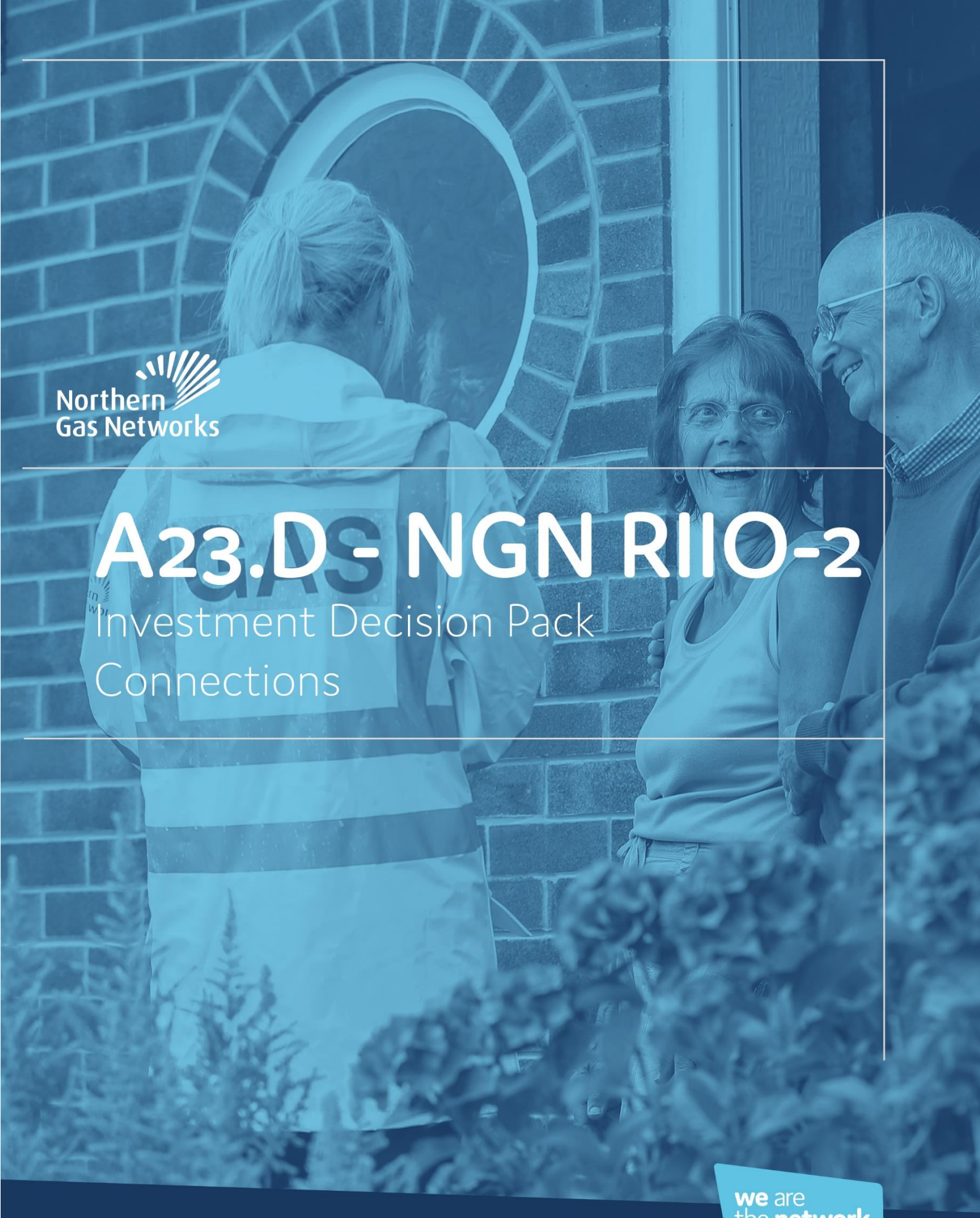


Northern Gas Networks

A23.D- NGN RIIO-2

Investment Decision Pack

Connections

we are the network

1. Table of Contents

2. Introduction

This Engineering Justification paper details our proposals for investment on our Connections during RIIO-2. It explicitly follows Ofgem's guidance and is set out in accordance with the headings therein. There is no accompanying Cost Benefit Analysis as the workload is Third Party driven.

We have an obligation under our gas transporters licence to develop and maintain an efficient and economical pipeline system and subject to that comply with any reasonable request to connect premises provided that is it is economic to do so. This includes both domestic customers and industrial or commercial customers. In addition, from the 1st April 2009, new arrangements for the extension of the network to facilitate the supply of gas to non-gas fuel poor communities came into force.

This engineering paper aims to outline the justification for our proposed RIIO-2 Connections investment, it explains the different options we have considered and the reasons why we have derived at our forecasts.

3. Equipment Summary

There are several types of connections which we can carry out, these are explained in detail below.

New connections to existing domestic properties – these are properties which are already existing but do not currently have a live gas connection. These are typically customers who have a gas main in the surrounding area and so new lengths of mains to facilitate the gas connection are not needed, although for some customers there may be a small mains extension required. If their private boundary is within 23m of the nearest main, all works are covered by the standard charge which typically include excavation in public and then private land (either we dig, or the customer can dig), installation of the service and connection to the existing main and to terminate at the Emergency Control Valve (ECV) in a meter box and reinstatement. Works exclude anything beyond the ECV including installation of the meter and connection of the customers appliances.

New connections to new build domestic properties – these connections are to properties which are new build and can range from either a single service to a single property to multiple services in a large housing development. For single new build properties, the works are like connecting an existing property and typically involve connecting to an existing main in public or private land and laying a single service. For housing developments, normally a length of main is required from the existing network to the new development which will facilitate gas connections. For larger developments, they do not qualify for a standard charge and individual bespoke prices are calculated for each scheme to allow for the most cost-effective solution to be developed.

New Connections to new and existing non-domestic properties – These cover a wide range of different properties, some examples of which are given below.

- Small commercial premises – These are typically customer who will not need a higher gas load than a normal house although they may have a higher annual usage depending on the type of business. For example, a newsagent or hair dresser may only require a small domestic boiler, but they may use it more often.

- Medium Commercial premises – These cover larger premises and can include commercial kitchens. Typical examples range from a large shop, pub, takeaway or restaurant.

- Large Commercial premises – These are premises where their load will be higher than 275kW and can cover large premises and factories where heating is required, or gas is used in their process.

These connections can be for any business wishing a gas connection and can include new build premises as well as existing premises such as small shop being converted to a restaurant.

For these customers a standard charge is not applicable, and a bespoke price is calculated based on the works they are having done to ensure they are only paying for the works they require and are charged fairly.

New Connections to fuel poor customers - This can benefit any customer who is eligible and who lives in an existing house without a gas connection. They qualify through their income which is assessed by an independent company and a voucher is issued if they are eligible which is matched back to the property and customer upon application. The value of the voucher is re-calculated every six months based upon the charges applicable for the customers gas usage over the life of the pipe. The voucher entitles most applicants to a free gas connection and the independent company can also check their eligibility for other schemes which can give them financial assistance in having a new boiler installed. A typical saving for these customers is £350 per year on their energy costs.

Alterations – This is any customer wishing to have their service pipe altered. For any customer with a 32mm PE or 1" metallic service who require an alteration of up to 20m in length, we offer standard charges whereby the cost is fixed for the first 3m (based on either ourselves to dig or the customer) with every metre after that charged at a fixed rate. For any customer with a service of greater than 32mm PE or 1" metallic, or where they require an alteration of greater than 20m in length, we produce a bespoke price based on the exact scope of works required.

Disconnections – This is any customer wishing to be disconnected from the transportation network. This can be for a variety of reasons but the most common they are demolishing the premises that was being supplied.

Note, alterations and disconnections workload and costs are not included in this paper as they are included within Maintenance as per Regulatory Reporting.

Utility Infrastructure Provider (UIP) – As well as being connected to the network by ourselves, a customer can have the works completed by a UIP who can then connect to our existing infrastructure. These sites can then be adopted and maintained by ourselves or an Independent Gas Transporter. We typically get most existing connections however generally only get around 7% to 10% of new connections.

4. Problem Statement

Why are we doing this work and what happens if we do nothing?

As per the Gas Act 1986 section 10, we have a duty to connect certain premises to the network. If we failed to connect, we would be in breach of the law and incur the relevant penalties for this breach.

What is the outcome that we want to achieve?

Our ambition is to give our customers their gas connection when they want it, delivered with great customer service and at a cost-effective price.

How will we understand if the spend has been successful?

Our measure to determine successful spend will be a customer connected to the gas network in a timely manner, at a cost-effective price and with no dissatisfaction experienced during the process. Overall, our complaints for connections workload will be low and the fuel poor targets met or exceeded.

4.1. Narrative Real-Life Example of Problem

Case Study 1 – Standard Charge Domestic Connection – 7 White Lodge, Selby - 87627

A typical standard charge connection would be where a customer applied to Northern Gas Networks to get their premises connected to the gas network. In this scenario, it was the owner of the premises who wanted to get their house connected to the transportation network. They applied not knowing the exact scope of works they were after as they were unsure where they wanted the meter box to go so to help them with their decision, a surveyor was sent out to visit them at their property.

Three days after their application, the surveyor met the customer at their house, discussed all the options available to them and helped them establish where the best place for their meter box to go to suit their needs while still complying with regulations. The survey confirmed that the works would qualify for the standard domestic charge as they were within 23m in public and 20m in private of the nearest gas main. The price for the works came to £585 plus VAT and the quote for the works was issued to the customer on the same day that their survey took place.

The customer accepted the works through our online payment system and the works were passed through to the planner in the area to arrange a date with the customer. The following week, the date was agreed with the customer for the works to go ahead.

The scope of the works was to lay a 32mm PE LP service, connecting to the existing 4” ductile iron main outside the property and laying for 1m in the public footpath followed by 15m in the customers land, including 13m in their lawn and 2m in some gravel at the side of the house. This was to terminate in a surface mounted box with the customer to arrange for a shipper and gas safe engineer to complete the works by installing their meter and installing and connecting their new gas appliances.

The team arrived on site as scheduled and completed the works without issue. The cost to the customer is £585 as the work qualified for the standard charge.

Case Study 2 – 2 x 200kW Non-Domestic Connection – Unit 5 & 6 Tilley Road, Washington - 88468

This job was to connect two existing industrial units on an industrial estate. The customer initially applied 12 months before they required the works and were only after an indicative cost at this stage, so they could establish is the works were commercially viable. As they required an internal termination, the normal procedure was followed to ensure that the requested location was suitable.

The survey took place the week after the initial application and following this site meeting, the customer asked for a variety of quotation options including for internal positions, an external kiosk and for both excavation options, customer or ourselves.

A few months later, the customer requested a change to the original request whereby the load was increased from 120kW to 200kW. This increase in load meant that the network had to be analysed in the area to confirm reinforcement was not required and then a new quote was provided.

Around five months later, the customer asked for the quote to be refreshed as they were now ready for the connections to go ahead as they had tenants ready to move into the premises. As the prices had been re-calculated since the previous quote, a new price was issued which they accepted via a BACS payment.

The scope of the works was to lay two 63mm PE LP services, with one connecting to an existing 125mm PE main outside the property and laying for 12m from the main in the public footpath to an internal termination. The second supply connected to an existing 6" ductile iron main and was 8m from the footpath to an external kiosk located on the side wall of the premises.

Before the works went ahead, the customer contacted us and requested a change to the scope of works whereby the second service would now also terminate internally. This triggered a refund to the customer for the cost of the kiosk that we were providing.

The team arrived on site as scheduled and completed the works without issue.

Case Study 3 – Fuel Poor Connection – 20 Alder Grove, Halifax – 89698

The customer applied for a connection having moved into a property and found it had no gas connection. As the premises had an old supply pipe, a team visited site who confirmed the pipe was dead and no longer connected to the transportation network. A surveyor followed up to confirm the best position for the new supply. Whilst this was going on, the customer had consented for their details to be passed onto an independent company that we work with to confirm eligibility for a fuel poor voucher, it was confirmed, and a voucher was issued.

The discount was applied to the works and a free of charge quote was issued to the customer which was accepted a few days later with no expense to the customer. The following week, the date was agreed with the customer for the works to go ahead.

The scope of the works was to lay a 32mm PE LP service, connecting to the existing 75mm PE main inside a 4" Cast iron main outside the property and laying for 1m in the public footpath followed by 8m in the customers land. This was to terminate in a surface mounted box with the customer to arrange for a shipper and gas safe engineer to complete the works by installing their meter and installing and connecting their new gas appliances.

