



# **Annex NGET\_A9.04\_T1 - T2 Interactions**

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As a part of the NGET Business Plan Submission

**nationalgrid**

**RIIO-T2**

**nationalgrid**  
Electricity Transmission

**NGET\_A9.04\_T1 - T2 Interactions**

Safe and Reliable  
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This annex provides an explanation as to how asset health investment decisions in RIIO-T1 have impacted on the RIIO-T2 plan.

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## 1. Executive Summary

There are three substantive issues to address:

1. Work deferrals out of the RIIO-T1 period
2. Impact of technical life extensions of asset families
3. Development of a targeted asset intervention that does not wholesale replace all subcomponents of an asset

This note demonstrates each issue in turn:

## 2. Work Deferrals

Some expenditure associated with 3 large cable schemes and replacement of several instrument transformers, that did not have outputs defined in RIIO-T1, has been deferred into future periods. In 2017 an amount of T1 allowance was also voluntarily deferred by NGET as there was no automatic mechanism in place to address this. As noted by Ofgem at the time, we expect the deferred allowance to be taken into account in setting T2 allowances where the work is now due. We are also proposing to expand the definition of outputs in T2 to address this issue going forward.

## 3. Asset Family Life Extension

For the main 'lead' asset categories, we are achieving the network risk outputs defined in RIIO-T1 and we present the volumes of planned interventions vs. current forecast. This demonstrates that we are achieving the RIIO-T1 targets with largely the same number of interventions as was in the RIIO-T1 plan in most categories, with the exception of Wound Plant (Transformers & Reactors) and OHL Fittings replacement where we have delivered materially fewer interventions than originally planned. This was because we have run a number of innovation projects over a number of years that have ultimately led us to extend the technical life of the entire asset families (not just the assets that were due in RIIO-T1). We demonstrate that the life-extension decisions in each category are NPV positive over the RIIO-T1 to RIIO-T3 periods. Consumers are better off, even after taking into account NGET's incentive benefit in RIIO-T1.

## 4. Targeted Asset Intervention

In RIIO-T1 we have innovated and developed a new intervention that targets life-limiting components of certain protection assets rather than wholesale replacement. We provide asset listing and confirm that we are not asking for allowances in RIIO-T2 to revisit the components that have not been replaced in RIIO-T1, and articulate the monitoring that Ofgem is intending to put in place to track interventions at asset level going forward. This new intervention is now BAU and is utilised in our RIIO-T2 plan. We have also committed to trying to extend this type of intervention to certain other protection types in our RIIO-T2 plan, at our risk, reducing the cost in T2 by a further £27m.

## 5. Introduction

This annex considers the impact of decisions in RIIO- T1 and their impact on the RIIO-T2 business plan.

## 6. Deferral of Expenditure and Allowances

A range of specific re-openers and volume-driven uncertainty mechanisms in the RIIO-T1 framework have acted to adjust Capex allowances to manage uncertainty. The framework has also set clear output-based targets (Network Output Measures) for the main non-load asset categories.

When taken in the round, mechanisms have worked well to adjust allowances to reflect changing requirements, whilst maintaining a strong incentive on networks to avoid unnecessary investment and to drive efficiencies. Where these mechanisms have not worked well (for example, around funding for investments without agreed RIIO-T1 outputs), we recognised that there were imperfections in the RIIO-T1 framework and were the first network company to voluntarily defer allowances totalling £0.6bn. In 2017 NGET announced the return of allowances relating to the non-load investment. The non-load element of this deferral was £460m, split between Underground Cables, and Cable Tunnels (related to the London Power Tunnels and the Birmingham and Sheffield cable schemes) in the Lead asset categories and Substation Other (for c. 300 CT/VT replacements) in the non-lead asset category.

The rationale for this return of allowance is that some of the activity that NGET thought would be needed as part of its business plan in 2012, is no longer necessary over the remainder of RIIO-T1. There was no change to Network Output Measure targets set for the RIIO-T1 price control period.

