Annex O

Assessment of RP6 Network Investment Direct Allowances

Draft Determination

24 March 2017



About the Utility Regulator

The Utility Regulator is the independent non-ministerial government department responsible for regulating Northern Ireland's electricity, gas, water and sewerage industries, to promote the short and long-term interests of consumers.

We are not a policy-making department of government, but we make sure that the energy and water utility industries in Northern Ireland are regulated and developed within ministerial policy as set out in our statutory duties.

We are governed by a Board of Directors and are accountable to the Northern Ireland Assembly through financial and annual reporting obligations.

We are based at Queens House in the centre of Belfast. The Chief Executive leads a management team of directors representing each of the key functional areas in the organisation: Corporate Affairs; Electricity; Gas; Retail and Social; and Water. The staff team includes economists, engineers, accountants, utility specialists, legal advisors and administration professionals.

Our Mission	Value and sustainability in energy and water.
Our Vision	We will make a difference for consumers by listening, innovating and leading.

Our Values

Be a best practice regulator: transparent, consistent, proportional, accountable, and targeted

Be a united team

Be collaborative and co-operative

Be professional

Listen and explain

Make a difference

Act with integrity

Contents

1 Introduction

Overview

1.1 This Annex sets out our assessment of NIE Networks proposals for direct network investment which forms part of the overall capital investment proposed by the company for RP6.

1.2 Direct investment are those activities which involve physical contact with network system assets such as refurbishment or reinforcement of existing assets and the creation of new assets. Other strands of investment not covered in this section include indirect expenditure and metering.

1.3 Direct network investment is treated in one of two ways in this Price Control:

i) investment for which an ex-ante allowance is included in this determination; and,

ii) investment carried out under the 'D5 mechanism' where an estimate included for costs which will be determined at a later date when the need for the project has been confirmed and the scope, cost and programme developed.

1.4 NIE Networks proposed direct investment in the distribution and transmission networks in RP6 of £446.5m in 2015/16 prices prior to the application of real price effects and on-going efficiencies. This included an estimate of major transmission maintenance projects which will be assessed under the D5 mechanism. Taking account of this and £10.5m of investment of which is planned for the latter half of RP6 to address load growth due to the projected uptake of low carbon technology, we have identified £383.4m of planned direct network investment in the company's submission for which we have determined an ex-ante allowance of £336.2m (before the application of frontier shift). This movement from the NIE Networks business plan submission to the draft determination is shown in Table 1.1 below.

	Distribution	Transmission	Total
NIE Networks Business Plan submission	342.1	104.4	446.5
Less D5 estimates included in the investment plan	-4.3	-48.3	-52.6
Less D57 LCT funding held for Mid-term Review	-10.5	0.0	-10.5
Business plan core investment net of estimates	327.3	56.1	383.4
Confirmed adjustments by NIE Networks post engagement	-12.6	-8.5	-21.1
Business plan core investment net of post engagement adjustments	314.7	47.6	362.3
UR adjustments to the core investment plan	-26.1	0.0	-26.1
Draft determination of core investment plan	288.6	47.6	336.2
Add back D5 estimates included in the investment plan	4.3	53.6*	57.9
Add back D57 LCT funding held for Mid Term Review	10.5	0.0	10.5
Draft determination including D5 estimates included in the business plan submission.	303.4	101.2	404.6

* We increased the estimated cost of BPS - Castlereagh (T601) project based on NIE Networks revised submission

Table 1.1: Change in direct network investment from the business plan submission to the draft determination

1.5 The treatment of D5 investment included in the business plan submission is set out in Section 6 below, beginning at paragraph 6.1. The treatment the £10.6m of direct investment planned for the latter half of RP6 to address load growth due to the projected uptake of low carbon technology is described below beginning paragraph 4.17.

1.6 For the remaining core investment, we have carried out a detailed assessment and challenge of the company's proposals, considering both the need for the work proposed, the scope of work proposed and estimated cost of the work. We have been assisted in this assessment by our technical consultants GHD whose experience covers the assessment and delivery of similar works in Northern Ireland, in GB and internationally.

1.7 We have concluded that an efficient cost of investment to maintain and develop the network as proposed by NIE Networks in its Business Plan is £336.2m before the application of real price effects and on-going efficiencies.

1.8 In this annex, all costs reported in 2015/16 prices and before the application of real price effects and the application of on-going efficiencies

1.9 In addition to the work necessary to maintain and enhance the distribution and transmission networks, further work is expected to be identified in the future to improve the capacity or capability of the transmission network. This could be a material strand of investment but the scope, timing and costs of the work which will be done are highly uncertain. In the RP5, efficient allowances for this type of work have been determined on a case by case basis as the work is confirmed. We intend to continue this approach in RP6. We have undertaken a preliminary assessment of the potential costs of this work, having taken advice from the Transmission Systems Operation (TSO) SONI which is described in Section 8.

Identification of allowances

1.10 The various distribution and transmission programmes and allowances have been identified by a numbering system and are shown in Tables 1.2 and 1.3 below. It should be noted that we intend to rationalise the numbering system for the allowances in our Final Determination document

Programme	Description
D06	Distribution Tower Lines
D07	33kV Overhead Lines
D08	11kV Overhead Lines
D09	LV Overhead Lines
D10	Undereaves
D11	LV cut-outs
D13	Primary Plant
D14	Primary Transformers
D15	Secondary Substations
D16	Distribution Cables
D39	SCADA
D41	Operational Telecoms network
D43	ESQCR - Distribution
D50	Substation Flooding Enforcement (D)
D57	Distribution Network Reinforcement
D101	Network Alterations
D601	33kV Congestion
D602	Investing for the Future
D603	Distribution Protection
D604	Connection Driven System Work
D605	Network Access & Commissioning

Table 1.2 – Distribution Programmes

Programme	Description
T06	Transmission Plant Switch Houses
T10	110kV Switchgear Replacement
T11	275kV Plant Ancillaries
T12	110kV Plant Ancillaries
T13	275kV/110kV Transformer Replacement
T14	110/33kV Transformers Replacement
T15	22kV Reactor Replacement
T16	Transmission Transformer Refurbishment
T17	275kV Overhead Line Asset Replacement
T19	110kV Overhead Line Asset Replacement
T20	Transmission Cables
T40	Transmission ESQCR
T602	Transmission Protection
T603	Network Access & Commissioning

Table 1.3 – Transmission Programmes

2 Distribution Asset Replacement and Refurbishment Expenditure

Plant Asset Replacement

D13 - Primary Plant – Primary Switchgear

D13 - Scope of work

2.1 Distribution primary plant covers the major electrical equipment located in 33/11kV substations. These substations can be either indoor with transformers and switchgear located in buildings or outdoor located in fenced sites.

2.2 The substations contain transformers which reduce voltage from 33kV to 11kV or 6.6kV and switchgear which is used to route power flow into or out of selected circuits or items of plant and to isolate faulty equipment or circuits.

2.3 Substations also contain ancillary equipment such as batteries and chargers and AC and DC substation supply systems, protection and telecommunication systems together with the substation infrastructure including fencing, security, access roads, foundations, cable trenches or ducts, drainage, oil bunds, oil water separators, lighting and heating and dehumidifiers

2.4 Replacement of primary transformers is covered under a separate allowance (D14).

2.5 The outputs within this allowance are defined by the various types of equipment mentioned above.

D13 - NIE Networks RP6 proposal

2.6 NIE Networks has set out its plans for investment in Primary Switchgear in Section 6.1 of its RP6 Network Investment Plan, beginning at paragraph 555. These plans are summarised in Table 2.1 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
33kV Indoor Switchgear	Each	36	137.665	4,955.940
33kV Outdoor Switchgear	Each	46	54.841	2,522.686
33kV Outdoor to Indoor Switchgear	Each	42	111.984	4,703.328
33kV Outdoor switchgear wood pole Mesh Replacement	Site	6	128.000	768.000
Primary switchgear (11kV & 6.6kV)	Each	200	46.586	9,317.200
Building refurbishment	Each	8	12.969	103.752
Civil works to primary substations	Each	40	40.000	1,600.000
Substation Site Costs	Lump sum			900.000
Rows below itemise RP6 sub-programmes for which there are no comparable RP5 costs or volumes				

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Primary switchgear (11kV & 6.6kV) Retrofit	Each	57	23.894	1,361.958
Primary S/S DC System	Each	60	12.748	764.880
Primary S/S rewire (inc. AC services panel)	Each	30	18.730	561.900
Plant Painting (primary)	Each	40	2.500	100.000
EFI replacement programme	Each	200	1.000	200.000
33kV Capacitor Bank	Each	2	148.288	296.576
11kV Capacitor Bank	Each	4	85.958	343.832
				28,500.052

Table 2.1 - NIE Networks proposed investment in Primary Switchgear

D13 – Draft determination

2.7 For most of the asset types, NIE Networks has provided a supporting annex describing the asset and providing brief details of the condition and performance of the equipment, in support of the needs case for investment. We used this information together with NIE Networks forecast outturn report to determine run rates and unit costs.

2.8 Although expenditure for 33kV switchgear is reported in the Network Investment RIGs, NIE Networks have reported very little completed volume data; hence we also used the RP5 Outturn Report (Section 3 of the RP6 Network Investment Plan) and the Business Plan Templates to assist us with developing our draft determination.

2.9 We accepted the volumes proposed by NIE Networks for all sub-programmes as we found the run-rates to be similar with those allowed in RP5.

2.10 We reduced the RP6 unit costs for the following items

- 33kV Indoor Switchgear
- 33kV Outdoor Switchgear
- 33kV Outdoor to Indoor Switchgear
- Primary Switchgear (11kV & 6.6kV)

2.11 33kV Indoor Switchgear

i) In the RP6 Business Plan Templates, NIE Networks forecast that they will replace 39 units at a cost of £4,439k. We used this information to derive a unit cost of £113.83k

ii) During pre-draft determination engagement NIE Networks informed us that they had not taken into account the use of more expensive double bus-bar units in their RP5 forecast outturn figures stated above. They further informed

us that 76% of the 33kV indoor switchgear installed in RP5 will be double bus-bar type; therefore, our initial assessment of RP6 allowances was incorrect.

iii) We re-examined the actual outturn costs reported in Network Investment RIGs for 33kV Indoor switchgear replacement and found that, to March 2016, NIE Networks have expended 67% of their RP5 allowance but have completed no outputs. Given the proportion of allowance expended to date we are left with no option than to assume that outturn expenditure includes double bus-bar switchgear, consequently, we were not convinced that the more expensive switchgear has been omitted from our analysis.

2.12 33kV Outdoor Switchgear

i) In the RP6 Business Plan Templates, NIE Networks forecast that they will replace 23 units at a cost of £1,153k. We used this information to derive a unit cost of £50.13k

2.13 33kV Outdoor to Indoor Switchgear

i) In the RP6 Business Plan Templates, NIE Networks forecast that they will replace 57 units at a cost of £5,566k. We used this information to derive a unit cost of £97.64k

2.14 Primary Switchgear (11kV & 6.6kV)

i) In the RP6 Business Plan Templates, NIE Networks forecasted that they will replace 261 units at a cost of £11,511k. We used this information to derive a unit cost of £44.10k

2.15 Our draft determination of direct allowance in RP6 and the associated outputs for Primary Switchgear is shown in Table 2.2 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
33kV Indoor Switchgear	Each	36	113.835	4,098.051
33kV Outdoor Switchgear	Each	46	50.133	2,306.110
33kV Outdoor to Indoor Switchgear	Each	42	97.643	4,101.002
33kV Outdoor switchgear wood pole Mesh Replacement	Site	6	128.000	768.000
Primary switchgear (11kV & 6.6kV)	Each	200	44.104	8,820.767
Building refurbishment	Each	8	12.969	103.752
Civil works to primary substations	Each	40	40.000	1,600.000
Substation Site Costs	Lump Sum			900.000
Rows below itemise RP6 sub-programmes for which there are no comparable RP5 costs or volumes				
Primary switchgear (11kV & 6.6kV) Retrofit	Each	57	23.894	1,361.958
Primary S/S DC System	Each	60	12.748	764.880
Primary S/S rewire (inc. AC services panel)	Each	30	18.730	561.900
Plant Painting (primary)	Each	40	2.500	100.000

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
EFI replacement programme	Each	200	1.000	200.000
33kV Capacitor Bank	Each	2	148.288	296.576
11kV Capacitor Bank	Each	4	85.958	343.832
				26,326.827

Table 2.2 – Draft determination of allowance and outputs for Primary Switchgear

D14 – Primary Plant - Primary Transformers

D14 - Scope of work

2.16 Transformers are used at substations to step the system voltage either up or down.

2.17 NIE Networks classify their 33kV substations as “primary” substations; hence, the power transformers located at these substations are called “primary transformers”.

2.18 Generally, primary transformers are used to step 33kV down to 11kV (or 6.6kV in certain parts of Belfast).

2.19 Transformers tend to become electrically and mechanically unstable as they age.

i) The windings can move and become loose due to the constant vibrations caused by the transformation process

ii) The paper insulation around the windings degrades and becomes less effective.

iii) The oil which provides electrical insulation and cooling becomes contaminated

2.20 Even with good maintenance programmes transformers have a finite service life but it is not good practice to run primary transformers to failure given the potential health and safety issues associated with a catastrophic failure.

D14 - NIE Networks RP6 proposal

2.21 NIE Networks has set out its plans for investment in Primary Transformers in Section 6.1 of its RP6 Network Investment Plan beginning at paragraph 646. These plans are summarised in Table 2.3 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Replace 33/11kV Transformer (up to 6.25MVA)	Each	14	185.613	2,598.582
Replace 33/11kV Transformer (up to 12.5MVA)	Each	2	228.700	457.400
Replace 33/11kV & 33/6.6kV Transformer (up to 18.75MVA)	Each	14	273.543	3,829.602
Procure Spare 33/11kV Transformer (15/18.75MVA)	Each	2	175.525	351.050
Transformer refurbishment	Each	6	80.000	480.000
				7,716.634

Table 2.3 – NIE Networks proposed investment in Primary Transformers

D14 – Draft determination

2.22 NIE Networks has provided a supporting annex, describing the asset and providing brief details of the condition and performance of the equipment, in support of the needs case for investment. We used this information together with NIE Networks forecast outturn report and annual RIGs reporting to determine run rates and unit costs.

2.23 With the exception of procuring spare transformers we accepted the volumes proposed by NIE Networks for all sub-programmes as we found the run-rates to be lower than RP5.

2.24 We also accepted the unit costs proposed by NIE Networks as these are lower than RP5 outturn costs.

2.25 We disallowed the procurement of spare transformers as we were not convinced that they were required given the mitigation of risk provided by the volume of transformers being procured during RP6 for business-as-usual replacement. Furthermore, NIE Networks managed network risks during RP5 price control period without the need to purchase spare transformers.

2.26 Our draft determination of direct allowance in RP6 and the associated outputs for Primary Transformers is shown in Table 2.4 below

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Replace 33/11kV Transformer (up to 6.25MVA)	Each	14	185.61	2,598.582
Replace 33/11kV Transformer (up to 12.5MVA)	Each	2	228.70	457.400
Replace 33/11kV & 33/6.6kV Transformer (up to 18.75MVA)	Each	14	273.54	3,829.602
Transformer refurbishment	Each	6	80.00	480.000
				7,365.584

Table 2.4 – Draft determination of allowance and outputs for Primary Transformers

D15 – Secondary Plant - Secondary Substations

D15 - Scope of work

2.27 Investment in this category relates to the replacement or refurbishment of secondary substation plant. The scope of assets within this investment category covers all types of 6.6/0.4kV and 11/0.4kV substations that contain high voltage equipment together with the associated low voltage equipment. This may be either located in a cabinet or be wall mounted, open terminal.

2.28 The smaller transformers may be pole mounted and could supply only one customer while others may feed up to 100 customers. Smaller transformers will be mounted on a single pole while some larger transformers may be mounted on an H-pole or a 4-pole structure.

2.29 The largest substations will be ground mounted located in either a brick building or a fibre glass or steel enclosure. These substations can supply up to 500 customers. In some instances, one or more secondary substations may supply a single commercial or industrial premise.

2.30 The most common form of high voltage switchgear is a ring main unit (RMU) consisting of 3 switching devices, two of which control the flow of power in the main circuit while the third device switches power to the transformer.

D15 - NIE Networks RP6 proposal

2.31 For each of the asset categories described in the above table NIE Networks provided a supporting annex describing the asset and providing brief details of the condition and performance of the equipment, in support of the needs case for investment.

2.32 For substation and RMU replacements, the main driver for investment is the age and condition of the equipment – a number of RMUs are subject to operational restriction. Recorded numbers of catastrophic failures have risen, due to age and condition related defects. Outdoor equipment is more susceptible to failure due to corrosion and moisture ingress. Approximately 18% of equipment was installed between 1956 (60 years old) and 1976 (40 years old).

2.33 The majority of secondary switchboards contain Reyrolle B and C switchgear installed between 1940s and early 1970s (located indoors). Asset condition assessments have identified age and condition related deterioration and defects. There is an increased maintenance burden and the lack of spare parts from the original equipment manufacturers also present a risk, together with the increased risk to operators due to ongoing deterioration of equipment.

2.34 For ground mounted transformers fed from HV overhead lines, the main drivers relate to the transformers being subject to corrosion, moisture ingress and oil leaks. In addition, the wood pole and associated equipment (including steel work and LV kiosk) is in poor condition and in some cases does not comply with current standards.

2.35 For transformer substations mounted on 4-pole structures, the replacement need is based on the general deterioration of the main components associated with the substation; the wooden LV kiosks are susceptible to acute decay and the structures are generally located in public areas – posing a greater risk to the public. The risk analysis process has identified 225 existing 4-pole structurers classed as high priority for intervention.

2.36 Low voltage mini pillars are generally located in open public areas, often adjacent to customer's premises and are subject to age-related deterioration of pillar walls and doors. In addition, they are susceptible to third party interference and present a safety risk due to the possible exposure of live equipment to members of the public and possible failure of plant resulting in explosion and risk to the safety of operational staff.

2.37 NIE Networks has set out its plans for investment in Secondary Substations in Section 6.1 of its RP6 Network Investment Plan beginning at paragraph 660. These plans are summarised in Table 2.5 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Replace RMU	Each	80	7.772	621.786
Replace complete S/S	Each	395	37.061	14,639.142
Replace complete S/S and temporary S/S works	Each	50	51.679	2,583.962
Replace Secondary Switchboard	Each	110	41.482	4,562.996
Replace OH fed GMT	Each	66	25.125	1,658.253
Replace H pole S/S	Each	72	13.410	965.552
Replace H pole Transformer	Each	10	4.500	45.000
Replace H pole mounted LV cabinet	Each	40	4.600	184.000
Replace 4-pole structure	Each	225	22.917	5,156.391
Repair 4-pole structure defects	Each	20	2.350	47.000
Replace sectionaliser	Each	55	11.618	638.990
Replace mini pillar	Each	1,035	3.389	3,507.615
Replace LV wall mounted fuse board	Each	50	13.509	675.445
Secondary Substation Ancillary Works	Lump Sum			2,000.000
Replace 4-pole structure mounted LV cabinet	Each	20	5.015	100.300
Refurbish LV plant	Each	20,914	0.156	3,260.490
Refurbish Substation LV cabinet	Each	30	4.050	121.500
Repair ABB LV cabinet	Each	800	0.750	600.000
RMU Substation - Mini Kiosk	Each	50	47.577	2,378.850
Refurbish 11kV GVS sectionaliser	Each	80	3.000	240.000
Secondary other	Lump Sum			435.000
Voltage Regulators	Each	3	44.914	134.743
				44,557.015

Table 2.5 – NIE Networks proposed investment in Secondary Substations

D15 – Draft determination

2.38 Through the Q&A process and a series of meetings with NIE Networks staff, we sought clarifications on a number of points relating to the RP6 programme for secondary plant. In general terms, our clarifications focused on obtaining more robust information to support the RP6 investments for certain sub-programmes (fault data, performance and condition data) and explanations regarding differences in implied asset lives (relative to Ofgem CNAIM asset lives) and unit costs (relative to RP5 outturn).

