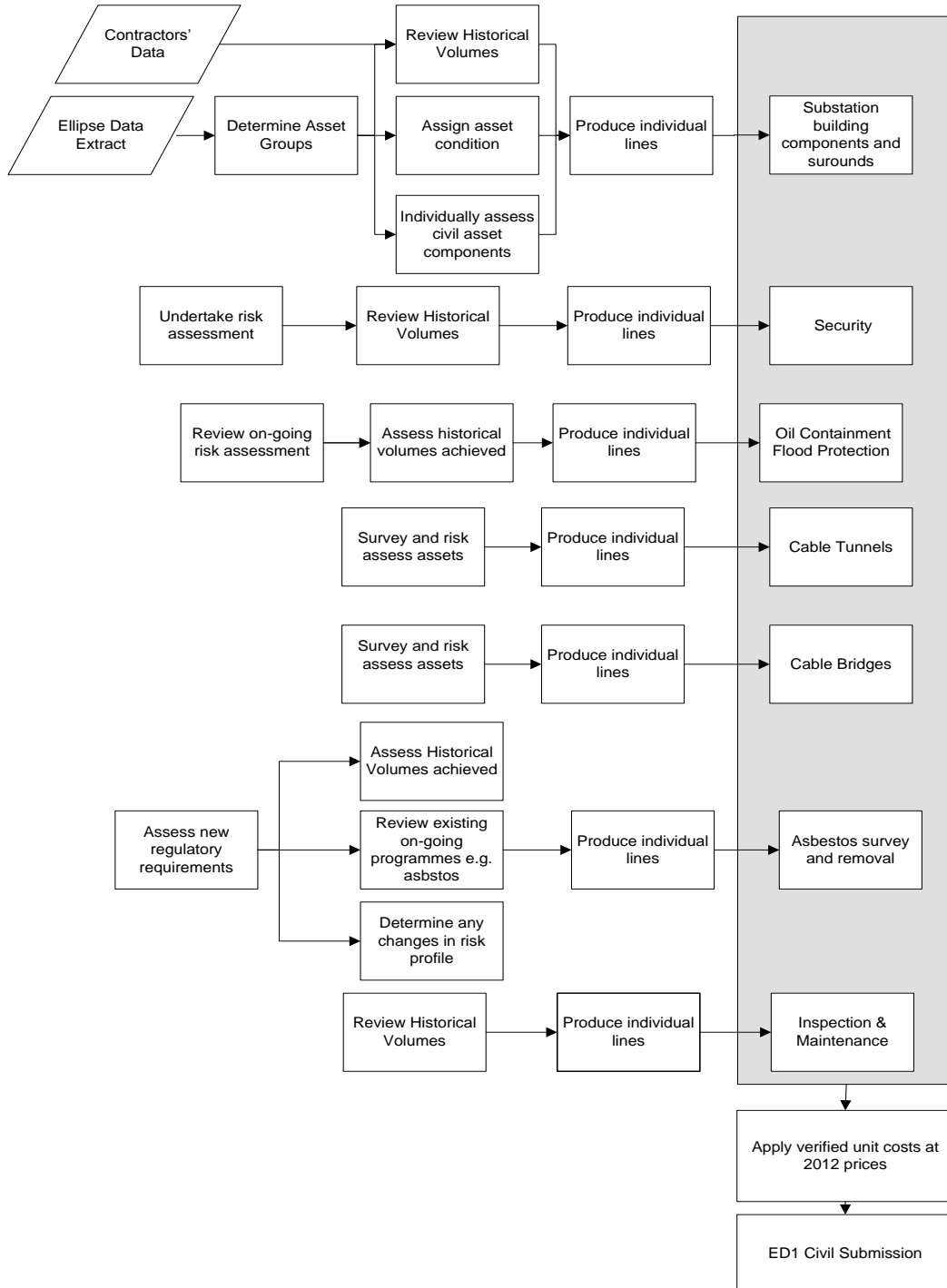


Figure 13 Process Diagram Showing Inputs and Outputs of ED1 Plan of Civil assets

7.2 Constructing the Plan

This section details the actual and predicted pro-rata expenditure in DPCR5 and the predicted expenditure in ED1 for the civil asset types identified in the plan. Where there is a significant variance between the two an explanation has been provided in the paragraphs following the tables.

7.2.1 Substation Building Components and Surrounds

Replacement of substation buildings and surrounds is the biggest contributor to the proposed ED1 Civil costs. All these costs are CAPEX. The most significant investment is in:

- Replacement of distribution substation surround & replacement of grid and primary substation roofs.
- Distribution Substation Building – Rewire.
- Grid and primary fencing enhancement.

Investment Type	DPCR5 pro rata to 8 years (£k)	Total ED1 (£k)	Variance (£k)	Total ED1 volume	Volume Unit	RIG Table	RIG Row	Comment
Sanding and capping programme – Secondary substations	1,282	972	-310	1985	Site	CV6	12	
Civil Works at Grid & Primary Substations	3,765	2,560	-1,205		£k			Justification 1
TC sump pump replacement	334	329	-5	264	Task	CV6	8	
TC replacement pavement hatches	1,017	709	-308	160	Task	CV6	6	Justification 2

Replacement of Distribution Substation Brick Surround	332	484	152	75	Site	CV6	11	Justification 3
Replacement of Distribution Substation Surround (Non Brick)	1,653	902	-751	248	Site	CV6	11	Justification 3
Replacement of Distribution Substation gates	458	751	293	160	Unit	CV6	11	Justification 4
Distribution Substation building - minor asset replacement	1,065	1,346	281	4440	Task	CV6	8	Justification 5
Distribution Substation building - replace roof	5,291	5,290	1	1280	Roof	CV6	7	
Grid/Primary - Replace compound floodlighting	22	47	25	8	SS	CV6	7	
Distribution Substation building - replace door	2,105	2,243	138	792	Door	CV6	6	Justification 6
Distribution Substation building - replace guttering	444	495	51	624	Task			

Distribution Substation building - rewire	7,542	3,981	-3,561	3416	Task	CV6	8	Justification 7
Distribution Substation Building - Install New LV Service	1,845	484	-1,361	582	Site	CV6	8	Justification 8
Grid/Primary - Replace roof	1,450	1,075	-391	67	Roof	CV6	16 and 17	Justification 9
Grid/Primary - Replace boundary brick wall	228	299	58	23	Site	CV6	16 and 17	Justification 10
Grid/Primary - Replace heating	580	424	-156	80	SS		16 and 17	Justification 11
Grid/Primary - Rewire	2,058	2,296	238	49	SS	CV6	16 and 17	Justification 12
Old Brompton Road: Fire protection measures	89	0	-89	0	£k			
Grid/Primary - Replace doors	163	207	47	73	SS	CV6	16 and 17	Justification 13
Grid/Primary - Replace compound trench covers	46	15	-31	16	SS	CV6	16 and 17	
Grid/Primary - internal refurbishment	44	34	-10	8	SS	CV6	16 and 17	
Enhance grid and primary fencing	1,254	1,037	-227	196	Site	CV6	16 and 17	Justification 14

Substation Major Structure Replacement	3,956	1,305	-2,651	160	Task	CV6	16	Justification 15
Substation Pressure Relief - Explosion Vents	1	13	12	1	Site	CV6	17	Justification 16
Drainage Replacement	509	0	-509	0	Site			Justification 17
TOTAL	37,533	27,298	-10,235					

Table 5 –Expenditure for Building Components and Surround Replacement

Even though there is an increase in expenditure for some of the civil assets, there is a significant decrease for other civil assets reducing overall ED1 expenditure when compared to current DPCR5 figures as shown in table 5.

1) Civil Works at Grid and Primary Sites

This represents any works not covered by a specific line or works necessary to support related development works or asset refurbishment. Expenditure is reducing as funding is to be allocated to work specific lines in order to give greater clarity of volumes and expenditure and to be able to support the development of robust programmes of work.

2) Transformer Chamber - Replace Pavement Hatches

Volume of work is reducing as non-functional and irreparable hatches are replaced throughout the ED1 period.

3) Replacement of Distribution Substation Brick Surround and Replacement of Distribution Substation Surround (Non Brick)

The replacement of a fence or brick wall around the perimeter of a site or a compound. The scope of work will be either like for like replacement or replacement

with a 1.8m high surround in accordance with the ESQC Regulations 2000. Table 5 shows an increase in expenditure for brick surrounds and a reduction for non-brick surrounds. This is driven by brick construction being the predominant type in LPN and the increased reporting of condition 4's (Figure 14 below) driven by the improved quality and detail of the inspections.

There are 3000 sites across LPN which have some form of enclosure around the site. The proposed ED1 volume and expenditure represent the replacement of only 9.3% of the total number of brick and non-brick distribution substation surrounds.

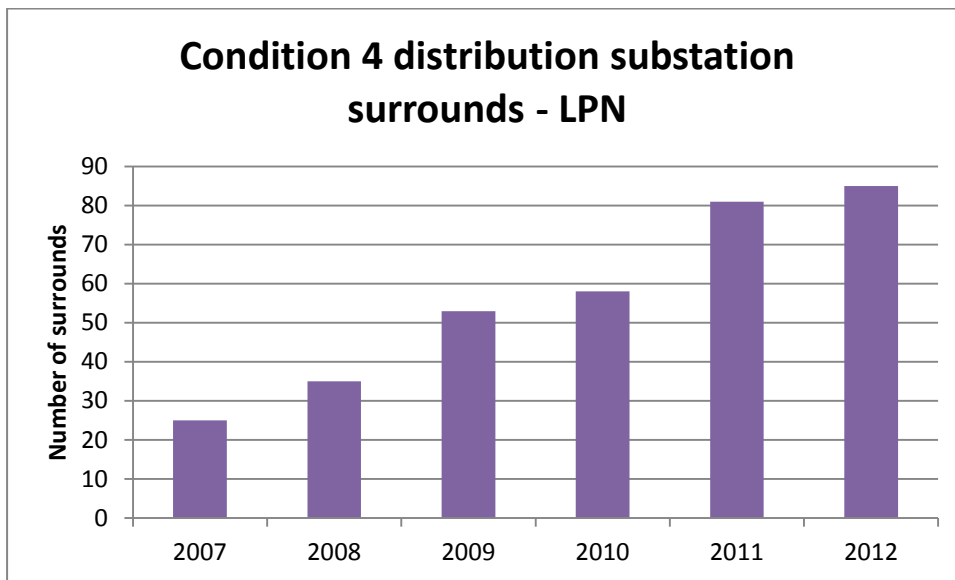


Figure 14

4) Replacement of Distribution Substation Gates

The condition chart (Figure 15) below shows an increase in condition 4s raised over the past years due to a greater number and improved, more targeted inspections.

This is leading to a better understanding of asset risk and is allowing more efficient interventions which are more closely focused on the building components and structures which are becoming unserviceable. The proposed volume of replacement in ED1 for distribution substation gates only represents 1% of the total number of gates, assuming each substation has one gate.