In an open letter published by Ofgem on 13<sup>th</sup> June 2017, they welcomed this action and noted that it was ‘a positive step that is in the interests of consumers.’ Ofgem also stated that ‘it may be the case that some of the deferred investments are needed in the RIIO T2 period – we’ll assess NGET’s RIIO T2 business plan and provide funding where there is a well-justified need that it is in the consumers’ interest.’

The original investments that were associated with the voluntary deferral of allowances in RIIO-T1, interact with investments now required to maintain a safe and reliable network which are in the RIIO-T2 plan along with justification. The total work package, need, scope and timing have changed since the RIIO-T1 submission. We would expect Ofgem to take the deferred allowances into account when setting allowances for these projects in RIIO-T2.

Further information of the associated RIIO-T2 projects can be found within the relevant investment decision packs; NGET\_A9.19\_London power tunnels phase 2, NGET\_A9.07\_Underground cables and NGET\_A9.05\_IT.

## 7. Remaining allowances

The net result of RIIO-T1 allowance adjustments due to flexibility built into the overall regulatory framework, and the voluntary deferral of allowances by NGET, is a reduction in aggregate CAPEX allowances. Relative to these adjusted allowances, we are currently reporting a difference between costs and allowances over the eight years of RIIO-T1. For the non-load related portfolio, due to efficiency and innovation, we have reported efficiencies of £1,412m against allowances.

The following table is a summary from Chapter 14, showing; efficiencies for which we have been able to establish counterfactuals for the RIIO-T2 period.

RIIO-T1 efficiency area	RIIO-T1 total savings [£m]	How RIIO-T1 efficiency has been embedded into RIIO-T2		RIIO-T2 total savings [£m]
<b>Life extension.</b> Worked with university and commercial research partners on specific asset-related projects, rolled out new technology for collecting asset data, invested in more-advanced data analytics and carried on with long-term programmes of testing failed and decommissioned equipment.	301	Knowledge gained allowed extension of technical lives of some asset families, reducing the amount of replacement that would have been due in T2.	Using today's unit costs and multiplying by the volume of work that is not now due in T2, the saving is described in Chapter 9.	385
<b>Targeted replacement.</b> Taken on more design responsibility to focus replacement activities on higher- risk or life-limiting components, engineering new equipment to interface between old and new components to allow us to retain reliable infrastructure.	369	Used cost-benefit analysis to check new interventions are in consumers' long-term interests and to determine which assets to use them.	Net savings systematically embedded in our draft plan by creating new Cost Book rates	198
<b>Application of innovation project outcomes.</b> Recovery of corroded tower steelwork via enhanced coatings	45	Ongoing use has been assumed	Estimated saving based on forecast volume	124
<b>Total 8-year RIIO-T1 efficiency = £715m*</b>		<b>Total 5-year RIIO-T2 efficiency = £707m</b>		

\*Other RIIO-T1 efficiencies *without* counterfactuals for the RIIO-T2 period = £697m. Total 8-year RIIO-T1 efficiency = £697m + £715m = £1,412m. (See chapter 14 for further breakdown).

With a longer eight-year price control period and strong totex incentives, we have taken an ambitious approach to deliver outputs at lower cost by taking action across our entire engineering, asset management and commercial activities. We are sharing just over half of these savings with consumers in the RIIO-T1 period. At the end of RIIO-T1, 53% of totex savings will be returned to customers through the Totex Incentive Mechanism. Systematically building these innovative approaches in our T2 business plan means that consumers will benefit by 100% of these savings in future price control periods.

## 8. T1 efficiency drivers and volumes interactions with T2

RIIO-T1 asset risk targets were set for a portfolio of assets with the framework incentivising networks to:

- Respond to changing network risks and emerging condition information over time, encouraging the substitution of specific assets to deliver long-term consumer benefit.
- Innovate to deliver the desired output, at the lowest possible cost

Further detail of the years of work involved with developing and implementing innovation during RIIO-T1 are brought to life in chapter 9 ‘Safe & Reliable’ in tables 9.14 to 9.20 where we summarise the innovations applied to each asset category in T1. The innovation T1 annex (A12.02, table 2) goes into further detail the innovations we have carried out on each asset type in T1.