2.39 For the majority of the sub-programmes included within D15, the RP6 plan to address the asset risk and performance involves a continuation of previously established replacement/refurbishment programmes progressed in RP5 (and in some cases in RP4).

2.40 We carried out an assessment of the volume ("run-rate") of asset replacement/refurbishment works proposed by NIE Networks during the RP6 period for each of the sub-programmes and compared them against the NIE Networks RP5 forecast outturn run rates. In general, we have observed a reduction in proposed RP6 run rates across most of the sub-programmes, with the exception of RMU replacement (2.6% increase) and H-pole LV cabinet replacement (53.8% increase). Based on the low volumes of these sub-programmes, these differences are not considered material.

2.41 We have also carried out modelling of the asset replacement volumes using NIE Networks asset age profiles and industry accepted asset lives (as stated within Ofgem's CNAIM) for each of the secondary plant asset categories to determine modelled outputs for RP6. We compared these modelled outputs with the NIE Networks proposed volumes for RP6 based on their condition based assessment, for which implied asset lives can be determined from the asset replacement model.

2.42 This comparison identified there are no asset categories where NIE Networks has assigned an asset life that is greater than the Ofgem CNAIM lives; for two of the categories, the NIE Networks asset lives are aligned to the Ofgem CNAIM lives; for the remaining nine categories, the NIE Networks asset lives are lower than the Ofgem CNAIM lives. As a consequence of using shorter asset lives, the NIE Networks RP6 replacement volumes are higher than the modelled volumes.

2.43 We also carried out a qualitative assessment of the information provided by NIE Networks to support the RP6 run-rates based on their condition assessment for each of the asset categories. Following this assessment we concluded that the requested volumes for RP6 are appropriate.

2.44 To supplement the analysis above relating to proposed run rates for RP6 (compared to RP5), we also carried out a comparison of the unit cost movement across RP5 and RP6 for each of the asset categories.

2.45 Following our initial review of the RP5 and RP6 unit costs and further Q&A on unit cost increases in certain categories, NIE Networks provided an update on RP5 unit costs (Oct 16) based on more up-to-date information available to NIE Networks. It was observed that there are five of the sub-programmes where there is no material movement (or indeed a reduction) in unit costs; for the other seven sub-programmes, the RP6 unit costs proposed by NIE Networks are higher than the forecast unit costs during RP5.

2.46 We requested NIE Networks provide further explanation in support of the proposed increase in unit costs for RP6. In its response, NIE Networks provided an explanation of the main drivers resulting in an increase in RP6 unit costs. For replacement substation works, NIE Networks itemised the main drivers affecting unit costs:

i) Increased transformer costs driven by Eco directive;

ii) Enhanced LV cabinet specification to address recent corrosion issues; and

iii) Increased substation shell costs associated with new civil contract.

2.47 We would expect the updated (increased) RP5 unit costs for replacement substation works to include sufficient provision for these cost increases and we do not consider it will provide sufficient incentive to NIE Networks to deliver RP6 investment plan efficiently if further increases in unit costs were allowed. We therefore determined allowances for RP6 based on the latest RP5 outturn unit costs.

2.48 For secondary switchboards, NIE Networks clarified that the RP5 unit cost had been derived from a single project consisting of five panels of secondary switchgear, whilst the RP6 unit cost is a "blended rate" based on a more detailed assessment of replacement needs using either primary CB panels, secondary CB panels or RMUs. Via the Q&A process, we sought additional details of the RP5 programme for secondary switchboard replacement (consisting of 15 switchboard replacements) and NIE Networks provided details of the costs for each individual project.

2.49 Our analysis of these costs confirmed that the NIE Networks unit costs for RP6 relating to RMUs and primary CB panels were broadly consistent with RP5 costs. We noted that the RP5 unit cost for secondary CBs was lower than the RP6 unit cost and therefore we recommend RP6 allowances based on the lower unit cost.

2.50 Our draft determination of direct allowance in RP6 and the associated outputs for Secondary Substations is shown in Table 2.6 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Replace RMU	Each	80	7.772	621.760
Replace complete S/S	Each	395	33.300	13,153.500
Replace complete S/S and temporary S/S works	Each	50	44.100	2,205.000
Replace Secondary Switchboard	Each	110	31.400	3,454.000
Replace OH fed GMT	Each	66	25.125	1,658.250
Replace H pole S/S	Each	72	13.410	965.520

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Replace H pole Transformer	Each	10	4.500	45.000
Replace H pole mounted LV cabinet	Each	40	3.700	148.000
Replace 4-pole structure	Each	225	22.917	5,156.325
Repair 4-pole structure defects	Each	20	2.350	47.000
Replace sectionaliser	Each	55	9.400	517.000
Replace mini pillar	Each	1,035	3.389	3,507.615
Replace LV wall mounted fuse board	Each	50	13.509	675.450
Secondary Substation Ancillary Works	Lump Sum			2,000.000
Replace 4-pole structure mounted LV cabinet	Each	20	5.015	100.300
Refurbish LV plant	Each	20,914	0.156	3,262.584
Refurbish Substation LV cabinet	Each	30	4.050	121.500
Repair ABB LV cabinet	Each	800	0.750	600.000
RMU Substation - Mini Kiosk	Each	50	47.577	2,378.850
Refurbish 11kV GVS sectionaliser	Each	80	3.000	240.000
Secondary other	Lump Sum			435.000
Voltage Regulators	Each	3	44.914	134.742
				41,427.396

Table 2.6 – Draft determination of allowance and outputs for Secondary Substations

D11 – Secondary Plant – Cut-outs

D11 - Scope of work

2.51 The majority of LV service cables to consumer premises are terminated in a house service cut-out with a fuse which is located before the meter and the subsequent customer's consumer unit/fuse board. The cut-out fuse provides protection against overload of the service and provides back-up fault protection to the meter and customer's installation.

2.52 The types of cut-out replacement undertaken are:

- Simple – Only the cut-out is replaced
- Complex – Partial replacement of service cable required to allow cut-out replacement

2.53 The mix of works proposed by NIE Networks is 90% simple and 10% complex cut-out replacement.

D11 - NIE Networks proposal

2.54 NIE Networks has set out its plans for investment in cut-outs in Section 6.1 of its RP6 Network Investment Plan beginning at paragraph 704. These plans are summarised in Table 2.7 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Replace house service cut-outs	Each	10,400	0.317	**3,296.800**

Table 2.7 – NIE Networks proposed investment in cut-outs

2.55 We accepted the volume proposed by NIE Networks as this is in keeping with RP5 run-rates.

2.56 We found the proposed unit cost to be high when compared to RP5 outturn and the industry median unit cost calculated by Ofgem.

2.57 During pre-draft determination engagement NIE Networks stated that they did not replace as many complex cut-outs in RP5 as envisaged hence their outturn unit cost was low. They further stated that they expect to carry-out 10% complex replacements during RP6 and; therefore, require increased funding

2.58 We were not convinced by NIE Networks' case for increased funding and are concerned that should they receive a higher level of funding they could again choose to deliver less complex replacements during RP6.

2.59 We based our draft determination on the industry median unit cost as determined by Ofgem for the GB DNOs.

2.60 Our draft determination of direct investment in RP6 and the associated outputs for Cut-outs is shown in Table 2.8 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Replace house service cut-outs	Each	10,400	0.208	**2,163.200**

Table 2.8 – Draft determination of direct investment and outputs for cut-outs

Overhead Line Asset Replacement

D06 Distribution Tower Lines

D06 - Scope of work

2.61 The majority of the 33kV overhead system is supported on wood poles; however, NIE Networks operate 28 circuits supported on steel towers. Most of the steel tower lines are double circuit and were originally designed to operate at 110kV or 69kV. The tower lines were installed between early 1930's and early 1970's.

2.62 Some of the circuits originally operated at a higher voltage but, due to operational requirements, were down-graded to run at 33kV as an economical alternative to being replaced with wood pole lines. Other circuits were over-designed with a view to upgrading to a higher voltage in the future if required.

2.63 It is now extremely unlikely that NIE Networks would upgrade any of the 33kV tower lines to a higher voltage[1]. However, there is a requirement to maintain the existing towers in a safe and serviceable condition.

2.64 NIE Networks undertook a cost benefit analysis which determined that maintaining the existing tower lines was the most economical option when compared with dismantling and rebuilding with wood poles.

D06 - NIE Networks RP6 proposal

2.65 NIE Networks has set out its plans for investment in Distribution Tower Lines in Section 6.2 of its RP6 Network Investment Plan beginning at paragraph 736. These plans are summarised in Table 2.9 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Re-conductor Double Circuit including earthwire	Span	103	26.450	2,724.350
Refurbishment	Lump Sum			1,056.130
				3,780.480

Table 2.9 – NIE Networks proposed investment in Distribution Tower Lines

2.66 We queried the conductor condition assessment data in NIE Networks' initial submission as we were not convinced that sufficient justification existed for the proposed replacement sub-programmes. NIE Networks subsequently provided new data and revised sub-programmes. These are summarised in Table 2.10 below.

[1] SONi do not have any upgrading projects in their 10 Year Transmission Forecast Statement

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Re-conductor Eden Main - Carrickfergus	Span	33	26.450	872.850
Refurbish Finaghy – Sprucefield - Lissue DC OHL	Span	66	8.150	537.900
General Refurbishment	Lump Sum			1,056.13
				2,466.880

Table 2.10 – NIE Networks revised proposed investment in Distribution Tower Lines

D06 – Draft determination

2.67 No historical data exists with which to compare re-conductoring works so we used the industry median unit cost data prepared by Ofgem.

2.68 We found the proposed re-conductoring costs to be high when compared to Ofgem data but NIE Networks subsequently explained that their scope of work also included an element of tower refurbishing. When we included the additional scope in the analysis we found the proposal to be acceptable.

2.69 The unit costs involved in general refurbishment are lower than the Ofgem industry median costs; therefore we find the proposal to be acceptable.

2.70 We saw no benefit in separating the Finaghy – Sprucefield – Lissue circuits from the other general refurbishment projects as the scope of work is almost identical.

2.71 Our draft determination of direct investment in RP6 and the associated outputs for Distribution Tower Lines is shown in Table 2.11 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Re-conductor Eden Main - Carrickfergus	Span	33	26.450	872.850
General Refurbishment	Lump Sum			1,594.030
				2,466.880

Table 2.11 – Draft determination of direct investment and outputs for Distribution Tower Lines

D07 Distribution 33kV and D08 11kV Wood Pole Overhead Lines

D07 and D08 - Scope of work

2.72 These allowances are to fund the replacement and refurbishment of the 33kV and 11/6.6kV overhead line networks due to age and condition.

2.73 NIE Networks' 11kV overhead network (approximately 21,000km) consists of main lines that form the "backbone" of the network and spur lines that radiate from these main lines. Main lines make up around 40% of the 11kV network of which a substantial proportion was constructed between the late 1950's to the mid 1970's.

2.74 Whilst the present 11kV overhead line design standard is 50mm^2 All Aluminium Alloy Conductor (AAAC) the majority of the existing network is constructed to a lighter 25mm^2 Aluminium Conductor Steel Reinforced (ACSR) design. NIE Networks also has some 6.6kV overhead line but given the low volumes and the fact that it is constructed to similar specification to 11kV it is included in the RP6 submission as 11kV lines.

2.75 The 33kV network (approximately 3,150km) is less reticulated than the 11kV network in that it is generally configured as radial or ring circuits with very few spur lines. The circuits supply relatively large 33/11kV substations however there are sections that continue to supply both small villages and individual customers via smaller 33kV/LV pole mounted transformers.

2.76 As overhead lines are composed of a mixture of components with differing asset lives (including wood poles, conductors, fittings and staywires) NIE Networks do not have a like for like end of life replacement strategy for overhead lines, instead they adopt a condition based replacement approach where only the elements of a line that require replacement based on condition monitoring are addressed.

D07 and D08 - NIE Networks RP6 proposal

2.77 NIE Networks has set out its plans for investment in Distribution 33kV, 11kV and 6.6kV Wood Pole Overhead Lines in Section 6.2 of its RP6 Network Investment Plan beginning at paragraph 772. These plans are summarised in Table 2.12 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
D07 33kV wood pole overhead lines				
Re-engineer	km	455	18.277	8,316.035
Refurbish	km	910	1.630	1,483.300
Remedial	LS			82.221
Sub-total				**9,881.556**
D08 11kV and 6.6kV wood pole overhead lines				
Re-engineer	km	3,033	8.900	26,996.667
Refurbish	km	6,067	1.892	11,478.133
Remedial	LS			2,663.120
Undergrounding	LS			605.932
Sub-total				**41,743.852**

Table 2.12 – NIE Networks proposed investment in Distribution 33kV and 11/6.6kV Wood Pole Overhead Lines

2.78 NIE Networks state that "Unless network performance is to be allowed to deteriorate, there is a requirement to continue with asset refurbishment of overhead lines at least at a pace that offsets deterioration.[2]"

2.79 Accordingly, the objectives of NIE Networks' asset management strategy for distribution HV overhead lines are stated as:

i) To ensure compliance with safety legislation;

ii) To invest at a pace that offsets network deterioration;

iii) To maintain, at a minimum cost, an acceptable level of network performance during day-to-day operations; and

iv) To ensure that the network is resilient under storm conditions.

2.80 NIE Networks make the point that given the predominance of light-duty 25mm2 conductor on the network, the reference to storm resilience refers to storms that would be normally experienced during a typical weather-related event and this work programme does not establish enhanced resilience for extreme events such as widespread ice accretion.

2.81 With respect to compliance with safety legislation, NIE Networks state[3] that "Compliance with legislation as part of refurbishment has always included work required to be compliant with legislation but, in parallel, now includes the additional work required to progressively work towards compliance with ESQCR legislation. The justification for this element of the work is dealt with [separately under D43]. Hence the first objective of the refurbishment and re-engineering programmes is to aim to leave all circuits worked on safe to the public and staff and, with the addition of a separate ESQCR allowance, progressively complying with all current legislation."

2.82 The proposed overhead line work programmes are a continuation of the RP5 programmes.

2.83 NIE Networks has four categories of work associated with the Overhead Lines

i) **Refurbishment** – 15 year cycle

ii) **Re-Engineering** – Major refurbishment including reconductoring (effectively a 45 year cycle). We note that this is not full reconductoring. Note that re-engineering is not a full rebuild and does not include full pole replacement or conductor replacement.

iii) **Remedial** – 3 year cycle - replacing equipment on the network which has been identified as poor condition outside of the 15 year refurbishment cycle

[2] NIP X13.3
[3] § 786

following helicopter patrols. This has previously been known as Targeted Asset Replacement (TAR).

iv) **Undergrounding** – NEIN state that this typically related to the undergrounding of existing overhead lines into substations where population growth has occurred. Costs and volumes in RP6 are based on projected RP5 outturn.

2.84 The 33kV OHL proposed costs are derived as follows:

i) 33kV re-engineering – RP5 outturn cost;

ii) 33kV refurbishment – RP5 outturn cost plus £125/km for additional climbing inspections to identify pole top rot prior to refurbishing; and

iii) 33kV remedial – RP5 TAR outturn (adjusted for 6.5 years instead of 5.5 years)

2.85 The 33kV OHL proposed volumes are derived as follows:

i) The volumes for RP6 are based on a 15 year cycle with two thirds of the lines being re-furbished and one third being re-engineered as the re-engineering cycle is stated as being required at 45 years.

ii) On an asset base of 3,150 km, this results in 455km requiring re-engineering and 910km requiring refurbishment in the RP6 period.

iii) There are no volumes provided for remedial works, however it is stated that these works will cover the assets that are not subject to re-engineering or refurbishment in the period and be based on 3-yearly condition assessments.

2.86 The 11kV OHL proposed costs are derived as follows:

i) 11kV re-engineering – based on 2015/16 outturn cost as the mix of 25% rebuild was in line with the expected forward requirement.

ii) 11kV refurbishment - RP5 outturn cost plus £250/km for additional climbing inspections to identify pole top rot prior to refurbishing (this was later reduced to £181/km for climbing patrols as the forecast outturn cost of RP5 has increased since the original submission and the proposed RP6 cost has stayed the same.

iii) 11kV remedial works – RP5 TAR outturn (adjusted for extra year) less £1,400,000 of Connection Driven System Work that had been allocated to TAR in RP5 but will be allocated to D604 in RP6 (ref URQ093).

iv) 11kV Undergrounding – (£611,330) – RP5 outturn adjusted for additional year in RP6.

2.87 The 11kV OHL proposed volumes are derived as follows:

i) The volumes for RP6 are based on a 15 year cycle with two thirds of the lines being re-furbished and one third being re-engineered as the re-engineering cycle is stated as being required at 45 years.

ii) On an asset base of 21,000km this gives 3,033km requiring re-engineering and 6,067km requiring refurbishment in the 6.5 year RP6 period.

iii) There are no volumes provided for remedial works, however it is stated that these works will cover the assets that are not subject to re-engineering or refurbishment in the period and are based on 3 yearly condition assessments.

iv) There are no volumes presented for undergrounding.

D07 and D08 – Draft determination

2.88 We have reviewed the derivation of the volumes of re-engineering and refurbishment at 33kV and 11kV and concur that the proposed volumes meet the stated cyclic periods, that the periods are a continuation of the RP5 programmes and are appropriate to manage the overhead wood pole assets.

2.89 We have reviewed the proposed 33kV OHL costs and find as follows:

i) 33kV re-engineering – The use of RP5 outturn cost is appropriate – we accept the NIE Networks proposed unit cost;

ii) 33kV refurbishment – NIE Networks have added £125/km to the RP5 outturn unit cost to cover the costs of additional climbing inspections to identify pole top rot prior to refurbishing. Additional inspections may be beneficial but, in our opinion, they should be self-funded through efficiency savings gained during the refurbishment process and the reduction of remedial and/or fault costs. NIE Networks have not demonstrated where the reduction in overall costs due to this increased inspection will be realised for customers.

iii) 33kV remedial (£11,445) – The remedial works cost submission is based on forecast outturn to the end of RP5. The forecast out turn is based on actual outturn of the four years to 2016 and a forecast from April 2016 to September 2017. The annual costs in the forecast period for RP5 are significantly higher than the actual average annual costs in the first four years of RP5. Therefore we propose a total allowance based on prorating the actual expenditure to 2016. This gives £11,445 rather than the requested £82,221.