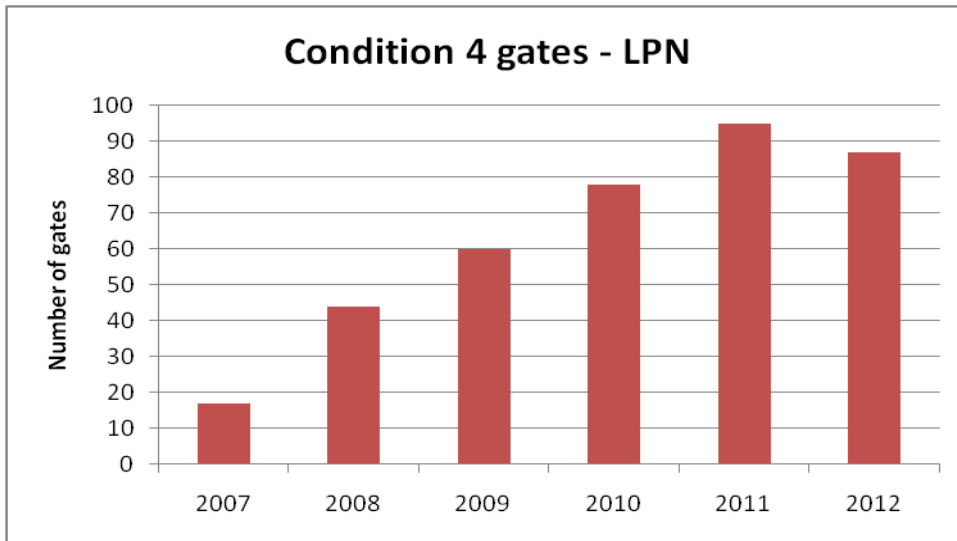


Figure 15

5) Minor Asset Replacement

Use to cover the replacement of low value, high volume items which are not covered by other lines. Examples are door hinges and handles, tap washers, window glass etc. With the LPN estate having the largest volume of buildings, the annual spend is considerably high.

6) Distribution Substation Building – Replace Door

Increase in funding due to the high volume of steel doors on LPN substations. A large proportion of the estate faces on to the public highway and therefore steel doors are used for security purposes. There are 16,426 Distribution substation doors recorded in LPN and the ED1 replacement volume represents 5.4% of this total. The increase in numbers is primarily happening due to a greater number and improved, more targeted inspections. This is leading to a better understanding of asset risk and is allowing more efficient interventions which are more closely focused on the building components and structures which are becoming unserviceable.

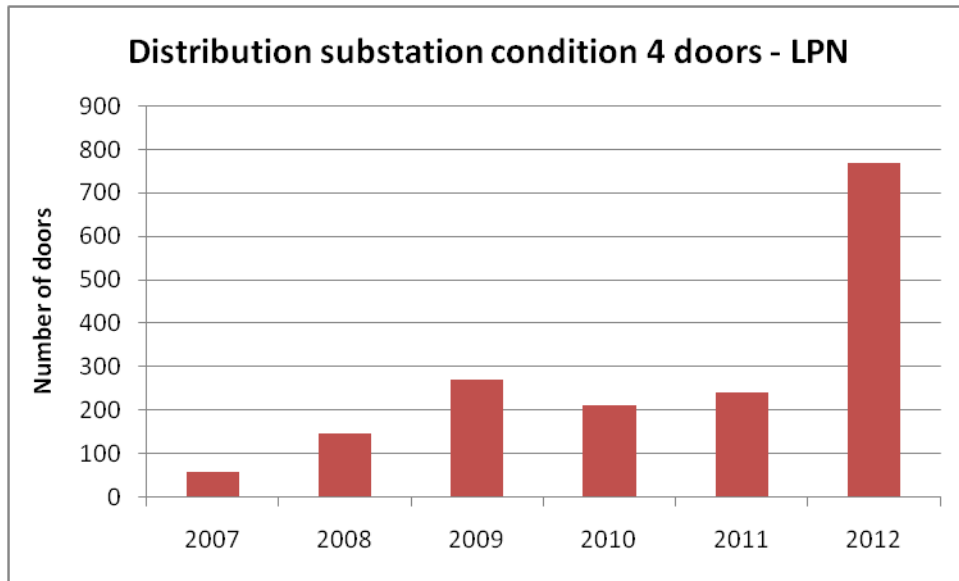


Figure 16

7) Distribution substation building – rewire

Table 5 shows a 47% reduction in expenditure for Distribution substation building rewires; this is due to a large number of works having been completed in DPCR5 to address existing issues. Reduction in ED1 is driven by defects vs. replacement volumes balancing out and also by reduced unit costs as works are to be carried out by internal staff in place of contractors therefore lowering the unit costs.

8) Distribution Substation Building - Install New LV Service

The majority of works on existing installation will be complete in DPCR5; the reduced ED1 expenditure represents ongoing LV service installations to support the rewiring of substations found to have no supply.

9) Grid/Primary - Replace roof

The reduction in ED1 is due to ongoing roof replacement through DPCR5 and the assumption that some of the condition 4's will in fact be defects which will be repaired on another line and the replacement postponed to ED2.

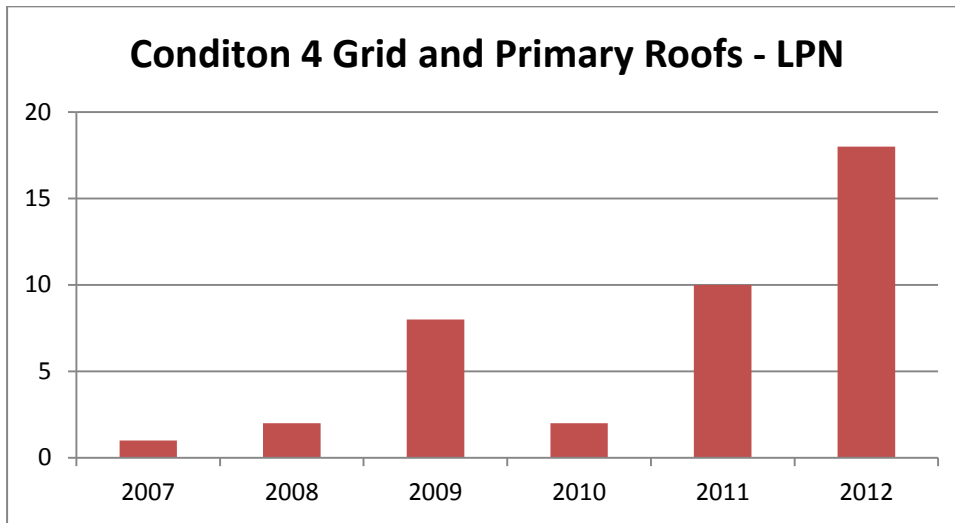


Figure 17

10) Grid/Primary – Replace Boundary Wall

Reduction in ED1 due to brickwork no longer being the choice of material for surrounds – replacement will be in metal (Palisade or Expamet).

11) Grid/Primary – Replace Heating

Reduction in ED1 due to heating systems being replaced during rewire programme.

12) Grid/Primary – Rewire

Increase during ED1 due to the poor condition of wiring in most substations. This increase allows for the programme to continue through ED1.

13) Grid/Primary – Replace Door

Increase in expenditure during ED1 due to increased reporting of condition 4's (shown in Figure 18 below) due to a greater number and improved, more targeted inspections. This is leading to a better understanding of asset risk and is allowing more efficient interventions which are more closely focused on the building components and structures which are becoming unserviceable. There are 215 Grid

and Primary substations in LPN and if an assumption is made that every site has 5 external doors the replacement volume through ED1 will be 6.7%.

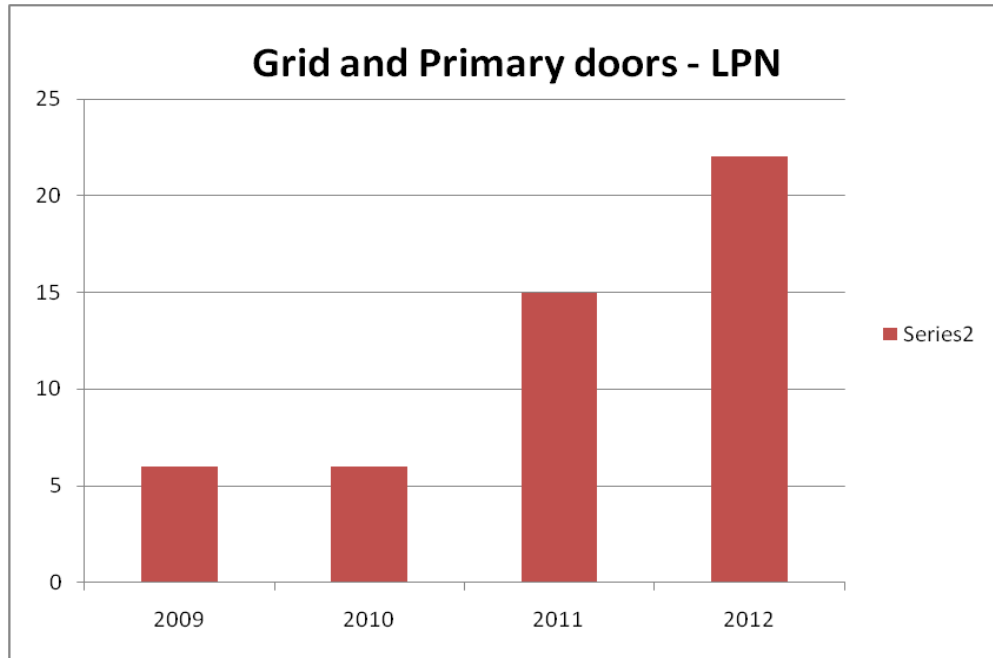


Figure 18

14) Enhance Grid and Primary Fencing

Reduction during ED1 due to completed work during DPCR5, ongoing replacement programme and current condition of existing surrounds.

15) Substation Major Structure Replacement

Expenditure and volumes are based on data gathered through inspections and independent surveys. This programme of work is driven by condition and recent incidence of failure and will include: replacement of assets damaged by plant failure, replacement of 132, 33 and 11kV support structures and condition 4 structures and buildings not due to be replaced through electrical asset replacement. The reduction in expenditure is due to a more focused approach to structure replacement aided by improved data from the inspections and independent surveys.

16) Substation Pressure Relief - Explosion Vents

Safety critical works were carried out prior to the commencement of DPCR5 in order to address the risk posed by the failure of known switchgear types. Throughout DPCR5 there has been little requirement to install additional vents at other substation sites and it is expected that this limited requirement will continue throughout ED1.

17) Drainage Replacement

The major spend in DPCR5 is for projects at Dartford and Hackney which are supporting ongoing works from the bunding programme. A programme of drainage surveys is planned during 2014 and into ED1 and these will build the programme of works for ED2.

7.2.2 Substation Security

Investment Type	DPCR5 pro rata to 8 years (£k)	ED1 total (£k)	Variance	Total ED1 volume	Volume Unit	RIG Table	RIG Row	Comment
Improve Grid and Primary Security	779	694	-86	96	Site	CV8	7	Justification 1
Improve Distribution Security	423	488	66	216	Site	CV8	6	Justification 1
Distribution Substation Lock Upgrade Installation	1,932	6,888	4,956	9209	Site	CV8	6	Justification 2
Grid & Primary Substation Security Access System Installation	727	1,477	750	160	Site	CV8	8	Justification 3
Replace Locking at Grid Substation	192	0	-192	0	Site			Justification 4
Replace Locking at Primary Substation	521	0	-521	0	Site			Justification 4
TOTAL	4,574	9,547	4,973					

Table 7 Expenditure of Civil Substation Security

1) Improve Grid, Primary and Distribution Security

Works include changing or replacing stolen gate padlocks, applying, re-securing or repairing anti-vandal barriers, fitting guards, fixing anti-scale toppings to fences, fixing bollards and labels. The statutory and legislative requirements (including ESQCR and H&SAWA) driving these interventions include our duty to ensure that both our operatives and the general public are protected from harm while we discharge our responsibilities as an electricity distributor. Improvements to security will reduce the likelihood of entry (protecting the public) and reduce the incidents of metal theft (protecting our operatives).

Volumes are reducing at Grid and Primary substations in ED1 due to the increased installation of security systems.

2) Distribution Substation Lock Upgrade Installation

Increase through ED1 in order to enable all padlocks to be changed to prevent unauthorised access and theft. The replacement programme is due to commence in 2013 and is due for completion at the end of the second year of the ED1 period. UK Power Network's strategy document *Secondary Substation Locking Replacement Strategy* details the company's approach for the installation of the intelligent locking at secondary substations after the successful completion at Grid and primary substations in LPN.