We have embedded innovation developed through the RIIO-T1 period into our RIIO-T2 plans, and continue to innovate utilising our advanced asset management capability. Our total plan cost in chapter 9 ‘Safe & Reliable’ is 16% lower, as a result, passing on £707m cost savings to consumers. We also have additional forward-looking stretching efficiencies (£27m) on protection & control, rolling out smart ways of working into further assets types.

Chapter 14 reconciles all RIIO-T1 non-load related efficiencies to our draft RIIO-T2 plan. The RIIO-T1 innovations developed, impact how network risk outputs are achieved. In the RIIO-T1 period we will deliver an improved level of network risk for lead assets at a lower cost.

To understand the volume interaction of these RIIO-T1 efficiencies; the next sections describe the RIIO-T2 impact on (1) the main lead asset categories (2) the main non-lead category; protection & control.

The table below highlights the key volume drivers for the main lead asset categories:

Main asset categories	Volumes replaced over RIIO-T1			Delivering Network Risk Output	Key drivers
	T1 Business Plan Submission	T1 Latest forecast	% change		
Wound Plant (Transformers & Reactors)			-39%	✓	The innovation allowed extension of technical lives of some asset families, reducing the amount of replacement needed to maintain network risk, delivering benefits in RIIO-T1 and beyond.
Overhead line fittings (km)			-29%	✓	
Overhead line conductors (km)			14%	✓	Extending technical asset lives for conductor delivers most benefit in RIIO-T2 (and beyond) The increase in T1 volume delivered vs original plan is because cost-benefit meant some schemes (circa 130km) were moved from fittings only to full conductor replacement
Circuit breakers			-4%	✓	Delivery package adapted e.g. between refurbish and replace. (Volumes broadly the same)
Underground Cables (km)			-9%	✓	Net reduction from deferrals (e.g. Birmingham) and advancements (e.g. Beddington-Rowdown). See associated allowance deferral

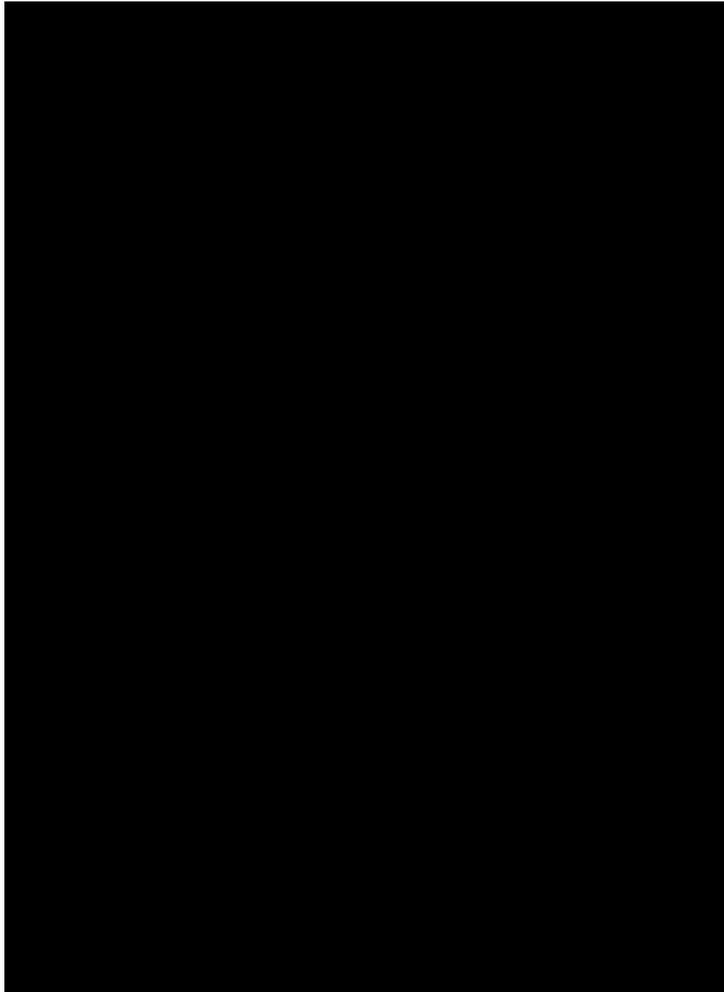
The table shows for wound plant and fittings, material decreases in volumes against submission and the key driver being an extension of asset lives.