2.90 We have reviewed the proposed 11kV OHL costs and find as follows:

i) 11kV re-engineering – 11kV re-engineering unit costs increase by 6.7% over the RP5 outturn average. This is stated as being due to the 2015/16 outturn figures being used rather than the outturn costs over the whole period of RP5. NIE Networks state that this was predominantly due to the fact that the percentage of reconductoring (25%) in 2015/16 was seen as more

representative of the re-engineering programme going forward into RP6 and that lines that were known to not require such works were addressed earlier in the RP5 period due to uncertainties arising from the Competition Commission process. This further indicates that there is a natural variation in the types of work and that NIE Networks have control of this to some extent. We are content with the assertion put forward by NIE Networks that the 2016 cost of £8,900 is appropriate. The unit cost compares favourably with the benchmark data supplied by NIE Networks of £13,527 which we have reviewed and consider to be reasonable. As with 33kV re-engineering, the scope of NIE Networks 11kV re-engineering is not easily quantified; hence we intend to review the reporting requirements for these projects in the latter stages of RP5.

ii) 11kV refurbishment - the unit costs for this activity have increased by 10.6% over RP5. NIE Networks state that this is due to an additional £181/km for climbing patrols to check for pole top rot. As with the 33kV refurbishment we do not consider this a justifiable additional cost as NIE Networks have not demonstrated where the cost savings of this additional investment will be seen by customers. We therefore propose a unit cost based on RP5 forecast outturn.

iii) 11kV remedial works – We accept the NIE Networks' proposal to use the RP5 TAR outturn adjusted for the additional year in RP6. This is £1,400,000 less than the reported outturn cost in the cost and volumes templates as this is Connection Driven System Work that had been allocated to TAR in RP5 but will be allocated to D604 in RP6 (ref URQ093).

iv) 11kV Undergrounding – We consider that the NIE Networks proposed cost based on RP5 outturn is appropriate. We investigated whether this expenditure would be covered by the ESQCR clearance projects but having discussed with NIE Networks we are content that these are used for incremental encroachment and are sufficiently different to allow separate classification of costs.

2.91 Our draft determination of direct investment in RP6 and the associated outputs for Distribution 33kV, 11kV and 6.6kV Wood Pole Overhead Lines is shown in Table 2.13 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
D07: 33kV wood pole overhead lines				
Re-engineer	km	455	18.277	8,316.035
Refurbish	km	910	1.505	1,369.550
Remedial	LS			11.493
Sub-total				**9,697.078**
D08: 11kV and 6.6kV wood pole overhead lines				
Re-engineer	km	3,033	8.900	26,996.667
Refurbish	km	6,067	1.711	10,380.637
Remedial	LS			2,663.120

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Undergrounding	LS			605.932
Sub-total				**40,646.356**

Table 2.13 – Draft determination of direct investment and outputs for Distribution 33kV and 11/6.6kV Wood Pole Overhead Lines

D09 – LV Overhead Lines

D09 - Scope of work

2.92 The low voltage distribution network in Northern Ireland comprises overhead lines supported on wood poles and underground cables. There is also a part of the network that is clipped to the eaves of properties and this is covered by a separate allowance (D10).

2.93 NIE Networks have not carried out refurbishment works on the low voltage overhead system on a cyclic basis; this has led to the system falling into a poor state of repair.

2.94 During RP5 NIE Networks executed an overhead line refurbishment programme which targeted replacement of those assets with less than estimated 3 years of remaining service life. These works covered the replacement of components such as wood poles, stay wires and insulators.

2.95 The other elements of the LV overhead line strategy are:

i) Line undergrounding (direct access): the LV overhead line is situated in between two streets of houses with back-to-back boundaries. Vehicular access may be possible although generally via a postman's walk

ii) Line undergrounding (land locked): the LV overhead line is situated in between two streets of houses with back-to-back gardens with no vehicular access possible

2.96 Due to the difficulty in accessing these parts of the network with cranes and machinery, the assets in both direct access and land locked locations tend to be in a very poor state of repair. NIE Networks' solution is to underground these sections of the network.

D09 - NIE Networks RP6 proposal

2.97 NIE Networks has set out its plans for investment in LV Overhead Lines in Section 6.2 of its RP6 Network Investment Plan beginning at paragraph 799. These plans are summarised in Table 2.14 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Refurbishment – Urban & Rural	Lump Sum			10,292.488
Line Undergrounding (Direct Access)	km	5	80.500	402.500
Line Undergrounding (Land-Locked)	km	13	164.138	2,133.794
Remedial	Lump Sum			790.611
				13,619.393

Table 2.14 – NIE Networks proposed investment in LV Overhead Lines

2.98 NIE Networks have proposed to execute the low voltage overhead line refurbishment programme in parallel with the ESQCR compliance programme (D43). We agree with this philosophy as we believe this will provide the greatest efficiency savings with respect to outage management and coordination of resources. We have, therefore, covered the refurbishment programme of works within chapter 3.

2.99 For Line Undergrounding (Direct Access) we accepted the proposed volumes as they are similar to RP5 run-rates. We also accepted the proposed unit cost as we found it to be lower than the RP5 outturn cost and the Industry Median unit cost as determined by Ofgem for the GB DNOs.

2.100 For Line Undergrounding (Land-Locked) we found the proposed unit costs to be high when compared with NIE Networks forecast outturn unit cost. We gave no weight to actual outturn costs reported in the Network Investment RIGs as NIE Networks have reported only 1km completed.

2.101 In a supplementary document submitted by NIE Networks 22 February 2017 they state that the unit cost for land-locked works has increased to £242.81k/km based on completion of projects since March 2016. At the time of writing we have received little documentary evidence of increased costs; hence we have taken no action to increase this allowance.

2.102 We accepted NIE Networks proposed costs for remedial works as we found these to be lower than the outturn costs incurred in RP5

2.103 Our draft determination of direct allowance in RP6 and the associated outputs for LV Overhead Lines is shown in Table 2.15.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Line Undergrounding (Direct Access)	km	5	80.500	402.500
Line Undergrounding (Land-Locked)	km	13	125.516	1,631.714
Remedial	Lump Sum			790.611
				2,824.825

Table 2.15 – Draft determination of direct allowance and outputs for LV Overhead Lines

D10 – Undereaves

D10 - Scope of work

2.104 Undereaves mains consist of a bundle of four insulated cables (3 phases and neutral) attached to the brickwork, facia or soffit of the property being supplied. Single or three phase services are connected to the mains and are clipped directly to the walls of the property being supplied. This form of supply was installed between 1950's and 1970s and was considered to be a low cost alternative to underground cabling.

2.105 A number of insulation types have been utilised on undereaves mains and services. The oldest cables still in commission were insulated with PolyButylJute (PBJ), this type of insulation deteriorates over time. First the jute outer serving rots and falls away from the cable then the polybutyl rubber insulation becomes brittle and forms cracks which expose the live core of the cable. The undereaves wiring is readily accessible to members of the public cleaning windows or carrying out maintenance to eaves woodwork, hence exposed live conductors represent a danger.

2.106 NIE Networks discontinued the use of PBJ insulation in the early 1970's and, instead, utilised a cable with a single layer of PolyVinylChloride (PVC) insulation referred to as "single insulated". PVC is much more stable than PBJ insulation but is still prone to cracking over time due to exposure to ultra-violet light.

2.107 Wiring regulations were updated in the late 1970's and the requirement to have mechanical protection over primary insulation came into being. NIE Networks began to use PVC insulated and PVC sheathed cables referred to as "double insulated". These cables provide better mechanical protection and are less prone to exposure of live conductors.

2.108 NIE Networks now use Aerial Bundled Conductor (ABC), a preformed bundle of four single core cables insulated with PVC or Cross Linked PolyEthylene (XLPE). The thickness and grade of insulation provide insulation and protection in one layer and the material is pre-treated to prevent degradation through exposure to ultra-violet light.

D10 - NIE Networks RP6 proposal

2.109 NIE Networks has set out its plans for investment in Undereaves Cables in Section 6.2 of its RP6 Network Investment Plan beginning at paragraph 811. These plans are summarised in Table 2.16 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Replace services (undereaves)	Each	19,500	0.513	**10,003.500**

Table 2.16 – NIE Networks proposed investment in Undereaves Cables

2.110 NIE Networks have stated that at the beginning of RP6, there will be approximately 10,000 PBJ insulated services still in commission. This number will be confirmed as ESQCR patrolling is concluded. NIE Networks have further stated that more than 24,000 properties are serviced by PVC insulated undereaves wiring and that the oldest stock is now ready for replacement.

2.111 As part of the query process we asked NIE Networks to verify the volumes in their undereaves replacement programme for RP6 as the annual volume of properties was not immediately clear. NIE Networks confirmed in their response to query URQ018 that their intention is to complete 3,000 properties per year which represents a price control total of 19,500 properties.

2.112 NIE Networks stated in their response to query URQ019 that they intend to begin replacement of PVC insulated mains and services during RP6 upon completion of PBJ replacement. Therefore, the funding request encompasses 10,000 PBJ insulated properties and 9,500 PVC insulated properties.

2.113 At an engagement meeting held 6 October 2016, NIE Networks informed us that they have not yet ascertained the actual volume of PVC replacements required in RP6 and the volume of 9,500 was used as a proxy to maintain the RP5 run-rate of 3,000 properties.

2.114 We found the proposed unit cost to be high when compared to the first four years of RP5 outturn costs. At a pre-draft determination engagement NIE Networks explained that the unit rate will increase during the later stages of RP5 due to sparsity of works caused by the advanced nature of the undereaves replacement programme. We were not convinced by this argument given the proposed continued run-rate of 3000 properties during RP6.

2.115 Owing to the uncertainty around the numbers of services to be replaced in RP6 we have decided to allow an ex-ante amount for the replacement of 10,000 PBJ insulated properties and a capped volume driven allowance for the replacement of up to 9,500 properties. The volume driven element will provide NIE Networks with the flexibility to replace all of the services required and provides greater protection to the customer than the cost risk sharing mechanism alone.

D10 – Draft determination

2.116 Our draft determination of direct investment in RP6 and the associated outputs for Undereaves Cables is shown in Table 2.17 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Replace PBJ wiring	Property	10,000	0.408	**4,077.997**
Replace PVC wiring	Property	<=9,500	0.408	**3,874.097**
				7,952.094

Table 2.17 – Draft determination of investment and outputs for Undereaves Cables

Cable Asset Replacement and Refurbishment

D16 – Distribution Cables

D16 - Scope of work

2.117 NIE Networks have an extensive underground cable network which is predominantly situated in urban areas where, for safety or aesthetic reasons, it is difficult to build overhead lines.

2.118 Underground cable cores are made from either copper or aluminium. Although aluminium is less expensive it is also less efficient as a conductor of electricity, hence aluminium cables tend to be physically larger than those using copper.

2.119 There are many different types of cable in use on NIE Networks' system. The various types of cable reflect the different standards and manufacturing techniques available at the time of purchase hence the oldest cables utilise Vulcanised Bitumen (VB) or oil impregnated paper as an insulation medium whilst the newest cables will use Cross Linked Polyethylene (XLPE) or Poly Vinyl Chloride (PVC).

2.120 Fluid filled cables were installed on the 33kV system between 1940's and 1970's. These cables are paper insulated but have ducts built into the cable which allow oil to circulate and cool the cable core. This allows greater current carrying capacity at a reduced initial outlay due to smaller core sizes. The trade-offs are :

i) greater environmental risk in the event of a cable or joint failure due to oil spillage;

ii) cable joints are more difficult (hence more costly) to install;

iii) general maintenance is more costly owing to the greater number of above ground components; and

iv) this type of cable is generally installed in city centres or under main arterial roads and is, therefore, difficult to replace.

2.121 CONSAC is a type of LV cable that was utilised by almost all UK DNOs during the late 1970's and early 1980's. Due to the design of the cable it performed very poorly and is the cause of numerous faults. The cable is now considered not fit for purpose and is being systematically replaced by all DNO's who installed it.

D16 - NIE Networks RP6 proposal

2.122 NIE Networks has set out its plans for investment in Distribution Cables in Section 6.3 of its RP6 Network Investment Plan beginning at paragraph 826. These plans are summarised in Table 2.18 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Replacement of HV cable	M	18,000	0.970	1,746.000
Replacement of LV cable	M	30,000	0.128	3,840.000
33kV FFC Refurbishment	Each	11	31.453	345.983
33kV PILC Cable part replacement	M	5,340	0.159	849.060
Leak Management Technologies	Lump Sum			137.873
Distribution cable accessories and ancillaries	Lump Sum			541.132
Condition monitoring	Lump Sum			210.000
				7,670.048

Table 2.18 – NIE Networks proposed investment in Distribution Cables

D16 – Draft determination

2.123 Replacement of HV cables is an ongoing task due to the age and condition of the existing assets. We accept the volumes proposed by NIE Networks as they are similar to the RP5 run-rates. We also accept the unit costs as they are lower than the RP5 outturn costs.

2.124 Replacement of LV cables is also an ongoing task due, mainly, to the need to replace CONSAC cable. NIE Networks are proposing to replace LV cables at a higher run-rate to that of RP5, totalling 30,000m for the RP6 period. This equates to an average annual output of around 4,600m per annum.

2.125 For RP5 NIE Networks were funded to replace 20,500m of LV cable (includes 6000m of VB cable) which equates to 3,727m per annum. As of March 2016 NIE Networks reported a total output of 5,992m which is equivalent to approximately 1,500m per annum. Although NIE Networks are forecasting to complete all outputs in this category during RP5 it seems unlikely that they will install 14,500m in the last 18 months of RP5. Furthermore, we found no justification in the business case to increase output by more than 30%.

2.126 Whilst we accept the unit cost for this sub-programme, we do not accept the volume and propose to allow funding for 24,227m which is the equivalent to the RP5 allowed run-rate mentioned in 2.125 above.

2.127 The refurbishment of fluid filled cables is an ongoing sub-programme. NIE Networks are proposing to carry out a higher volume of works during RP6 at a greatly reduced unit cost. Upon reviewing the RP5 business plan we found that the RP6 scope of work is reduced to refurbishing cable joints only. We accept both the volumes and costs proposed.

2.128 Replacement of 33kV Paper Insulated Lead Covered (PILC) cable is a new sub-programme; hence we have no historical data on which to make a comparison. We accept the volumes as NIE Networks provided a strong technical justification for the

proposed cable replacement; we also accept the unit cost as it is lower than the industry median unit cost calculated by Ofgem for the GB DNOs.

2.129 We accept the proposed lump sum for leak management technologies. The proposed expenditure is lower than that of RP5 but provides clear benefits in the detection of leaks on fluid filled cables

2.130 We accept the proposed lump sum for cable accessories and ancillaries. NIE Networks provide a strong justification in their business plan for the need for this expenditure.

2.131 We accept the proposed lump sum for purchase of on-line condition monitoring equipment. NIE Networks provide a strong justification in their business plan for the need for this expenditure.

2.132 Our draft determination of direct investment in RP6 and the associated outputs for Distribution Cables is shown in Table 2.19 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Replacement of HV cable	M	18,000	0.970	1,746.000
Replacement of LV cable	M	24,227	0.128	3,101.056
33kV FFC Refurbishment	Each	11	31.453	345.983
33kV PILC Cable part replacement	M	5,340	0.159	849.060
Leak Management Technologies	Lump Sum			137.873
Distribution cable accessories and ancillaries	Lump Sum			541.132
Condition monitoring	Lump Sum			210.000
				6,931.104

Table 2.19 – Draft determination of investment and outputs for Distribution Cables

D603 Distribution Protection

D603 - Scope of work

2.133 The proposed investment covers three main equipment categories:

i) Electrical Protection systems

ii) Substation monitors

iii) Reverse Power monitoring

2.134 Protection systems and monitoring equipment inherently have a shorter asset life than their associated switchgear and plant and therefore in addition to end of life replacement for switchgear and plant there is a requirement to replace protection systems during the life of the associated switchgear and plant.

D603 - NIE Networks RP6 proposal

2.135 Electrical Protection Systems

i) NIE Networks has stated that previous switchgear replacement carried out during RP5 also included for replacement of the associated protection systems. However, there remains a significant quantity of switchgear on the system in satisfactory condition but with associated protection systems that are more than 25 years of age.

ii) The protection systems are considered to be at end of life condition, and NIE Networks state they are no longer supported by the original equipment manufacturer and suffer from condition related problems.

iii) Given the critical nature of protection systems for successful network operation, NIE Networks consider that replacement of the systems at an end of life condition is required to ensure appropriate plant and equipment isolation under fault conditions, and that there is no deterioration of current service levels to customers.

2.136 Substation Monitors

i) The existing substation monitors were installed in the late 1980's and early 1990's. Their primary function was to act as a Fault Recorder for post-fault data investigation and analysis. NIE Networks state that the monitors are now obsolete and in poor condition, with several no longer able to function correctly.

ii) Furthermore, industrial and business customers now require a wide range of information that cannot be obtained from the existing monitors, mainly related to power quality monitoring.

iii) NIE Networks consider that the investment is required to replace the obsolete and mal-functioning monitors and increase the data available for post-fault investigation and Quality of Supply issues.

2.137 Reverse power monitoring

i) The increased penetration of distributed generation, typically connected to the distribution system, means that load can be supplied via generation on the distribution system and, under certain conditions, reverse the flow of power on the system. The original network design principles were based on generation connected to the transmission system without reverse power flow.

ii) Given these new operating conditions, NIE Networks consider there is a requirement to obtain reverse power flow information to assist with real time operation of the network and to inform planning and investment decisions.

2.138 NIE Networks has set out its plans for investment in Distribution Protection in Section 6.4 of its RP6 Network Investment Plan beginning at paragraph 955. These plans are summarised in Table 2.20 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
33kV Protection Systems	Lump Sum			339.100
11kV Protection Systems	Lump Sum			793.750
Substation Monitors	Lump Sum			1,226.300
Reverse Power Flow	Lump Sum			1,500.000
				3,859.150

Table 2.20 – NIE Networks proposed investment in Distribution Protection

D603 – Draft determination

2.139 We have reviewed the information provided by NIE Networks in the RP6 Investment plan and subsequent responses to our questions.

2.140 We are satisfied that there is a need for the D603 work programme.

2.141 The volume of the potential work programme during RP6 is clearly defined and the requested volumes are appropriate.

2.142 We have reviewed the unit costs and consider that they are in line with industry norms; however, we have disallowed capital expenditure on Strategic Spare Relays as NIE Networks have not defined the specific items or volumes. Furthermore, the replacement programme extends throughout the RP6 period so any risk should be able to be mitigated.

2.143 Our draft determination of direct investment in RP6 and the associated outputs for Distribution Protection is shown in Table 2.21 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
33kV Protection Systems	Each	49	5.900	289.100
11kV Protection Systems	Each	125	5.950	743.750
Substation Monitors	Each	51	24.045	1,226.300
Reverse Power Flow	Each	900	1.670	1,503.000
				3,762.150

Table 2.21 – Draft determination of investment and outputs for Distribution Protection

Other non- load related expenditure

D39 and D41 – Network IT and Telecommunications

D39 and D41 - Scope of work

2.144 Network IT and Telecoms equipment enables NIE Networks to control the Distribution network through the SCADA (Supervisory Control and Data Acquisition) system and Operational Telecoms Network. This investment category includes:

i) Replacement of RTUs (Remote Terminal Units), Marshalling Kiosks and Receivers

ii) Control Centre hardware and software (SCADA) upgrade

iii) Communications for switching and monitoring replacement including BT 21st Century (BT21CN) replacement.

D39 and D41 - NIE Networks RP6 proposal

2.145 NIE Networks has set out its plans for investment in Network IT and Telecommunications in Section 6.5 of its RP6 Network Investment Plan beginning at paragraph 1001. These plans are summarised in Table 2.22 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
D39 - SCADA	Lump Sum			5187.000
D41 – Operational Telecoms Network	Lump Sum			3,302.000
D41 - BT21CN	Lump Sum			1,654.000
				10,143.000

Table 2.22 – NIE Networks proposed investment in Network IT and Telecommunications

2.146 Replacement of RTUs, Marshalling Kiosks and Receivers

i) The replacement of the RTUs has been delayed from RP5 based on advice from the manufacturer that the 15 year product life could be extended a further 5 years with some hardware upgrades. During the RP6 period the majority of RTUs will reach their 20 year service life. NIE Networks are proposing to replace 50% of the existing RTUs with modern units.

ii) NIE Networks' unit cost for replacing 122 RTUs is £30.2k each. NIE Networks state that they have not undertaken any replacements of their own RTU's in RP5 hence their proposed unit cost rate has been developed based on the cost of new units installed as part of customer connections. A reduction to this

unit cost has however been included based on anticipated efficiencies obtainable during RP6 through competitive tendering approaches.

iii) RTU unit costs vary depending on the size of the unit and NIE Networks have based the unit cost on the most common RTU size that they are replacing.

iv) NIE Networks have proposed the replacement of the remaining 50% of the RTUs during the RP6 period to facilitate the implementation of 'smart' solutions under the 'Investing for the future' programme. We have addressed this in chapter 4 (D602).