3) Grid & Primary Substation Security Access System Installation

Increased expenditure through the ED1 period in order to enable a new access system to be installed at Grid and Primary substations as a replacement for the current faulty and unsupported RITA system.

4) Replace Grid and Primary Locking

Lock replacement locks at Grid and Primary substation sites will be completed during the DPCR5 period.

7.2.3 Substation Flood Protection

Substation flood protection is forecasted on a planned basis according to its risk of flooding and subsequent loss of supplies due to impact on critical plant and equipment. There is an ongoing work programme of substation flood protection works based on environmental risk assessments. This programme will provide flood protection in the period 2015 to 2023 for 16 sites in LPN prioritised based on customer number, load and flood depth. The Plan budgets for flood protection work at 1 Grid substation and 1 Primary site per year.

The flood protection works will include protection against 1:100, 1:200 and 1:1000 fluvial and tidal flood events as well as protection against surface water flooding.

Information and guidance on the extent and degree of pluvial flooding is currently being gathered in conjunction with the Environment Agency. All flood risk scenario protection schemes will be developed to produce a site specific solution taking into account vulnerable critical equipment, customer numbers and vulnerability and, **where appropriate but not exclusively, existing flood protection schemes with a proven record of operational reliability and adequate long term maintenance.**

Investment Type	DR5 pro rata to 8 years	ED1 proposed expenditure (£k)	Variance	Total ED1 Volume	NAMP Line	RIG Table	RIG Row
Substation Flooding (Grid)	6,000	2,331	-3669**	8	1.47.61	CV11	17
Substation Flooding (Primary)	1,122	1,399	277	8	1.47.62	CV11	11
Total	7,122	3,730	-3392	16			

Table 8 Substation Flood Protection Expenditure

** The reduction in expenditure is due to the completion of the high value flood protection project at West Ham Grid in DPCR5 and the high priority sites due for completion by the end of DPCR5 period.

Planning, feasibility studies and design of flood protection works of the most critical sites have been completed for delivery over the DPCR5 period.

Having addressed the sites at risk from water main failure inundation and high priority fluvial and tidal risk sites in DPCR5, the flood protection programme of works will be extended in RIIO ED1 to address the issues of surface water (pluvial) flooding in addition to the remaining medium priority sites already identified as a risk from fluvial and tidal flooding and not protected by the existing Thames flood defences.

Publication of the Environment Agency reservoir flooding inundation maps is highlighting growing concern about the possibility of failure of existing water storm structures such as dams or reservoirs, and the consequent flooding event and destabilisation of overhead line assets associated.

The table below shows the list of sites due for completion in ED1.

LPN Grid Sites	LPN Primary Sites
Barking West	Barnes 6.6kV
Barking C 132kV	West Ferry Circus
Deptford Grid 132kV	Crayford
Landmann Way(Selchp) 132	Churchfields Rd
Brunswick Wharf 132kV	Lombard Rd A 11kV
Hackney	South Bank
Bow 132kV	Bulwer St
Wandsworth Grid 66kV	Redbridge Supergrid 33kV

Table 9 List of sites for flood protection in ED1

7.2.4 Oil Containment / Bunding

This programme will provide full bunding of 40 primary transformers in the ED1 period in LPN. All the Grid transformers have been bunded in LPN.

The plan also budgets for the cleaning of oil contamination from Grid and Primary substations and it is now intended to extend this programme of works to Secondary substation sites as well.

Investment Type	DR5 pro rata to 8 years	ED1 proposed expenditure (£k)	Variance (£k)	Total ED1 Volume	NAMP Line	Unit	RIG Table	RIG Row
Oil Containment at primary substations	6,393	3,673	-2720	40	1.30.02	Transformer	CV12	9
Clean up oil contaminated site to prevent external pollution	776	280	-496	480	1.30.05	Site	CV12	13
Total	7169	3953	-3216					

Table 10 Oil containment expenditure

Majority of sites will be completed by the end of DPCR5. The work during ED1 will be refurbishment and improvement of existing bunds in order to comply with EDS 07-0110 and to bund bulk oil circuit breakers not due for replacement as part of Network Improvement Projects.

7.2.5 Cable Tunnels

The programme allows for the refurbishment of 2 cable tunnel every year.

Following inspection and refurbishment works are identified and put into works plan.

Investment Type	DR5 pro-rata to 8 years	ED1 proposed expenditure (£k)	Variance	NAMP Line	RIG Table	RIG Row	Comment
Cable Tunnel Refurbishment	7,205	4,663	-2,543	1.47.02	CV6	18	Justification 1
Cable Tunnel Inspections	1,999	6,402	4,403	2.30.14	CV13	78	Justification 2
Cable Tunnel Maintenance	3,615	7,466	3,851	2.32.17	CV13	79	Justification 2
Tunnel non compliance rectification Works	1,766	1,516	-250	2.33.09	CV13	79	Justification 3
LPN Cable tunnel pump and alarm maintenance	1,177	1,752	576	1.47.24	CV6	18	Justification 4
Cable Tunnel Discharge Consent	1,333	1,643	309	2.30.24	CV13	79	Justification 5
Tunnel Discharge Consent Survey	306	0	-306	2.30.24	CV13	79	Justification 6
TOTAL	17,401	23,442	6,040				

Table 11 Cable Tunnel Expenditure

The increased expenditure of cable tunnels in ED1 is due to the increased requirement of inspection, maintenance and refurbishment works predicted to be identified during the improved inspection regime being commenced in 2013 as directed in EDS 10-7004.

1) Cable Tunnel Refurbishment

The reduction in expenditure for cable tunnel refurbishment works in LPN is due to the fact that majority of works have been completed in ED1 before the Olympics. The works in ED1 will be a combination of non-Olympic essential works identified during inspection and surveys.

2) Cable Tunnel Inspections and Maintenance

From 2016 there will be 13km new tunnels requiring increased maintenance and inspection expenditures due to the complex nature of the ventilation control and tunnel management systems.

ED1 inspection is based on a cost (£200) per each 25m; the current policy requires a twice yearly inspection. Tunnels recently constructed (Lower lea valley and City of London tunnels) require more detailed inspection due to the complex nature of the ventilation and tunnel management systems. In addition there will be a requirement to inspect our assets in public utility subways and tunnels owned by other parties, for example National Grid tunnels and inspection to establish more detailed scoping of refurbishment works.

Cable Tunnel Discharge – This is based on current rate of billing.

3) Tunnel Non-compliance Rectification Work

Reduction in ED1 due to works completed in DPCR5; works to include replacement signage, replacement drawings and replacement harness fixing points.

4) LPN Cable Tunnel Pump and Alarm Maintenance

Increase during ED1 to cover the ongoing supply and refurbishment of pumps, replacement of floats with contacts, discharge pipework replacement, the supply and installation of alarm panels at 54 locations in the tunnel network and the storage of 54 strategic pumps for maintenance replacement.

5) Cable Tunnel Discharge Consent

Increase in expenditure during ED1 to consider additional costs incurred in quantifying the amount of flood water being pumped from cable tunnels into utility sewers. Further charges involving discharge from culverts and basements also need to be considered.

6) Tunnel Discharge Consent Survey

Completed in the DPCR5 period.

7.2.6 Cable Bridges

The programme allows for the refurbishment of 2 Cable Bridge per year in ED1. The increased number of cable bridge refurbishment is due to the increased number of cable bridges in LPN compared to other UK Power Networks licensed areas. There are 57 cable bridges in LPN.

Cable bridges are inspected at six monthly intervals by UK Power Networks inspectors. Following inspections refurbishment work are identified and put into works plan.

Investment Type	DR5 pro-rata to 8 years	ED1 proposed expenditure (£k)	Variance	Total ED1 Volume	Volume Unit	NAMP Line	RIG Table	RIG Row	Justification
Cable Bridge Refurbishment	1,234	2,331	1079	16	Site	1.47.03	CV6	18	Justification 1
Cable Bridge Inspections - LPN	146	228	82	912	Site	2.30.13	CV13	80	Justification 2
Cable Bridge Maintenance - LPN	2,342	1,420	-922	456	Site	2.32.18	CV13	81	Justification 3
Cable Bridge Repairs	30	94	64	£k	Site	2.33.05	CV13	81	
Total	3,752	4,073	303						

Table 12 Cable Bridge Expenditure

The increased expenditure of cable bridges in ED1 is due to the increased inspection, maintenance and refurbishment works.

1) Cable Bridge Refurbishment

Increased through ED1 to allow for 2 cable bridges to be refurbished each year – works include refurbishment or replacement of doors, cladding, structural members etc.

2) Cable Bridge Inspections

Increase during ED1 to allow for 2 inspections per year in order to comply with EDS 10-7003 Cable Bridge Inspection and Maintenance Policy.

3) Cable Bridge Maintenance

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects

Maintenance volume forecast based on one visit to rectify issues identified during inspection.

4) Cable Bridge Repairs

Increased to cover specific one-off repairs previously captured on the Maintenance lines. This allows for more efficient recording of work types and an indication of deteriorating condition should repair rates begin to increase for any one bridge asset.

7.2.7 Safety

Investment Type	DR5 pro-rata to 8 years (£k)	ED1 proposed expenditure (£k)	Variance	ED1 Volume	Unit	RIG Table	RIG Row	Comment
LPN Cable Tunnel Safety Radio Systems	619	933	314	16	Site	CV8	15	Justification 1
Removal of Asbestos	871	832	-39	832	Task	CV8	9	
Roding River Cable Tunnel Asbestos Removal	611	0	-611	0	£k			
CO2 Bottle Replacement - Statutory Provision	2,373	1,351	-1,022		£k	CV8	12	Justification 2
Asbestos Survey Distribution Sites - Outdoor	1,099	1,221	122	7606	Site	CV8	9	Justification 3
Grid Sub-station Fire Risk Assessment	162	3	-159	3	Site	CV8	12	Justification 4
Primary Sub-station Fire Risk Assessment	241	0	-241	0	Site	CV8	12	Justification 4
Grid Substation FRA Review LPN	42	74	32	604	FRA	CV8	12	Justification 4
Primary Substation FRA Review	126	228	102	1864	FRA	CV8	12	Justification 4
Tunnel Fire Risk Assessments	65	0	-65	0	Units	Cv13	78	Justification 4
TOTAL	6,209	4,642	-2,185					

Table 13 – Safety Expenditures

1) LPN Cable Tunnel Safety Radio Systems

Increase in ED1 as this is a replacement for Cable Tunnel Safety Radio Systems – LPN which had no previous funding for ED1. This funding will enable the replacement of faulty leaky feeders, repeater boxes and base stations which will be compatible with the emergency services.

2) CO₂ Bottle Replacement - Statutory Provision

Reduced expenditure through ED1 due to the ongoing maintenance programme through DPCR5. Each fixed cylinder has to be tested every 10 years as per the Pressure Vessel Regulations and this programme will continue through ED1 and ED2.

3) Asbestos Survey Distribution Sites – Outdoor

Asbestos survey of all indoor and outdoor sites will be completed in DPCR5. The funding on the asbestos survey distribution sites – outdoor, is to cover the Asbestos Monitoring and reviews that are to follow up on the completed survey work as required by law for all asbestos found in operational substations. The Monitoring is less detailed requiring less time and expenditure to undertake

4) Fire Risk Assessment

Fire risk assessments for Grid's, Primary's and Cable Tunnels are due for completion in DPCR5. 2014 will see the start of the review programme and this will be ongoing through ED1 and ED2.

7.2.8 Inspection and Maintenance

This programme covers major and minor grid, primary and secondary site inspections and maintenance, defect repairs identified during inspection and maintenance activities and other operational responsibilities, including demolishing abandoned/unsafe buildings.

The table below details the actual and predicted pro-rata expenditure in DPCR5 and the predicted expenditure in ED1 for Civil inspection and maintenance. Explanations have been provided for the variances between DPCR5 and ED1 in the paragraphs following the table.