**Life extension innovations provide efficiency over multiple periods:**

We have run a number of innovation projects over a number of years that have ultimately led us to extend the technical life of the entire asset families (not just the assets that were due in RIIO-T1).

The following analysis shows life extension decisions in each category are NPV positive over the RIIO-T1 to RIIO-T3 periods, so consumers are better off, even after taking into account the NGET incentive reward received in RIIO-T1.

Life extension innovations affect populations of assets (not just the ones that were forecast for replacement in RIIO-T1). Consequently, some of the assets which were forecast for replacement in RIIO-T1 may now require replacement in RIIO-T2. Equally, other assets which would have been replaced in RIIO-T2 can now be planned in RIIO-T3 (and so on).



**Long term risk impact:**

Illustrated for transformers, this graph plots forecast network risk over time if no more investment is made after the end of RIIO-T1.

The forecast level of network risk is lower in all years following life extension, meaning that fewer units will need replacement out to (say) 2040.

**Consumer impact:**

Again for transformers this waterfall shows that, although NGET retains 47% of any savings over RIIO-T1 (£90m), the longer-term impact (as the life extension rolls out over the whole asset population) for future price control periods means that customers will benefit (all other things being equal) by an estimated £210m by the end of RIIO-T3.

The above graph is based on long-term volumes from NOMs modelling pre-life extension (orange bars) and post-life extension (blue bars) multiplied by a top-down average unit cost for the replacement (i.e. ignoring the effect of cost changes over time to simplify the analysis). The costs are compared on a Net Present Cost basis using a discount rate of 4%.

Long-term net present cost analysis (in this case, over 18 years) illustrates that consumers are better off even after accounting for the sharing of savings through the Totex Incentive Mechanism and replacement of deferred asset volumes is funded in future price controls.

The same analysis has been used to assess the value of extending the life of overhead line fittings. In this case, while NGET retains benefits of £24m in RIIO-T1, customers are anticipated to benefit (all other things being equal) by £42m by the end of RIIO-T3.

## 9. Main non-lead asset category efficiencies:

The main asset category in non-lead is Protection & Control, with associated efficiencies of £231m in RIIO-T1 (highlighted in the RIIO-T1 to RIIO-T2 efficiency reconciliation in Chapter 14 of our RIIO2 Business Plan).

During the RIIO-T1 period, our engineers have worked collaboratively with the supply chain, to develop innovative solutions to address the life-limiting components of protection and control systems. (Chapter 9 of our RIIO2 Business Plan and the innovation T1 annex A12.02 table 2, provide further detail of the work involved).

These solutions include retaining some of the non-life-limiting protection assets in the cubicle. In RIIO-T1 this included retaining the existing circuit breaker fail protection and back-up protection units, whilst replacing ‘the brain’ as the life-limiting component. Providing interfaces between ‘old and new’ and replacing only the life-limiting components, reduces outages times and cost.

This ‘smart’ replacement strategy provides an investment life similar to a full replacement. Because of this, for the circuits we adopted a ‘smart’ replacement strategy in RIIO-T1, we do not plan to revisit these units in RIIO-T2, as the intervention extends the unit life beyond the period.

The following table details the ‘smart’ replacements (delivered and planned circuits) in RIIO- T1 for feeder protection. For these circuits, the retained circuit breaker fail and back-up protection units do not form part of the RIIO-T2 submission.