2.147 Control Centre hardware and software (SCADA) upgrade

i) The existing ABB "Spider" SCADA control centre system was commissioned in 2008/09 and is approaching the end of its design life and will be required to be replaced during RP6.

ii) Upgrading the existing system achieves NIE Networks requirements without the consequential costs associated with moving to a completely new system. NIE Networks are planning to complete the upgrade by 2019/20

2.148 Communications for switching and monitoring replacement (including BT 21st Century replacement)

i) As indicated above, the proposed telecommunications expenditure comprises a number of programmes of work to replace/upgrade existing communications infrastructure assets. The asset replacement is driven primarily by the requirement to replace aging and obsolete assets.

ii) In the case of the major components of the Operational Telecoms Network (OTN), these are reported to be in excess of 20 years old, which is beyond the expected product life.

iii) In the replacement programme NIE Networks are implementing an IP based communication infrastructure so increasing capacity and improving the resilience of the network. This is in line with industry practice.

iv) British Telecom has informed NIE Networks that support for legacy leased low bandwidth digital (less than 2 mbps) and analogue pilot circuits will not be extended beyond 31st March 2020. Migration of the services using these circuits commenced in RP5 with completion in RP6 as planned. The cost estimate for completion of this programme is £1,654k based on the costs provided from the existing telecommunication provider.

D39 and D41 – Draft determination

2.149 We have reviewed the need for the replacements programmes identified by NIE Networks and agree that Network IT and Telecoms assets concerned require replacement.

2.150 We have reviewed the costs provided by NIE Networks and consider that they are reflective of industry current norms for the type and size of equipment to be replaced/upgraded.

2.151 Our draft determination of direct allowance in RP6 and the associated outputs for Network IT and Telecommunications is shown in Table 2.23 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
D39 - Substation RTUs, marshalling kiosks, receivers	Each	122	30.221	3,687.000
D39 - Control centre hardware & software (SCADA IT)	Lump Sum			1,500.000
D41 - Communications for switching & monitoring	Lump Sum			3,302.00
D41 - BT21CN	Lump Sum			1,654.00
				10,143.000

Table 2.23 – Draft determination of direct allowance and outputs for Network IT and Telecommunications

D101 – Network Alterations

D101 - Scope of work

2.152 From time to time NIE Networks receive requests from customers to make alterations to the system for which they are unable to recover their costs (either partially or totally) due to the nature of existing wayleave agreements.

2.153 In addition the Northern Ireland Road Authority and Utility Committees (NIRAUC) have developed the Diversionary Works Code of Practice which requires all of the utility companies to make a contribution to TransportNI whenever their apparatus is to be moved due to works in the highways. At present the contribution is 18% of the costs to move the apparatus.

D101- NIE Networks RP6 proposal

2.154 NIE Networks has set out its plans for investment in Network Alterations in Section 6.5 of its RP6 Network Investment Plan beginning at paragraph 1077. These plans are summarised in Table 2.24 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Non Recoverable Alterations	Lump Sum			11,999.507
Part Recoverable Alterations	Lump Sum			3,548.085
NIRAUC Schemes	Lump Sum			135.662
				15,683.254

Table 2.24 – NIE Networks proposed investment in Network Alterations

D101– Draft determination

2.155 Given the reactive nature of these works we would expect historic expenditure to be a good indicator of future expenditure. When we compared NIE Networks proposed lump sums with their direct outturn expenditure for the first 4 years of RP5, we found the proposed amounts to be high.

2.156 In paragraph 1079 of the RP6 Networks Investment Plan, NIE Networks state “It should be noted that in RP5, Non recoverable alterations and Part recoverable alterations are reported together”.

2.157 We found the RP5 outturn expenditure between 2012/13 – 2015/16 to be £8.41m. We extrapolated this figure over the duration of the RP6 business plan to determine an allowance.

2.158 Our draft determination of direct investment in RP6 and the associated outputs for Network Alterations is shown in Table 2.25 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
All non-recoverable alterations	Lump Sum			13,534.876
NIRAUC Schemes	Lump Sum			135.662
				13,670.538

Table 2.25 – Draft determination of direct investment and outputs for Network Alterations

D604 - Connections Driven System Work

D604 - Scope of work

2.159 This investment project has been included in the RP6 submission to provide funding in relation to works associated with customer driven activity requests for new connections or alterations in existing connections where costs are not chargeable to the customer. The work is reactive in nature and arises as part of providing a new or upgraded customer connection where NIE Networks will need to replace pre-1992 assets that are not in a suitable condition to maintain the integrity of the customer connection due to reasons such as deterioration. The works completed under this category will only be replaced if required to facilitate a reliable and secure connection whilst not providing an increase in capacity. If a capacity increase in the existing assets is required as part of a customer connection then the customer would be expected to fund the replacement assets.

2.160 Further commentary on the works that are chargeable to customers are detailed in NIE Networks "Statement of Charges for Connection to the Northern Ireland Electricity Distribution System".

D604 - NIE Networks RP6 proposal

2.161 NIE Networks has set out its plans for investment in Connections Driven System Work in Section 6.5 of its RP6 Network Investment Plan beginning at paragraph 1110. These plans are summarised in Table 2.26 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Connection driven system work	Lump Sum			**7,255.215**

Table 2.26 – NIE Networks proposed investment in Connections Driven System Work

D604 – Draft determination

2.162 NIE Networks have not reported their historic costs for this work stream in the Network Investment RIGs. Although the costs were included in the Financial Data RIGs and the C1 matrices of the Cost and Volume RIGs, they were not reported as discrete line items therefore we were unable to determine outturn expenditure.

2.163 Upon request NIE Networks submitted a breakdown of their costs which included 4 years of outturn costs and 1.5 years of forecast costs.

2.164 We disregarded the forecast costs, given the reactive nature of the works, and based our determination solely on outturn costs.

2.165 We found that NIE Networks have been reporting a portion of their costs in the indirect costs section of the Cost & Volumes RIGs and, subsequently, we have included these costs in our opex benchmarking process.

2.166 We used the average annual expenditure (based on 2012/13 – 2015/16) extrapolated for the RP6 price control duration, less £69k pa, which was included in the opex benchmark, as the RP6 allowance.

2.167 Our draft determination of direct allowance in RP6 and the associated outputs for Connections Driven System Work is shown in Table 2.27 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Connection driven system work	Lump Sum			**2,988.404**

Table 2.27 – Draft determination of direct allowance and outputs for Connections Driven System Work

D50 – Distribution Substations Flood Prevention

D50 - Scope of work

2.168 After the flooding incidents which occurred in England during 2007, the Energy Minister requested a comprehensive assessment of the resilience to flooding of primary and higher voltage substations and the steps taken to mitigate current and future risks. As a result of this, the Energy Networks Association (ENA) produced Engineering Technical Report (ETR) 138

2.169 ETR138 concluded that flood reinforcement works should be carried out on sites at risk of flooding.

2.170 NIE Networks propose to protect all primary substation sites at risk of flooding and a number of secondary sites that are at most risk of flooding or where the consequences of flooding at that site would be highest

D50 - NIE Networks RP6 proposal

2.171 NIE Networks has set out its plans for investment in Distribution Substations Flood Prevention in Section 6.5 of its RP6 Network Investment Plan beginning at paragraph 1119. These plans are summarised in Table 2.28 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Permanent protection several distribution substations	Each	9	122.882	1,105.939
RMU substations - provision of flood protection by raising the kiosk	Each	200	13.000	2,600.000
				3,705.939

Table 2.28 – NIE Networks proposed investment in Distribution Substations Flood Prevention

D50 – Draft determination

2.172 We accepted the volume for the protection of primary substation sites as there is sufficient technical justification in the business plan. We also accepted the unit costs as they are lower than both the RP5 allowance and the industry median unit cost.

2.173 We have no data with which to compare the costs of RMU flood protection; however NIE Networks did provide a detailed breakdown of their risk analysis, prioritisation of sites and expected unit costs. From the information submitted we accepted the unit costs but could not find justification for the volumes proposed.

2.174 NIE Networks identified 15 very high risk sites and 63 high risk sites. A further 487 sites were categorised as medium, low or very low risk.

2.175 During RP6 NIE Networks propose to install flood defences at the very high and high risk sites plus a further 122 medium risk sites.

2.176 We decided to allow funding for the very high and high risk sites and the substations classified as “strategic” that are in the medium risk category and are at risk from coastal or fluvial flooding.

2.177 Given the developmental stage of pluvial flood maps coupled with the fact that there is little evidence of historical flooding issues, we were not convinced that there was sufficient justification for funding to provide flood defences at 200 RMU sites.

2.178 Our draft determination of direct investment in RP6 and the associated outputs for Distribution Substations Flood Prevention is shown in Table 2.29 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Permanent protection several distribution substations	Each	9	122.882	1,105.938
RMU substations - provision of flood protection by raising the kiosk	Each	84	13.000	1,092.000
				2,197.938

Table 2.29 – Draft determination of direct investment and outputs for Distribution Substations Flood Prevention

Distribution Network Access and Commissioning

D605 Scope of work

2.179 At the outset of RP5 NIE Networks outsourced all operational activities to their subsidiary, NIE Powerteam. Part of NIE Networks' related party costs was a payment to NIE Powerteam called the "Managed Service Charge" (MSC). This transaction covered the costs of NIE Powerteam's technical engineers and "ops and outage".

2.180 Basically, the above cost categories were NIE Powerteam's costs for:

- commissioning new network components,
- routine system testing,
- fault location, and
- switching operations to allow access to the network

2.181 NIE Networks reorganised their operations during RP5 and absorbed NIE Powerteam into the core business. Although the transaction between NIE Networks and NIE Powerteam ceased, the costs covered by the MSC still exist within the core business.

D605 NIE Networks RP6 proposal

2.182 NIE Networks has set out its plans for investment in Distribution Network Access and Commissioning in Section 6.6 of its RP6 Network Investment Plan beginning at paragraph 1137. These plans are summarised in Table 2.30 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Network Access & Commissioning	Lump Sum			5,165.000

Table 2.30 – NIE Networks proposed investment in Network Access and Commissioning

D605 Draft determination

2.183 After discovering an error in their calculations, NIE Networks revised their RP6 proposal from £8.70m to £5.17m.

2.184 We calculated an allowance based on reported outturn expenditure between 2012/13 and 2015/16 extrapolated for the RP6 price control duration. When compared to our calculated figure the NIE Networks proposal was deemed to be acceptable.

3 Distribution ESQCR (D43)

General

3.1 The Electricity Safety, Quality and Continuity Regulations (Northern Ireland) were introduced in 2012 and outline the requirements for the network operator to (i) assess the risk posed by equipment, (ii) rectify specific issues, and (iii) take steps to make the public aware of dangers. Similar legislation was introduced in GB in 2002.

3.2 The timescales for compliance with the ESQCR legislative requirements are summarised in Table 3.1 below:

Date	Requirement
31 DEC 2014	Patrolling substations - Risk Assessment[4]
31 DEC 2017	Patrolling Overhead Lines - Risk Assessment
	Vegetation - safety (43-08)
31 DEC 2022	Fitting safety signs, stay insulators and anti-climbing devices on 11kV Poles.
	Fitting safety signs on LV poles and stay insulators where appropriate
	Fitting safety signs and anti-climbing devices on 33kV and 110kV Poles
On-going	Patrolling - Compliance inspection
	Establish Clearances: LV, 11kV and 33kV alterations
	Vegetation - resilience (ENA ETR132)
	Public Awareness

Table 3.1 – Timescales for Compliance with ESQCR legislation

[4] NIE Networks state that this is complete

Distribution Plant

D43 (distribution plant) - Scope of work

3.3 This expenditure item relates to the requirement to reduce the risk of fire associated with oil filled distribution transformers located within integral buildings, where the adjacent units are populated.

3.4 In order to comply with legislation the existing mineral oil will be replaced by a modern synthetic ester based fluid which will provide the same level of cooling and insulation as the mineral oil but which has a much higher flash point. As the existing transformers were designed to operate with mineral oil rather than synthetic ester the fluid replacement will be carried out only on transformers loaded to less than 80% of rating. Above this level of loading the transformers will need to be replaced with new ester filled transformers.

D43 (distribution plant) - NIE Networks RP6 proposal

3.5 115 sites have been designated as High Risk, due to the risk of transformer fire, and transformers at these sites will be refilled with ester based fluid during RP6.

3.6 NIE Networks has set out its plans for investment in ESQCR Distribution Plant in Section 7.1 of its RP6 Network Investment Plan. These plans are summarised in Table 3.2 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Distribution Transformers	Each	115	4.000	**460.000**

Table 3.2 – NIE Networks proposed investment in ESQCR Distribution Plant

D43(distribution plant) – Draft determination

3.7 We agree with the need for NIE Networks to undertake these works and that the options chosen are reasonable.

3.8 The costs proposed appear in line with industry norms.

3.9 Our draft determination of direct investment in RP6 and the associated outputs for ESQCR Distribution Plant is shown in Table 3.3 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Distribution Transformers	Each	115	4.000	**460.000**

Table 3.3 – Draft determination of direct investment and outputs for ESQCR Distribution Plant

Very High Risk and High Risk Sites

D43 (Very High and High Risk Sites) - Scope of work

3.10 NIE Networks is required to undertake a formal risk assessment of its network as stipulated in regulation 3(2). A risk matrix has been developed to identify Very High and High risk sites in compliance with ESQCR and apply a hierarchy of mitigation measures to reduce the risk at these sites.

3.11 This sub-programme covers resolution of all identified very high and high risk sites during the RP6 period.

D43 (Very High and High Risk Sites) - NIE Networks RP6 proposal

3.12 NIE Networks has identified 19,373 pole sites through a combination of patrols and desk top survey. The assessment and application of the mitigation hierarchy identifies that 2,722 pole sites require network alteration and 16,651 require additional signing and guarding.

3.13 At the time of the latest submission NIE Networks has undertaken individual assessment on 872 pole sites and identified 486 projects to address these. The majority of projects address 1 or 2 pole sites but there are 10 projects that address over 5 pole sites with the largest addressing 17 pole sites.

3.14 Table 3.4 below shows NIE Networks' detailed breakdown of the cost build to address the very high and high risk sites as presented in their response to query URQ091.

ESQCR Location Type	No of Pole sites	Labour (£k)	Material (£k)	BIS (£k)	Total Direct Proposal(£k)
School	517	1,790.896	544.394	738.981	3,074.271
Caravan /Camping	152	2,839.999	783.871	1,633.883	5,257.753
Fishing Area	141	2,113.387	1,322.154		3,435.541
Playpark	62	1,097.451	767.866	1,879.637	3,744.954
Subtotal	**872**	**7,841.733**	**3,418.285**	**4,252.501**	**15,512.519**
The above 872 pole sites have been individually assessed					
Other Recreational Area	1,033	508.201	234.086	15.646	757.933
Industrial	2,044	201.806	42.513		244.319
Garden	14,881	2,043.154	442.790		2,485.944
Forestry	543	74.505	16.129		90.634
Subtotal	**18,501**	**2,827.666**	**735.518**	**15.646**	**3,578.830**
Total	**19,373**	**10,669.399**	**4,153.803**	**4,268.147**	**19,091.349**

Table 3.4 – NIE Networks proposed investment in ESQCR Very High and High Risk Sites

3.15 It is anticipated that the mitigation measures for high risk sites will be a combination of additional signage, enhanced anti-climbing devices and increased public awareness. While these mitigation measures will also be deployed at the Very High risk sites, this will only be an interim measure until a permanent solution is achieved.

D43 (Very High and High Risk Sites) – Draft determination

3.16 We have reviewed NIE Networks' proposals addressing the Very High and High risk sites.

3.17 We have discussed the risk assessment matrix and the application of a hierarchy of mitigation measures to address the risks with NIE Networks and we are satisfied that they have a reasonable process for identifying the sites and the required solution.

3.18 Given the types of sites that are covered by this work category and the variation in solutions comparative benchmarking of the overall "units" is not practical.

3.19 Ofgem requires the UK DNO to capture units and costs based on the solution category identified (Shrouding, Diversion, Reconductor, Rebuild, Underground and other) and assesses the average cost for each solution. NIE Networks have not built the programme based on these solution classifications.

3.20 NIE Networks has provided a high level basis of costing for the individually assessed projects. We have reviewed a number of these and consider that the costs are in line with benchmark costs for the scopes identified.

3.21 Although the individually assessed pole sites account for only 4.5% of the identified Very High and High Risk sites they account for 81% of the total spend. The unit cost on the remaining 18,500 pole sites is approximately £200/pole site.

3.22 We will require NIE Networks to report against the identified projects and the overall high and very high risk sites. We will also require the outputs to be reported against the Ofgem solution categories to increase the availability of useful comparators in the future.

3.23 Our draft determination of direct investment in RP6 and the associated outputs for ESQCR High Risk Sites is shown in Table 3.5 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Very High Risk Sites	Site	19,373	-	19,091.349

Table 3.5 – Draft determination of investment and outputs for ESQCR High Risk Sites

Overhead Lines and Vegetation Management

D43 (Overhead lines and vegetation management) - Scope of work

3.24 The ESQC Regulations affect all parts of the distribution system but none more so than overhead lines. There are high volumes of safety sign, stay wire and clearance issues to resolve.

3.25 It is a legislative requirement to have a safety sign, anti-climbing device and stay insulator fitted, where required, by the end of 2022. It is anticipated that all other ESQCR compliance issues will be dealt with over the course of 3 price controls (by the end of RP8)

3.26 Due to the high volume of ESQCR compliance issues associated with LV overhead lines, NIE Networks are proposing to execute the ESQCR compliance programme in parallel with the refurbishment programme.

D43 (Overhead lines and vegetation management) - NIE Networks RP6 proposal

3.27 NIE Networks has set out its plans for investment in ESQCR Overhead Lines and Vegetation Management in Section 7.2 of its RP6 Network Investment Plan beginning at paragraph 1188. These plans are summarised in Table 3.6 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Resolve stays and safety signs	Lump Sum			14,104.205
Resolve LV Clearances & Refurbish OHL	km	1,045	21.272	22,229.240
Resolve 11kV Clearances	km	9,100	0.350	3,203.200
Resolve 33kV Clearances	km	1,365	0.062	84.630
Provide 11kV Resilience Cut	km	843	1.115	939.945
Provide 33kV Resilience Cut	km	2,000	0.929	1,858.000
Provide S/S Resilience Cut	Sites	300	0.667	200.000
				42,619.220

Table 3.6 – NIE Networks proposed investment in ESQCR Overhead Lines and Vegetation Management

D43 (Overhead lines and vegetation management) – Draft determination

3.28 NIE Networks provided a breakdown of volumes and costs for resolving safety sign and stay wire issues which we accepted and, although the allowance is issued as a lump sum, the outputs associated with this funding are that all legislative requirements will be met within the time-frame permitted and no further funding will be allowed to resolve stay wire or safety sign issues in the future except for business as usual maintenance programmes.

