Cadent
Your Gas Network

Appendix 10.04

Uncertainty Mechanism Case

Heat policy including Fuel poor network extension scheme (FPNES)

Cadent
Your Gas Network

Cadent's systematic approach to developing uncertainty mechanisms to manage forecast uncertainty

1. Defining our customers' needs

- What is the area?
- Why is it important to customers and stakeholders?
- What insights are shaping our thinking?
  - Customer insights
  - Stakeholder insights
  - Legislative insights
  - BAU operational information
  - Historic insights
  - Wider research

2. Evidencing forecast uncertainty

- What do we know about future workload & costs in this area?
- Why can't expenditure be forecast with sufficient confidence?
  - For example using historical / independent benchmarks
- Why are levels of expenditure outside of network control?
- What customer / network impacts could there be from a forecast error?
- What network behaviours could arise from inclusion within the base plan?
  - What would the customer impact be?

3. Qualitative assessment of the options

- What options other than inclusion in the base plan are available?
- Why are they the options?
- What option(s) are we proposing and why?
- How would the mechanism(s) work? (Implementation, triggers, materiality thresholds etc.)
- What are the customer benefits & drawbacks of the mechanism(s)? (Inc. simplicity)
- Why do the customer benefits outweigh the drawbacks?
- What network behaviours could the mechanism drive?
  - What would the customer impact be?

4. Quantitative assessment of the proposed options

- How do we know our 'input variables' are the best available? (i.e. ranges of workload, costs, trigger points, frequency, probability)
- How are we assuring our modelling results?
- What is the best view of materiality for the area?
- What is the modelled cost volatility for the area?
- How does the proposed mechanism(s) deliver value for money?

5. Quantifying the overall customer impact

- What is the overall customer impact of all areas of forecast uncertainty – with and without mechanisms?
- What does this mean for the balance of forecast risk between customers and networks?
- What does this mean for customer bills?

6. Setting standards that customers love

- Are our proposals, and the associated impacts, easy to understand?
- Can it be demonstrated that they protect customers and investors?
- Is our suite of proposed mechanisms acceptable to customers and stakeholders?

Uncertainty area			
Demand uncertainty	Legislative uncertainty	Cost confidence	**Heat policy**

Heat Policy and Fuel Poor Network Extension Scheme (FPNES)

Proposed by Ofgem

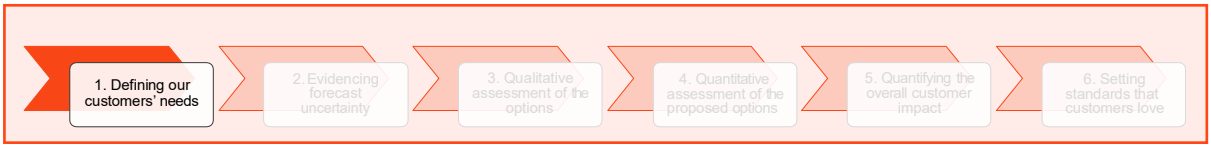
Re-opener Uncertainty Mechanism

The Government has committed to reducing greenhouse gas emissions from 1990 levels by 80% by 2050 and has now legislated to deliver a net-zero target by 2050. The scale of this climate-change challenge is immense and urgent action is needed in the next few years to ensure pathways are available to deliver a low-cost, secure and sustainable energy transition for future customers. However, there is considerable uncertainty over the direction of future government decisions to support reaching this target and the form that policy may take as we move into the RIIO-2 period.

Future heat policy decisions will have significant and wide-ranging implications for our operations. The RIIO-2 framework needs to support these activities, either through innovation mechanisms or with bespoke adjustments through the heat policy re-opener.

A further element of uncertainty from the future of heat policy are the consequences for the Fuel Poor Network Extension Scheme (FPNES). There is the potential that future new connections may be discouraged if policy sought to limit the use of gas heating in homes. A re-opener has been proposed to maintain flexibility in the scheme for this eventuality.