RIIO-T1 ‘smart’ asset replacement feeder protection circuits		
BAGLAN BAY - SWANSEA NORTH	GRIMSBY WEST - SOUTH HUMBERBANK	KIRKBY - LISTER DRIVE 2
BRIDGWATER - HINKLEY POINT 1	HAMSHALL SGT6	KITWELL – OLDBURY
ABERTHAW – UPPER BOAT1	ELLAND – KIRKSTALL	LEGACY– IRON BRIDGE–SHREWSBURY
AXMINSTER – EXETER	FECKENHAM – HAMSHALL	MELKSHAM - MINETY 1 (EX MITY/FECK)
BRIDGWATER - HINKLEY POINT 2	HAMSHALL SGT8	NORTON - SALTHOLME
BARKING – REDBRIDGE 1	HAMSHALL SGT9	KIRKSTALL 'A' - SKELTON GRANGE
BARKING – REDBRIDGE 2	IRONACTON - MELKSHAM1	NORWICH MAIN - NORWICH TROWSE 1
BERKSWELL - OCKER HILL	HAMS HALL – NECHELLS 2/SGT5	NORWICH MAIN - NORWICH TROWSE 3
BLYTH 'B'- STELLA WEST 3	Harker - Stella West 2	PEMBROKE - SWANSEA NORTH 3
BOTLEY WOOD - LOVEDEAN	HINKLEY POINT 400 - MELKSHAM 1	PENTIR – TRAWSFYNYDD/SGT 1
BRADFORD WEST - KIRKSTALL 275KV	HINKLEY POINT 400 - MELKSHAM 2	OSBALDWICK-THORNTON 2
BRAMLEY - MELKSHAM 1 400KV	HINKLEY POINT - TAUNTON1	PITSMOOR –TEMPLEBOROUGH
DAMHEAD CREEK - KINGSNORTH	HUMBER REFINERY - KILLINGHOLME	RUGELEY - RUGELEY SGT3 BRERETON
BRINSWORTH – THURCROFT	IRON ACTON - WHITSON 1	RUGELEY - RUGELEY SGT4 BRERETON
CAPENHURST- FRODSHAM 2	NORTHFLEET EAST - SINGLEWELL	PITSMOOR - WINCOBANK
CARRINGTON – SOUTH MANCHESTER 1	IRON ACTON - WHITSON 2	SALTEND NORTH - SALTEND SOUTH
CARRINGTON – SOUTH MANCHESTER 2	IRON BRIDGE – LEGACY 2	SPALDING NORTH - WALPOLE
CARRINGTON- DAINES 1/SGT 5	KIRKBY - LISTER DRIVE 1	TEMPLEBOROUGH – WINCOBANK
CARRINGTON- DAINES 2/SGT 6	IVER - NORTH HYDE 11	TYNEMOUTH – WEST BOLDON
CITY ROAD - WEST HAM 2	KINGSNORTH - SINGLEWELL	SWANSEA IC2
COVENTRY- RATCLIFFE ON SOAR	KIRKBY - RAINHILL 1	WYMONDLEY - COREYSMILL SGT4
CREYKE BECK – SALTEND NORTH	KIRKBY – RAINHILL 2	

**10.**

This methodology reduces costs in RIIO-T1 and does not increase our RIIO-T2 baseline as a result. In addition, for our RIIO-T2 plans this innovation has resulted in:

- Unit cost reductions (£66m), though a continuation of smart ways of working for similar asset types as RIIO-T1
- Forward-looking efficiencies (£27m), rolling our smart ways of working to other asset types (transformer & reactor protection)

**11. Providing ongoing visibility and transparency of our plans:**

Ofgem's revised business plan data tables (BPDTs) require networks to detail asset volumes, allowing the tracking of interventions across regulatory periods.

Our formal submission in December is transparent, and includes completed additional BPDT which provide further detail including protection and control and other non-lead assets which we understand will also be the basis for Ofgem's ongoing monitoring within the T2 period.