3.29 As mentioned in paragraph 2.98, NIE Networks propose to execute the ESQCR compliance programme in parallel with the LV overhead line refurbishment programme. NIE Networks also propose to introduce a new refurbishment specification which will ensure that all decayed poles are replaced during the refurbishment cycle instead of replacing only those with less than 3 years of remaining service life. This effectively doubles the volume of replacement poles and increases the unit cost per km of overhead line refurbished.

3.30 NIE Networks have provided no justification for the increased pole replacement costs nor have they indicated how this will benefit customers through improved service levels.

3.31 Due to the lack of local historic data with which to compare the proposed refurbishment costs coupled with ESQCR compliance costs we used industry median unit costs calculated by Ofgem for GB DNOs. Using the rates for:

i) Replace LV Main (OHL) Conductor;

ii) Replace LV Service (OHL);

iii) Replace LV Pole; and

iv) Refurbish LV Pole.

3.32 We calibrated our determination to take account of the RP5 pole replacement rate (15%) plus an additional 10% for sound poles being replaced for ESQCR clearance purposes. Using this method we found NIE Networks unit cost to be high.

3.33 We accepted the volumes for both 11kV and 33kV clearance resolutions as these align with the volumes of re-engineering/refurbishment proposed for RP6. NIE Networks' proposed unit costs are based on costs incurred whilst executing trial works. We have accepted these costs without challenge.

3.34 We compared the unit costs of both the 11kV and 33kV resilience tree cutting with the GB DNOs using DPCR5 Cost and Volumes RIGs reporting. We found NIE Networks costs to be acceptable after comparing them with a calculated industry median unit cost for ETR132 tree cutting activities.

3.35 Our draft determination of direct investment in RP6 and the associated outputs for ESQCR Overhead Lines and Vegetation Management in Section is shown in Table 3.7 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Resolve stays and safety signs	Lump Sum			14,104.205
Resolve LV Clearances & Refurbish OHL	km	1,045	18.377	19,203.965
Resolve 11kV Clearances	km	9,100	0.352	3,203.200
Resolve 33kV Clearances	km	1,365	0.062	84.630
Provide 11kV Resilience Cut	km	843	1.115	939.945

Provide 33kV Resilience Cut	km	2,000	0.929	1,858.000
Provide S/S Resilience Cut	Sites	300	0.667	200.000
				39,593.945

Table 3.7 – Draft determination of investment and outputs for ESQCR Overhead Lines and Vegetation Management in Section

Cables

D43 (Cables) - Scope of work

3.36 The proposed funding is for the purpose of replacing existing 'looped' services with a separate service. NIE Networks has a legacy of 'looped' services where the main electricity connection to one property is provided by a 'looped' connection from an adjacent property normally through common walls between semi-detached homes using rubber insulated tails with no earth screen. These types of service are not compliant with ESQCR legislation

D43 (Cables) - NIE Networks RP6 proposal

3.37 The proposed solution is to install a new service to the looped property and the original service is to be retained. This allows removal of the unprotected cable through the party wall and also means that each property has an individual service which is more in line with current load requirements. NIE Networks estimate the volume of these looped services to be in the region of 10,000.

3.38 NIE Networks propose to replace 10% of the total number of looped services (1,000) during RP6.

3.39 NIE Networks has set out its plans for investment in ESQCR Cables in Section 7.3 of its RP6 Network Investment Plan. These plans are summarised in Table 3.8 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
0.4kV Cables (Looped Services)	Each	1,000	2.450	**2,450.000**

Table 3.8 – NIE Networks proposed investment in ESQCR Cables

D43(Cables) – Draft determination

3.40 We have reviewed the NIE Networks plans and agree that the solution chosen to address this issue is appropriate and that the volumes are appropriate.

3.41 We have reviewed the unit costs proposed by NIE Networks and find them to be high. We consider that the works are equivalent to a replacement service with the addition of a new cutout. The Ofgem DPCR5 industry median unit cost for replacement services was £1,439 in 2015/16 price base. NIE Networks material cost for a cutout is £25. We therefore consider that an appropriate unit cost is £1,464 per service.

3.42 Our draft determination of direct investment in RP6 and the associated outputs for ESQCR Cables is shown in Table 3.9 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
0.4kV Cables (Looped Services)	Each	1,000	1.464	**1,464.210**

Table 3.9 – Draft determination of investment and outputs for ESQCR Cables

3.43 We summarise our draft determination for the entire RP6 ESQCR programme in Table 3.10 below

Sub-programme	Total Direct Allowance(£k)
Distribution Plant	460.000
High Risk Sites	19,091.349
Overhead Lines and Vegetation Management	39,593.945
Cables	1,464.210
	60,609.504

Table 3.10 – Draft determination of allowances for ESQCR programme

4 Distribution Network Reinforcement

D57a - Primary Network Projects

D57a - Scope of work

4.1 Load related primary network reinforcement is required to maintain compliance with statutory and licence obligations, primarily relating to thermal and voltage constraints on the network under intact and single circuit outage conditions.

D57a - NIE Networks RP6 proposal

4.2 NIE Networks has set out is plans for investment in Primary Network Reinforcement Projects in Section 8.1 of its RP6 Network Investment Plan beginning at paragraph 1239. These plans are summarised in Table 4.1 below.

33 kV Reinforcement Projects	Description	Proposed Costs (£k)
Armagh Main - Distribution Costs	Distribution costs associated with establishing Armagh Main 110/33kV substation	1,620.000
Airport Road	Establish 33kV substation at Airport Road to resolve load issues on the Belfast Central Main network	2,730.000
Belcoo 33/11kV Substation	Establish 33/11kV primary substation at Belcoo to resolve resupply issues associated with the single transformer site at Belleek South substation	1,970.000
Silverbridge West – Newtownhamilton East	Reinforce existing 33kV network to resolve voltage issues in the Silverbridge/Newtownhamilton area	660.000
Annsborough Central - Newcastle North	Install capacitor banks at Annsborough Central to resolve voltage issues on the Newcastle North/Annsborough Central 33kV network	250.000
Larne Main – Ballyclare Central	Build a new 33kV circuit from Larne Main to Ballyclare Central to resolve thermal and voltage issues associated with single circuit outages on the existing double circuit tower line.	1,260.000
Ballycastle Central	Install capacitor banks at Ballycastle Central to resolve voltage issues associated with single circuit outages on the 33kV network	290.000
Creagh Central	Install new 11kV circuits to transfer load from Creagh Central to Creagh Main	370.000
Cushendall Central	Reinforce 11kV network to provide resupply to Cushendall Central under fault conditions.	1,960.000
Poyntzpass Central	Replace existing 33/11kV transformers with 10/12.5MVA units to secure existing and future load at the site	460.000
Killyman Central	Replace existing 33/11kV transformers with 15/18.75MVA units to secure existing and future load at the site	550.000
Plumbridge Central	Install second transformer to enable site to	1,460.000

33 kV Reinforcement Projects	Description	Proposed Costs (£k)
	operate within licence standards under fault conditions	
Draperstown North	Install second transformer to enable site to operate within licence standards under fault conditions	830.000
Carnlough Central	Install second transformer to enable site to operate within licence standards under fault conditions	1,220.000
Ballyfodrin Central	Install second transformer to enable site to operate within licence standards under fault conditions	850.000
Derryleckagh Central	Install second transformer to enable site to operate within licence standards under fault conditions	1,400.000
TOTAL[5]		**17,856.129**

Table 4.1 – NIE Networks proposed investment in Primary Network Reinforcement Projects

D57a – Draft determination

4.3 For all proposed investments, NIE Networks provided a supporting annex, describing the need, optioneering and cost benefit analysis to support the investment. We used this information, together with load index data provided by NIE Networks for all substations and substation groups, to accept the proposed projects.

4.4 Proposed least cost reinforcements at Armagh Main and Airport Road included above are the distribution costs associated with transmission projects and we therefore move these two projects to the D5 mechanism. We recognise that should the transmission projects not proceed then the cost of the distribution solutions may be higher than the amounts we have ring-fenced in the D5 mechanism. Regardless, we will assess the project costs when they are presented to us.

4.5 Our draft determination of direct investment in RP6 and the associated outputs for Primary Network Reinforcement Projects is shown in Table 4.2.

33 kV Reinforcement Projects	Description	Costs (£k)
Armagh Main - Distribution Costs	Moved to D5 mechanism	
Airport Road	Moved to D5 mechanism	
Belcoo 33/11kV Substation	Establish 33/11kV primary substation at Belcoo to resolve resupply issues associated with the single transformer site at Belleek South substation	1,970.000
Silverbridge West – Newtownhamilton East	Reinforce existing 33kV network to resolve voltage issues in the Silverbridge/Newtownhamilton area	660.000

[5] Does not total due to rounding of individual project costs

33 kV Reinforcement Projects	Description	Costs (£k)
Annsborough Central - Newcastle North	Install capacitor banks at Annsborough Central to resolve voltage issues on the Newcastle North/Annsborough Central 33kV network	250.000
Larne Main – Ballyclare Central	Build a new 33kV circuit from Larne Main to Ballyclare Central to resolve thermal and voltage issues associated with single circuit outages on the existing double circuit tower line.	1,260.000
Ballycastle Central	Install capacitor banks at Ballycastle Central to resolve voltage issues associated with single circuit outages on the 33kV network	290.000
Creagh Central	Install new 11kV circuits to transfer load from Creagh Central to Creagh Main	370.000
Cushendall Central	Reinforce 11kV network to provide resupply to Cushendall Central under fault conditions.	1,960.000
Poyntzpass Central	Replace existing 33/11kV transformers with 10/12.5MVA units to secure existing and future load at the site	460.000
Killyman Central	Replace existing 33/11kV transformers with 15/18.75MVA units to secure existing and future load at the site	550.000
Plumbridge Central	Install second transformer to enable site to operate within licence standards under fault conditions	1,460.000
Draperstown North	Install second transformer to enable site to operate within licence standards under fault conditions	830.000
Carnlough Central	Install second transformer to enable site to operate within licence standards under fault conditions	1,220.000
Ballyfodrin Central	Install second transformer to enable site to operate within licence standards under fault conditions	850.000
Derryleckagh Central	Install second transformer to enable site to operate within licence standards under fault conditions	1,400.000
TOTAL[6]		**13,530.000**

Table 4.2 – Draft determination of investment and outputs for Primary Network Reinforcement Projects

[6] Does not total due to rounding of individual project costs

D57 Secondary Network Expenditure and LCT

11/6.6kV and LV Network Load Related Expenditure

D57 (11/6.6kV and LV network load related) - Scope of work

4.6 Load related 11/6.6kV and LV network reinforcement is required to maintain compliance with statutory and licence obligations, primarily relating to thermal and voltage constraints on the network under intact and single circuit outage conditions. NIE Networks also included modelled expenditures related to Low Carbon Technology uptake in this investment stream, we deal with this later in this section.

D57 (11/6.6kV and LV network load related) - NIE Networks RP6 proposal

4.7 NIE Networks has set out is plans for investment in Secondary Network Reinforcement and LCT in Section 8.2 of its RP6 Network Investment Plan beginning at paragraph 1253.

4.8 NIE Networks has developed an 11/6.6kV risk register and an LV risk register. These tools allow the recording of identified network risks, assigning associated solutions and prioritisation of network reinforcements to address the most problematic areas. The highest priority schemes only are included for investment during RP6.

4.9 As the specific investments that form this plan are only determined during the investment period, for both 11/6.6kV and LV load related expenditure, NIE Networks proposed that a 'run rate' based on RP5 expenditure be applied.

4.10 The proposed investment costs based on the RP5 outturns are summarised in Table 4.3 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Load related 11/6.6kV Investment	Lump Sum			2500.000
Load Related LV Investment	Lump Sum			5800.000
				8,300.000

Table 4.3 – NIE Networks proposed investment in 11/6.6kV and LV network load related

D57 (11/6.6kV and LV network load related) – Draft determination

4.11 We have reviewed the methodology developed by NIE Networks and accept the proposed load related investment in the 11/6.6kV and LV network based on the RP5 run rate.

Secondary Network Expenditure associated with Low Carbon Technologies

D57 (Secondary network LCT) - Scope of work

4.12 Low Carbon Technologies (LCTs) are designed to reduce the use of carbon fuels through the increased use of electricity for heating and transport e.g. heat pumps and electric vehicles. The scope of work is to identify reinforcements required to cater for these developments.

4.13 NIE Networks have utilised an industry recognised parametric model (TRANSFORM model) to forecast the uptake of LCTs and identify the likely reinforcements required to accommodate these connections. This model has been configured to reflect the electricity network in Northern Ireland and forecast scenarios of LCT uptake that have been developed by NIE Networks' consultants.

4.14 TRANSFORM predicts which elements in the parametric model will exceed their design parameters and presents a probabilistic view of the expenditure requirement to meet the chosen scenario.

4.15 NIE Networks presented expenditure requirements based on the low uptake scenarios, with a further reduction of 10% on the electric vehicle forecast.

D57 (Secondary network LCT) - NIE Networks RP6 proposal

4.16 NIE Networks has set out is plans for investment in Secondary Network LCT in Section 8.2 of its RP6 Network Investment Plan beginning at paragraph 1317. These plans are summarised in Table 4.4 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
LCT related 11 & 6.6 kV Investment	Lump Sum			11,700.000
LCT related LV Investment	Lump Sum			1,500.000
				13,200.000

Table 4.4 – NIE Networks proposed investment in Secondary Network LCT

D57 (Secondary network LCT) – Draft determination

4.17 We have reviewed the methodology used by NIE Networks to develop the parametric model and the scenarios used in TRANSFORM.

4.18 We note that the expenditure requirements forecast fall specifically on two main areas. The 11/6.6kV investments are predominantly forecast to be required due to overloading of small primary transformers and the LV Investment is predominantly due to overloading of distribution transformers.

4.19 The main driver for the investment in the model in the RP6 period appears to be electric vehicle charging point connections.

4.20 NIE Networks accept that at present they do not have the mechanisms to forward forecast specifically where LCT investment will be required in the year identified by the TRANSFORM model, but anticipate developing systems to achieve this by midway through the RP6 period. There will, therefore, be a delay between identification of the LCT driver and the reinforcement requirement being made.

4.21 Due to the level of uncertainty in the uptake of LCTs and the growth trajectories towards the end of RP6, our draft determination is on the basis of allowing proposed investment to March 2021, based on investment being made in the year after the need is predicted by TRANSFORM. We will re-evaluate NIE Networks' requirements as described in section 13 of the main document under "Load Re-openers".

4.22 Our draft determination of direct investment in RP6 for Secondary Network LCT is shown in Table 4.5 below.

Investment	6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	Total
11/6.6kV: LCT related investment	10.000	140.000	650.000	1,500.000	Re-evaluation			2,310.000
LV: LCT related investment	0.000	3.000	9.000	200.000	Re-evaluation			320.000
								2,630.000

Table 4.5 – Draft determination of investment for Secondary Network LCT

D57d - Fault Level

D57d - Scope of work

4.23 The driver for this investment is to ensure that all items of switchgear on the NIE Networks distribution system from 33kV down to 6.6kV level are operated within their fault level rating.

D57d - NIE Networks RP6 proposal

4.24 NIE Networks has set out its plans for investment in Fault Level Reinforcement in Section 8.3 of its RP6 Network Investment Plan beginning at paragraph 1335. These plans are summarised in Table 4.6 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Fault Level Reinforcement	Lump Sum			**1,830.000**

Table 4.6 – NIE Networks proposed investment in Fault Level Reinforcement

D57d– Draft determination

4.25 NIE Networks have proposed fault level reinforcement for any equipment currently identified to exceed its fault rating by 90%.

4.26 We make reference to Ofgem document 'Strategy Consultation for the RIIO-ED1 electricity distribution price control – Tools for cost assessment – Supplementary annex to RIIO-ED1' which states under paragraph 5.89 'Historically, forecasting the level and likely location of fault level issues has been difficult. As a result previous baselines have been set based on known issues at the time of the price control process. This has usually been based around the number of switchboards and substation busbars that have at least one item of switchgear that is experiencing a fault current level that exceeds 95 per cent of its current fault rating.'

4.27 With Ofgem's consultation document concluding under paragraph 5.91 that 'We propose to set initial baselines for Fault Level Reinforcement based on known issues affecting the network at the time the business plan is submitted.'

4.28 We agree with Ofgem's position and our determination is to accept NIE Networks fault level reinforcements for assets exceeding 95% of fault rating at the time of submission.

4.29 Our draft determination of direct investment in RP6 for Fault Level Reinforcement is shown in Table 4.7 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Fault Level Reinforcement	Lump Sum			**1,680.000**

Table 4.7 – Draft determination of allowance for Fault Level Reinforcement

4.30 We summarise our draft determination of the D57 Category in Table 4.8 below

Sub-programme	Description	RP6 Proposal (£k)	RP6 Allowance (£k)
D57a	Primary Network Projects (33 kV)	17,856.129	13,530.000
D57b	Secondary Network (11/6.6kV & LV) Load Related Expenditure	21,500.000	8,300.000
D57c	Secondary Network (11/6.6kV & LV) LCT Related Expenditure		2,600.000
D57d	Fault Level Investment	1,800.000	1,700.000
Total		**41,156.129**	**26,130.000**
Airport Rd & Armagh Main projects moved to D5 mechanism			4,350.000
LCT funding moved to mid-term review[7]			10,500.000
Total including uncertainty mechanism		**41,156.129**	**41,000.000**

Table 4.8 – Draft determination of investment Distribution Reinforcement

[7] NB. Should scenarios strengthen based on uptake of government initiatives then the reopener may be more than the current balancing figure.

D601 33kV Congestion

D601 - Scope of work

4.31 Due to forecast load erosion and the connection of further distributed generation, reverse power flows on the 33kV network may exceed statutory operating limits under intact and single circuit outage conditions.

D601 - NIE Networks RP6 proposal

4.32 NIE Networks has set out its plans for investment in 33kV Congestion in Section 8.4 of its RP6 Network Investment Plan beginning at paragraph 1351. These plans are summarised in Table 4.9 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
33kV Congestion	Lump Sum			**10,421.000**

Table 4.9 – NIE Networks proposed investment in 33kV Congestion

D601– Draft determination

4.33 NIE Networks proposed 33kV congestion reinforcement requirements are based on the scenario of zero demand and concurrent maximum generation output. Sensitivity analysis has been provided for 75%, 50% and 25% of historic minimum demand.

4.34 Our draft determination is on the basis of proposed reinforcements required when considering 75% of historic minimum demand, reflecting an average load erosion of 25% on current levels within the price control period. We believe this is a more appropriate assessment in the time scales of the RP6 period.

4.35 It is appreciated that there may be specific local factors that mean a zero demand scenario occurs, but this should not be the scenario which is used for all substations. Some substations will face more onerous conditions than this scenario and some less onerous. Load erosion rates as a result of energy efficiency may also be combatted by the take up of LCTs.

4.36 The required reinforcements were not particularly sensitive to load erosion rates with 9 of the 12 specific projects required when considering a minimum demand of 75% of current levels.

4.37 Our draft determination of direct allowance in RP6 and the associated outputs for 33kV Congestion is shown in Table 4.10 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
33kV Congestion	Lump Sum			**8,900.000**

Table 4.10 – Draft determination of direct allowance and outputs for 33kV Congestion

D602 Investing for the Future

D602 - Scope of work

4.38 Proposed plans for innovative technologies to be trialled, focussing on integrating suitably advanced smart solutions into business as usual activities.

D602 - NIE Networks RP6 proposal

4.39 NIE Networks has set out is plans for investment in 'Investing for the Future' in Section 8.5 of its RP6 Network Investment Plan beginning at paragraph 1376. These plans are summarised in Table 4.11 below.