1. Defining the need



1.1. What is the area?

There is considerable uncertainty over the future of UK heat policy. While the Government has committed to reducing greenhouse gas emissions by 80% from 1990 levels by 2050 and has now legislated to deliver a net-zero target by 2050, a number of different pathways could be used to achieve these targets.

How the Government decides to pursue decarbonisation targets will have significant implications for the gas networks, which are currently unclear. In their recent report, the Committee on Climate Change recognised the key role lower-carbon gas and hydrogen could play in delivering the most cost-effective and secure pathway to decarbonise heat.

Therefore, future policy decisions will play a crucial role in supporting a range of hydrogen initiatives that are now underway, including the roll-out of a UK-wide hydrogen blending regime, or the deployment of a large-scale hydrogen cluster in the North West through the HyNet project.

Currently, a range of projects is underway in RIIO-1 that will produce evidence to enable a heat policy decision to be made. This includes our own network innovation competition (NIC)

projects HyDeploy and H21 equipment testing, which are providing the evidence base to show substantial percentages of hydrogen can be blended with methane, reducing carbon intensity without having to change. These projects are alongside BEIS's own non-network projects such as Hy4Heat, which are currently considering activities such as large-scale hydrogen conversion trials for occupied premises.

1.2. Why is it important?

It is critical to maintain momentum in delivering pathways which will meet the UK's climate change targets, and we recognise the essential role the gas network plays given that it predominantly transports a fossil fuel product. This includes our role in working with the Government to understand the future role of gas networks in a world of decarbonisation targets. Therefore, it is important that a mechanism is established to fund projects during RIIO-2 delivered by the gas networks that provide the evidence base to inform the Government's strategic decisions or facilitate or enable emerging initial policy decisions.

Ofgem has recognised the importance of managing uncertainty in this area and has confirmed that companies will have the opportunity to receive innovation stimulus in relation to the energy system transition. This is designed to provide opportunities for learning and information gathering to support future policy development.

Ofgem has also confirmed a heat policy re-opener uncertainty mechanism to allow network companies to respond to significant changes in government policy. Our proposals are in line with this mechanism and seek to address the significant uncertainty from the wide range of heat decarbonisation policy impacts that could arise in RIIO-2.

1.3. What insights are shaping our thinking?

In Section 3 of our Environmental Action Plan (Appendix 07.04.00), we have set out how we are responding to the urgent need to decarbonise the energy systems. To do this, we have used four possible stable 2050 'End States' for the gas network, as summarised in Figure 1

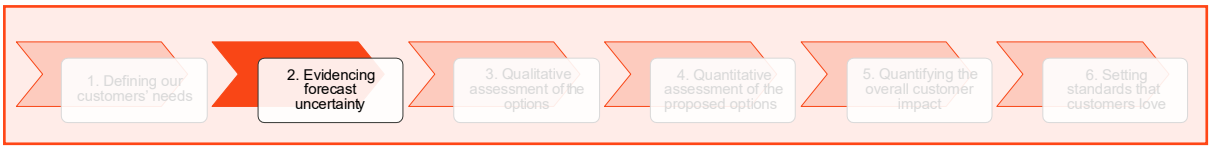
Figure 1: Possible 2050 End States

Green Gases	The gas network is retained but is delivering low carbon green gases such as biomethane, blended with hydrogen.
Re-purposed for Hydrogen	The gas network is repurposed to transport hydrogen safely to homes, businesses, industry, power generators and the transport sector.
Peak and Emergency Energy Store: "Powerbank"	The gas network is retained to transport hydrogen or green gases to deal with peak and emergency conditions, such as cold spells, or renewable electricity generation shortfalls. Homes would use hybrid heating systems to use clean electricity for most of the year, but an efficient gas boiler on peak days.
Decommissioned	The Gas network has been decommissioned. This would need close to full electrification of heat and new large scale secure and reliable energy sources for power generation and peak heat. This would require very large scale and highly visible infrastructure upgrades, to at least duplicate the existing electricity grid.