The team arrived on site as scheduled and completed the works without issue.

4.2. Spend Boundaries

We are obliged to prepare a statement setting out the methodology upon which charges will be made for connection to the transportation network. It goes into detail for what we charge back to our customers and what we do not as well as explaining how these charges are reached.

The costs passed back to the customer cover everything that would normally be expected to be incurred by us to complete the works and include the following;

- **Direct labour wages** - These are the teams who carry out the works and their direct support, such as the support drivers who deliver barriers to the site in advance of the works taking place.
- **Reinstatement costs** - This is the cost of reinstating the works both in public and private land. For any customer that requires a bespoke non-standard reinstatement (patterned concrete, coloured tarmac etc) this is excluded from our normal pricing structure, so a price is requested directly from the contractor which is then used to calculate the quote.
- **Contractor costs** - This is any aspect of work which we must pass to a specialist contractor to complete for anything other than reinstatement. An example of this would be if the works required a welded steel section of main. This would be passed to an external contractor to fabricate.
- **Materials** - The pipes and fittings required to do the works.
- **NRSWA/TM** - These are the charges and fees incurred from councils and local authorities for permits, road closures etc as well as the costs of traffic management.
- **Plant Hire** - Any plant required to do the work, a typical example would be a mini digger used for excavation.
- **Other Employment costs** – This covers all the things required by the team on site such as their mobile phones, tablets and PPE.
- **Transport** – the cost of the vans and fuel.
- **Tools & Consumables** – Small tools such as gas monitors and spades, and consumables such as grease and sealants.
- **Back office costs** – These are the costs of all the back-office staff required to support the onsite works. This includes the customer care advisors, admin staff, surveyors and planners.

Items which are not included within the price of a connection are:

- **CSEP Connections** – These jobs are dealt with by a separate team and the cost for these works and the team are not passed onto direct connections customers.
- **Insurance**
- **Compensation**
- **Legal/Consultancy**
- **IT costs**

Exclusions from this Engineering Justification Paper:

- **Reinforcement** – This is any additional works required to the network to provide the load the customer is requesting. These costs are subject to the economic test whereby the future income due from gas usage is considered and contributes towards the reinforcement required. Further information can be found in a separate Engineering Justification paper.

5. Probability of Failure

As the works are Third Party driven there is no requirement for a Cost Benefit Analysis. This section is left blank.

6. Consequence of Failure

As the works are Third Party driven there is no requirement for a Cost Benefit Analysis. This section is left blank.

7. Options Considered

To determine our RIIO-2 Connections forecasts we have split our option analysis into the four connection types which align with our regulatory reporting and allow confidence in the workload and cost data we are using to model future expectations. These categories are:

- New domestic properties
- Existing domestic properties
- Non-domestic properties
- Fuel poor domestic properties

Our option analysis will consider workload in terms of number of services and length of mains and cost in terms of gross unit costs and the amount we recover from our customers, referred to as the Recovery Rate.

We have generally considered two methods when developing our RIIO-2 forecasts. These are:

1. **Backward looking –** We will use historic data to trend forward possible workload volumes and unit costs for each connection work type. Consideration will be given to outliers and anomalies and an understanding of the granular detail will be required to appreciate spikes in the data and discrepancies.

2. **Forward looking –** We will consider other external factors which impact and drive workload and cost for each connection type and adjust forecasts based on these assumptions.

Future Energy Pathways

We have gone with the default assumption of current assumed proportion of methane CO2 in natural gas projected forwards due to uncertainties in the potential energy pathways and because this is reflective of the current gas quality legislation. However, we acknowledge that significant changes to gas demand or the allowed methane content of gas, for example due to the blending with or conversion to hydrogen, would impact our investments.

Arup conducted analysis on the potential benefits of our H21 Programme (see A13 - NGN RIIO-2 Consumer Value Proposition) that showed 45% of the gas in our network is expected to be Natural, 15% biomethane and the remaining 40% hydrogen by 2040; due to a combination of blending and sub-areas of our networks being fully converted. This is consistent with Net-zero by 2050 aligned with the ENA Navigant report.

We have not explicitly modelled changes in the methane content of gas in our forecasts, as overall the change in C02 content of the gas is not expected to be different enough to materially impact our preferred investment programme. We have considered the governments Future Homes Standard however which plans to ban gas boilers in new homes by 2025. Our strategy therefore represents a no regrets investment programme that is consistent with net zero and will deliver value to customers whether a hydrogen or electrification pathway is chosen.

7.1. Option Summaries

7.1.1. First Option Summary – Workload

We have considered three options for both service and main workloads, these are:

- **Option 1: Eleven Year Trend –** where we use the last eleven years of historic data to trend forward workload forecasts into RIIO-2. An advantage of this method is it uses the largest dataset which should improve reliability, however a disadvantage is that changes in external factors over time such as how the economy is performing may mask current trends.

- **Option 2: Six Year Trend –** where we use the last six years of historic data to trend forward workload forecasts into RIIO-2. An advantage of this method is it uses more recent data which will provide a better idea of current trends, however a disadvantage is anomalies could be left within the data set affecting future forecasts.

- **Option 3: Adjusted Six Year Trend –** where we use the last six years of historic data, removing anomalies or outliers and accounting for assumptions on future external factors to trend forward workload forecasts into RIIO-2. An advantage of this method is that it considers the disadvantages of the previous two options, however a disadvantage might be that the data set becomes too small and less reliable.

7.1.2. Second Option Summary – Unit Costs

We have considered three options for both service and main unit costs, these are:

- **Option 1**: **Mean of Six Years Averages –** where we use the mean of the last six years of average unit costs to forecast a unit cost for RIIO-2. An advantage of this method is that it uses a reasonably sized dataset that will include a variety of project scopes to provide a reliable average unit cost, however a disadvantage is if the workloads vary significantly between years we may not get the true total average unit cost.

- **Option 2: Six Year Total Average –** This option uses the total average unit cost of the last six years to forecast a unit cost for RIIO-2. An advantage of this method is that it uses a reasonably sized dataset that will include a variety of project scopes to provide a reliable average unit cost, however a disadvantage may be that recent construction efficiencies may be diluted.

- **Option 3**: **Four Year Total Average –** This option uses the total average unit cost of the last six years to forecast a unit cost for RIIO-2. An advantage of this method is that it uses more recent data which will include recent construction efficiencies and cost models to provide a more accurate unit cost going forward, however a disadvantage may be that there is not the wealth of project types to reflect the true variety of unit costs.

7.1.3. Third Option Summary – Recovery Rate

Connections customers can be charged one of two ways, they will either qualify for a standard charge or their price will be non-standard. For every customer that qualifies for a standard charge, they will pay the same amount for the works regardless of the actual costs incurred to ourselves.

The standard charge is calculated by taking the workload and costs from delivering the standard charge works over a historical 12-month period which is then adjusted for any future forecasted changes in costs or workload over the coming 12-month period. These costs and workload are then put into a model which calculates the applicable proportion of costs to the connection and the first 10m. The remaining costs are then attributed to the type of standard charge and spilt by the next 12 months forecast. This gives the standard charges which will be applied for that period. Options for either our customers to excavate the trench in private land or for ourselves to dig are available to give the customer the most cost-effective service.

For non-standard works there are a set of over 600 rates which are used to calculate the price of a job to make sure that the customers are getting the most accurate cost possible. Each of these rates represent a different element of the work and each variation possible. Such as for a 32mm PE termination and the different options that are available, surface mounted meter boxes, house entries etc. These rates are analysed and adjusted every year based on information gathered to make them as accurate as possible and reflective of the costs of the works being conducted.

We have considered four options for the recovery costs for services and mains, these are:

- **Option 1**: **Mean of Six Years Averages –** where we use the mean of the last six years of average recovery rates to forecast the customer funded element of the gross cost for RIIO-2. An advantage of this method is that it uses a reasonably sized dataset that will include a variety of project scopes to provide a reliable average unit cost, however a disadvantage is if the income was recovered in one year and the costs were incurred in another year then the recovery percentages would be a true reflection of reality.

- **Option 2: Six Year Total Average –** This option uses the total average recovery rate of the last six years to forecast the customer funded element of the gross cost for RIIO-2. An advantage of this method is that by using the sum of gross costs and income of all six years to create an average it avoids the situation where income is incurred in one year and costs another leading to incorrect recovery rates for that year, however a disadvantage may be that recent changes to our recovery model would be diluted by earlier price control years.

- **Option 3**: **Four Year Total Average –** This option uses the total average recovery rate of the last four years to forecast the customer funded element of the gross cost for RIIO-2. An advantage of this method is that it uses more recent data which will include recent changes to our recovery model such as removal of IT costs, however a disadvantage may be that there is not the wealth of project types to reflect the true variety in gross costs and therefore recovery rates.

- **Option 4: Four Year Total Average Split by Standard and Non-Standard Connections** – This option splits the recovery rates by standard and non-standard connections and uses the total average recovery rate of the middle four years of RIIO-1 to forecast the customer funded element of the gross cost for RIIO-2. This option is only considered for new and existing domestic connections where the standard and non-standard charges apply. An

advantage of this method is by splitting the data into standard and non-standard connections we get a recovery rate which is more representative of that type of connection. A disadvantage of this method is it adds another layer of complexity and requires us to forecast the split of standard and non-standard jobs in the future.

7.2. Options Cost Details

When a customer is charged, they will either qualify for a standard charge or they will have a bespoke price calculated for their works. To qualify for a standard charge, the premise being connected will need to be within 23m of public land to the nearest relevant main owned by Northern Gas Networks. This is measured from the main to the boundary of private land. They then need to be within 20m of the boundary to the premise being connected. If a customer is within 23m in public but a longer length is required in private, they qualify for a Domestic Load Connection Allowance which gives them the connection and up to the first 10m in public for free with the rest of the works being chargeable.

When forecasting future unit costs for services, we look at each work type individually and look at what makes up the unit costs we have experienced historically and what changes are coming which may affect our costs.

The proportion of the cost of project we recover on existing domestic premises can fluctuate as the works which can take place under a standard charge connection (within 23m from an existing main) can vary from a few metres in a public grass verge up to twenty-three metres in a roadway. The customer pays the standard charge whatever the total cost of the project. This can lead to changes year on year to the unit rate based on the previous work done in the last twelve months, but it will trend around a common average. For mains to feed existing domestic connections, the rate per metre can vary significantly due to the typically short length involved and the variance of where those short lengths can be laid. Three metres being laid in a grass verge will have a significant price difference to the same works in a highway.

The average unit rate for new build premises are significantly lower than one for an existing domestic premise as these tend to involve new build developments where most of the work is taking place in private land and the customer is excavating bringing the time and cost down. The same is true for the mains being laid with the cost being affected by the length of mains that are being laid in private land (and therefore typically a customer would excavate) compared with the mains leading to the site (where we would be more likely to excavate). There are still some service connections that require us to excavate for example on single connections which can drive small variances in the unit rate over time.

Fuel Poor properties are existing domestic houses whereby the occupant qualifies for a contribution towards their connection. This means that the unit rate for this follows the same logic as the calculations for existing domestic. For fuel poor mains however, the gross unit cost can be higher as the fuel poor voucher value is currently higher than the cost of the standard connection. This means that in general, more expensive Fuel Poor connection projects are undertaken when compared to existing domestic connections, as the remaining Fuel Poor voucher value covers the additional project cost where an existing domestic customer would have otherwise declined the quotation.

Due to the variance in the size of industrial and commercial connections, from 32mm PE services to feed a small shop up to large 125mm PE connections to feed factory units, the unit cost has a wider scope for variation. For larger connections, the costs are immediately higher due to the increased works required but even for the smaller connections, the costs can vary due to the location of the commercial unit, for example in a busy city centre location compared to a rural industrial estate. The same logic applies to the mains being laid leading to large swings in unit costs.