CV13: I&M								
LPN				Total				
				DPCR5	DPCR5 pro rata to 8 years	RIIO-ED1	DPCR5/ED1 Variance	ED1/ DPCR5 variance justification
Asset category	Activity	RIGs Table	RIGs Row	£m	£m	£m	£m	
Substations - GM Indoor & Outdoor	Repair & Maintenance (Civil Works)	CV13	25	5.08	8.13	7.91	-0.21	Justification 1
Substation	Repair & Maintenance (Civil Works)	CV13	45	4.26	6.82	5.04	-1.77	Justification 2
Substation	Repair & Maintenance (Civil Works)	CV13	73	3.30	5.28	5.74	0.46	Justification 3
Substation	Inspections	CV13	72	1.73	2.76	1.62	-1.14	Justification 4
Substation	Inspections	CV13	44	2.69	4.30	1.66	-2.64	Justification 5

7.2.9 Table 14 – Inspection and Maintenance Expenditure

Justification 1

The reduction shown in ED1 expenditure is due to:

- Reduction in vegetation clearance expenditure due to operational site tree trimming expenditure being allocated to a specific expenditure line – this allows improved budgetary control and correct allocation of expenditure.
- It is expected that as maintenance and asset replacement (e.g. doors, roofs, surrounds) works are undertaken in ED1, the volume consequentially expenditure of defect rectification of secondary substations will reduce.

Justification 2

The reduction shown in ED1 expenditure is due to:

- Maintain Primary Site & Building

Reduction in expenditure through ED1 as defect rectification programme throughout DPCR5 which will lead to fewer interventions.

- Defect Repairs at Primary Substations

It is expected that as maintenance and asset replacement (e.g. doors, roofs, surrounds) works are undertaken in ED1, the volume consequentially expenditure of defect rectification of secondary substations will reduce.

Justification 3

The increase shown in ED1 expenditure is due to:

- Increase in fire risk assessment expenditures – Fire risk assessment programme is now intended to include secondary substations as well as Grid and Primary sites.
- Increase in tree trimming expenditure - The expenditure for tree trimming was originally allocated to the vegetation clearance line - because tree trimming is low volume high value activity and was distorting reporting of vegetation clearance expenditure this new line has been created to allow more accurate reporting and works programming.

Justification 4

The majority of the expenditure is non Civil. Only few Civil lines have been mapped to this table. The total expenditure for the civil lines equates to £0.25m.

This expenditure is for the lines;

- Water Quality Testing at Grid Substations and Water Testing - Remedial Works

The decrease in expenditure in ED1 for water quality testing at grid substations is due to the work being carried out by internal staff as part of direct cost savings and initiative.

- PAT Testing at Grid & Primary Substations

The requirement for PAT testing is to be greatly reduced as UK Power Networks are planning to remove portable electrical appliances from operational substation buildings, as part of the Welfare Removal programme of works.

- Mulsifyre Inspection & Testing and monthly checks

Justification 5

The majority of the expenditure is non Civil. Only few Civil lines have been mapped to this table. The total expenditure for the civil lines equates to £1m.

This expenditure is for lines;

- Water Quality Testing at Primary substation and water testing remedial works

The decrease in expenditure in ED1 for water quality testing at primary substations is due to the work being carried out by internal staff as part of direct cost savings and initiative.

- Drainage inspection and maintenance

7.2.9 Civil Works Driven By Plant Asset Replacement

The forecast volumes for civil works driven by plant asset replacement have been reviewed since the 2013 submission and changed accordingly. The volumes and costs are outlined below.

Civil Works Driven By Plant Asset Replacement	RIGs Table	RIGs Row	DPCR5 volume	RIIO-ED1 Volume	DPCR5 (£m)	RIIO-ED1 (£m)
Plinths and Groundworks	CV6	27	1	38	0	0
Building		28	32	31	2	2
Enclosures and Surrounds		29	1	-	0	0
Plinths and Groundworks		30	20	72	0	0
Building		31	22	24	12	6
Enclosures and Surrounds		32	3	6	0	0
Plinths and Groundworks		33	8	180	0	2
Building		34	39	1	8	3
Enclosures and Surrounds		35	24	46	0	1
Cable Tunnel		36	1	-	-	-
Cable Bridge		37	-	-	0	-
						24

Table 15 Civil works driven by plant asset replacement

HV Costs and Volumes

On the three HV lines the volumes have been based on the number of Distribution switchgear and transformer replacements in CV3. The volumes are less than those seen in CV3 as not all replacements require a plinth, building or enclosure. The volume of plinths in LPN is low compared to EPN and SPN as the majority of sites are located in buildings and basements, where plinths aren't required.

The costs on the HV lines have been based on a standard unit cost associated with each of the individual activities such as installing a plinth or shingle.

132kV and EHV Costs and Volumes

The volumes on the 132kV and EHV lines are based on the volumes from individual major projects. These include mainly grid and primary switchgear and transformer replacements from CV3. Since the 2013 submission the activities included on the table have been reviewed and removed where they were considered to follow the guidance. This has seen a drop in the number of buildings. EHV building volumes consist of works on 11kV and 33kV switchgear replacements. At 33kV a number of new buildings are required where outdoor switchgear is being replaced with indoor equipment.

Costs are based on Compatible Units selected in individual projects.

7.3 Additional Considerations

Not applicable.

7.4 Expenditure Graphs

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects

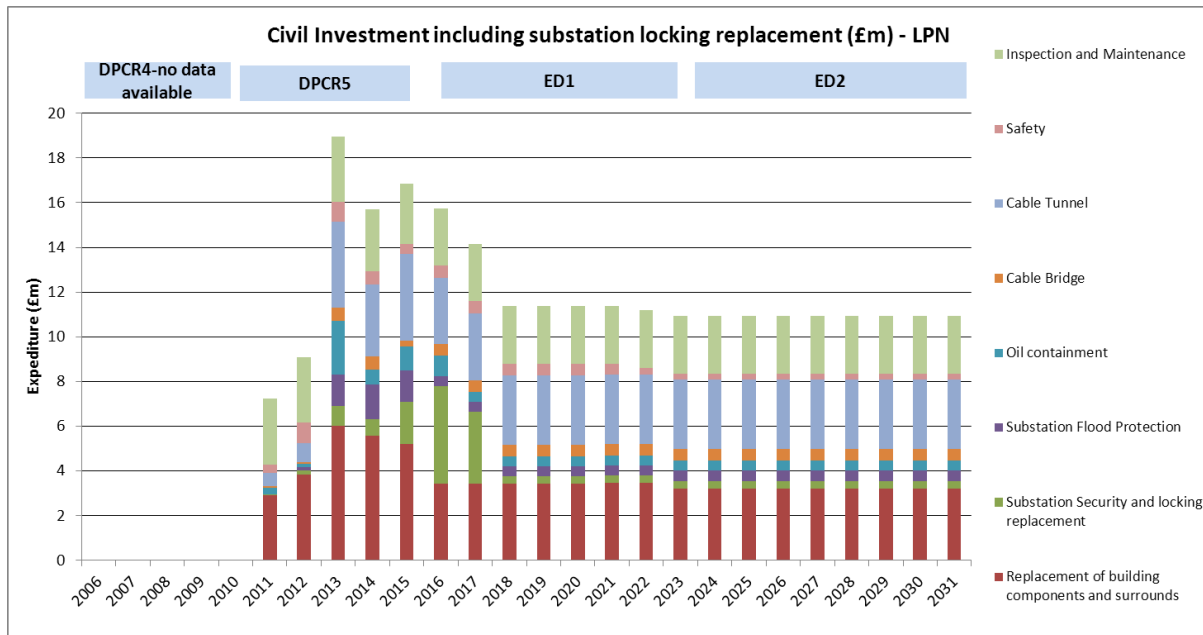


Figure 19 DPCR5 and ED1 expenditures (including locking replacement programme at distribution substation). (See commentary below)

The increase in expenditure at the start of the ED1 period is due to high volume of locking replacement at distribution substations and civil works at grid and primary substations (NAMP 1.47.08) which represents unplanned refurbishment work similar to those shown in figure 5.

Due to the increased theft and unauthorised entry to our substation and the loss of copyright of our locking system, it was decided to adopt a new locking system which is programmable electronic locking system.

Work started on this programme in 2013 and is due for completion at the second year of the ED1 period. The estimated total value of this programme in ED1 is £6.9m, of which £5.509m is the expenditure in ED1 and £0.591m in DPCR5. The peak at the start of the ED1 period represents the expenditure for the planning and installation of the padlocks and lock barrels.

The peak at the end of DPCR5 is due to an increased programme in order to deliver the works detailed in the DPCR5 submission. These include major substation replacement, substation flooding grid (e.g. west ham flood defence which is due for

completion by the end of 2013 and the total cost is £1.4m) civil works at grid and primary, cable tunnel refurbishment and oil containment.

The following chart shows the expenditure without distribution substation locking replacement.

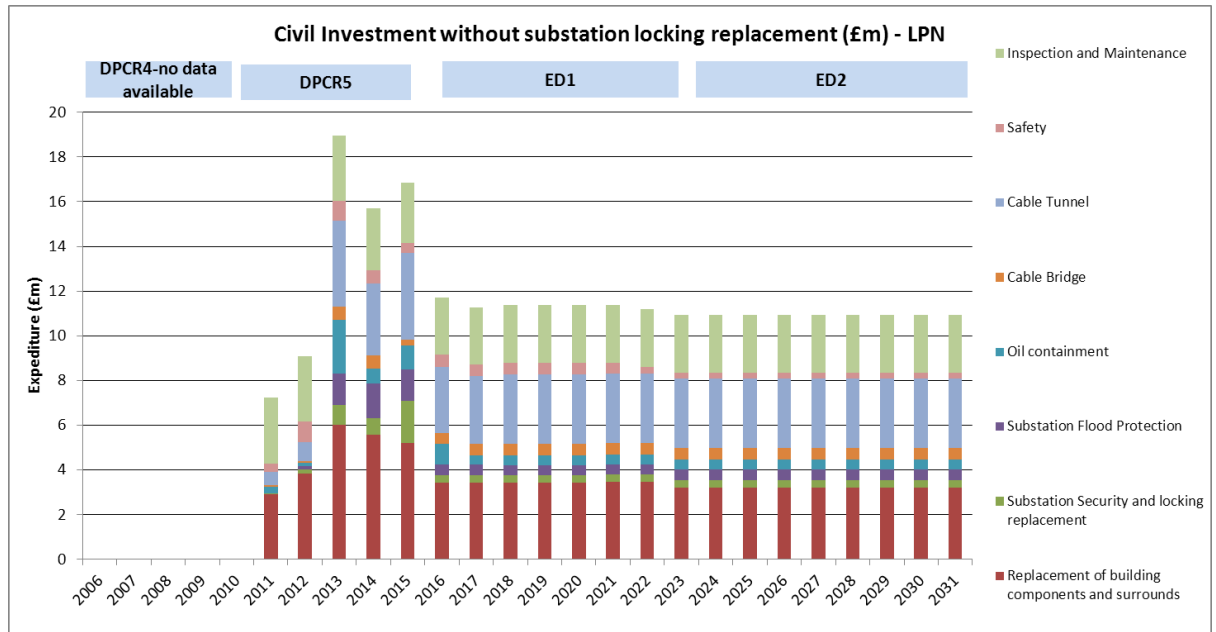


Figure 20 DPCR5 and ED1 expenditures without distribution substation locking replacement programme.

7.5 Commentary

The proposed expenditure for some of the civil asset groups in ED1 are greater than in DPCR5 for the following reasons:

- Better quality and completeness of data in recent years has led to identification of greater number of condition 3 and 4 assets requiring replacement or refurbishment.

There is now more historical information and better asset information.

- Where a new driver of investment or replacement has been identified a new programme of work has been drawn up since the submission of DPCR5 plan. For example installation of security systems on substations, substation major structures (e.g. external support structure) replacement.