Sub-programme	Trial Sites/Deliverables	Direct Costs (£k)
Smart Asset Monitoring	$4N^{o}$ Traffo + $2N^{o}$ OHL	1,160.000
Demand Side Response	4	1,300.000
LV Active Network Management	4	1,600.000
Voltage Management	1 (SVC/STATCOM) 5 DVRC	2,220.000
Facilitation of Energy Storage Services	0 (Literature & Policy Review only)	300.000
Forward investment in Communications Infrastructure	50% of RTUs	3,900.000
		10,480.000

Table 4.11 – NIE Networks proposed investment in 'Investing for the Future'

D602 – Draft determination

4.40 For all projects, with the exception of the facilitation of energy storage services, cost benefit analysis was provided to justify the expenditure in the innovative projects. As no cost benefit analysis was provided to support it, and the scope of the energy storage services project is considered to be a business as usual activity as new connections are requested, the costs associated with this project have been excluded from our draft determination.

4.41 The NIE Networks proposals include direct staff costs to support the innovative projects. NIE Networks have not provided evidence to detail how these additional staff costs are considered outside of existing indirect allowances via non job costed employees. NIE Networks manpower costs are therefore excluded from our draft determination in relation to investing in the future expenditure.

4.42 NIE Networks are replacing 50% of the existing RTUs under the RP6 Network IT and Telecommunications programme. In this investment programme, 'Forward investment in communications infrastructure' relates to the proposed advancement of upgrades to the remaining 50% of the RTU population in RP6 to facilitate the use of innovative solutions over conventional only solutions in addressing LCT investment requirements.

4.43 We note that in the TRANSFORM model the smart solutions are made available to the model in the following years.

Project	Solution	Available from
EAVC & STATCOM	D-FACTS – EHV connected STATCOM	2020
	D-FACTS – HV connected STATCOM	2020
DSR	DSR_DNO to Central business District DSR	2020
	DSR - DNO to residential	2020
	DSR_DNO to aggregator led EHV connected commercial DSR	2020
	DSR_DNO to EHV connected commercial DSR	2020
	DSR_DNO to aggregator led HV commercial DSR	2020
	DSR_DNO to HV commercial DSR	2021
RTTR	RTTR for EHV Overhead Lines	2020
	RTTR for EHV/HV transformers	2021
	RTTR for HV Overhead Lines	2020
LV ANM & MESHING	Permanent Meshing of Networks - LV Urban	2021
	Permanent Meshing of Networks - LV Sub-Urban	2021
	Temporary Meshing (soft open point) - LV	2021
	Active Network Management - LV	2021

Table 4.12 – NIE Networks SMART solution availability

4.44 We have analysed the forecast marginal costs associated with conventional reinforcements due to delaying RTU replacements against the use of smart solutions already included in the TRANSFORM model expenditure forecast. This analysis shows that an optimised RTU reinforcement rollout could be achieved with replacement of 50% of the proposed RTUs in the latter half of the RP6 period and the remainder of the population in the first half of the RP7 period.

4.45 Our draft determination of direct allowance in RP6 and the associated outputs for 'Investing for the Future' is shown in Table 4.13 below.

Sub-programme	Direct Costs (£k)
Smart Asset Monitoring	740.000
Demand Side Response	1,190.000
LV Active Network Management	1,450.000
Voltage Management	1,930.000
Facilitation of Energy Storage Services	0.000
Forward investment in Communications Infrastructure	1,950.000
	7,260.000

Table 4.13 – Draft determination of allowance and outputs for 'Investing for the Future'

4.46 However, we have concluded that there is further work to do to confirm that the projects proposed will deliver value and that the company should complete this work and submit the results to us before embarking on the procurement of assets and systems and the trials themselves. For example:

i) The cost benefit analysis submitted by the company to support the work proposed addressed the application of the technology in a single case assuming that the trial had been successful. The company should assess the potential application of each type of technology it proposes to trial, take account of the risk of the trial not being successful and consider the net-present value of the costs and benefits over the life of the relevant assets.

ii) In its submission, the company has highlighted technical issues which arose in some of the innovation projects carried out in GB which do not appear to have been resolved. The company should show how these technical issues can be resolved either within or outwith the proposed trial.

iii) The scope of works which the trials will deliver should be confirmed. For example, whether all software and systems necessary to manage information flow will be procured during the trials or whether additional procurement will be required. This should be built into the cost benefit analysis described above.

iv) The company has noted that the trials will be carried out on assets which are not at the limit of load because the company cannot yet confirm that the solution being trialled will work. Where an immediate solution is necessary a 'traditional' asset replacement or reinforcement is planned. However, the company should show that the trials it plans to carry out can fully test the equipment and systems over a full range of operating conditions allowing them to be applied in practice.

v) While the company does not plan to use the trial work as a means of delivering RP6 planned network investment outputs, we expect the company to deliver the solutions outlined in the programme of work as permanent solutions which could provide benefit in the long term.

vi) The company should set out the programme for the trials. We would expect the trials to inform the assessment of the LCT load reopener set out in Section **Error! Reference source not found.** beginning paragraph **Error! Reference source not found.**.

vii) In general, the trials should be sufficient to inform future application. It should address the generic technology (as opposed to the specific type tested). It should be complete in that any recommendations for further research necessary to implement the trials should be carried out under the RP6 allowance subject to the cost risk sharing mechanism.

4.47 Once we have considered NIE Networks views on these issues and further detail on its projects we will incorporate these into our final determination, including setting out the structure of the allowances and consideration of what incentive NIE Networks should have to deliver successful projects.

5 Distribution Network Optional Expenditure

5.1 In its business plan, the company identified a further £45.4m of investment which is categorised as 'optional' which it did not include in its plans for RP6. This investment is summarised in Table 5.1.

	Optional investment £m	Notes
Investment to strengthen the 11kV overhead line network.	25.6	Phased replacement of 25mm conductors on the spine of the 11kV overhead line network with 50mm conductors to address capacity and potential failure under ice loads.
Additional investment to improve flood resilience.	2.6	Improved flood resilience at 200 sites which serve 4000 consumer.
Acceletrated resilience tree cutting.	0.7	Resilience tree cutting will reduce the risk of falling trees causing damage to the network. The optional investment is to accelerate resilience tree cutting over a period of 20 years rather than the planned 25 years.
Further investment to reduce unplanned power cuts.	16.5	The company suggested that investment in additional generators (£1.0m) and investment in additional dedicated resources available for fault and emergency response (£11.5m) would reduce the 5000 homes and businesses experiencing an power cut of over 10 hours by 25%. Investment of a further £5.0m improving cirucits serving worst served customers would (those affected by 6 or more power cuts in an 18 month period) by 20%.
Total 'optional' investment	45.4	

Table 5.1: Optional network investment proposed by NIE Networks

5.2 The company presented these programmes of investment as optional[8]:

> *"because the investments received mixed levels of support during our customer and stakeholder engagement process. Domestic customers surveyed were generally supportive of the programmes and willing to pay for improvements, whilst business customers supported improvements in principle but the majority were not willing to pay for these improvements."*
>
> *"given other competing priorities in our core plan, we have decided to include these projects as optional."*

5.3 We note the company's view that this investment is optional because they are not fully supported by consumer engagement and because of the other competing priorities in the core plan. It is for the company to assess the needs of its consumers including their willingness to pay and the balance of competing priorities in its business plan. In view of this, we have not included this investment in the draft

[8] Source NIE Networks RP6 business plan 2017-2024, 8.2 and 8.3

determination. Direct network investment outputs and incentives and uncertainty mechanisms.

6 Transmission Expenditure

Major Transmission Projects

Major transmission projects - Scope of work

6.1 In its final determination for RP5, the Competition Commission defined a "D5 Mechanism" to allow for additional investment projects to increase the capacity and capabilities of NIE's transmission system. The details of the mechanism are set out in the RP5 final determination from paragraph 5.246.[9].

6.2 While the D5 project was primarily designed for additional investment to increase the capacity and capability of the transmission, its use was extended to named major transmission maintenance projects whose need had been established but where the scope, cost and programme had yet to be established.

6.3 In this section we note the need for four major transmission projects expected to incur expenditure in RP6 (the completion of investment in one D5 project determined in RP5 and three major maintenance transmission projects) as follows:

i) T501 - Ballylumford Power Station Switchboard

ii) T502 - Coolkeeragh Power Station – Magherafelt 275kV Overhead Line

iii) T503 – Omagh Tamnamore 110kV overhead line – D5

iv) T601 - Ballylumford Power Station to Castlereagh 110kV Overhead line

T501 - Ballylumford Power Station Switchboard
T502 - Coolkeeragh Power Station – Magherafelt 275kV Overhead Line

6.4 In its determination for RP5 the Competition Commission concluded that an allowance for these major transmission maintenance projects should be determined under the D5 mechanism when the company had developed the scope of the project and was in a position to prepare a reasonable scope and cost estimate. Neither of these projects has been undertaken in RP5 and NIE Networks now plans to undertake the work in RP6.

6.5 In view of the continuing uncertainty over the scope and cost estimate of these projects, we have concluded that they should be dealt with under the D5 mechanism in RP6. For the purpose of estimating tariffs, an allowance of £16.0m and £25.8m (pre-frontier shift) was included in the financial model the determination. These are

[9] https://assets.publishing.service.gov.uk/media/535a5768ed915d0fdb000003/NIE_Final_determination.pdf

ring fenced allowances to be replaced with ex-ante allowances which will be determined under the D5 mechanism.

T503 – Omagh Tamnamore 110kV overhead line – D5

6.6 An allowance for Omagh Tamnamore 3rd circuit was determined in RP5 at £21.865m in 2015/16 prices. This allowance has been profiled in proportion to the current estimated expenditure profile reported by the company in response to a query on the business plan.

6.7 The company's current estimate is that £1.0m of this investment will be made in the first year of RP6. This has been taken into account in our analysis for RP6 pending confirmation of actual expenditure which will be used in the calculation of future tariffs.

T601 - Ballylumford Power Station to Castlereagh 110kV Overhead line

6.8 The company provided an estimate for the refurbishment of this project in its business plan submission but has since identified a major risk associated with the existing foundations following similar investigations on the Coolkeeragh - Magherafelt transmission line refurbishment project. In addition, the project may be subsumed into a transmission capacity project.

6.9 In view of the uncertainty over the scope and cost estimate of this project, we have concluded that it should be dealt with under the D5 mechanism in RP6. For the purpose of estimating tariffs, an allowance of £11.8m was included in the financial model for the determination. This is a ring fenced allowance to be replaced with an ex-ante allowance which will be determined under the D5 mechanism.

General Transmission Asset Replacement

T06 - Transmission Plant Switch Houses

T06 - Scope of work

6.10 There are 3 transmission plant switch houses in commission on NIE Networks' system:

- 275kV switch house at Ballylumford
- 275kv switch house at Kilroot
- 110kV switch house at Ballylumford

6.11 The buildings are metal framed and house the open terminal switchgear at the generating plants.

6.12 The cladding on the buildings is manufactured from "Galbestos" which is a galvanised steel sheet coated in an asbestos felt and finished with a layer of polyester or bitumen. NIE Networks state that the cladding on all three buildings is now in a poor state of repair due, mainly, to saline corrosion as a result of being situated in coastal locations. The deterioration of the cladding is now becoming a safety issue given the risk of release of asbestos fibres.

T06 - NIE Networks RP6 proposal

6.13 NIE Networks has set out its plans for investment in Transmission Plant Switch Houses in Section 10.2 of its RP6 Network Investment Plan beginning at paragraph 1566. These plans are summarised in Table 6.1 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Refurbish substation buildings and associated works (Kilroot)	Site	1	350.000	**350.000**

Table 6.1 – NIE Networks proposed investment in Transmission Plant Switch Houses

T06 – Draft determination

6.14 NIE Networks forecast to complete the cladding of 1.5 buildings during RP5 at a cost of £1.6m. This equates to a unit cost per building of around £1m. Therefore, NIE Networks' proposal to complete the remaining 50% of replacement cladding at Kilroot switch house at a cost of £350k appears to be reasonable.

6.15 Although the allowance is issued as a lump sum, we still require reporting of output during the RP6 period.

6.16 Our draft determination of direct investment in RP6 and the associated outputs for Transmission Plant Switch Houses is shown in Table 6.2 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Refurbish substation buildings and associated works (Kilroot) including the removal of all Galbestos cladding	Lump Sum			**350.000**

Table 6.2 – Draft determination of investment and outputs for Transmission Plant Switch Houses

T10 - 110kV Switchgear Replacement

T10 - Scope of work

6.17 In RP4 NIE Networks began a programme of replacing Reyrolle Small Oil Volume (SOV) 110kV circuit breakers. These items of switchgear are required to isolate sections of network in the event of a fault and are therefore subjected to high current operations.

6.18 The switchgear was installed during the 60's and 70's in outdoor locations and is now showing signs of age related wear. NIE Networks also claim that the acquisition of spare parts is becoming problematic as the original equipment manufacturer is no longer supporting this type of switchgear.

6.19 National Grid is also undertaking a programme of replacing Reyrolle SOV circuit breakers.

T10 - NIE Networks RP6 proposal

6.20 NIE Networks has set out its plans for investment in 110kV Switchgear Replacement in Section 10.2 of its RP6 Network Investment Plan beginning at paragraph 1574. These plans are summarised in Table 6.3 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Replace 110kV Switchgear	Each	11	420.000	**4,620.000**

Table 6.3 – NIE Networks proposed investment in 110kV Switchgear Replacement

T10 – Draft determination

6.21 In the Network Investment RIGs NIE Networks have reported expenditure but no completed outputs; however, in paragraph 97 of the RP6 Network Investment Plan it is clearly stated that 9 outputs are complete (8 at Dungannon Main and 1 at Lisburn Main)

6.22 We used the outputs and expenditure mentioned above to calculate an outturn unit cost.

6.23 We accepted the proposed RP6 volume as NIE Networks presented a strong technical justification; however, we found the proposed unit costs to be high when compared to the RP5 outturn unit cost.

6.24 Our draft determination of direct investment in RP6 and the associated outputs for 110kV Switchgear Replacement is shown in Table 6.4 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Replace 110kV Switchgear	Each	11	313.839	**3452.233**

Table 6.4 – Draft determination of investment and outputs for 110kV Switchgear Replacement

T11 - 275kV Plant Ancillaries

T11 - Scope of work

6.25 275kV substations require many ancillary systems to enable safe and reliable operation, these include:

- LV AC supply to run lighting, heating, battery charging and building services
- LV DC supply to run protection and communication systems
- Standby generator for emergency back up and black start services
- Water service for staff facilities
- Sewerage system (not in all substations)
- Drainage
- Security

6.26 During RP4 and RP5 a rolling programme of refurbishment and replacement of substation ancillary components was undertaken.

6.27 The tasks included in the sub-programme have ranged from civil works such as drainage and concrete structure refurbishment to electro-mechanical works such as replacement of bus bars and instrument transformers.

T11 - NIE Networks RP6 proposal

6.28 NIE Networks has set out its plans for investment in 275kV Plant Ancillaries in Section 10.2 of its RP6 Network Investment Plan beginning at paragraph 1580. These plans are summarised in Table 6.5 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Replace catenary	Site	3	250.000	750.000
Remove asbestos	Lump Sum			100.000
Refurbish concrete structure	Site	3	133.333	399.999
Refurbish transformer bunds	Site	3	200.000	600.000
Replace security system	Lump Sum			100.000
Refurbish DC standby system	Lump Sum			268.790
Refurbish/upgrade earthing system	Site	5	20.000	100.000
Rewire AC system	Site	2	42.596	85.192
Refurbish control room	Site	3	25.000	75.000
Refurbish/upgrade drainage	Site	1	100.000	100.000
Replace 275kV CVT including line trap (Ballylumford)	Each	6	25.908	155.448
Replace CT (Kilroot)	Each	33	26.498	874.434
Replace 275kV disconnector	Each	12	75.000	900.000

(Hannahstown)				
Refurbish 22kV Capacitor Bank	Lump Sum			25.000
				4,533.863

Table 6.5 – NIE Networks proposed investment in 275kV Plant Ancillaries

T11 – Draft determination

6.29 We accepted the volumes and unit costs for all sub-programmes based on the fact that the total proposed amount is less than that allowed for RP5 when taken as annual spend per annum.

6.30 Most of the outputs defined in the RP5 final determination for this sub-programme were "Specified improvement at specified location(s)". Unfortunately, NIE Networks' RP5 business plan submission did not specify any volumes; subsequently we have limited data with which to form a comparison.

6.31 Our draft determination of direct investment in RP6 and the associated outputs for 275kV Plant Ancillaries is shown in Table 6.6 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Replace catenary	Site	3	250.000	750.000
Remove asbestos	Lump Sum			100.000
Refurbish concrete structure	Site	3	133.333	399.999
Refurbish transformer bunds	Site	3	200.000	600.000
Replace security system	Lump Sum			100.000
Refurbish DC standby system	Lump Sum			268.790
Refurbish/upgrade earthing system	Site	5	20.000	100.000
Rewire AC system	Site	2	42.596	85.192
Refurbish control room	Site	3	25.000	75.000
Refurbish/upgrade drainage	Site	1	100.000	100.000
Replace 275kV CVT including line trap (Ballylumford)	Each	6	25.908	155.448
Replace CT (Kilroot)	Each	33	26.498	874.434
Replace 275kV disconnector (Hannahstown)	Each	12	75.000	900.000
Refurbish 22kV Capacitor Bank	Lump Sum			25.000
				4,533.863

Table 6.6 – Draft determination of direct investment and outputs for 275kV Plant Ancillaries

T12 - 110kV Plant Ancillaries

T12 - Scope of work

6.32 110kV substations require many ancillary systems to enable safe and reliable operation, these include:

- LV AC supply to run lighting, heating, battery charging and building services
- LV DC supply to run protection and communication systems
- Standby generator for emergency back up and black start services
- Water service for staff facilities
- Sewerage system (not in all substations)
- Drainage
- Security

6.33 During RP4 and RP5 a rolling programme of refurbishment and replacement of substation ancillary components was undertaken.

6.34 The tasks included in the allowance have ranged from civil works such as drainage and concrete structure refurbishment to electro-mechanical works such as replacement of bus bars and instrument transformers.

T12 - NIE Networks RP6 proposal

6.35 NIE Networks has set out is plans for investment in 110kV Plant Ancillaries in Section 10.2 of its RP6 Network Investment Plan beginning at paragraph 1604. These plans are summarised in Table 6.7 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Refurbish transformer bunds	Each	4	45.000	180.000
Replace standby generator	Each	16	29.971	479.537
Refurbish DC standby system	Lump Sum	1	410.665	410.665
Rewire AC system	Site	3	40.215	120.645
Replace 110kV CTs	Each	3	15.521	46.563
Refurbish S/S buildings	Site	1	200.000	200.000
Replace 110kV disconnector	Each	23	35.000	805.000
Refurbish/upgrade drainage	Site	1	25.000	25.000
				2,267.410

Table 6.7 – NIE Networks proposed investment in 110kV Plant Ancillaries

T12 – Draft determination

6.36 As with T11, we accepted the volumes and unit costs for all sub-programmes based on the fact that the total proposed amount is less than that allowed for RP5 when taken as annual spend per annum.

6.37 Most of the outputs defined in the RP5 final determination for this sub-programme were “Specified improvement at specified location(s)”. Unfortunately, NIE Networks’ RP5 business plan submission did not specify any volumes; subsequently we have limited data with which to form a comparison.