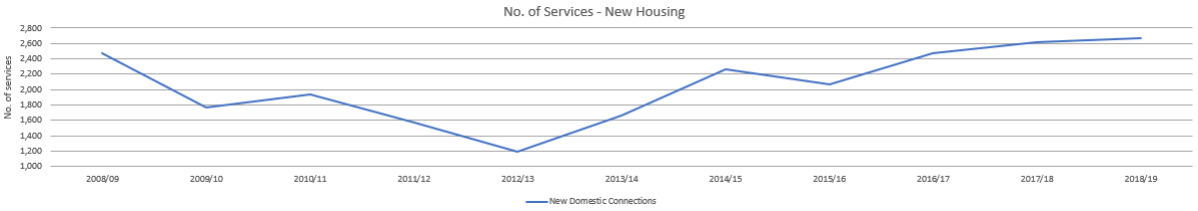
8. Business Case Outline and Discussion

8.1. Key Business Case Drivers Description

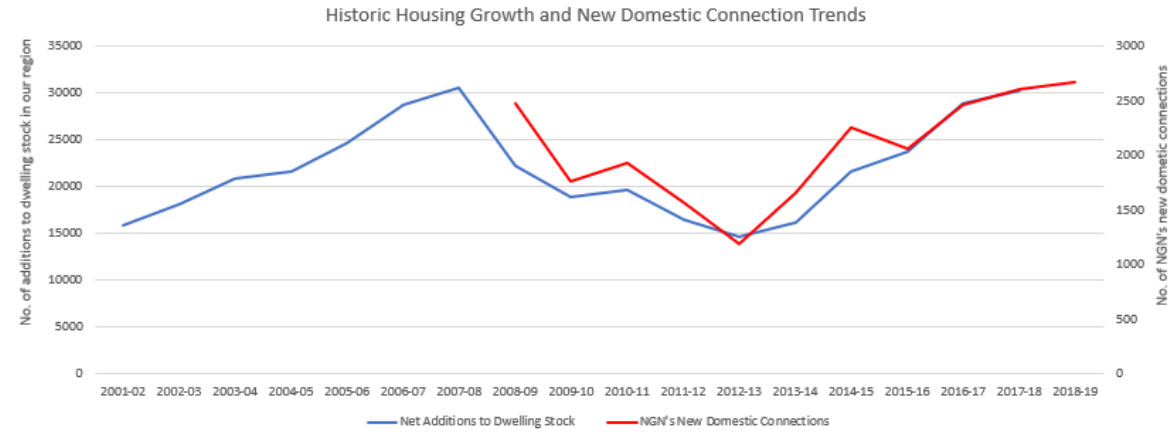
Service workload

New Domestic Connections

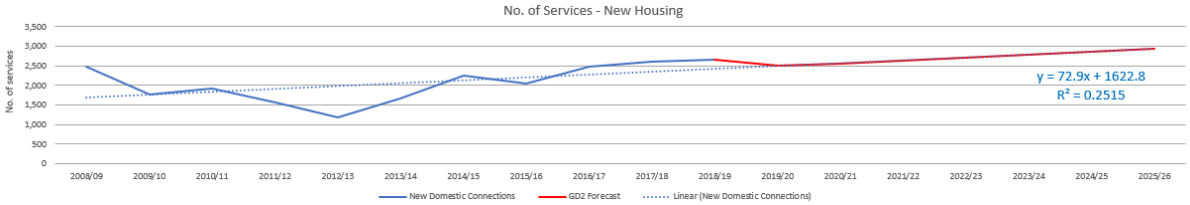
The number of new build domestic connections has varied considerably over the last eleven years ranging from 1,187 in 2012 to 2,668 in 2018. The general trend indicates a fall in volume from 2008 to 2012 where it reaches its lowest point, since then we have seen a steady increase.



The number of new domestic premises being connected to the gas network is directly linked to the number of new houses being built in our network. This relationship can be seen in the graph below which plots the numbers of new connections we undertake each year with the numbers of new additions to the dwelling stock within our region (source: Office for National Statistics). From this analysis we can see the effect the UK financial crisis of 2007/08 had on housing growth severely slowing the housing market and correspondingly the numbers of new domestic properties we were connecting. Since 2012 we have seen a steady growth in the housing market and the numbers of new domestic properties we connect. By understanding future housing growth we can more accurately forecast new domestic connections.

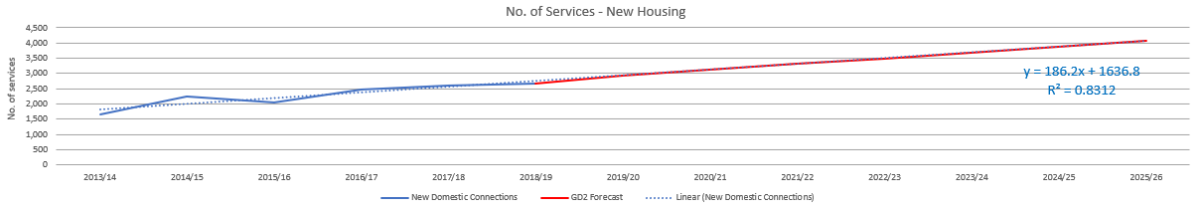


Option 1 – Eleven Year Trend



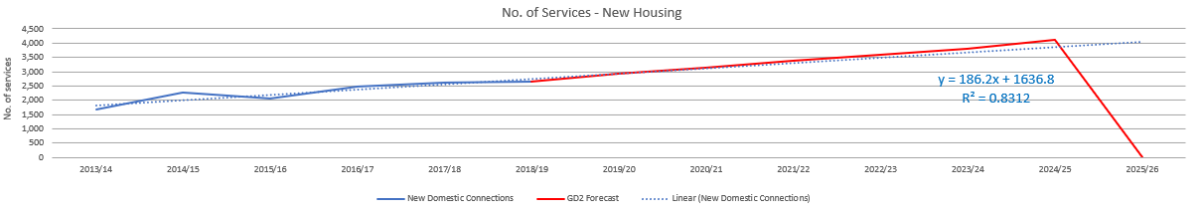
This option uses a long period of historical data to determine the trend line used to forecast workload in RIIO-2. Due to the large workload variances year on year, this results in a low R-squared value of 0.25 which indicates that the trendline is not a good fit of the observed data. This is because the data set contains both the period following the UK financial crash and the economic recovery leading to large variances between years. This option forecasts a total of 13,946 new domestic connections in RIIO-2.

Option 2 – Six Year Trend



This option uses a shorter period of historical data to determine the trend line used to forecast workload in RIIO-2. The numbers of new domestic connections in RIIO-1 have been steadily increasing year on year in line with the improving housing market growth which has resulted in a better R-squared value than option 1 of 0.83 which indicates that the trend line is a good fit to the observed data. This forecast assumes that the housing market will continue to grow at the same rate. This option forecasts a total of 18,425 new domestic connections in RIIO-2.

Option 3 – Adjusted Six Year Trend



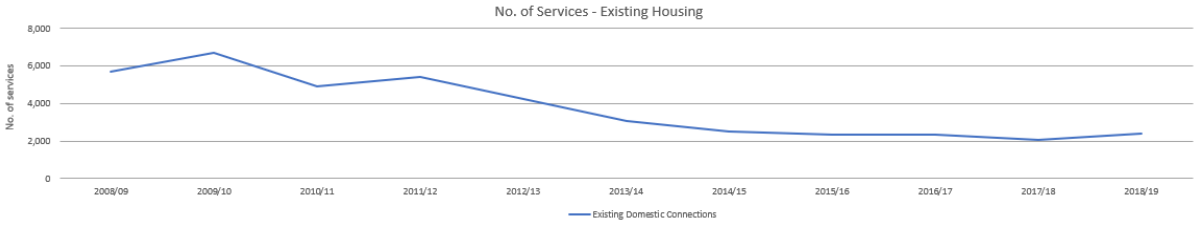
This option considers the impact of the government's policy decision to ban gas connections in new homes from 2025. Through dialogue with housing developer's our forecast considers an acceleration in the housing market in the lead up to this date to take advantage of cheaper gas connections compare to the alternatives such as heat pumps. We have forecast zero connections in 2025/26. This option forecasts a total of 14,931 new domestic connections.

Recommendation

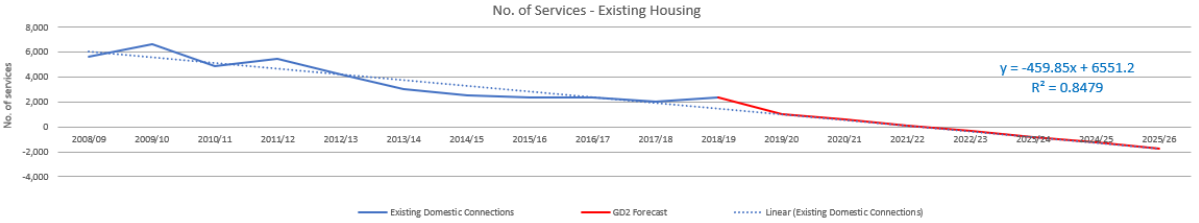
Option 3 – Adjusted Six Year Trend considers the governments Future Homes Standard and provides the most likely forecast for the number of new domestic connections in RIIO-2.

Existing Domestic Connections

The number of existing domestic connections has varied considerably over the last eleven years ranging from 6,684 in 2009 to 2,075 in 2017. The general trend indicates a fall in volume from year on year over this period but also trending towards a plateau. This is due to there being a finite number of existing properties which have yet to get a gas connection, but the number of existing domestic connections are unlikely reach zero as there will always be properties which had previously been disconnected from the network and then later on are reconnected, and in addition there are new build premises which were built without a gas connection and then later connect to the gas network.

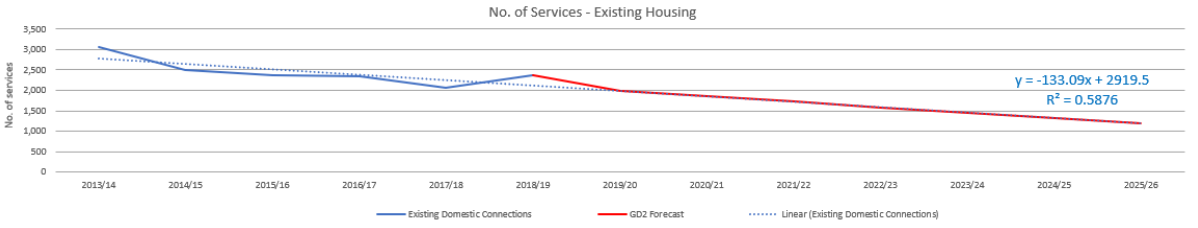


Option 1 – Eleven Year Trend



This option uses a long period of historical data to determine the trend line used to forecast workload in RIIO-2. Due to the falling trend year on year over this period it has resulted in a high R-squared value of 0.85 which indicates that the trendline is a good fit of the observed data. However, by continuing this trend into RIIO-2 the numbers of existing domestic properties we would be forecasting to connect becomes negative which is clearly not realistic. This option forecasts a total of minus 4,032 existing domestic connections in RIIO-2.

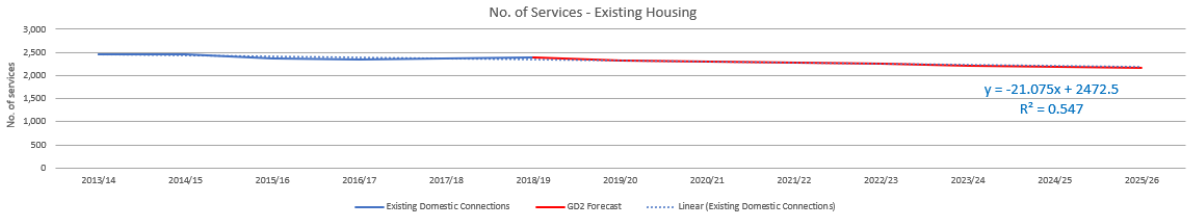
Option 2 – Six Year Trend



This option uses a shorter period of historical data to determine the trend line used to forecast workload in RIIO-2. Due to the peaks and troughs in this five year period the R-squared value is not as good as Option 1 suggesting that the trendline is not as good of a fit to the observed data. However, with this option we do not see the forecasted number of existing connections fall below zero which provides this option more merit. This option forecasts a reduction year on year and does

not consider the numbers of connections reaching a plateau. This option forecasts a total of 7,278 existing domestic connections in RIIO-2.

Option 3 – Adjusted Six Year Trend



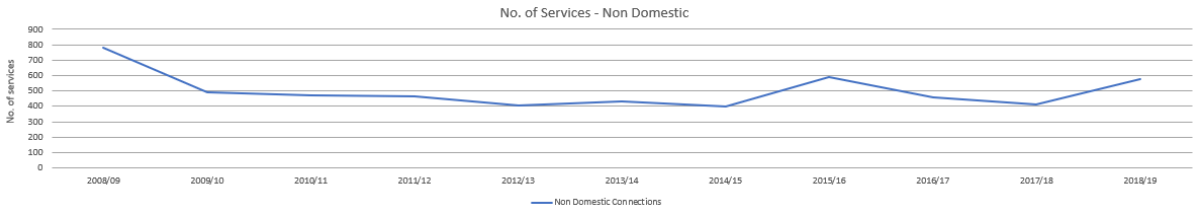
This option uses the same five year timeframe as the previous option however removes the years where the workload has been significantly higher or lower (2013/14 and 2017/18). This results in providing a reasonable RIIO-2 starting point as well as a steady decline however less steep than the previous two options. This option forecasts a total of 11,112 existing domestic connections in RIIO-2. This represents nearly a ten percent fall in the expected numbers of existing domestic connections when compared to the volume we are experiencing in RIIO-1.