- Historical achievements show that we have been spending more than the original DPCR5 submission for the past few years of the DPCR5 period.

7.6 RIGS vs. ASR Volumes and Expenditure

The tables below details the variances between the volumes and expenditure recorded in this ASR and PIMS and what is reported in the submitted RIGS tables.

Outputs	NAMP Line	Asset Stewardship report		RIG Table			Variance	Variance explanation
		Total volume	Group total volume	RIG Table	RIG Row	Total RIG Volume		
Sanding and capping programme – Secondary substations	1.47.01.6319	1,985	1,985	CV6	12	1985	0	
Civil Works at Grid & Primary Substations	1.47.08					0		
TC sump pump replacement	1.47.17.8218	264						
Dist s/stn building - minor asset replacement	1.47.32.8223	4,440	8,702	CV6	8	8,702	0	
Dist s/stn building - rewire	1.47.36.8227	3,416						
Dist S/Stn Building - Install New LV Service	1.47.38.8228	582						
Replacement of Dist S/S Brick Surround	1.47.29.8221	75						
Replacement of Dist S/stn Surround (Non Brick)	1.47.30.8222	248	483	CV6	11	483	0	
Replacement of dist s/stn gates	1.47.31.8411	160						
Dist s/stn building - replace roof	1.47.33.8224	1,280	1,288			1,288	0	
Grid/Primary - Replace compound floodlighting	1.47.33.8233	8		CV6	7			
Dist s/stn building - replace door	1.47.34.8225	792	952	CV6	6	952	0	
TC replace pavement hatches	1.47.19.8219	160						
Dist s/stn building - replace guttering	1.47.35.8226	624	624	ZCV6	11			
Grid/Primary - Replace roof	1.47.50.8229	67	673	CV6	16 and	673	0	

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects

Grid/Primary - Replace bounday brick wall	1.47.51.8230	23			17			
Grid/Primary - Replace heating	1.47.52.8231	80						
Grid/Primary - Rewire	1.47.53.8232	49						
Grid/Primary - Replace doors	1.47.55.8234	73						
Grid/Primary - Replace compound trench covers	1.47.58.8235	16						
Grid/Primary - internal refurbishment	1.47.59.8236	8						
Enhance grid and primary fencing	1.47.63.8239	196						
Substation Major Structure Replacement	1.47.64.8241	160						
Substation Pressure Relief - Explosion Vents	1.47.65.8242	1						
Improve Grid and Primary Security	1.08.01.8350	96	96	CV8	7	123	27	Explanation 1
Improve Distribution Security	1.08.02.8351	216	9,426	CV8	6	9426		
Distribution Substation Lock Upgrade Installation	1.08.04.6476	9,209						
Grid & Primary Substation Security Access System Installation	1.08.05.6735	160	160	CV8	8	194	34	Explanation 2
Substation Flooding (Grid)	1.47.61.8237	8	8	CV11	17	8		
Substation Flooding (Primary)	1.47.62.8238	8	8	CV11	11	8		
Oil Containment at primary substations	1.30.02	120	40	CV12	9	40		
Cleanup oil contaminated site to prevent external pollution	1.30.05.6309	40	480	CV12	13	480		
LPN Cable Tunnel Refurbishment ED1	1.47.02.6321	16	480	CV6	18	486	6	Explanation 3
LPN Cable Tunnel Pump and Alarm Maintenance	1.47.24	464						
LPN Cable bridge refurbishment	1.47.03.6323	16	16	CV6	19	16	0	
LPN Cable tunnel safety radio systems	1.20.06.8352	16	16	CV8	15	16	0	

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects

Removal of Asbestos	1.20.09	832	8,638	CV8	9	8,638	0	
Asbestos Survey Distribution Sites - Outdoor	1.20.18	7,606						
Asbestos Survey - Remedial Works	2.33.18	200						
Grid Substation FRA Review LPN	1.20.46.7086	604	2,471	CV8	12	2,471	0	
Primary Substation FRA Review	1.20.47	1,864						
Grid Substation Fire Risk Assessment	1.20.43	3						
CO2 Bottle Replacement - Statutory Provision	1.20.17.6283	1,351	1,351					

Table 16 ASR and RIG Volumes comparison

LPN Asset Name (Stewardship report)	NAMP Line	Asset Stewardship Report			RIG Table		Variance
		ASR total investment (£m)	RIGs Table	RIGs Row	RIG Total Investment		
Sanding and capping programme – Secondary substations	1.47.01.6319	0.969	CV6	12	0.97	0.00	
Replacement of Dist S/S Brick Surround	1.47.29.8221	2.71	CV6	11	2.71	0.00	
Replacement of Dist S/stn Surround (Non Brick)	1.47.30.8222						
Replacement of dist s/stn gates	1.47.31.8411						
Dist s/stn building - replace guttering	1.47.35.8226						
Demolish Abandoned/Unsafe Buildings							
TC sump pump replacement	1.47.17.8218	6.14	CV6	8	6.14	0.00	
Dist s/stn building - minor asset replacement	1.47.32.8223						
Dist s/stn building - rewire	1.47.36.8227						

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects

Dist S/Stn Building - Install New LV Service	1.47.38.8228					
Dist s/stn building - replace roof	1.47.33.8224	5.34	CV6	7	5.34	0.00
Grid/Primary - Replace compound floodlighting	1.47.33.8233					
Dist s/stn building - replace door	1.47.34.8225	2.95	CV6	6	2.95	0.00
TC replace pavement hatches	1.47.19.8219					
Civil Works at Grid & Primary Substations	1.47.08					
Grid/Primary - Replace roof	1.47.50.8229		CV6	16 and 17		0.00
Grid/Primary - Replace bounday brick wall	1.47.51.8230					
Grid/Primary - Replace heating	1.47.52.8231	9.27				
Grid/Primary - Rewire	1.47.53.8232					
Grid/Primary - Replace doors	1.47.55.8234					
Grid/Primary - Replace compound trench covers	1.47.58.8235					
Grid/Primary - internal refurbishment	1.47.59.8236					
Enhance grid and primary fencing	1.47.63.8239					
Substation Major Structure Replacement	1.47.64.8241				17	
Substation Pressure Relief - Explosion Vents	1.47.65.8242				16	
Improve Grid and Primary Security	1.08.01.8350	0.70	CV8	7	1.84	1.15
Improve Distribution Security	1.08.02.8351	7.38	CV8	6	7.41	0.03
Distribution Substation Lock Upgrade Installation	1.08.04.6476					
Grid & Primary Substation Security Access System Installation	1.08.05.6735	1.48	CV8	8	2.91	1.43
Substation Flooding (Grid)	1.47.61.8237	2.33	CV11	17	2.33	0.00
Substation Flooding (Primary)	1.47.62.8238	1.40	CV11	11	1.40	0.00

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects

Oil Containment at primary substations	1.30.02	3.67	CV12	9	3.67	0.00
Cleanup oil contaminated site to prevent external pollution	1.30.05.6309	0.28	CV12	13	0.28	0.00
LPN Cable Tunnel Refurbishment ED1	1.47.02.6321	6.42	CV6	18	24.62	18.20
LPN Cable tunnel pump and alarm maintenance	1.47.24					
LPN Cable tunnel safety radio systems	1.20.06.8352	0.94	CV8	15	0.93	0.00
Removal of Asbestos	1.20.09	2.26	CV8	9	2.26	0.00
Asbestos Survey Distribution Sites - Outdoor	1.20.18					
Asbestos Survey - Remedial Works	2.33.18					
Grid Substation FRA Review LPN	1.20.46.7086	1.66	CV8	12	1.66	0.00
Primary Substation FRA Review	1.20.47					
CO2 Bottle Replacement - Statutory Provision	1.20.17.6283					

Table 17 ASR and RIG expenditure comparison

The RIGS/ASR variance in volumes expenditure explanation

Tables 16 and 17 above show the link of the Civil costs and volumes within this Asset Stewardship Report and the RIG tables. The variance in volumes and expenditure on the tables above is because the RIGS tables contain civil works driven by other asset replacement such as switchgear replacement, transformer replacement, general substation reinforcement etc. as well as steel kiosk replacement, switchgear cover replacement and project specific works with some element of Civil work. The volume and expenditure detailed in Section 7.2 of this report do not include these additional other works.

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects

Explanation 1

27 project specific security related line have been mapped to CV8 row 7. This equates to an expenditure of £1.15m. These projects have a Security works element which has been mapped to this line but the works are not Security risk driven.

Explanation 2

34 project specific security related line have been mapped to CV8 row 8 . This equates to an expenditure of £1.43m. These projects have a Security works element which has been mapped to this line but the works are not Security risk driven.

Explanation 3

CV6 row 18 contains the new Hackney - Waterloo Rd Cable Tunnel and New Cross - Wellclose Square Cable tunnel construction works which are not condition led refurbishment works.

8 Deliverability

There are no significant issues with regards to outages and network access during civil asset replacement, inspection and maintenance works. Oil containment and substation surrounds replacement works may require outages.

Proposed replacement volumes in RIIO-ED1 are similar to historical delivery levels. Volumes are continually reviewed to ensure that that they are deliverable. Progress will be monitored via the works volumes shown in appendix 5. Contractors record the work through closed work orders and photographs and the works are independently monitored and reviewed by UK Power Networks project managers or staff. Increase in volumes will be managed by engaging with existing frame work contractors to increase their staff and subcontractors.

The civil replacement work program will be prioritised and lists of assets for replacement and site specific projects/programmes determined using the condition data and risk assessment. These lists are planned by the asset management team before being issued to the delivery teams and are discussed 3-4 months before the annual delivery period begins to ensure understanding and resource availability; for major project works (including bunding and flood protection) the delivery teams are engaged in the feasibility and preliminary design works.

Security, flooding protection and oil containment works are converted into approved projects by producing scope of work and high level costing and passed onto programme delivery team.

Inspection and maintenance of civil assets is carried out by internal inspectors or external specialist contractors. Inspection and maintenance programmes are converted into approved projects by generating work orders on ellipse and passed onto contractor/inspector.

9 Appendices

Appendix 1 - Age profiles

The age analysis of all civil assets within Ellipse were undertaken as shown below.

Of all the civil assets being considered under civil assets replacements, 2,279 out of 332,468 assets have build year data.

In order to generate a proxy age for the remaining assets it was assumed the build year of an asset to be the same as of its parent asset. As not all parent assets have build year information, remaining assets with still missing build year data were assumed to be the same as of its child asset's build year.