6.38 Our draft determination of direct investment in RP6 and the associated outputs for 110kV Plant Ancillaries is shown in Table 6.8 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Refurbish transformer bunds	Each	4	45.000	180.000
Replace standby generator	Each	16	29.971	479.537
Refurbish DC standby system	Lump Sum	1	410.665	410.665
Rewire AC system	Site	3	40.215	120.645
Replace 110kV CTs	Each	3	15.521	46.563
Refurbish S/S buildings	Site	1	200.000	200.000
Replace 110kV disconnector	Each	23	35.000	805.000
Refurbish/upgrade drainage	Site	1	25.000	25.000
				2,267.410

Table 6.8 – Draft determination of direct investment and outputs for 110kV Plant Ancillaries

T13 - 275/110kV Transformer Replacement

T13 - Scope of work

6.39 This programme of investment has been included in the RP6 submission to provide funding for NIE Networks to replace transmission transformer assets on its network due to condition. The population of assets within this investment category covers eighteen[10] 275/110 kV transformers located in transmission substations and includes their associated auxiliary systems

T13 - NIE Networks RP6 proposal

6.40 NIE Networks has set out is plans for investment in 275/110kV Transformer Replacement in Section 10.2 of its RP6 Network Investment Plan beginning at paragraph 1617. These plans are summarised in Table 6.9 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Transformers (275/110 kV) Buy & Install	Each	1	2,743.534	2,743.534
Transformers (275/110 kV) Install only	Each	2	602.062	1,204.124
Auxiliary Transformer Replacement	Each	4	59.708	238.832
Transformer Cooler Replacement	Each	2	125.000	250.000
				4,436.490

Table 6.9 – NIE Networks proposed investment in 275/110kV Transformer Replacement

6.41 In addition to the data included in the RP6 Network investment Plan and Annex, NIE Networks also provided details of the condition assessment and dissolved gas analysis (DGA) scoring of the transformers that are proposed to be replaced. (Hannahstown IBTX2, Castlereagh IBTX1 and Tandragee IBTX2)

6.42 NIE Networks also provided modelling based on the risk cost of the transmission transformer asset base using the Common Network Asset Indices Methodology (CNAIM).

T13 – Draft determination

6.43 We reviewed the initial data and the risk cost and asset age information presented and considered that the information did not strongly support the NIE Networks proposal of replacing three transformers in RP6 and two in RP7 over replacing two transformers in RP6 and three in RP7. Following a meeting held 1 February 2017 NIE Networks have provided additional supporting information:

[10] Includes strategic spare currently located at Castlereagh

i) Most recent oil analysis results for the three 275/110kV transformer units (total population of 18) which were proposed to be replaced (Hannahstown IBTX2, Castlereagh IBTX1 and Tandragee IBTX2). Most recent results are June 2016 with trending figure information for carbonic gasses

ii) Transformer scoring sheets (275_110kV%20Transformer%20Scoring.xlsx) for ten 275/110kV transformers which includes the originally provided summary table together with derivations for the scores which had not previously been provided and included a commentary of transformer condition.

6.44 Our conclusion from the review of the latest data is that there is still inadequate demonstration of the need for any specific transformer replacement. However we recognise that NIE Networks need a strategic approach for the replacement of these assets but do not consider that the current information favours replacement of three transformers in RP6 over two replacements.

6.45 Following discussion with UR, NIEN have revised their proposal to include only the installation of two transformers in the RP6 period. NIEN note that they do not have an outage plan from SONI at this stage for the three transformers that were originally identified for replacement. However, in removing a unit from the programme, they will manage the risk of failure by delaying the replacement of Hannahstown IBTX2 until the very end of RP6. (due to the long lead times in procuring a unit of this size, approximately. 1.5 - 2 years).

6.46 Our draft determination of direct investment in RP6 and the associated outputs for 275/110kV Transformer Replacement is shown in Table 6.10 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Transformers (275/110 kV) Install only	Each	2	602.062	1,204.124
Auxiliary Transformer Replacement	Each	4	59.708	238.832
Transformer Cooler Replacement	Each	2	125.000	250.000
				1,692.956

Table 6.10 – Draft determination of direct investment and outputs for 275/110kV Transformer Replacement

T14 – 110/33kV Transformer Replacement

T14 - Scope of work

6.47 This programme of investment has been included in the RP6 submission to provide funding for NIE Network in order to replace transmission transformer assets on its network due to condition. The population of assets within this investment category covers 78N^{o} 110/33 kV transformers located in transmission substations and includes their associated auxiliary systems.

T14 - NIE Networks RP6 proposal

6.48 NIE Networks has set out its plans for investment in 110/33kV Transformer Replacement in Section 10.2 of its RP6 Network Investment Plan beginning at paragraph 1629. These plans are summarised in Table 6.11 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Install Transformer Only	Each	7	379.920	2,659.440
Procure Transformer Only	Each	6	681.000	4,086.000
Associated Cable Works	Lump Sum			1,670.000
Replace Earthing Transformer	Each	2	72.708	145.416
Replace Transformer Cooler	Each	7	125.000	875.000
				9,435.856

Table 6.11 – NIE Networks proposed investment in 110/33kV Transformer Replacement

6.49 NIE Networks propose to replace nine transformers (Ballymena Tx3, Ballymena Tx4, Banbridge Tx1, Banbridge Tx2, Banbridge TX3, Banbridge TX4, Enniskillen Tx1, Enniskillen Tx2 and Glengormley TXB) with seven transformers. The two transformers Bainbridge T3 and T4 will be managed off the system through the replacement of Bainbridge T1 and T2.

6.50 NIE Networks have the cost of one transformer funded in RP5 (this is 50% of the cost of purchasing the replacement for Ballymena Tx3 and Tx4). There is a system spare transformer at Donegall that that will be used as a rolling spare through the replacement programme leaving a system spare at the end of RP6. Hence the proposed plan to buy six transformers in RP6 and install seven.

6.51 NIE Networks have provided the most recent oil analysis results for nine of the 110/33kV transformer units which are proposed to be replaced. These are from June 2016 with trending figure information for carbonic gasses

6.52 Transformer scoring sheets have also been provided following request from UR which provides derivations for the condition scores which had not previously been provided.

6.53 NIE Networks considered three investment options:

Option 1 – Replace 12 transformers with condition monitoring of the remaining population

Option 2 – Replace 9 transformers and defer 3 transformers until RP7.

Option 3 – Refurbish as an alternative to replacement.

6.54 NIE Networks concluded that Option 3 increased the risk to a level that NIE Networks could not accept, Option 1 is the least risk option but Option 2 was preferred from a cost perspective (and as the reduced number of outages would be easier to arrange with SONI) but would require greater focus on condition monitoring.

T14 – Draft determination

6.55 We have reviewed in detail the information provided by NIE Networks.

6.56 Whilst the additional DGA trend information provided by NIE Networks is supportive of the methodology adopted by NIE Networks, the detail does not demonstrate the clear need for replacement of specific units in isolation. However we recognise the need for NIE Networks to have a strategic approach to replacement of these assets but given that the programme will take place throughout the RP6 period and into RP7 we do not consider that there is a need to fund the retention of a strategic spare in RP6 and we have reduced the expenditure accordingly.

6.57 We have reviewed the unit costs provided by NIE Networks and consider them to be in line with current industry norms.

6.58 It is noted that NIE Networks have not yet agreed an outage plan with SONi for the proposed works.

6.59 Our draft determination of direct investment in RP6 and the associated outputs for 110/33kV Transformer Replacement is shown in Table 6.12 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Install Transformer Only	Each	7	379.920	2,659.440
Procure Transformer Only	Each	5	681.000	3,405.000
Associated Cable Works	Each	1	1,670.000	1,670.000
Replace Earthing Transformer	Each	2	72.708	145.416
Replace Transformer Cooler	Each	7	125.000	875.000
				8,754.856

Table 6.12 – Draft determination of direct investment and outputs for 110/33kV Transformer Replacement

T15 22kV Reactor Replacement

T15 - Scope of work

6.60 Due to the fact that transmission lines and cables are naturally capacitive it is possible for the voltage at the remote ends of feeders to be higher than that of the source at times of low load.

6.61 In order to keep voltages within statutory limits, large inductors (reactors) are installed at strategic points on the system and are brought into service at times of lowest load to provide inductive reactance which counters the natural capacitive reactance of the system.

6.62 The reactors are installed on the 22kV tertiary windings of 275/110kV transformers at:

- Castlereagh IBT2
- Tandragee IBT1
- Tandragee IBT2
- Kells IBT1
- Kells IBT2
- Hannahstown IBT1
- Hannahstown IBT2

6.63 The reactors were originally installed between 1963 and 1979

T15 - NIE Networks RP6 proposal

6.64 NIE Networks has set out is plans for investment in 22kV Reactor Replacement in Section 10.2 of its RP6 Network Investment Plan beginning at paragraph 1642. These plans are summarised in Table 6.13 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Procure and install 22kV Reactors	Each	2	681.961	1,363.922
Procure 22kV Reactors only	Each	1	550.000	550.000
Replace Reactor Cooler	Each	1	47.000	47.000
				1,960.922

Table 6.13 – NIE Networks proposed investment in 22kV Reactor Replacement

T15 – Draft determination

6.65 We compared NIE Networks' RP6 proposal with their forecast outturn as no RIGs data has yet been submitted and no external comparative data is available.

6.66 We found the unit costs to be acceptable when compared to the RP5 allowances and forecast outturn unit costs. Taking into account the age of the originally installed reactors and the increasing risk of failure we also found the volume to be acceptable and the procurement of a spare reactor to be justified.

6.67 Our draft determination of direct investment in RP6 and the associated outputs for 22kV Reactor Replacement is shown in Table 6.14 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Procure and install 22kV Reactors	Each	2	681.961	1,363.922
Procure 22kV Reactors only	Each	1	550.000	550.000
Replace Reactor Cooler	Each	1	47.000	47.000
				1,960.922

Table 6.14 – Draft determination of investment and outputs for 22kV Reactor Replacement

T16 Transmission Transformer Refurbishment

T16 - Scope of work

6.68 NIE Networks has historically carried out refurbishment works on its fleet of 275/110kV and 110/33kV transformers. The works have generally focussed on:

- Bushing refurbishment/replacement
- Painting
- Tap changer repairs
- Disconnector refurbishment and spares

6.69 The purpose of the above works is to replace transformer and associated components to allow key items of plant to remain in service until they are no longer fit for purpose due to an unacceptable risk of failure or are deemed to be beyond economic repair.

T16 - NIE Networks RP6 proposal

6.70 NIE Networks has set out its plans for investment in Transmission Transformer Refurbishment in Section 10.2 of its RP6 Network Investment Plan beginning at paragraph 1657. These plans are summarised in Table 6.15 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Refurbish/Replace 275kV bushing	Each	3	30.924	92.772
Paint 275kV Plant	Site	4	10.512	42.048
Refurbish 275kV TX tap changer	Each	2	17.345	34.690
Refurbish 110kV cooler	Each	4	56.351	225.404
Replace 110kV Bushing	Each	18	15.446	278.028
Paint 110kV Plant	Site	9	7.880	70.920
Refurbish 110kV disconnector	Lump Sum	1	50.000	50.000
Refurbish 110kV TX tap changer	Each	4	13.780	55.120
PST Tap changer defect repair	Each	1	40.000	40.000
				888.982

Table 6.15 – NIE Networks proposed investment in Transmission Transformer Refurbishment

T16 – Draft determination

6.71 We compared NIE Networks' RP6 proposal with their forecast outturn as no volume data has been included in the RIGs submission and no external comparative data is available.

6.72 With the exception of 275kV plant painting and 110kV disconnector refurbishment all unit costs proposed for RP6 are below the RP5 forecast unit costs. In addition, the proposed annual average expenditure is £0.14m compared with an RP5 allowance of £0.22m and NIE Networks' RP5 forecast of £0.26m. We, therefore, accepted the volumes and unit costs for this sub-programme.

6.73 Our draft determination of direct investment in RP6 and the associated outputs for Transmission Transformer Refurbishment is shown in Table 6.16 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Refurbish/Replace 275kV bushing	Each	3	30.924	92.772
Paint 275kV Plant	Site	4	10.512	42.048
Refurbish 275kV TX tap changer	Each	2	17.345	34.690
Refurbish 110kV cooler	Each	4	56.351	225.404
Replace 110kV Bushing	Each	18	15.446	278.028
Paint 110kV Plant	Site	9	7.880	70.920
Refurbish 110kV disconnector	Lump Sum	1	50.000	50.000
Refurbish 110kV TX tap changer	Each	4	13.780	55.120
PST Tap changer defect repair	Each	1	40.000	40.000
				888.982

Table 6.16 – Draft determination of investment and outputs for Transmission Transformer Refurbishment

Transmission Overhead Lines

T17 – 275kV Transmission Overhead Line Asset Replacement

T17 - Scope of work

6.74 NIE Networks has included this project as a result of the deteriorated condition of many of the component elements that comprise the 275 kV overhead line network. The key issues cited by NIE Networks in their original submission included:

i) Eight failures of one or more line conductor sections on the Coolkeeragh PS – Magherafelt line have occurred between 2008 – 2016 with the overall remaining conductor lifetime indicated as being towards end RP5.

ii) Line conductor phase spacers have previously caused problems, particularly Bowthorpe metal-to-metal connections, which can cause chafing and result in broken conductor strands and ultimately a broken conductors.

iii) Conductor galloping has been an issue on a number of 275 kV circuits include Coolkeeragh PS – Magherafelt, Ballylumford PS – Hannahstown, Ballylumford PS – Magherafelt, Ballylumford PS - Kells and Tandragee – Louth circuits. This can lead to weakening of tension insulator sets resulting in subsequent failure.

iv) Around 20% of 275 kV overhead line tension and suspension insulators have yet to be replaced and are in poor condition.

v) The condition of overhead line tower steelwork is dependent on regular painting and replacement of damaged / corroded steel members. NIE Networks data indicates that around 19% of the tower population has steelwork condition such that painting alone would not be expected to increase remaining life and replacement steel sections will be required.

vi) Steel tower foundation protective paint is in generally poor condition. NIE Networks propose to carry out a number of surveys of tower foundation corrosion during RP6.

T17 - NIE Networks RP6 proposal

6.75 In relation to the proposed volumes of equipment presented in Table 6.17, NIE Networks are proposing to:

i) Replace all poor condition colour & number plates plus 50% of average condition plates, the latter being included to account for some average condition plates that will deteriorate in condition during the period.

ii) Perform line conductor spacers replacements relating to the Kilroot – Kells and Kilroot – Hillsborough 275 kV overhead lines.

iii) Replace 275 kV line insulators in poor condition as well as those on the Kilroot – Kells and Kilroot – Hillsborough lines which are over 40 years old.

iv) Perform samples on 10% of tower population for overall condition as well as foundation condition (only one leg per tower) during RP6 to better understand full remedial requirements.

v) Perform foundation muff repairs (separate from the detailed foundation condition assessment above) on 20% of towers during RP6 given that few have been assessed previously.

6.76 NIE Networks has set out its revised plans for investment in 275kV Transmission Overhead Line Asset Replacement in Section 2.10 of the NIE Networks Response Post Engagement and Queries – Part 2. These plans are summarised in Table 6.17 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Colour & No Plates	Each	310	0.595	184.450
Spacers	Site	502	1.100	552.200
Suspension Insulators	Each	390	3.597	1402.830
Tension Insulators	Each	112	11.240	1258.800
Tower Painting	Each	536	5.045	2704.120
Foundation Assessment	Site	124	3.000	372.000
Condition Assessment	Lump Sum			195.012
Trolley Inspection	Each	245	0.600	147.000
Foundation Muff Repair	Each	247	1.900	469.300
				7,285.712

Table 6.17 – NIE Networks proposed investment in Transmission Overhead Line Asset Replacement

T17 – Draft determination

6.77 We have reviewed the NIE Networks' submission information in detail provided.

6.78 Based on review of the latest supporting information, the proposed NIE Networks T17 work activity volumes are considered appropriate being substantiated with specific reference and commentary to supporting asset condition data.

6.79 Similarly, we have reviewed the revised plant unit costs provided by NIE Networks. These are also supported by reference to current contracted costs for the majority of activities and in some proposed RP6 unit costs are slightly lower than present RP5 outturns. We therefore consider the proposed NIE Networks unit costs to be reasonable and in line with industry norms.

6.80 Overall, the total proposed T17 work programme cost, which has been reduced by circa £561k from the initial submission, is considered reasonable.

6.81 Our draft determination of direct investment in RP6 and the associated outputs for Transmission Overhead Line Asset Replacement is shown in Table 6.18 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Colour & No Plates	Each	310	0.595	184.450
Spacers	Site	502	1.100	552.200
Suspension Insulators	Each	390	3.597	1402.830
Tension Insulators	Each	112	11.240	1258.800
Tower Painting	Each	536	5.045	2704.120
Foundation Assessment	Site	124	3.000	372.000
Condition Assessment	Lump Sum			195.012
Trolley Inspection	Each	245	0.600	147.000
Foundation Muff Repair	Each	247	1.900	469.300
				7,285.712

Table 6.18 – Draft determination of direct investment and outputs for Transmission Overhead Line Asset Replacement

T19 – 110kV Transmission Overhead Line Asset Replacement

T19 - Scope of work

6.82 NIE Networks has included this project as a result of the deteriorated condition of many of the component elements that comprise the 110 kV overhead line network. The key issues cited by NIE Networks in their submission include:

i) A sizeable proportion of the 110 kV overhead line network has been the focus of refurbishment investments during RP4 and RP5. However, the remainder of the network has not seen significant refurbishment and consequently is in poor condition.

ii) A number of 110 kV overhead lines utilise Hardex type earthwire (containing an internal pilot wire) which is a redundant type of equipment. NIE Networks propose to replace all Hardex earthwire by the end of RP6.

iii) The condition of 110 kV overhead line conductors is generally considered to be acceptable and hence suitable for continued use through RP6. The exception is in relation to 30 specific span lengths on the Finaghy – Donegall and Castlereagh – Rosebank 110 kV circuits which have been identified for replacement.

iv) 110 kV wooden poles have seen replacement over previous regulatory period. However, NIE Networks data indicates around 582 wooden poles, predominantly those over 50 years old, are currently in a decayed state and require replacement during RP6. Further 110 kV wooden poles are also expected to reach a decayed state during RP6 and also require replacement.

v) The condition of overhead line tower steelwork is dependent on regular painting and replacement of damaged / corroded steel members. NIE Networks data indicates that around 16% of the tower population currently has steelwork condition such that painting alone would not be expected to increase remaining life and replacement steel sections will be required.

vi) Steel tower foundation protective paint is in generally poor condition. NIE Networks propose to carry out a number of surveys of tower foundation corrosion during RP6.

6.83 Note that the T19 work programme excludes the Ballylumford PS – Castlereagh 110 kV overhead line which is in particularly poor condition and consequently is the subject of a separate (T601) investment project.

T19 - NIE Networks RP6 proposal

6.84 In relation to the proposed volumes of equipment presented in Table 6.17, NIE Networks are proposing to:

i) Replace all poor condition colour & number plates plus 50% of average condition plates, the latter being included to account for some average condition plates that will deteriorate in condition during the period.

ii) Undertake replacement of 1,100 wooden pole sets that are, or expected to become decayed during RP6 along with a further 200 wooden poles that will be greater than 60 years old at the start of the RP6 period.

iii) Perform samples on 10% of tower population for overall condition as well as foundation condition (only one leg per tower) during RP6 to better understand full remedial requirements. Tower condition assessments will be performed largely via tower climbing and in some cases supported by drone or helicopter assessment.

iv) Replace the earthwire on the Ballylumford – Ballyvallagh and Eden – Kilroot 110 kV double circuit overhead lines.

v) Perform foundation muff repairs (separate from the detailed foundation condition assessment above) on 20% of double circuit towers during RP6 given that few have been assessed previously.

vi) Undertake tower painting on 571 double circuit and 202 single circuit 110 kV towers during RP6. This will add to the 553 towers that were addressed during RP5 representing broadly three quarters of the total tower population where tower painting will have been undertaken over two price review periods.