Recommendation

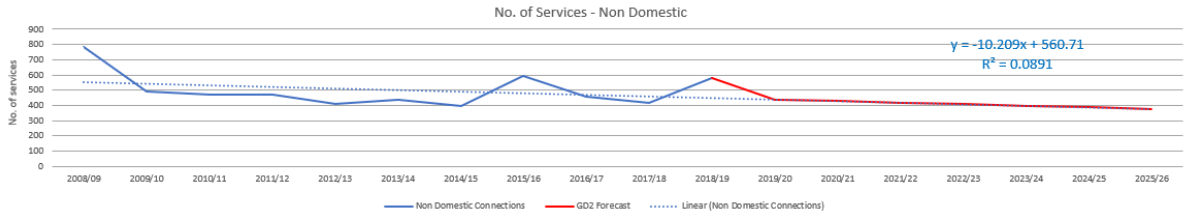
Option 3 – Adjusted Six Year Trend provides the most likely forecast for the number of existing domestic connections in RIIO-2.

Non-Domestic Connections

Industrial and commercial connections are made up of two main types of work, the first being connections to existing properties which previously didn't have any need for a gas connection but now does following a change in usage (for example, a shop being converted to a restaurant). The second type is made up of new build developments and these can be in a variety of scale, from the small commercial developments featuring two or three connections up to the large-scale retail developments which can have upwards of twenty connections on one site. The number of non domestic connections has varied considerably over the last eleven years ranging from 782 in 2008 to 341 in 2018. The general trend is relatively flat over this period however there are peaks within the data which can occur if several large commercial developments are connected within the year. We expect there to be a relationship between how the economy is performing in our region and the numbers of non domestic connections as commercial and industrial growth will lead to an increase in the numbers of new or existing non domestic properties requesting a connection to our network.

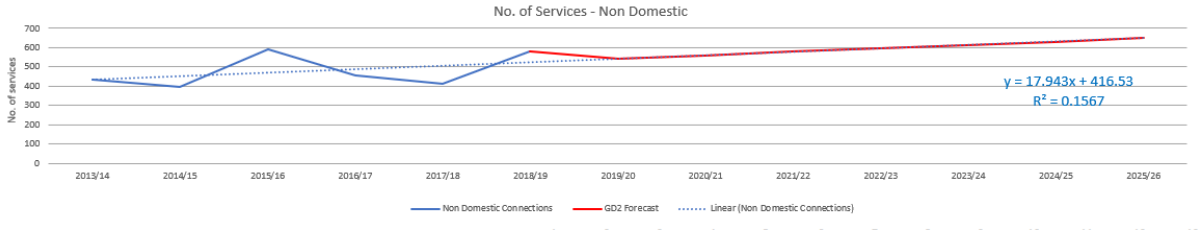


Option 1 – Eleven Year Trend



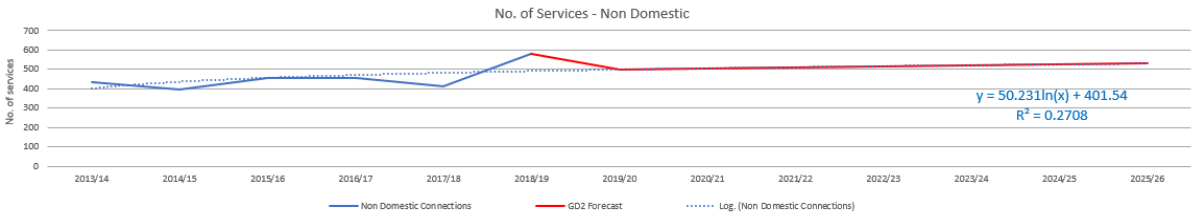
This option uses a long period of historical data to determine the trend line used to forecast workload in RIIO-2. Due to the troughs and peaks within this data set it has resulted in a low R-squared value of 0.09 which indicates that the trendline is a not good fit of the observed data. The significant fall in the first year of this data set is likely to be due to the impact of the UK financial crisis and results in a steeper declining trendline than otherwise would be if this outlier was removed. This option forecasts a total of 1,987 non domestic connections in RIIO-2.

Option 2 – Six Year Trend



This option uses a shorter period of historical data to determine the trend line used to forecast workload in RIIO-2. This option removes the significant fall in the numbers of connections immediately following the UK financial crisis and focuses on the economic recovery thereafter. The numbers of non domestic connections follow and increasing trend and the forecast assumes this growth continues into RIIO-2. The R-squared value is slightly better than the previous option with a value of 0.16. This option forecasts a total of 3,070 non domestic connections.

Option 3 – Adjusted Six Year Trend



This option considers a slowing of economic growth and therefore the numbers of non domestic connections and uses a logarithmic trendline to model this. This trend has the highest R-squared value of all the options which indicates that the trend is a better fit to the observed data. This option forecasts a total of 2,608 non domestic connections in RIIO-2 which is a 9% annual average increase from RIIO-1.

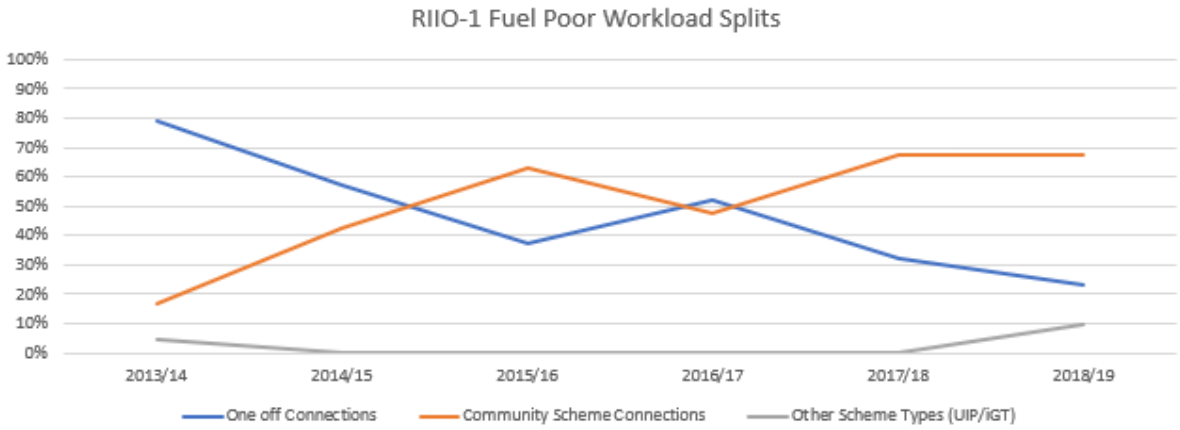
Recommendation

Option 3 – Adjusted Six Year Trend provides the most likely forecast for the number of non domestic connections in RIIO-2.

Fuel Poor Connections

Changes to the rules for Fuel Poor connections has made it harder to find eligible households. We are forecasting a lower target for RIIO-2 however believe it is realistic considering these changes. To ensure we connect as many fuel poor customers as we can during RIIO-2 we are proposing a re-opener in the event we can outperform our forecast. We are forecasting 5,000 fuel poor connections in RIIO-2.

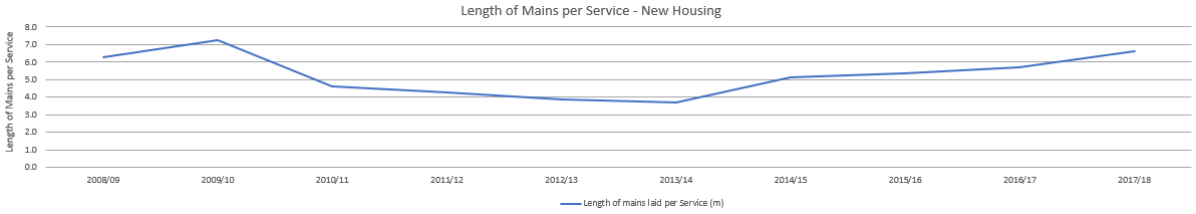
During RIIO-1 we have seen a fall in one off connections and an increase in community scheme connections, this is due to the rule changes. For RIIO-2 we are forecasting that the split is 80:20 community schemes to one offs.



Mains workload

New Domestic Connections

The total length of mains laid is directly linked to the number of services laid. This means that the most accurate method of forecasting workloads is to understand the ratio between the length of mains laid and the number of services to give the number of metres of mains laid per service.

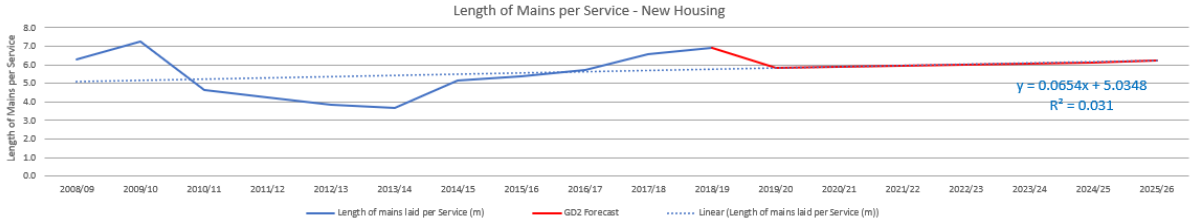


The length of mains laid per service has varied considerably over the last eleven years ranging from 7.2m per service in 2009 to 3.7m in 2013. The length of mains laid per new connection is closely linked to the type of housing estate being built which is linked to the overall economy. For example, if a housing estate is going to be made up of smaller properties, typically 2- or 3-bedroom houses,

these are on smaller plots of land per property and therefore the amount of main needed between each property is less. These types of development also tend to have a shorter length of mains leading into the site because if they are too far from the existing transportation network, it isn't worth the investment per property to undertake the gas connection. Alternatively, if the housing estate is going to consist of larger properties such as 4 bedroom houses, the plots upon which they sit are generally larger and therefore require longer lengths of mains between each connection. As the houses are of greater value, there is also greater capital available to pay for more mains required to reach the site, so the greater chance the developer will pay for longer lengths of main to the site.

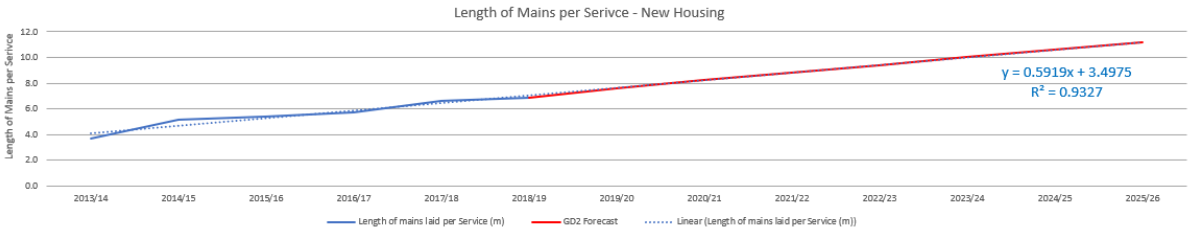
There is a period between 2009 and 2013 where the length of mains per service falls year on year which is likely to be due to the UK financial crisis and developers either not building as larger houses as before or unwilling to fund a gas connection to their site if the nearest main is some distance away. From 2013 we can see a gradual increase year on year which aligns with the economic recovery and shows that the developers are more willing to fund longer lengths of mains per property as they can reclaim the costs with higher house prices.