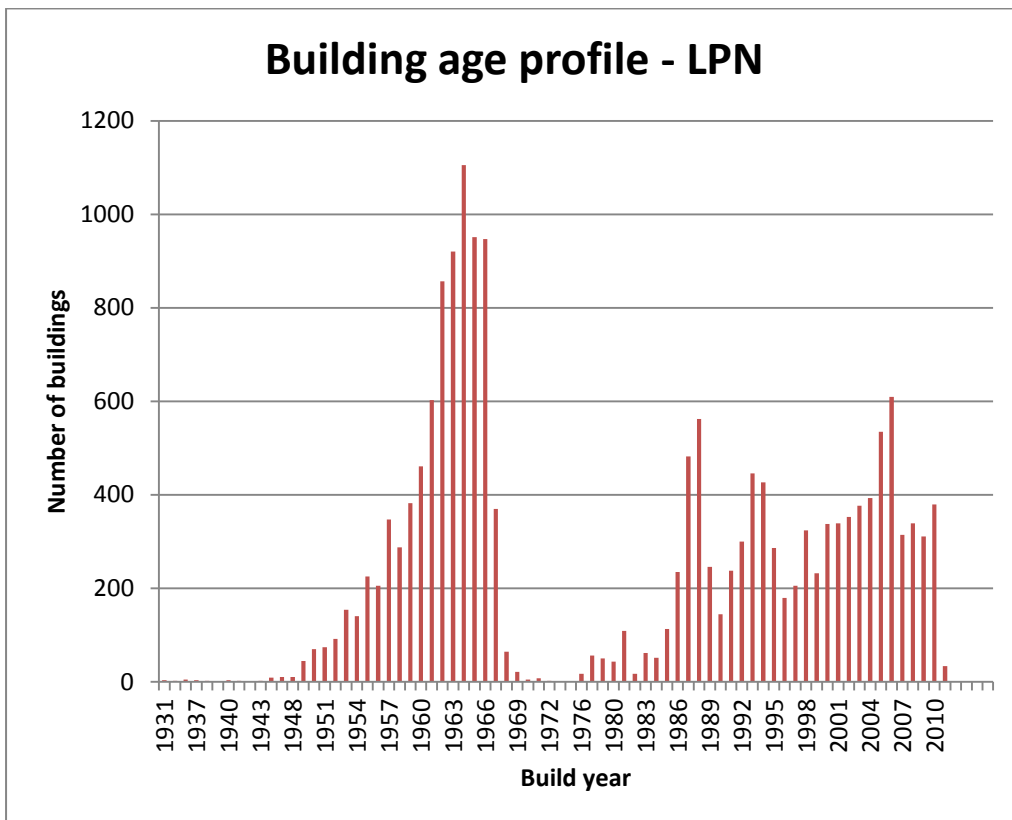
For the remaining assets without a build year, this was estimated as follows. An average build year was determined for each group of assets and then assigned to each asset without a built year.

For example, only 67 out of the 32,447 building assets records contained the actual built year information. The build year information of an additional 24,418 building assets was determined using either the parent or child assets such as rooms and roofs. The remaining 8,023 building assets were distributed proportionally throughout the known build years.

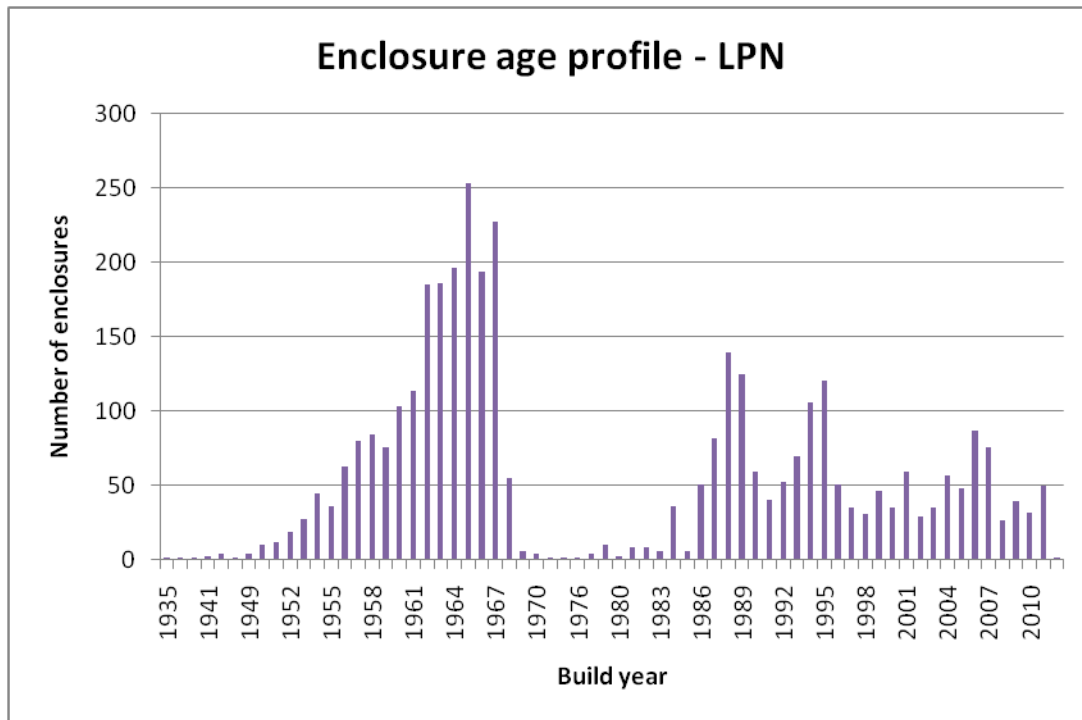
Using this methodology we have determined a reasonable and effective asset age for 99.9% of our assets recorded in Ellipse. There have only been 148 assets where it was not possible to assign the average asset group built year. For these assets, an overall average built year of 1980 was assumed. The overall average was determined by taking the average built year of all other assets with known built year determined as described previously.

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects

Our age analysis showed that a substantial number of assets were older than the design life proposed, yet still in good condition. The analysis also showed that a significant number of assets were in poor condition but had not exceeded the proposed asset life. Therefore age alone could not be used as an indicator for replacement strategy. History and current work rates have also been used to forecast the volumes for some civil assets.



Due to most of the buildings being installed during the 1960s, the age profile of the buildings and enclosures (see below) is now at a point where a large replacement work is required.



Appendix 2 - HI profiles

Not available at time of preparing narrative.

Appendix 3 - Fault data

Not applicable.

Appendix 4 - WLC case studies - risk, cost, performance, condition profiles for various options

Not applicable

S&R - Baseline_Final ED1 Re-submission_19th February 2014_15:15															
GWP	Namp Reference	Project ID	DNO	Op Unit	Description	UCI	Project Type	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023
1.47	1.47.38	8228	LPN	CP Hub 1 - London	Dist S/S Building - Install New LV Service	833	GWP	74	74	74	74	74	74	74	62
1.47	1.47.50	8229	LPN	CP Hub 1 - London	Grid - Replace Roof	16,051	GWP	2	2	2	2	2	2	2	3
1.47	1.47.50	8784	LPN	CP Hub 1 - London	Primary - Replace Roof	16,051	GWP	6	6	6	6	6	6	6	8
1.47	1.47.51	8230	LPN	CP Hub 1 - London	Grid - Replace Bounday Brick Wall	12,993	GWP	1	1	1	1	1	1	1	2
1.47	1.47.51	8787	LPN	CP Hub 1 - London	Primary - Replace Boundary Brick Wall	12,993	GWP	2	2	1	1	1	1	1	5
1.47	1.47.52	8231	LPN	CP Hub 1 - London	Grid - Replace Heating	5,299	GWP	3	3	3	3	3	3	3	3
1.47	1.47.52	8788	LPN	CP Hub 1 - London	Primary - Replace Heating	5,299	GWP	7	7	7	7	7	7	7	7
1.47	1.47.53	8232	LPN	CP Hub 1 - London	Grid - Rewire	46,855	GWP	2	2	2	2	2	2	2	2
1.47	1.47.53	8789	LPN	CP Hub 1 - London	Primary - Rewire	46,855	GWP	4	4	4	4	4	4	5	4
1.47	1.47.55	8234	LPN	CP Hub 1 - London	Grid- Replace Doors	2,833	GWP	3	3	3	3	3	3	3	3
1.47	1.47.55	8790	LPN	CP Hub 1 - London	Primary - Replace Doors	2,833	GWP	6	6	6	6	6	6	6	7
1.47	1.47.58	8235	LPN	CP Hub 1 - London	Grid - Replace Compound Trench Covers	967	GWP	1	1	1	1	1	1	1	1
1.47	1.47.58	8793	LPN	CP Hub 1 - London	Primary - Replace Compound Trench Covers	967	GWP	1	1	1	1	1	1	1	1
1.47	1.47.59	8236	LPN	CP Hub 1 - London	Primary - Internal Refurbishment	4,266	GWP	1	1	1	1	1	1	1	1
1.47	1.47.61	8237	LPN	PD Hub 1 - London	Substation Flooding (Grid)	291,414	GWP	1	1	1	1	1	1	1	1
1.47	1.47.62	8238	LPN	PD Hub 1 - London	Substation Flooding (Primary)	174,849	GWP	1	1	1	1	1	1	1	1
1.47	1.47.63	8239	LPN	CP Hub 1 - London	Enhance Grid Fencing	5,292	GWP	7	7	7	7	7	7	7	6
1.47	1.47.64	8241	LPN	PD Hub 1 - London	Substation Major Structure Replacement	8,159	GWP	20	20	20	20	20	20	20	20
1.47	1.47.65	8242	LPN	PD Hub 1 - London	Substation Pressure Relief - Explosion Vents	13,987	GWP	0	0	0	0	0	0	0	0
1.47	1.47.66	8243	LPN	PD Hub 1 - London	Drainage Replacement	158,953	GWP	0	0	0	0	0	0	0	0
2.30	2.30.10	9893	LPN	CO Hub 1 - London	Mulsifyre Inspection & Testing	144	GWP	13	13	13	13	13	13	13	13
2.30	2.30.13	6442	LPN	CO Hub 1 - London	Cable Bridge Inspections - LPN	250	GWP	114	114	114	114	114	114	114	114
2.30	2.30.14	6445	LPN	CO Hub 1 - London	Cable Tunnel Inspections	12,556	GWP	13	13	13	13	13	13	13	13
2.30	2.30.16	6448	LPN	CO Hub 1 - London	Council Subway Survey / Inspection	12,556	GWP	13	13	13	13	13	13	13	13
2.30	2.30.18	6450	LPN	CO Hub 1 - London	Annual Maint Contracts for Tunnel Gas Detectors, Temp Sensors Etc	1	Major	0	0	0	0	0	0	0	0
2.30	2.30.21	8259	LPN	CO Hub 1 - London	Building, Tunnel and Bridge Survey	12,556	GWP	1	1	1	1	1	1	1	1
2.30	2.30.22	6826	LPN	CO Hub 1 - London	PAT Testing at Grid & Primary Substations	144	GWP	10	10	10	10	10	10	10	9
2.30	2.30.23	8260	LPN	CO Hub 1 - London	Water Quality Testing at Grid & Primary Substations	144	GWP	160	160	160	160	160	160	160	160
2.30	2.30.23	8986	LPN	CO Hub 1 - London	Description: Water Quality Testing at Primary Substations	242	GWP	485	485	485	485	485	485	485	485
2.30	2.30.24	6840	LPN	CO Hub 1 - London	Cable Tunnel Discharge Consent	3,400	GWP	17	17	17	17	17	17	17	17
2.34	2.34.07	9601	LPN	CO Hub 1 - London	Abandoned/Unidentified Cable Location	70	GWP	25	25	25	25	25	25	25	25
2.34	2.34.08	9693	LPN	CO Hub 1 - London	Noise Complaint Investigations by Operations	144	GWP	12	12	12	12	12	12	12	12