6.85 NIE Networks has set out its plans for investment in 110 kV Transmission Overhead Line Asset Replacement in Section 2.11 of the NIE Networks Response Post Engagement and Queries – Part 2. These plans are summarised in Table 6.19 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Replace conductor	Span	30	27.556	826.680
Replace colour and number plates	Each	248	0.600	148.800
Tower Painting	Site	773	1.906	1,473.338
Replace wood poles	Each	1,300	3.135	4,075.500
Foundation assessment	Each	178	3.000	534.000
Condition assessment	Lump Sum			154.518
Earthwire Replacement	Site	70	16.450	1,151.500
Muff repairs	Site	263	1.900	499.700
				8,864.036

Table 6.19 – NIE Networks proposed investment in Transmission Overhead Line Asset Replacement

T19 – Draft determination

6.86 We have review the NIE Networks submission information in detail including supplementary data provided through the clarification process.

6.87 Based on review of the submission information the proposed NIE Networks T19 work activity volumes are considered appropriate for the majority of T19 activities. Proposed work activity volumes have been substantiated with specific reference and commentary to supporting asset condition data.

6.88 The exception is in relation to proposed 110 kV wooden pole set replacements where we have been unable to identify a similar total volume requirement as per the NIE Networks submission by applying the same methodology. Using the NIE Networks methodology and the assets data provided in the business plan submission we derived a lower total volume of 1,170 replacement wooden pole sets. We have therefore based our assessed expenditure on this volume.

6.89 The submitted NIE Networks unit cost data has also been reviewed. Proposed plant / activity unit costs have therefore been confirmed as being reasonable and in line with industry norms with the exception of the proposed 110 kV earthwire replacement cost. Despite providing data to support claimed unit costs for other T19 work activities NIE Networks have provided little substantiation for their claimed unit cost rate despite stating that a bottom-up estimate has been used in deriving their proposed value (£16,450 per span). This has not been provided as part of their submission. Therefore, we consider that the quoted cost for earthwire replacement is effectively a budgetary cost estimate which we consider will, in line with standard practice, include an element of cost safety margin for certain delivery elements, 10% being the norm. Consequently, we have reduced the unit cost for earthwire replacement by 10% to £14,805 per span.

6.90 Our draft determination of direct investment in RP6 and the associated outputs for Transmission Overhead Line Asset Replacement is shown in Table 6.20 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Replace conductor	Span	30	27.556	826.680
Replace colour and number plates	Each	248	0.600	148.800
Tower Painting	Site	773	1.906	1,473.338
Replace wood poles	Each	1,170	3.135	3667.950
Foundation assessment	Each	178	3.000	534.000
Condition assessment	Lump Sum			154.518
Earthwire Replacement	Site	70	14.805	1,036.350
Muff repairs	Site	263	1.900	499.700
				8,341.336

Table 6.20 – Draft determination of direct investment and outputs for Transmission Overhead Line Asset Replacement

T20 – Transmission Cables

T20 - Scope of work

6.91 Prior to RP5, NIE Networks (and most GB DNOs) had taken a reactive approach to transmission cable management. However, as new technologies have progressed and have become more affordable DNOs are becoming more proactive.

6.92 Technologies which are becoming more prevalent are:

- Partial Discharge (PD) testing – trend analysis can help determine the condition of cable insulation
- Dodecylbenzene (DDB) – a modern synthetic insulating fluid used to supplement conventional mineral insulating oil. Provides improved dielectric performance.
- Perfluorocabon Tracer (PFT) – used to dope insulating fluid and can be detected at extremely low levels allowing small leaks on fluid filled cable to be easily detected.

T20 - NIE Networks RP6 proposal

6.93 NIE Networks has set out is plans for investment in Transmission Cables in Section 10.2 of its RP6 Network Investment Plan beginning at paragraph 1708. These plans are summarised in Table 6.21 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Replacement of Sheath Voltage Limiters	Each	9	5.357	48.213
110kV cable refurbishment	Lump Sum			273.471
Cable Flushing	M	9800	0.013	127.400
Transmission Cables Accessories and Ancillaries	Lump Sum			407.870
				856.954

Table 6.21 – NIE Networks proposed investment in Transmission Cables

T20 – Draft determination

6.94 We accepted the proposed volume of sheath voltage limiters as these replacements remove the last of the old, unreliable SVLs from the system. The proposed unit costs are lower than RP5 outturn therefore we accept.

6.95 The lump sum for cable refurbishment has been accepted based on the strong technical justification provided by NIE Networks.

6.96 During the query process NIE Networks provided further breakdown of costs associated with cable flushing. The additional data was sufficient justification for the increased unit costs in RP6 therefore we accepted.

6.97 Cable accessories and ancillaries is an ongoing programme to replace/refurbish key elements of the 110kV cable system. Given the strong technical justification provided by NIE Networks, we accept the continuation of this sub-programme.

6.98 Our draft determination of direct investment in RP6 and the associated outputs for Transmission Cables is shown in Table 6.22 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Replacement of Sheath Voltage Limiters	Each	9	5.357	48.213
110kV cable refurbishment	Lump Sum			273.471
Cable Flushing	M	9800	0.013	127.400
Transmission Cables Accessories and Ancillaries	Lump Sum			407.870
				856.954

Table 6.22 – Draft determination of direct investment and outputs for Transmission Cables

T602 – Transmission Protection

T602 - Scope of work

6.99 The proposed investment covers three main equipment categories;

i) Electrical protection systems

ii) Control panels

iii) Substation monitors

6.100 Protection systems and monitoring equipment inherently have a shorter asset life than their associated switchgear and plant and therefore in addition to end of life replacement for switchgear and plant there is a requirement to replace protection system during the life of the associated switchgear and plant.

T602 - NIE Networks RP6 proposal

6.101 Electrical Protection Systems

i) NIE Networks has stated that replacement of protection systems covering four main technology types is required:

(i) Electromechanical protection systems – most of the devices on the system are more than 40 years old, so well past the typical design life of 30 years. Although the systems have been generally reliable, more recently there has been evidence of deterioration and the technology is now obsolete.

(ii) Static technology relays – these relays will be over 25 years old during RP6, so can be considered obsolete. Spares will be limited and there is no ongoing original manufacturer support. Equipment failures have been reported in recent years.

(iii) Early digital protection – these protection devices will also be over 25 years during RP6 so can be considered obsolete, without support from the original manufacturer.

(iv) Unit protection schemes – the need for investment is driven by equipment reliability issues. The technology is also no longer supported by the original manufacturer.

ii) Given the critical nature of protection systems for successful network operation, NIE Networks consider that replacement of the systems is required to prevent deterioration of the network leading to system stability and safety issues, along with a need to reduce the risk of damage to the network that could cause significant impact on customer service levels.

iii) In determining the investment requirement NIE Networks presented options for replacing all units identified as in need of replacement in RP6 and also an option to defer a proportion until RP7. NIE Networks determined that the deferment option was preferred and provides a number of spares that can be used to manage the population that remains into RP7.

iv) Costs are based on current contract prices.

6.102 Control Panels

i) NIE Networks state they have identified two control panels for replacement. This assessment has been based upon failed control switches and relays.

ii) Due to these discrete equipment failures, NIE Networks cannot operate certain items of plant remotely. This lack of remote control and operation can cause post-fault restoration delays causing unnecessary system disruption.

iii) Costs are based on current contract prices.

6.103 Substation Monitors

i) The existing substation monitors were installed in the late 1980's and 1990's. The primary function of the monitor was to act as a Fault Recorder for post-fault data investigation and analysis. NIE Networks state that the monitors are now obsolete and in poor condition with several no longer able to function correctly.

ii) Modern networks now require a wide range of information that cannot be obtained from the existing monitors, mainly related to power quality issues. NIE Networks therefore consider that the investment is required to both replace the obsolete and mal-functioning monitors, and also increase the data available for post-fault investigation and power quality monitoring.

iii) NIE Networks considered options of replacing the proposed 30 monitors against just replacing monitors on one side of a 275kV circuit. This would allow deferring a number of replacements until RP7. It was determined that due to the critical nature of the 275kV network and the impact that one fault can have on the entire network, it is essential that NIE Networks and SONI have access to recorded information on faults to carry out effective investigation and so the option to replace the 30 monitors was chosen.

iv) Costs are based on current contract prices.

6.104 NIE Networks has set out its plans for investment in Transmission Protection in Section 10.2 of its RP6 Network Investment Plan beginning at paragraph 1773. Further detailed volumes and costs were provided in response to query URQ031a. These plans are summarised in Table 6.23 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
275kV Protection				
275kV Buszone (5 Zone)	Each	1	87.000	87.000
275kV Buscoupler	Each	3	13.500	40.500
275KV Control Panel	Each	2	117.538	235.076
275kV Buszone (3 Zone)	Each	2	55.800	111.600
Interbus Transformer Protection	Each	5	61.250	306.250
Mesh Corner	Each	2	14.600	29.200
275KV Group Alarms	Each	5	24.324	121.618
275kV Feeder Protection	Each	20	71.113	1,422.260
OCEF Gen Prot	Each	2	24.000	48.000
Circuit Breaker Fail	Each	23	7.163	164.749
22kV Reactors	Each	4	24.000	96.000
Strategic Spare Relays	-	-		50.000
275kV Protection Total				**2,712.253**
110kV Protection				
110kV Buszone Protection (4 Zone)	Each	12	15.000	180.000
Group Alarms	Each	3	42.292	126.876
Transformer Protection	Each	6	31.300	187.800
Distance Protection	Each	8	32.225	257.800
Tap Change Control	Each	6	12.025	72.150
Combined Transformer Protection and Tap Changer	Each	1	77.200	77.200
Load Shedding (Relay Change Only and Minor Wiring	Each	7	3.625	25.375
Unit Protection (3 end scheme)	Each	12	26.625	319.500
Unit Protection	Each	2	31.575	63.150
Intertripping	Each	2	16.750	33.500
Computer Based Alarm Panel	Each	1	11.500	11.500
Load Shedding Panel	Each	2	9.113	18.226
Strategic Spare Relays	-	-		50.000
110kV Protection Total				**1,423.077**
Substation Monitors				
Grid 275kV	Each	15	25.873	388.095
Grid 110kV	Each	9	25.232	227.088
Main 110kV	Each	6	26.850	161.100
Substation Monitors Total				**776.283**
Transmission Protection Total				**4,911.613**

Table 6.23 – NIE Networks proposed investment in Transmission Protection

T602 – Draft determination

6.105 We have reviewed the information provided by NIE Networks and clarified the volumes and costs through question and answer sessions.

6.106 We consider that there is a clear current need for the T602 work programme.

6.107 The volume of the potential work requirements during RP6 has been adequately defined and the requested volumes are appropriate.

6.108 We have reviewed the costs and find them in line with industry norms.

6.109 We have confirmed that that protection costs are not included under plant specific items and are apportioned under discrete protection allowances, thereby removing the potential for overlap of allowances across equipment categories.

6.110 We disallowed the cost for strategic spares with no defined volumes (£100,000) owing to lack of justification in the Business Plan.

6.111 Our draft determination of direct investment in RP6 and the associated outputs for Transmission Protection is shown in Table 6.24 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
275kV Protection				
275kV Buszone (5 Zone)	Each	1	87.000	87.000
275kV Buscoupler	Each	3	13.500	40.500
275KV Control Panel	Each	2	117.538	235.076
275kV Buszone (3 Zone)	Each	2	55.800	111.600
Interbus Transformer Protection	Each	5	61.250	306.250
Mesh Corner	Each	2	14.600	29.200
275KV Group Alarms	Each	5	24.324	121.618
275kV Feeder Protection	Each	20	71.113	1,422.260
OCEF Gen Prot	Each	2	24.000	48.000
Circuit Breaker Fail	Each	23	7.163	164.749
22kV Reactors	Each	4	24.000	96.000
275kV Protection Total				**2,662.253**
110kV Protection				
110kV Buszone Protection (4 Zone)	Each	12	15.000	180.000
Group Alarms	Each	3	42.292	126.876
Transformer Protection	Each	6	31.300	187.800
Distance Protection	Each	8	32.225	257.800
Tap Change Control	Each	6	12.025	72.150
Combined Transformer Protection and Tap Changer	Each	1	77.200	77.200
Load Shedding (Relay Change Only and Minor Wiring	Each	7	3.625	25.375
Unit Protection (3 end scheme)	Each	12	26.625	319.500

Unit Protection	Each	2	31.575	63.150
Intertripping	Each	2	16.750	33.500
Computer Based Alarm Panel	Each	1	11.500	11.500
Load Shedding Panel	Each	2	9.113	18.226
110kV Protection Total				**1,373.077**
Substation Monitors				
Grid 275kV	Each	15	25.873	388.095
Grid 110kV	Each	9	25.232	227.088
Main 110kV	Each	6	26.850	161.100
Substation Monitors Total				**776.29**
Transmission Protection Total				**4,811.613**

Table 6.24 – Draft determination of direct investment and outputs for Transmission Protection

Transmission Networks Access and Commissioning

T603 Scope of work

6.112 At the outset of RP5 NIE Networks outsourced all operational activities to their subsidiary, NIE Powerteam. Part of NIE Networks' related party costs was a payment to NIE Powerteam called the "Managed Service Charge" (MSC). This transaction covered the costs of NIE Powerteam's technical engineers and "ops and outage".

6.113 Basically, the above cost categories were NIE Powerteam's costs for:

- commissioning new network components,
- routine system testing,
- fault location, and
- switching operations to allow access to the network

6.114 NIE Networks reorganised their operations during RP5 and absorbed NIE Powerteam into the core business. Although the transaction between NIE Networks and NIE Powerteam ceased, the costs covered by the MSC still exist within the core business.

T603 NIE Networks RP6 proposal

6.115 NIE Networks has set out its plans for investment in Distribution Network Access and Commissioning in Section 6.6 of its RP6 Network Investment Plan beginning at paragraph 1137. These plans are summarised in Table 6.25 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Network Access & Commissioning	Lump Sum			1,305.000

Table 6.25 – NIE Networks proposed investment in Network Access and Commissioning

T603 Draft determination

6.116 We calculated an allowance based on reported outturn expenditure between 2012/13 and 2015/16 extrapolated for the RP6 price control duration. When compared to our calculated figure the NIE Networks proposal was deemed to be acceptable.

7 T40 – Transmission ESQCR

T40 - Scope of work

7.1 The works for transmission ESQCR fall into the same categories as distribution. The works in RP6 include:

i) addressing the signs and anti-climbing guards as required by 2022;

ii) completing a programme to address the risks associated with Very High Risk sites; and

iii) commencing the programme of additional remedial works addressing clearances.

7.2 It is expected that all of these will be addressed by enhanced signage and climbing guards.

T40 - NIE Networks RP6 proposal

7.3 NIE Networks has set out is plans for investment in Transmission ESQCR in Section 11 of its RP6 Network Investment Plan. These plans are summarised in Table 7.1 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Proposal(£k)
Transmission ESQCR	Lump Sum			165.128

Table 7.1 – NIE Networks proposed investment in Transmission ESQCR

T40 – Draft determination

7.4 We are satisfied that the proposal is based on the population of 110kV and 275kV towers and that the proposed costs have been calculated based on the remedial works arising from trial samples undertaken in RP5.

7.5 The funding is allowed on the basis of the transmission network being ESQCR compliant within the timeframe stated in the legislation and that no further funding will be allowed for these works with the exception of business as usual maintenance.

7.6 Our draft determination of direct investment in RP6 and the associated outputs for Transmission ESQCR is shown in Table 7.2 below.

Sub-programme	UoM	Volume	Unit Cost (£k)	Total Direct Allowance(£k)
Transmission ESQCR	Lump Sum			165.128

Table 7.2 – Draft determination of direct investment and outputs for Transmission ESQCR

8 Transmission – Potential Additional Investment

Overview

8.1 NIE Network highlighted the potential for a material amount of additional investment in RP6 to improve the capacity or capability of the transmission network. This includes:

v) strategic projects such as the North South interconnector necessary to enhance security of supply and facilitate the energy market across the island of Ireland;

vi) local reinforcement of the transmission network to cater for load growth; and,

vii) reinforcement to secure the dispatch of energy from wind farms and reduce the risk of curtailment of generation capacity.

8.2 NIE Networks is not responsible for developing, designing and promoting these projects. This is the role of the Transmission Systems Operator (TSO), SONI. NIE Networks' responsibility is to procure and construct the projects once SONI has completed its work and handed the project over to NIE Networks for delivery. NIE Networks funds the investment and the efficient cost of investment is recovered from consumers through tariffs net of any contributions received.

8.3 In RP5, investment necessary to improve the capacity or capability of the transmission network was approved on a case by case under the 'D5' mechanism which formed part of the Competition Commissions 'Price Control Design'. We have set out our intention to continue with this 'D5' mechanism for RP6. As a result, our determination does not commit to an allowance for this type of project. However, as the level of investment is expected to be material, we have taken account of information provided by NIE Networks and SONI and our own estimates to include an estimate value in tariff modelling for RP6 to ensure that the impact on tariffs of the potential scale of investment is clear to consumers.

NIE Networks submission

8.4 In its submission, the company provided an itemised list and description of potential additional transmission investment.[11]

8.5 The company indicated that the total value of the list of projects was in excess of £250m but it anticipated that the amount that will be incurred during RP6 will be considerably less than this amount due to:

[11] NIE Networks Business Plan submission, Chapter 10.

i) the validation of the case of need and optimal solution for each project;

ii) the pace at which SONI is able to progress the necessary pre construction, taking account in particular of the uncertainties around securing landowner and statutory permissions; and

iii) the level of expenditure incurred on the construction of the proposed North South Interconnector.

8.6 The company did not include an allowance for these projects in the financial submissions or tariff modelling included in its Business Plan.

Engagement with SONI

8.7 We asked SONI, which is responsible for developing, designing and promoting these projects, for its current best estimate of the costs of these projects and the annual profile of expenditure.

8.8 SONI's current best estimate of all projects which are likely to progress in RP6 was £259m. It suggested that a potential lower end of the capex range was £230m. SONI caveated its response to us highlighting uncertainties over need, optimal solution development, cost estimates and potential delays to project start dates as projects are taken through their development, planning and land acquisition stages.

Assessment of potential additional transmission investment

8.9 We reviewed the status of the projects identified by NIE Networks and SONI against the Ten Year Transmission Forecast Statement (TYTFS) produced by SONI. Based on the high level project descriptions and the TYTFS, we confirmed that the order of magnitude of the additional costs provided by SONI was reasonable.

8.10 We note the caveats expressed by SONI, the general difficulties of promoting major projects, and our experience to date of the small volume of limited additional transmission investment which has progressed to construction to date. We are also cognisant of the significant investment required in the North South interconnector which will underpin additional transmission investment in RP6.

8.11 Taking account of the estimates of potential future investment, we have concluded that it would be reasonable to assess the impact of an additional £200m of investment to increase the capacity of the transmission network in our financial modelling for RP6.

8.12 The inclusion of this estimated additional investment in our financial modelling does not constitute an ex ante allowance within our RP6 determination. The efficient cost of additional transmission investment will continue to be funded through allowances determined under the D5 mechanism.