Option 1 – Eleven Year Trend



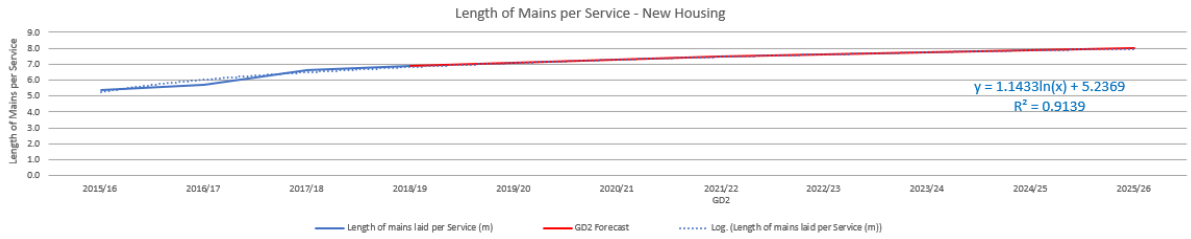
This option uses a long period of historical data to determine the trend line used to forecast workload in RIIO-2. Due to the troughs and peaks within this data set it has resulted in a low R-squared value of 0.03 which indicates that the trendline is a not good fit of the observed data. This option includes the period covered by the economic downturn which is no longer a true reflection of the current situation. Using the estimate for the number of new domestic services as previously determined, this option forecasts a total of 91km on new mains to facilitate new domestic connections.

Option 2 – Six Year Trend



This option uses a shorter period of historical data to determine the trend line used to forecast workload in RIIO-2. This option considers the year on year increase in the length of mains laid per service and continues this growth trend into RIIO-2. It does not consider the possibility that there might come a point where the length of mains laid per service plateaus as it becomes uneconomical to continue to install longer lengths of mains. This option forecasts a length of 11.2m in the last year of RIIO-2 which is over 50% higher than the next longest length in the previous eleven years. Using the estimate for the number of new domestic services as previously determined, this option forecasts a total of 150km on new mains to facilitate new domestic connections.

Option 3 – Adjusted Six Year Trend



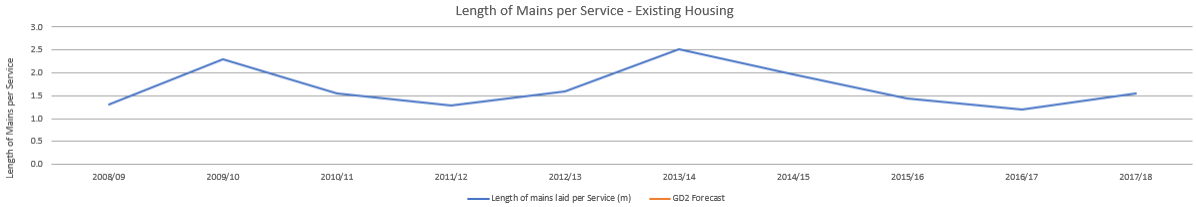
This option removes the first two years of RIIO-1 and uses a logarithmic trendline to model the length of mains laid per service plateauing. This option provides a more realistic forecast and one which has a R-squared value which is close to one representing a good fit for the observed data. In addition, this forecast continues with a slight increase in the length of mains laid per service in line with our service forecasts which predict the housing market to continue to grow during RIIO-2 however this option does not provide unrealistic lengths with the longest length of main laid in the final year is only 14% higher than what we have witnessed in previous years. Using the estimate for the number of new domestic services as previously determined, this option forecasts a total of 119km on new mains to facilitate new domestic connections.

Recommendation

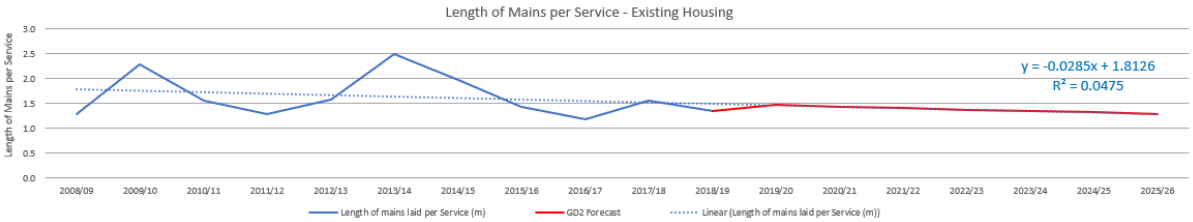
Option 3 – Adjusted Six Year Trend provides the most likely forecast for the length of mains laid per service in RIIO-2.

Existing Domestic Connections

The length of mains laid per service has remained consistent over eleven years ranging from ranging from 1.2m per service in 2016 to 2.5m in 2013. The length of the mains laid is determined by the distance from the nearest transportation pipe as the existing houses are typically located within the existing network. This means the variance in the meterage laid per property is small.



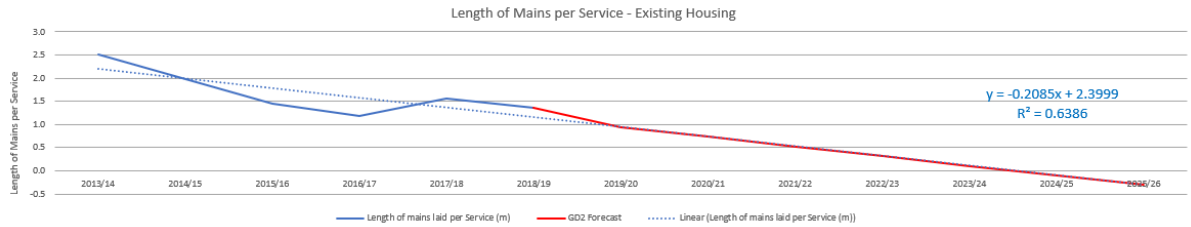
Option 1 – Eleven Year Trend



This option uses a long period of historical data to determine the trend line used to forecast workload in RIIO-2. Due to the troughs and peaks within this data set it has resulted in a low R-

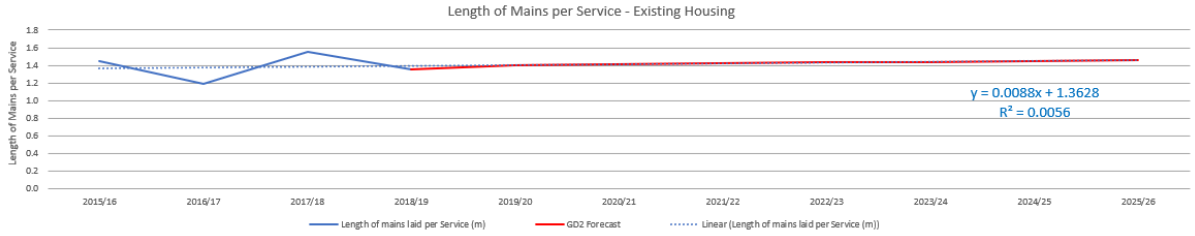
squared value of 0.05 which indicates that the trendline is a not good fit of the observed data. Using the estimate for the number of existing domestic services as previously determined, this option forecasts a total of 15km on new mains to facilitate existing domestic connections.

Option 2 – Six Year Trend



This option uses a shorter period of historical data to determine the trend line used to forecast workload in RIIO-2. Since the start of RIIO-1 we have seen a fall year on year for the length of mains laid per service for existing domestic properties which results in a reasonable R-squared value indicating that the trendline is a good fit for the observed data. However, by continuing this trend into RIIO-2 the numbers of length of mains laid per service becomes negative which is clearly not realistic. Using the estimate for the number of existing domestic services as previously determined, this option forecasts a total of 1km on new mains to facilitate existing domestic connections.

Option 3 – Adjusted Six Year Trend



This option removes the first two years of RIIO-1 which saw the longest lengths of mains laid per service over the previous eleven year period to allow for a relatively consistent dataset without any spikes on which to trend forward into RIIO-2. Using the estimate for the number of existing domestic services as previously determined, this option forecasts a total of 16km on new mains to facilitate existing domestic connections.

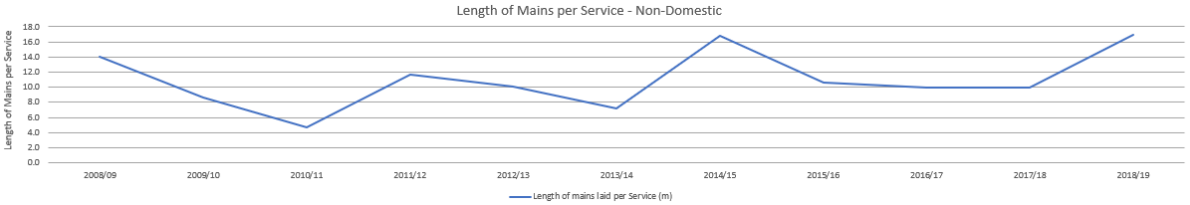
Recommendation

Option 3 – Adjusted Six Year Trend provides the most likely forecast for the length of mains laid per service in RIIO-2.

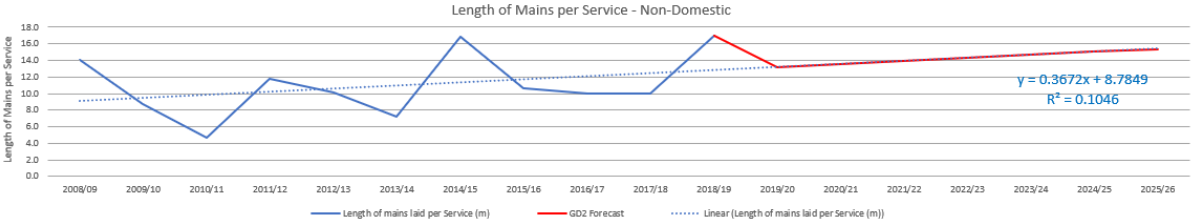
Non-domestic Connections

Industrial and commercial mains follow a similar pattern to new build domestic premises and follow a similar reasoning with large out of town developments attracting a greater distance of mains compared to smaller developments located within the existing transportation network. The general trend over this eleven year period shows a slight increase however notably we see a fall in the length of mains laid per non domestic service in the two years following the UK financial crisis and then increasing from 2010 with a significant spike in 2014. Due to the smaller data set, it is more likely to

spike higher or lower as it can be more easily influenced by one or two large projects within the 12 month period.

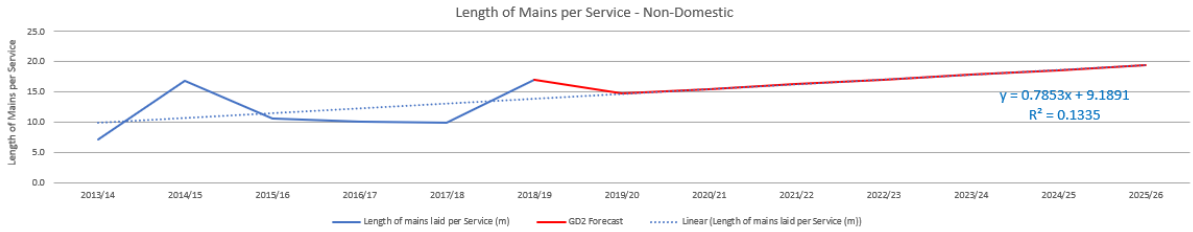


Option 1 – Eleven Year Trend



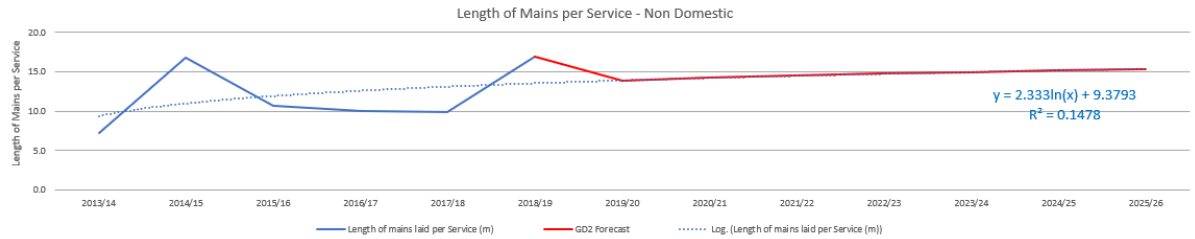
This option uses a long period of historical data to determine the trend line used to forecast workload in RIIO-2. Due to the troughs and peaks within this data set it has resulted in a low R-squared value of 0.10 which indicates that the trendline is a not good fit of the observed data. Since the length of mains laid per service for non domestic connections is sensitive to the economy and the trendline utilises data covered by the economic downturn, this is no longer a true reflection of the current situation. Using the estimate for the number of non domestic services as previously determined, this option forecasts a total of 38km on new mains to facilitate non domestic connections.

Option 2 – Six Year Trend



This option still uses a reasonably long period of data to trend out but the linear growth continuing into RIIO-2 results in lengths of mains being laid per service which are greater than any in the previous eleven years and so is unlikely to materialise as the cost of mains per property will become prohibitive to connecting to the gas network. Using the estimate for the number of non domestic services as previously determined, this option forecasts a total of 47km oF new mains to facilitate non domestic connections.