S&R - Baseline_Final ED1 Re-submission_19th February 2014_15:15															
GWP	Namp Reference	Project ID	DNO	Op Unit	Description	UCI	Project Type	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023
2.32	2.32.02	8270	LPN	CO Hub 1 - London	Graffiti Removal (Was Veg Clearance)	267	GWP	575	575	575	575	575	575	575	575
2.32	2.32.03	6451	LPN	CO Hub 1 - London	Maintain Grid Sites & Building - 132kV	742	GWP	311	311	311	311	311	311	311	311
2.32	2.32.04	6452	LPN	CO Hub 1 - London	Maintain Primary Sites & Building - 33kV	1,004	GWP	78	78	78	78	78	78	78	78
2.32	2.32.05	6453	LPN	CO Hub 1 - London	Maintain Distribution Sites & Building - 11kV	52	GWP	590	590	590	590	590	590	590	590
2.32	2.32.05	8283	LPN	CO Hub 1 - London	Demolish Abandoned/Unsafe Buildings	170,000	GWP	0	0	0	0	0	0	0	0
2.32	2.32.06	8271	LPN	CO Hub 1 - London	Vegetation Clearance - 132kV	773	GWP	134	134	134	134	134	134	134	134
2.32	2.32.06	8272	LPN	CO Hub 1 - London	Vegetation Clearance - 33kV	848	GWP	125	125	125	125	125	125	125	125
2.32	2.32.08	6392	LPN	CO Hub 1 - London	Vegetation Clearance - 11kV	52	GWP	5,040	5,040	5,040	5,040	5,040	5,040	5,040	5,040
2.32	2.32.11	9929	LPN	CO Hub 1 - London	Luxcrete Flap Maintenance	52	GWP	84	150	150	150	150	150	150	150
2.32	2.32.12	6457	LPN	CO Hub 1 - London	Maintain Fixed Fire Protection Equipment	360	GWP	122	122	122	122	122	122	122	121
2.32	2.32.13	6458	LPN	CO Hub 1 - London	Mulsifyre Systems Monthly Checks	144	GWP	31	31	31	31	31	31	31	31
2.32	2.32.15	8273	LPN	CO Hub 1 - London	Tree Trimming (Distirbution Sites)	52	GWP	14	14	14	14	14	14	14	14
2.32	2.32.15	8687	LPN	CO Hub 1 - London	Tree Trimming (Primary Sites)	1,771	GWP	8	8	8	8	8	8	8	8
2.32	2.32.15	8688	LPN	CO Hub 1 - London	Tree rimming (Grid Sites)	1,771	GWP	5	5	5	5	5	5	5	5
2.32	2.32.16	6927	LPN	CO Hub 1 - London	Maintain Portable Fire Protection Equipment	1	GWP	960	960	960	960	960	960	960	720
2.32	2.32.17	8274	LPN	CO Hub 1 - London	Cable Tunnel Maintenance	3,400	GWP	240	240	240	240	240	240	240	240
2.32	2.32.18	8275	LPN	CO Hub 1 - London	Cable Bridge Maintenance - LPN	3,115	GWP	57	57	57	57	57	57	57	57
2.33	2.33.02	9591	LPN	CO Hub 1 - London	Defect Repair - Secondary Substation Civils	52	GWP	11,652	11,772	11,888	12,008	12,128	12,248	12,372	12,496
2.33	2.33.03	9592	LPN	CO Hub 1 - London	Defect Repair - Grid Substation Civils	367	GWP	56	56	59	58	58	58	60	60
2.33	2.33.05	9594	LPN	CO Hub 1 - London	Cable Bridge Repairs	974	GWP	12	12	12	12	12	12	12	12
2.33	2.33.06	6459	LPN	CO Hub 1 - London	132 & 33kV Fly Tipping Site Clearance	1,004	GWP	6	6	6	6	6	6	6	6
2.33	2.33.09	8277	LPN	CO Hub 1 - London	Tunnel Non Compliance Rectification Work	3,400	GWP	47	47	47	47	47	47	47	47
2.33	2.33.15	8278	LPN	CO Hub 1 - London	Main Substation Fire Prot. System Defect Repair	3,285	GWP	20	20	20	20	20	20	20	20
2.33	2.33.17	8279	LPN	CO Hub 1 - London	Pumping Out Flooded Substations	550	GWP	290	290	290	290	290	290	290	290
2.33	2.33.18	8353	LPN	CO Hub 1 - London	Asbestos Survey - Remedial Works	1,060	GWP	25	25	25	25	25	25	25	25
2.33	2.33.19	8280	LPN	CO Hub 1 - London	Water Testing - Remedial Works	242	GWP	26	26	26	26	26	26	26	26
2.33	2.33.20	8281	LPN	CO Hub 1 - London	Fire Risk Assessment - Remedial Work	95	GWP	29	29	28	29	29	29	29	29
2.33	2.33.21	6831	LPN	CO Hub 1 - London	Portable Appliance Removal	70	GWP	0	0	0	0	0	0	0	37
2.33	2.33.22	8282	LPN	CO Hub 1 - London	Electrical Wiring - Defect Repair at Grids	244	GWP	315	318	320	324	327	331	334	337
2.33	2.33.24	7085	LPN	CO Hub 1 - London	Electrical Wiring - Defect Repair at Secondary Substations	52	GWP	18	18	18	18	19	20	19	19
2.33	2.33.25	8457	LPN	CO Hub 1 - London	Drainage Inspection & Maintenance	242	GWP	4	4	4	4	4	4	4	4



ED1 Expenditure (£k)

SR_Table J															
S&R - Baseline Final ED1 Re-submission_19th February 2014_15:15															
GWPID	Namp Line	Project ID	Operational Unit	DNO	Description	Project Type	Budget Type	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023
1.08	1.08.01	8350	CP Hub 1 - London	LPN	Improve Grid and Primary Security	GWP	Capex	86,730	86,730	86,730	86,730	86,730	86,730	86,730	86,730
1.08	1.08.02	8351	CP Hub 1 - London	LPN	Improve Distribution Security	GWP	Capex	61,053	61,053	61,053	61,053	61,053	61,053	61,053	61,053
1.08	1.08.04	6476	CP Hub 1 - London	LPN	Distribution Substation Lock Upgrade Installation	GWP	Capex	4,018,005	2,869,896	0	0	0	0	0	0
1.08	1.08.05	6735	CP Hub 1 - London	LPN	Grid & Primary Substation Security Access System Installation	GWP	Capex	184,631	184,631	184,631	184,631	184,631	184,631	184,631	184,631
1.20	1.20.06	8352	PD Hub 1 - London	LPN	LPN Cable Tunnel Safety Radio Systems	GWP	Capex	116,566	116,566	116,566	116,566	116,566	116,566	116,566	116,566
1.20	1.20.09	9419	CP Hub 1 - London	LPN	Removal of Asbestos	GWP	Capex	103,985	103,985	103,985	103,985	103,985	103,985	103,985	103,985
1.20	1.20.17	6283	PD Hub 1 - London	LPN	CO2 Bottle Replacement - Statutory Provision	Major	Capex	234,996	234,996	234,996	234,996	234,996	176,247	0	0
1.20	1.20.18	9755	CP Hub 1 - London	LPN	Asbestos Survey Distribution Sites - Outdoor	GWP	Capex	157,582	157,582	157,582	157,582	157,421	157,421	157,421	117,945
1.20	1.20.43	6778	Asset Optimisation	LPN	Grid Substation Fire Risk Assessment	GWP	Capex	2,605	0	0	0	0	0	0	0
1.20	1.20.44	6779	PD Hub 1 - London	LPN	Primary Substation Fire Risk Assessment	GWP	Capex	0	0	0	0	0	0	0	0
1.20	1.20.46	7086	Asset Optimisation	LPN	Grid Substation FRA Review LPN	GWP	Capex	9,551	9,551	9,551	9,551	9,551	9,551	9,551	7,102
1.20	1.20.47	9442	CP Hub 1 - London	LPN	Primary Substation FRA Review	GWP	Capex	28,530	28,530	28,530	28,530	28,530	28,530	28,530	28,530
1.20	1.20.49	6822	CP Hub 1 - London	LPN	Tunnel Fire Risk Assessments	GWP	Capex	0	0	0	0	0	0	0	0
1.30	1.30.02	9430	PD Hub 1 - London	LPN	Oil Containment at Primary Substations	GWP	Capex	887,748	397,956	397,956	397,956	397,956	397,956	397,956	397,956
1.30	1.30.05	6309	CP Hub 1 - London	LPN	Cleanup Oil Contaminated Site to Prevent External Pollution	GWP	Capex	34,969	34,969	34,969	34,969	34,969	34,969	34,969	34,969
1.47	1.47.01	6319	CP Hub 1 - London	LPN	Sanding and Capping Programme - Secondary Substations	GWP	Capex	121,468	121,468	121,468	121,468	121,468	121,468	121,468	121,958
1.47	1.47.02	6321	CP Hub 1 - London	LPN	LPN Cable Tunnel Refurbishment ED1	GWP	Capex	582,826	582,826	582,826	582,826	582,826	582,826	582,826	582,826
1.47	1.47.03	6323	PD Hub 1 - London	LPN	LPN Cable Bridge Refurbishment	GWP	Capex	291,414	291,414	291,414	291,414	291,414	291,414	291,414	291,414
1.47	1.47.08	9467	CP Hub 1 - London	LPN	Civil Works at Grid & Primary Substations	Major	Capex	320,000	320,000	320,000	320,000	320,000	320,000	320,000	320,000
1.47	1.47.17	8218	CP Hub 1 - London	LPN	TC Sump Pump Replacement	GWP	Capex	41,149	41,149	41,149	41,149	41,149	41,149	41,149	41,149
1.47	1.47.19	8219	CP Hub 1 - London	LPN	TC Replace Pavement Hatches	GWP	Capex	88,591	88,591	88,591	88,591	88,591	88,591	88,591	88,591
1.47	1.47.21	8794	PD Hub 1 - London	LPN	Enhance Primary Fencing	GWP	Capex	95,252	95,252	95,252	95,252	95,252	95,252	95,252	79,377
1.47	1.47.24	8220	CO Hub 1 - London	LPN	LPN Cable Tunnel Pump and Alarm Maintenance	GWP	Capex	219,037	219,037	219,037	219,037	219,037	219,037	219,037	219,037
1.47	1.47.29	8221	CP Hub 1 - London	LPN	Replacement of Dist S/S Brick Surround	GWP	Capex	60,488	60,488	60,488	60,488	60,488	60,488	60,488	60,488
1.47	1.47.30	8222	CP Hub 1 - London	LPN	Replacement of Dist S/S Surround (Non Brick)	GWP	Capex	112,738	112,738	112,738	112,738	112,738	112,738	112,738	112,738
1.47	1.47.31	8411	CP Hub 1 - London	LPN	Replacement of Dist S/S Gates	GWP	Capex	98,571	98,571	98,571	98,571	98,571	93,877	93,877	70,408
1.47	1.47.32	8223	CP Hub 1 - London	LPN	Dist S/S Building - Minor Asset Replacement	GWP	Capex	168,198	168,198	168,198	168,198	168,198	168,198	168,198	168,198
1.47	1.47.33	8224	CP Hub 1 - London	LPN	Dist S/S Building - Replace Roof	GWP	Capex	681,945	681,945	681,945	681,945	681,945	681,945	681,945	516,625
1.47	1.47.33	8233	PD Hub 1 - London	LPN	Grid/Primary - Replace Compound Floodlighting	GWP	Capex	5,828	5,828	5,828	5,828	5,828	5,828	5,828	5,828
1.47	1.47.34	8225	CP Hub 1 - London	LPN	Dist S/S Building - Replace Door	GWP	Capex	280,430	280,430	280,430	280,430	280,430	280,430	280,430	280,430
1.47	1.47.35	8226	CP Hub 1 - London	LPN	Dist S/S Building - Replace Guttering	GWP	Capex	61,842	61,842	61,842	61,842	61,842	61,842	61,842	61,842
1.47	1.47.36	8227	CP Hub 1 - London	LPN	Dist S/S Building - Rewire	GWP	Capex	497,582	497,582	497,582	497,582	497,582	497,582	497,582	497,582
1.47	1.47.38	8228	CP Hub 1 - London	LPN	Dist S/S Building - Install New LV Service	GWP	Capex	61,816	61,816	61,816	61,816	61,816	61,816	61,816	51,566
1.47	1.47.50	8229	CP Hub 1 - London	LPN	Grid - Replace Roof	GWP	Capex	32,102	32,102	32,102	32,102	32,102	32,102	32,102	48,153

SR_Table J															
S&R - Baseline Final ED1 Re-submission_19th February 2014_15:15															
GWPID	Namp Line	Project ID	Operational Unit	DNO	Description	Project Type	Budget Type	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023
1.47	1.47.50	8784	CP Hub 1 - London	LPN	Primary - Replace Roof	GWP	Capex	96,305	96,305	96,305	96,305	96,305	96,305	96,305	128,407
1.47	1.47.51	8230	CP Hub 1 - London	LPN	Grid - Replace Bounday Brick Wall	GWP	Capex	12,993	12,993	12,993	12,993	12,993	12,993	12,993	25,986
1.47	1.47.51	8787	CP Hub 1 - London	LPN	Primary - Replace Boundary Brick Wall	GWP	Capex	25,986	25,986	12,993	12,993	12,993	12,993	12,993	64,964
1.47	1.47.52	8231	CP Hub 1 - London	LPN	Grid - Replace Heating	GWP	Capex	15,897	15,897	15,897	15,897	15,897	15,897	15,897	15,897
1.47	1.47.52	8788	CP Hub 1 - London	LPN	Primary - Replace Heating	GWP	Capex	37,093	37,093	37,093	37,093	37,093	37,093	37,093	37,093
1.47	1.47.53	8232	CP Hub 1 - London	LPN	Grid - Rewire	GWP	Capex	93,709	93,709	93,709	93,709	93,709	93,709	93,709	93,709
1.47	1.47.53	8789	CP Hub 1 - London	LPN	Primary - Rewire	GWP	Capex	187,419	187,419	187,419	187,419	187,419	187,419	234,274	187,419
1.47	1.47.54	6491	CP Hub 1 - London	LPN	Grid/Primary - Replace Compound Floodlighting	Major	Capex	0	0	0	0	0	0	0	0
1.47	1.47.55	8234	CP Hub 1 - London	LPN	Grid- Replace Doors	GWP	Capex	8,498	8,498	8,498	8,498	8,498	8,498	8,498	8,498
1.47	1.47.55	8790	CP Hub 1 - London	LPN	Primary - Replace Doors	GWP	Capex	16,996	16,996	16,996	16,996	16,996	16,996	16,996	19,828
1.47	1.47.58	8235	CP Hub 1 - London	LPN	Grid - Replace Compound Trench Covers	GWP	Capex	967	967	967	967	967	967	967	967
1.47	1.47.58	8793	CP Hub 1 - London	LPN	Primary - Replace Compound Trench Covers	GWP	Capex	967	967	967	967	967	967	967	967
1.47	1.47.59	8236	CP Hub 1 - London	LPN	Primary - Internal Refurbishment	GWP	Capex	4,266	4,266	4,266	4,266	4,266	4,266	4,266	4,266
1.47	1.47.61	8237	PD Hub 1 - London	LPN	Substation Flooding (Grid)	GWP	Capex	291,414	291,414	291,414	291,414	291,414	291,414	291,414	291,414
1.47	1.47.62	8238	PD Hub 1 - London	LPN	Substation Flooding (Primary)	GWP	Capex	174,849	174,849	174,849	174,849	174,849	174,849	174,849	174,849
1.47	1.47.63	8239	CP Hub 1 - London	LPN	Enhance Grid Fencing	GWP	Capex	37,043	37,043	37,043	37,043	37,043	37,043	37,043	31,751
1.47	1.47.64	8241	PD Hub 1 - London	LPN	Substation Major Structure Replacement	GWP	Capex	163,182	163,182	163,182	163,182	163,182	163,182	163,182	163,182
1.47	1.47.65	8242	PD Hub 1 - London	LPN	Substation Pressure Relief - Explosion Vents	GWP	Capex	1,550	1,550	1,550	1,550	1,550	1,550	1,550	1,550
1.47	1.47.66	8243	PD Hub 1 - London	LPN	Drainage Replacement	GWP	Capex	0	0	0	0	0	0	0	0
2.30	2.30.10	9893	CO Hub 1 - London	LPN	Mulsifyre Inspection & Testing	GWP	Opex	1,872	1,872	1,872	1,872	1,872	1,872	1,872	1,872
2.30	2.30.13	6442	CO Hub 1 - London	LPN	Cable Bridge Inspections - LPN	GWP	Opex	28,500	28,500	28,500	28,500	28,500	28,500	28,500	28,500
2.30	2.30.14	6445	CO Hub 1 - London	LPN	Cable Tunnel Inspections	GWP	Opex	163,228	163,228	163,228	163,228	163,228	163,228	163,228	163,228
2.30	2.30.16	6448	CO Hub 1 - London	LPN	Council Subway Survey / Inspection	GWP	Opex	163,228	163,228	163,228	163,228	163,228	163,228	163,228	163,228
2.30	2.30.18	8257	CO Hub 1 - London	LPN	Annual Maint Contracts for Tunnel Gas Detectors, Temp Sensors Etc	GWP	Opex	0	0	0	0	0	0	0	0
2.30	2.30.21	8259	CO Hub 1 - London	LPN	Building, Tunnel and Bridge Survey	GWP	Opex	12,556	12,556	12,556	12,556	12,556	12,556	12,556	12,556
2.30	2.30.22	6826	CO Hub 1 - London	LPN	PAT Testing at Grid & Primary Substations	GWP	Opex	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,296
2.30	2.30.23	8260	CO Hub 1 - London	LPN	Water Quality Testing at Grid & Primary Substations	GWP	Opex	23,040	23,040	23,040	23,040	23,040	23,040	23,040	23,040
2.30	2.30.23	8986	CO Hub 1 - London	LPN	Description: Water Quality Testing at Primary Substations	GWP	Opex	117,370	117,370	117,370	117,370	117,370	117,370	117,370	117,370
2.30	2.30.24	6840	CO Hub 1 - London	LPN	Cable Tunnel Discharge Consent	GWP	Opex	57,800	57,800	57,800	57,800	57,800	57,800	57,800	57,800
2.32	2.32.02	8270	CO Hub 1 - London	LPN	Graffiti Removal (Was Veg Clearance)	GWP	Opex	153,566	153,566	153,566	153,566	153,566	153,566	153,566	153,566
2.32	2.32.03	6451	CO Hub 1 - London	LPN	Maintain Grid Sites & Building - 132kV	GWP	Opex	230,709	230,709	230,709	230,709	230,709	230,709	230,709	230,709
2.32	2.32.04	6452	CO Hub 1 - London	LPN	Maintain Primary Sites & Building - 33kV	GWP	Opex	78,317	78,317	78,317	78,317	78,317	78,317	78,317	78,317
2.32	2.32.05	6453	CO Hub 1 - London	LPN	Maintain Distribution Sites & Building - 11kV	GWP	Opex	30,680	30,680	30,680	30,680	30,680	30,680	30,680	30,680
2.32	2.32.05	8283	CO Hub 1 - London	LPN	Demolish Abandoned/Unsafe Buildings	GWP	Opex	40,562	4,998	4,998	4,998	4,998	4,998	4,998	5,006
2.32	2.32.06	8271	CO Hub 1 - London	LPN	Vegetation Clearance - 132kV	GWP	Opex	103,644	103,644	103,644	103,644	103,644	103,644	103,644	103,644
2.32	2.32.06	8272	CO Hub 1 - London	LPN	Vegetation Clearance - 33kV	GWP	Opex	105,992	105,992	105,992	105,992	105,992	105,992	105,992	105,992
2.32	2.32.08	6392	CO Hub 1 - London	LPN	Vegetation Clearance - 11kV	GWP	Opex	262,080	262,080	262,080	262,080	262,080	262,080	262,080	262,080

SR_Table J		S&R - Baseline Final ED1 Re-submission_19th February 2014_15:15													
GWPID	Namp Line	Project ID	Operational Unit	DNO	Description	Project Type	Budget Type	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023
2.32	2.32.11	9929	CO Hub 1 - London	LPN	Luxcrete Flap Maintenance	GWP	Opex	4,368	7,800	7,800	7,800	7,800	7,800	7,800	7,800
2.32	2.32.12	6457	CO Hub 1 - London	LPN	Maintain Fixed Fire Protection Equipment	GWP	Opex	43,920	43,920	43,920	43,920	43,920	43,920	43,920	43,560
2.32	2.32.13	6458	CO Hub 1 - London	LPN	Mulsifyre Systems Monthly Checks	GWP	Opex	4,464	4,464	4,464	4,464	4,464	4,464	4,464	4,464
2.32	2.32.15	8273	CO Hub 1 - London	LPN	Tree Trimming (Distirbution Sites)	GWP	Opex	728	728	728	728	728	728	728	728
2.32	2.32.15	8687	CO Hub 1 - London	LPN	Tree Trimming (Primary Sites)	GWP	Opex	14,165	14,165	14,165	14,165	14,165	14,165	14,165	14,165
2.32	2.32.15	8688	CO Hub 1 - London	LPN	Tree rimming (Grid Sites)	GWP	Opex	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853
2.32	2.32.16	6927	CO Hub 1 - London	LPN	Maintain Portable Fire Protection Equipment	GWP	Opex	960	960	960	960	960	960	960	720
2.32	2.32.17	8274	CO Hub 1 - London	LPN	Cable Tunnel Maintenance	GWP	Opex	816,000	816,000	816,000	816,000	816,000	816,000	816,000	816,000
2.32	2.32.18	8275	CO Hub 1 - London	LPN	Cable Bridge Maintenance - LPN	GWP	Opex	177,555	177,555	177,555	177,555	177,555	177,555	177,555	177,555
2.33	2.33.02	9591	CO Hub 1 - London	LPN	Defect Repair - Secondary Substation Civils	GWP	Opex	605,904	612,144	618,176	624,416	630,656	636,896	643,344	649,792
2.33	2.33.03	9592	CO Hub 1 - London	LPN	Defect Repair - Grid Substation Civils	GWP	Opex	20,571	20,571	21,673	21,306	21,306	21,306	22,040	22,040
2.33	2.33.05	9594	CO Hub 1 - London	LPN	Cable Bridge Repairs	GWP	Opex	11,694	11,694	11,694	11,694	11,694	11,694	11,694	11,694
2.33	2.33.06	6459	CO Hub 1 - London	LPN	132 & 33kV Fly Tipping Site Clearance	GWP	Opex	6,024	6,024	6,024	6,024	6,024	6,024	6,024	6,024
2.33	2.33.09	8277	CO Hub 1 - London	LPN	Tunnel Non Compliance Rectification Work	GWP	Opex	159,800	159,800	159,800	159,800	159,800	159,800	159,800	159,800
2.33	2.33.15	8278	CO Hub 1 - London	LPN	Main Substation Fire Prot. System Defect Repair	GWP	Opex	65,693	65,693	65,693	65,693	65,693	65,693	65,693	65,693
2.33	2.33.17	8279	CO Hub 1 - London	LPN	Pumping Out Flooded Substations	GWP	Opex	159,500	159,500	159,500	159,500	159,500	159,500	159,500	159,500
2.33	2.33.18	8353	CO Hub 1 - London	LPN	Asbestos Survey - Remedial Works	GWP	Opex	26,505	26,505	26,505	26,505	26,505	26,505	26,505	26,505
2.33	2.33.19	8280	CO Hub 1 - London	LPN	Water Testing - Remedial Works	GWP	Opex	6,292	6,292	6,292	6,292	6,292	6,292	6,292	6,292
2.33	2.33.20	8281	CO Hub 1 - London	LPN	Fire Risk Assessment - Remedial Work	GWP	Opex	2,752	2,752	2,657	2,752	2,752	2,752	2,752	2,752
2.33	2.33.21	6831	CO Hub 1 - London	LPN	Portable Appliance Removal	GWP	Opex	8	8	8	8	9	9	9	2,588
2.33	2.33.22	8282	CO Hub 1 - London	LPN	Electrical Wiring - Defect Repair at Grids	GWP	Opex	76,822	77,554	78,042	79,017	79,749	80,724	81,456	82,188
2.33	2.33.24	7085	CO Hub 1 - London	LPN	Electrical Wiring - Defect Repair at Secondary Substations	GWP	Opex	936	936	936	936	988	1,047	988	988
2.33	2.33.25	8457	CO Hub 1 - London	LPN	Drainage Inspection & Maintenance	GWP	Opex	968	968	968	968	968	968	968	968

Appendix 6- Sensitivity Analysis

Not applicable.

Appendix 7- Named Schemes

Not applicable.