Option 3 – Adjusted Six Year Trend



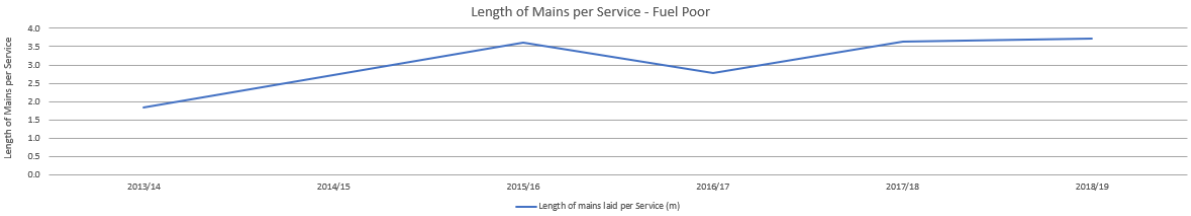
This option uses a logarithmic trendline to model the length of mains laid per service plateauing as continual growth in RIIO-2 in unlikely due to cost. This option provides a more realistic forecast and one which has the best R-squared value of all the options. In addition, this option does not forecast a single year in RIIO-2 where the length of mains laid per service is longer than we have seen in the past which is evident that the estimates are realistic. Using the estimate for the number of non domestic services as previously determined, this option forecasts a total of 39km on new mains to facilitate non domestic connections.

Recommendation

Option 3 – Adjusted Six Year Trend provides the most likely forecast for the length of mains laid per service in RIIO-2.

Fuel Poor Connections

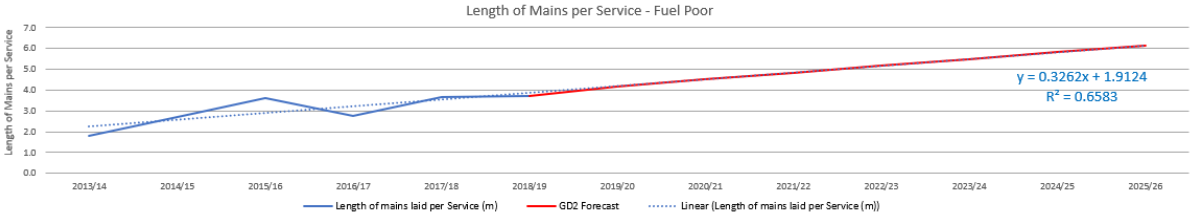
The length of mains laid per service tends to be slightly larger than that of existing domestic connections as the Fuel Poor voucher covers more than the cost of the service and so can be put towards the cost of mains meaning quotes with longer lengths of mains would be accepted where they might not be for a standard existing domestic connection. Over RIIO-1 we are seeing an upward trend in the length of mains laid per service ranging from 1.8m at the start of the period to 3.7m in 2018.



Option 1 – Eleven Year Trend

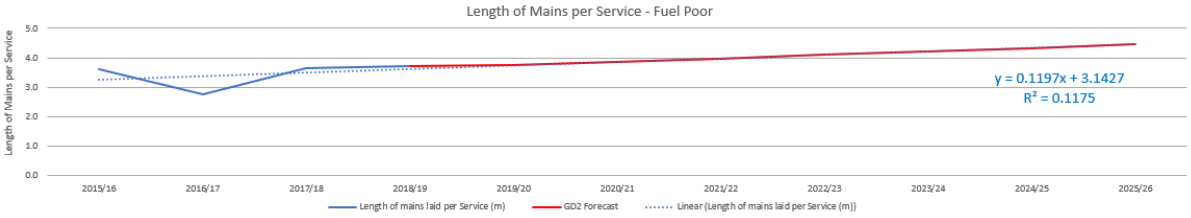
Recording of Fuel Poor connections in Regulatory Reporting does not go this far back.

Option 2 – Six Year Trend



This option still uses a reasonably long period of data to trend out but the linear growth continuing into RIIO-2 results in lengths of mains being laid per service which are greater than any in the previous six years and so is unlikely to materialise as the cost of mains per property will become cost prohibitive to connecting to the gas network. Using the estimate for the number of Fuel Poor services as previously determined, this option forecasts a total of 28km on new mains to facilitate Fuel Poor connections.

Option 3 – Adjusted Six Year Trend



This option removes the first two years of RIIO-1 which saw the shortest lengths of mains laid per service causing a steep inclining trendline in the previous option leading to unrealistic lengths of mains laid per service. Of the four years of data used, three years are all within 0.1m of each other providing confidence in the volumes this option forecasts. Using the estimate for the number of Fuel Poor services as previously determined, this option forecasts a total of 21km on new mains to facilitate Fuel Poor connections.

Recommendation

Option 3 – Adjusted Six Year Trend provides the most likely forecast for the length of mains laid per service in RIIO-2.

Unit Cost Analysis – Services

New Domestic Connections

New Domestic Connections	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	4 Year Total	6 Year Total	Average (£)
Gross Cost (£m)	£1.80	£2.22	£2.09	£2.27	£2.36	£2.48	**£9.20**	**£13.22**	-
No. of services	1660	2257	2062	2471	2613	2668	**9814**	**13731**	-
Option 1 - Mean of Six Years Averages	£1,083.92	£983.56	£1,015.89	£918.06	£904.49	£928.69	-	-	**£972.44**
Option 2 - Six Year Total Average							-	-	**£963.05**
Option 3 - Four Year Total Average							-	-	**£937.89**

There is only a 4% difference between the maximum and minimum average unit cost and there appears to be a slight downward trend over RIIO-1 as we become more efficient at delivery.

Existing Domestic Connections

Existing Domestic Connections	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	4 Year Total	6 Year Total	Average (£)
Gross Cost (£m)	£4.70	£4.05	£3.54	£3.87	£3.61	£3.89	**£14.91**	**£23.67**	-
No. of services	3051	2504	2366	2345	2075	2381	**9167**	**14722**	-
Option 1 - Mean of Six Years Averages	£1,541.29	£1,617.92	£1,497.94	£1,651.57	£1,739.25	£1,632.98	-	-	**£1,613.49**
Option 2 - Six Year Total Average							-	-	**£1,607.65**
Option 3 - Four Year Total Average							-	-	**£1,626.94**

There is only a 1% difference between the maximum and minimum average unit cost and there appears to be a slight upward trend over RIIO-1 however as previously stated the existing domestic connection unit costs will vary due to the possibilities covered under the standard charge.

Non-Domestic Connections

Non Domestic Connections	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	4 Year Total	6 Year Total	Average (£)
Gross Cost (£m)	£2.07	£1.81	£2.89	£1.97	£2.03	£2.36	**£9.25**	**£13.13**	-
No. of services	435	398	593	458	414	578	**2043**	**2876**	-
Option 1 - Mean of Six Years Averages	£4,750.62	£4,546.27	£4,879.49	£4,310.87	£4,891.65	£4,077.80	-	-	**£4,576.12**
Option 2 - Six Year Total Average							-	-	**£4,563.97**
Option 3 - Four Year Total Average							-	-	**£4,527.67**

There is only a 1% difference between the maximum and minimum average unit cost and the trend appears relatively flat apart from the last year which is the lowest to date. Unit costs can fluctuate due to the types of jobs undertaken in the year because of the variety of possible connection sizes from small shops to large industrial units.

Fuel Poor Connections

Fuel Poor - One Offs	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	4 Year Total	6 Year Total	Average (£)
Gross Cost (£m)	£1.28	£1.77	£1.80	£2.41	£1.56	£1.05	**£6.82**	**£9.87**	-
No. of services	919	982	915	1379	676	639	**3609**	**5510**	-
Option 1 - Mean of Six Years Averages	£1,392.37	£1,797.82	£1,968.34	£1,750.74	£2,306.98	£1,639.49	-	-	**£1,809.29**
Option 2 - Six Year Total Average							-	-	**£1,790.83**
Option 3 - Four Year Total Average							-	-	**£1,890.40**

Fuel Poor - Community Schemes	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	4 Year Total	6 Year Total	Average (£)
Gross Cost (£m)	£0.78	£1.63	£3.70	£2.50	£3.08	£3.38	**£12.66**	**£15.08**	-
No. of services	194	725	1543	1259	1423	1860	**6085**	**7004**	-
Option 1 - Mean of Six Years Averages	£4,015.86	£2,252.37	£2,399.83	£1,987.24	£2,166.42	£1,815.38	-	-	**£2,439.52**
Option 2 - Six Year Total Average							-	-	**£2,152.53**
Option 3 - Four Year Total Average							-	-	**£2,081.23**

There is a 6% difference between the maximum and minimum average unit cost for one off fuel poor connections and the trend appears to trend very slightly upwards. For community scheme fuel poor connections there is the largest variance between the maximum and minimum average unit costs of 17% however this is due to 2013/14 which could be considered an outlier and not taking this year into account the difference is only 2%.

Recommendation

The above analysis shows that unit costs have been relatively stable over RIIO-1 however in all cases there has been a slight trend over the period, either upwards or downwards. For this reason, we recommend that Option 3 – Four Year Trend is most appropriate as this provides a long enough period to include most varieties of jobs and costs and will also most likely represent the range of unit costs moving forward. Of the five unit costs this option represents three of the lowest and two of the highest unit cost options. The two highest unit costs are for one off fuel poor connections which is only 1% higher than the lowest unit cost option and we are forecasting workload to only be 20% of all fuel poor connections in RIIO-2 and the other is existing connections is only 6% higher than the lowest cost option and we are forecasting workload to continue to fall during RIIO-2.

Unit Cost Analysis – Mains

New Domestic Connections

New Domestic Connections (£m/km)	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	4 Year Total	6 Year Total	Average (£/m)
Gross Cost (£m)	£0.40	£0.62	£0.83	£0.62	£0.78	£0.68	**£2.90**	**£3.92**	-
Length of mains (km)	6.1	11.6	11.1	14.1	17.3	18.4	**60.8**	**78.6**	-
Option 1 - Mean of Six Years Averages	£65.26	£53.11	£74.64	£43.58	£45.16	£36.90	-	-	**£53.11**
Option 2 - Six Year Total Average							-	-	**£49.84**
Option 3 - Four Year Total Average							-	-	**£47.66**

There is an 11% difference between the maximum and minimum average unit cost and there appears to be a slight downward trend over RIIO-1, this will be due to the number of housing estates increasing following the economic downturn and so there is a decreasing amount of works where Northern Gas Networks will be excavating.

Existing Domestic Connections

Existing Domestic Connections (£m/km)	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	4 Year Total	6 Year Total	Average (£/m)
Gross Cost (£m)	£0.72	£0.43	£0.31	£0.27	£0.22	£0.39	**£1.19**	**£2.34**	-
Length of mains (km)	7.7	4.9	3.4	2.8	3.2	2.8	**12.2**	**24.8**	-
Option 1 - Mean of Six Years Averages	£93.51	£87.40	£90.73	£96.23	£69.64	£138.03	-	-	**£95.92**
Option 2 - Six Year Total Average							-	-	**£94.14**
Option 3 - Four Year Total Average							-	-	**£97.25**

There is a 3% difference between the maximum and minimum average unit cost which is due to the first five years which are all relatively consistent. 2018/19 sees a sudden jump up in unit cost which is due to a higher proportion of the works within the road than previous years which drives a high unit cost due to the added difficulties of this surface type.

Non-Domestic Connections

Non Domestic Connections (£m/km)	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	4 Year Total	6 Year Total	Average (£/m)
Gross Cost (£m)	£0.62	£0.83	£0.63	£0.38	£0.82	£1.12	**£2.95**	**£4.39**	-
Length of mains (km)	3.1	6.7	6.3	4.6	4.1	9.8	**24.8**	**34.6**	-
Option 1 - Mean of Six Years Averages	£198.36	£123.80	£99.67	£83.13	£198.20	£114.25	-	-	**£136.24**
Option 2 - Six Year Total Average							-	-	**£126.86**
Option 3 - Four Year Total Average							-	-	**£118.73**

There is a 3% difference between the maximum and minimum average unit cost which is due to the first five years which are all relatively consistent. 2018/19 sees a sudden jump up in unit cost which is due to a higher proportion of the works within the road than previous years which drives a higher unit cost due to the added costs involved in working with this surface type.

Fuel Poor Connections

Fuel Poor Connections - All (£m/km)	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	4 Year Total	6 Year Total	Average (£/m)
Gross Cost (£m)	£0.60	£0.73	£1.44	£0.58	£1.17	£1.19	**£4.37**	**£5.70**	-
Length of mains (km)	2.1	4.7	8.9	7.3	7.7	10.3	**34.2**	**41.0**	-
Option 1 - Mean of Six Years Averages	£281.52	£157.19	£161.33	£78.77	£152.49	£115.44	-	-	**£157.79**
Option 2 - Six Year Total Average							-	-	**£139.17**
Option 3 - Four Year Total Average							-	-	**£127.86**

There is an 23% difference between the maximum and minimum average unit cost which is the largest difference in all unit costs. Again, it is the first year of RIIO-1 where we see the outlier and by removing this average unit costs the difference falls to only 4%.

Recommendation

The above analysis shows that unit costs again have been relatively stable over RIIO-1 however not quite to the same scale as unit costs for services. This is likely due to the swings in cost due to works within different surface types however by taking an average of unit costs over a long enough period should account for the variety of jobs and provide a realistic unit cost going forward. For this reason, we again recommend that Option 3 – Four Year Trend as the most appropriate. Of the four unit costs this option represents three of the lowest and one of the highest unit costs. This high unit cost is for Existing Domestic connections in which there is the lowest range of unit costs at only a 3% difference between the maximum and minimum average unit costs.

Recovery Rate Analysis – Services and Mains

New Domestic Connections

New Domestic Connections	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	4 Year Total	6 Year Total	Average
Gross Cost (£m)	£2.20	£2.84	£2.92	£2.88	£3.14	£3.16	**£12.10**	**£17.14**	-
Contribution (£m)	£1.51	£2.23	£1.51	£1.46	£1.42	£1.80	**£6.19**	**£9.94**	-
Option 1 - Mean of Six Years Averages	69%	79%	52%	51%	45%	57%	-	-	**59%**
Option 2 - Six Year Total Average							-	-	**58%**
Option 3 - Four Year Total Average							-	-	**51%**

New Domestic Connections	Standard	Non-Standard	Combined
Gross Cost Split	35%	65%	100%
Option 4 - Four Year Average	23%	80%	60%

The amount we recover from our customers for new domestic connections has varied over RIIO-1 ranging from 45% up to 79% which average ranging between 59% and 51%. When considering the split between standard and non-standard we recover only 23% on average from our customers for standard connections compared to non-standard connections where we recover on average 80%. This is because the standard connections relate to existing or new build houses which are within 23m in public and 20m in private of the nearest gas main and therefore qualify for a standard connection charge. This means that regardless of the expense of the works required, they are only charged a flat rate. Non-standard connections on the other hand tend do not qualify and as such, the works are fully charged to the customer with the 20% not charged being covered by DLCA when the customer is within the 23m in public, therefore not qualifying for the full standard charge but still eligible for a discount.

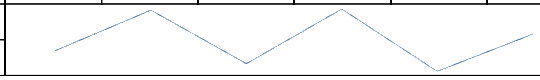
Existing Domestic Connections

Existing Domestic Connections	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	4 Year Total	6 Year Total	Average
Gross Cost (£m)	£5.42	£4.48	£3.85	£4.14	£3.83	£4.27	**£16.10**	**£26.00**	-
Contribution (£m)	£1.92	£1.37	£1.34	£1.33	£1.14	£1.28	**£5.09**	**£8.37**	-
Option 1 - Mean of Six Years Averages	35%	31%	35%	32%	30%	30%	-	-	**32%**
Option 2 - Six Year Total Average							-	-	**32%**
Option 3 - Four Year Total Average							-	-	**32%**

Existing Domestic Connections	Standard	Non-Standard	Combined
Gross Cost Split	75%	25%	100%
Option 4 - Four Year Average	27%	60%	35%

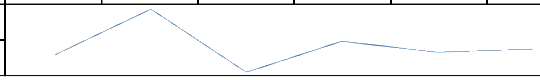
The amount we recover from our customers for existing domestic connections has been consistent over RIIO-1 ranging from 30% to 35% with an average of 32%. When considering the split between standard and non-standard existing connections we recover only 27% on average from our customers for standard connections compared to non-standard connections where we recover on average 60%. This is because non-standard existing domestic premises are more likely to be accepted if within 23m of the existing main in public but out of the distance in private. This means a high proportion will qualify for DLCA. If they do not qualify for DLCA, the high cost of connection tends to make customers consider other alternatives.

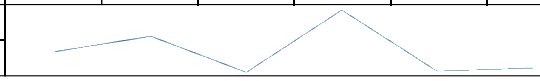
Non-Domestic Connections

Non Domestic Connections	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	4 Year Total	6 Year Total	Average
Gross Cost (£m)	£2.68	£2.64	£3.52	£2.36	£2.84	£3.48	**£12.20**	**£17.52**	-
Contribution (£m)	£1.70	£2.08	£2.05	£1.88	£1.57	£2.42	**£7.91**	**£11.70**	-
Option 1 - Mean of Six Years Averages	63%	79%	58%	80%	55%	70%	-	-	**68%**
Option 2 - Six Year Total Average							-	-	**67%**
Option 3 - Four Year Total Average							-	-	**65%**

The amount we recover from our customers for non-domestic connections has been varied over RIIO-1 ranging from 55% up to 80% with a smaller range in the average of between only 65% and 68%. The variance between years is due to the timing of income received and costs incurred. The overall averages are more consistent as they account for the variety of job types over a longer period.

Fuel Poor Connections

Fuel Poor Connections - One Offs	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	4 Year Total	6 Year Total	Average
Gross Cost (£m)	£1.28	£1.77	£1.81	£2.42	£1.56	£1.05	**£6.83**	**£9.89**	-
Contribution (£m)	£0.02	£0.08	£0.00	£0.06	£0.02	£0.02	**£0.10**	**£0.20**	-
Option 1 - Mean of Six Years Averages	1.4%	4.6%	0.2%	2.4%	1.6%	1.8%	-	-	**2.0%**
Option 2 - Six Year Total Average							-	-	**2.0%**
Option 3 - Four Year Total Average							-	-	**1.5%**

Fuel Poor Connections - Community Schemes	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	4 Year Total	6 Year Total	Average
Gross Cost (£m)	£0.78	£1.64	£3.71	£2.51	£3.08	£3.38	**£12.68**	**£15.10**	-
Contribution (£m)	£0.02	£0.05	£0.07	£0.11	£0.06	£0.07	**£0.30**	**£0.37**	-
Option 1 - Mean of Six Years Averages	2.6%	3.2%	1.8%	4.3%	1.9%	2.0%	-	-	**2.6%**
Option 2 - Six Year Total Average							-	-	**2.5%**
Option 3 - Four Year Total Average							-	-	**2.4%**

We recover much less from fuel poor connections as the voucher funds a lot of the cost of the connection. We have split fuel poor connections into one off connections and community scheme connections, both are trending around 2% with not much difference in the different averages we have produced.

Recommendation

For new and existing domestic connections we are proposing to use Option 4 – Four Year Average split by standard and non-standard connection types. The reason for this is we will be using the more granular recovery rate which should provide a more accurate and representative forecast. If we assume for new connections a 35/65 and for existing a 25/75 gross cost split between standard and non-standard as we have seen in RIIO-1, we would be averaging a common recovery rate of 60% for new and 35% for existing connections. Both of which are on the high side of all the options proposed which will mean a lower RIIO-2 allowance.

For non-domestic and fuel poor connections we are proposing Option 3 – Four Year Total Average. This accounts for recent changes we have made to our cost recovery model where we have removed IT costs being included within the base cost. For this reason, the four year average option provides

the lowest recovery rate however only by a small amount, 0.5% - 1.1%. As we intend to continue with our recovery model the four year average provides the most accurate forecast for RIIO-2.

8.2. Business Case Summary

The table below summarises the headline business case metrics for RIIO-2 workloads:

Category 1	Category 2	Category 3	Option	Description	Unit	Total RIIO-2 Value	Preffered
Workload	Services	New Domestic	Option 1	Eleven Year Trend	No.	13,946	×
Workload	Services	New Domestic	Option 2	Six Year Trend	No.	18,425	×
Workload	Services	New Domestic	Option 3	Adjusted Six Year Trend	No.	14,931	✓
Workload	Services	Existing Domestic	Option 1	Eleven Year Trend	No.	-4,032	×
Workload	Services	Existing Domestic	Option 2	Six Year Trend	No.	7,278	×
Workload	Services	Existing Domestic	Option 3	Adjusted Six Year Trend	No.	11,112	✓
Workload	Services	Non Domestic	Option 1	Eleven Year Trend	No.	1,987	×
Workload	Services	Non Domestic	Option 2	Six Year Trend	No.	3,070	×
Workload	Services	Non Domestic	Option 3	Adjusted Six Year Trend	No.	2,608	✓
Workload	Services	Fuel Poor - One Offs	Option 1	RIIO-2 Forecast	No.	1,000	✓
Workload	Services	Fuel Poor - Schemes	Option 1	RIIO-2 Forecast	No.	4,000	✓
Workload	Mains	New Domestic	Option 1	Eleven Year Trend	Km	90.8	×
Workload	Mains	New Domestic	Option 2	Six Year Trend	Km	149.7	×
Workload	Mains	New Domestic	Option 3	Adjusted Six Year Trend	Km	118.7	✓
Workload	Mains	Existing Domestic	Option 1	Eleven Year Trend	Km	15.1	×
Workload	Mains	Existing Domestic	Option 2	Six Year Trend	Km	1.2	×
Workload	Mains	Existing Domestic	Option 3	Adjusted Six Year Trend	Km	16.0	✓
Workload	Mains	Non Domestic	Option 1	Eleven Year Trend	Km	38.2	×
Workload	Mains	Non Domestic	Option 2	Six Year Trend	Km	46.5	×
Workload	Mains	Non Domestic	Option 3	Adjusted Six Year Trend	Km	39.0	✓
Workload	Mains	Fuel Poor	Option 1	Six Year Trend	Km	27.5	×
Workload	Mains	Fuel Poor	Option 2	Adjusted Six Year Trend	Km	21.1	✓

The table below summarises the headline business case metrics for RIIO-2 unit costs:

Category 1	Category 2	Category 3	Option	Description	Unit	Total RIIO-2 Value	Preffered
Unit Costs	Services	New Domestic	Option 1	Mean of Six Years Averages	£/no.	£972.44	×
Unit Costs	Services	New Domestic	Option 2	Six Year Total Average	£/no.	£963.05	×
Unit Costs	Services	New Domestic	Option 3	Four Year Total Average	£/no.	£937.89	✓
Unit Costs	Services	Existing Domestic	Option 1	Mean of Six Years Averages	£/no.	£1,613.49	×
Unit Costs	Services	Existing Domestic	Option 2	Six Year Total Average	£/no.	£1,607.65	×
Unit Costs	Services	Existing Domestic	Option 3	Four Year Total Average	£/no.	£1,626.94	✓
Unit Costs	Services	Non Domestic	Option 1	Mean of Six Years Averages	£/no.	£4,576.12	×
Unit Costs	Services	Non Domestic	Option 2	Six Year Total Average	£/no.	£4,563.97	×
Unit Costs	Services	Non Domestic	Option 3	Four Year Total Average	£/no.	£4,527.67	✓
Unit Costs	Services	Fuel Poor - One Offs	Option 1	Mean of Six Years Averages	£/no.	£1,809.29	×
Unit Costs	Services	Fuel Poor - One Offs	Option 2	Six Year Total Average	£/no.	£1,790.83	×
Unit Costs	Services	Fuel Poor - One Offs	Option 3	Four Year Total Average	£/no.	£1,890.40	✓
Unit Costs	Services	Fuel Poor - Schemes	Option 1	Mean of Six Years Averages	£/no.	£2,439.52	×
Unit Costs	Services	Fuel Poor - Schemes	Option 2	Six Year Total Average	£/no.	£2,152.53	×
Unit Costs	Services	Fuel Poor - Schemes	Option 3	Four Year Total Average	£/no.	£2,081.23	✓
Unit Costs	Mains	New Domestic	Option 1	Mean of Six Years Averages	£/m	£53.11	×
Unit Costs	Mains	New Domestic	Option 2	Six Year Total Average	£/m	£49.84	×
Unit Costs	Mains	New Domestic	Option 3	Four Year Total Average	£/m	£47.66	✓
Unit Costs	Mains	Existing Domestic	Option 1	Mean of Six Years Averages	£/m	£95.92	×
Unit Costs	Mains	Existing Domestic	Option 2	Six Year Total Average	£/m	£94.14	×
Unit Costs	Mains	Existing Domestic	Option 3	Four Year Total Average	£/m	£97.25	✓
Unit Costs	Mains	Non Domestic	Option 1	Mean of Six Years Averages	£/m	£136.24	×
Unit Costs	Mains	Non Domestic	Option 2	Six Year Total Average	£/m	£126.86	×
Unit Costs	Mains	Non Domestic	Option 3	Four Year Total Average	£/m	£118.73	✓
Unit Costs	Mains	Fuel Poor	Option 1	Mean of Six Years Averages	£/m	£157.79	×
Unit Costs	Mains	Fuel Poor	Option 2	Six Year Total Average	£/m	£139.17	×
Unit Costs	Mains	Fuel Poor	Option 3	Four Year Total Average	£/m	£127.86	✓

The table below summarises the headline business case metrics for RIIO-2 recovery rates:

Category 1	Category 2	Category 3	Option	Description	Unit	Total RIIO-2 Value	Preffered
Recovery Rate	Mains & Services	New Domestic	Option 1	Mean of Six Years Averages	%	59%	×
Recovery Rate	Mains & Services	New Domestic	Option 2	Six Year Total Average	%	58%	×
Recovery Rate	Mains & Services	New Domestic	Option 3	Four Year Total Average	%	51%	×
Recovery Rate	Mains & Services	New Domestic	Option 4	Four Year Total Average - Standard	%	23%	✓
Recovery Rate	Mains & Services	New Domestic	Option 4	Four Year Total Average - Non Standard	%	80%	✓
Recovery Rate	Mains & Services	Existing Domestic	Option 1	Mean of Six Years Averages	%	32%	×
Recovery Rate	Mains & Services	Existing Domestic	Option 2	Six Year Total Average	%	32%	×
Recovery Rate	Mains & Services	Existing Domestic	Option 3	Four Year Total Average	%	32%	×
Recovery Rate	Mains & Services	Existing Domestic	Option 4	Four Year Total Average - Standard	%	27%	✓
Recovery Rate	Mains & Services	Existing Domestic	Option 4	Four Year Total Average - Non Standard	%	60%	✓
Recovery Rate	Mains & Services	Non Domestic	Option 1	Mean of Six Years Averages	%	68%	×
Recovery Rate	Mains & Services	Non Domestic	Option 2	Six Year Total Average	%	67%	×
Recovery Rate	Mains & Services	Non Domestic	Option 3	Four Year Total Average	%	65%	✓
Recovery Rate	Mains & Services	Fuel Poor - One Offs	Option 1	Mean of Six Years Averages	%	2.0%	×
Recovery Rate	Mains & Services	Fuel Poor - One Offs	Option 2	Six Year Total Average	%	2.0%	×
Recovery Rate	Mains & Services	Fuel Poor - One Offs	Option 3	Four Year Total Average	%	1.5%	✓
Recovery Rate	Mains & Services	Fuel Poor - Schemes	Option 1	Mean of Six Years Averages	%	2.6%	×
Recovery Rate	Mains & Services	Fuel Poor - Schemes	Option 2	Six Year Total Average	%	2.5%	×
Recovery Rate	Mains & Services	Fuel Poor - Schemes	Option 3	Four Year Total Average	%	2.4%	✓

9. Preferred Option Scope and Project Plan

9.1. Preferred Option

The table below summarise the preferred options for workload, unit cost and recovery rates:

Category 1	Category 2	Category 3	Option	Description	Unit	Total RIIO-2 Value
Workload	Services	New Domestic	Option 3	Adjusted Six Year Trend	No.	14,931
Workload	Services	Existing Domestic	Option 3	Adjusted Six Year Trend	No.	11,112
Workload	Services	Non Domestic	Option 3	Adjusted Six Year Trend	No.	2,608
Workload	Services	Fuel Poor - One Offs	Option 1	RIIO-2 Forecast	No.	1,000
Workload	Services	Fuel Poor - Schemes	Option 1	RIIO-2 Forecast	No.	4,000
Workload	Mains	New Domestic	Option 3	Adjusted Six Year Trend	Km	118.7
Workload	Mains	Existing Domestic	Option 3	Adjusted Six Year Trend	Km	16.0
Workload	Mains	Non Domestic	Option 3	Adjusted Six Year Trend	Km	39.0
Workload	Mains	Fuel Poor	Option 2	Adjusted Six Year Trend	Km	21.1
Unit Costs	Services	New Domestic	Option 3	Four Year Total Average	£/no.	£937.89
Unit Costs	Services	Existing Domestic	Option 3	Four Year Total Average	£/no.	£1,626.94
Unit Costs	Services	Non Domestic	Option 3	Four Year Total Average	£/no.	£4,527.67
Unit Costs	Services	Fuel Poor - One Offs	Option 3	Four Year Total Average	£/no.	£1,890.40
Unit Costs	Services	Fuel Poor - Schemes	Option 3	Four Year Total Average	£/no.	£2,081.23
Unit Costs	Mains	New Domestic	Option 3	Four Year Total Average	£/m	£47.66
Unit Costs	Mains	Existing Domestic	Option 3	Four Year Total Average	£/m	£97.25
Unit Costs	Mains	Non Domestic	Option 3	Four Year Total Average	£/m	£118.73
Unit Costs	Mains	Fuel Poor	Option 3	Four Year Total Average	£/m	£127.86
Recovery Rate	Mains & Services	New Domestic	Option 4	Four Year Total Average - Standard	%	23%
Recovery Rate	Mains & Services	New Domestic	Option 4	Four Year Total Average - Non Standard	%	80%
Recovery Rate	Mains & Services	Existing Domestic	Option 4	Four Year Total Average - Standard	%	27%
Recovery Rate	Mains & Services	Existing Domestic	Option 4	Four Year Total Average - Non Standard	%	60%
Recovery Rate	Mains & Services	Non Domestic	Option 3	Four Year Total Average	%	65%
Recovery Rate	Mains & Services	Fuel Poor - One Offs	Option 3	Four Year Total Average	%	1.5%
Recovery Rate	Mains & Services	Fuel Poor - Schemes	Option 3	Four Year Total Average	%	2.4%

9.2. Asset Health Spend Profile

The tables below summarise the spend profile in RIIO-2:

Connection	Activity	Unit	Workload						Unit Cost (£/no.) / (£/m)
			2021/22	2022/23	2023/24	2025/26	2025/26	Total	
New Domestic	Services	No.	2,882	2,939	2,991	3,038	3,081	14931	£937.89
New Domestic	Mains	Km	21.9	22.9	23.8	24.7	25.5	118.7	£47.66
Existing Domestic	Services	No.	2,271	2,247	2,222	2,198	2,174	11112	£1,626.94
Existing Domestic	Mains	Km	3.2	3.2	3.2	3.2	3.2	16.0	£97.25
Non Domestic	Services	No.	512	517	522	526	530	2608	£4,527.67
Non Domestic	Mains	Km	7.4	7.6	7.8	8.0	8.1	39.0	£118.73
FP - One Offs	Services	No.	200	200	200	200	200	1000	£1,890.40
FP - One Offs	Mains	Km	0.8	0.8	0.8	0.9	0.9	4.2	£127.86
FP - Schemes	Services	No.	800	800	800	800	800	4000	£2,081.23
FP - Schemes	Mains	Km	3.2	3.3	3.4	3.5	3.6	16.9	£127.86
DG's	-	No.	2.0	2.0	2.0	2.0	2.0	10.0	£13,761.35
Risers	-	No.	19.0	19.0	19.0	19.0	19.0	95.0	£1,676.38
Total Services	-	No.	**6,665**	**6,703**	**6,735**	**6,762**	**6,785**	**33,651**	-
Total Mains	-	Km	**37**	**38**	**39**	**40**	**41**	**195**	-
Grand Total	-	-	-	-	-	-	-	-	-

Gross Cost (£m)						Gross Cost Split	
2021/22	2022/23	2023/24	2025/26	2025/26	Total	Std	Non-Std
£2.7	£2.8	£2.8	£2.8	£2.9	£14.0	35%	65%
£1.0	£1.1	£1.1	£1.2	£1.2	£5.7	35%	65%
£3.7	£3.7	£3.6	£3.6	£3.5	£18.1	75%	25%
£0.3	£0.3	£0.3	£0.3	£0.3	£1.6	75%	25%
£2.3	£2.3	£2.4	£2.4	£2.4	£11.8	-	-
£0.9	£0.9	£0.9	£0.9	£1.0	£4.6	-	-
£0.4	£0.4	£0.4	£0.4	£0.4	£1.9	-	-
£0.1	£0.1	£0.1	£0.1	£0.1	£0.5	-	-
£1.7	£1.7	£1.7	£1.7	£1.7	£8.3	-	-
£0.4	£0.4	£0.4	£0.4	£0.5	£2.2	-	-
£0.0	£0.0	£0.0	£0.0	£0.0	£0.1	-	-
£0.0	£0.0	£0.0	£0.0	£0.0	£0.2	-	-
£10.8	**£10.8**	**£10.8**	**£10.9**	**£10.9**	**£54.1**	**-**	**-**
£2.7	**£2.8**	**£2.9**	**£3.0**	**£3.1**	**£14.5**	**-**	**-**
£13.6	**£13.7**	**£13.8**	**£13.9**	**£14.0**	**£68.9**	**-**	**-**

Recovery Rate		Contribution (£m)	Net Cost (£m)					
Std	Non-Std		2021/22	2022/23	2023/24	2025/26	2025/26	Total
23%	80%	£8.4	£1.08	£1.10	£1.12	£1.14	£1.15	£5.6
23%	80%	£3.4	£0.42	£0.44	£0.45	£0.47	£0.48	£2.3
27%	60%	£6.3	£2.40	£2.37	£2.35	£2.32	£2.30	£11.7
27%	60%	£0.5	£0.20	£0.20	£0.20	£0.20	£0.20	£1.0
65%	-	£7.7	£0.81	£0.82	£0.83	£0.84	£0.84	£4.1
65%	-	£3.0	£0.31	£0.32	£0.33	£0.33	£0.34	£1.6
1.5%	-	£0.0	£0.37	£0.37	£0.37	£0.37	£0.37	£1.9
1.5%	-	£0.0	£0.10	£0.10	£0.11	£0.11	£0.11	£0.5
2.4%	-	£0.2	£1.63	£1.63	£1.63	£1.63	£1.63	£8.1
2.4%	-	£0.1	£0.40	£0.41	£0.42	£0.43	£0.45	£2.1
43.2%	-	£0.1	£0.02	£0.02	£0.02	£0.02	£0.02	£0.1
43.2%	-	£0.1	£0.02	£0.02	£0.02	£0.02	£0.02	£0.1
-	-	**£22.6**	**£6.3**	**£6.3**	**£6.3**	**£6.3**	**£6.3**	**£31.5**
-	-	**£7.0**	**£1.4**	**£1.5**	**£1.5**	**£1.5**	**£1.6**	**£7.7**
-	-	**£29.6**	**£7.7**	**£7.8**	**£7.8**	**£7.8**	**£7.9**	**£39.17**

The total forecast capital expenditure for Connections can be referenced back to the following documents:

- RIIO-2 Business Plan – Tables 6.7
- RIIO-2 Business Plan Data Tables – Table 3.04

9.3. Investment Risk Discussion

We have controls and processes in place throughout the development of our RIIO-2 Capital Expenditure programme to ensure we mitigate both our customer's and our own exposure to risk. Workload and unit cost risks are inherent when forecasting third party driven work. The bullet points below outline the steps we have undertaken to ensure we limit these risks to provide an accurate capital programme.

Workload Risk Mitigations

- We have considered various options including workload volumes and chosen the solution which provides our customers with the most likely outcome.
- We have shared our preferred strategy with our businesses industry experts to sense check volumes and costs
- Our RIIO-2 strategy is comparable with our RIIO-1 strategy and so we have a proven record we can manage our assets in this way.
- Zero new domestic connections in 2025 as ambition not written into legislation yet.

Unit Cost Risk Mitigations

- We have considered various options including unit costs and chosen the costs which provides our customers with the most likely outcome.

- We are not planning to undertake new work activities. We have undertaken all interventions previously and have historic costs allocated within our Unit Cost Database.
- We have benchmarked our unit costs against other GDN's to ensure our unit costs are efficient.
- We have experienced Project Managers who have a proven track record of delivering this type of work in the past and we have a commercial team of quantity surveyors who are focussed on delivering value for money.