We have engaged extensively on the future role of the gas network and have discussed this work within our Environmental Action Plan.

While the clearance for large scale projects must be given by the Government, our role is to show the options available and ensure the evidence required by the Government to make their strategic policy decisions is robust. This includes feeding in the views and experiences of our customers who will be directly impacted by any change. Robust customer opinions need to be based on real experiences, and trials and pilots involving hydrogen are a key part of the evidence gathering, both by the gas networks and by the Government.

2. Evidencing the uncertainty



2.1. What we know about the future

As heat and energy policy in England is governed centrally, supporting initiatives and activities will be triggered by a future Government decision, direction or legislation. Costs could be incurred in delivering projects but also in supporting the Government in developing and designing options.

In our work with the BEIS team responsible for developing heat policy, we know that we are entering a period of trials and pilots at varying scales to fill critical evidence gaps, including demonstrating how consumers may react to different options. There will be projects and initiatives that will emerge after our Business Plan has been submitted, but there are also several specific projects and areas where we Government direction could result in us delivering a large and complex project.

These known unknowns include:

- **HyNet** – A large scale hydrogen cluster in the North West
- **HyDeploy UK** – Delivering hydrogen blending across our networks
- **Hy4Heat Occupied Premises trials** – Large-scale, in-premises trails of hydrogen domestic heating.

A conversion to hydrogen is likely to have less of an impact for our customers and stakeholders. However, if a decision is taken to electrify all heat and decommission the gas network, the whole gas transportation regime will need to be dismantled, and a detailed transition plan established with consumer protection at its heart. Delivery plans for such large strategic policy decisions can only realistically be developed once the policy decisions have been made.

For example, if the decision is made to remove the gas network the investment in mains replacement will cease. Whereas, if the decision to move to hydrogen networks is made, the need to complete, extend and accelerate the mains replacement programme earlier may be necessary. The scope of the mains requiring replacing would be informed by the findings of the H21 NIC work already underway in RIIO-1.

While the final trigger for projects will be from the Government, there are other live projects that require completion to inform these decisions. In addition to the H21 work, the findings from the HyDeploy hydrogen blending project, and the related Future Billing Methodology project, will demonstrate the level of work required to implement blending. Depending on the outcomes, this could lead to either a reduced likelihood of implementation or a greater pull to

implement an earlier and quicker rollout. Further details on these projects are provided in our Environmental Action Plan, in Appendix 07.04.00.

Comparing uncertainty to costs included in our base plan

Heat policy

During RIIO-1, we have been awarded funding for several specific projects under the Network Innovations Competitions for work related to the future role of gas:

- **Future Billing Methodology:** £4.8m was awarded to support our work to identify the best approach to enable customer billing arrangements to accommodate hydrogen blends or other injections of distributed gas, including biomethane.
- **HyDeploy:** £6.8m was awarded to support the HyDeploy project, designed to demonstrate how much hydrogen can be added to methane without requiring any changes to customer appliances. This includes live trails on Keele University's private network.
- **HyDeply2:** A further £13.8m was awarded to continue supporting the demonstrating that hydrogen can be injected onto the public gas network. This work includes testing the safety case and trialling injection into untested parts of the network.

Our base plan includes a range of costs associated with our environmental outputs as discussed in Chapter 7 of our Business Plan, and in our Environmental Action Plan (Appendix 07.04.00). The proposed heat policy uncertainty mechanism does not interact with these costs. As discussed in Section 4, the costs we propose to reclaim through this mechanism relate to costs that may be triggered in response to external changes in legislation. Our base plan has been developed to deliver our strategy in line with known requirements to date.

FPNES

During RIIO-1, we have a target to deliver 36,616 fuel poor connections. We receive funding in the form of a fuel poor voucher, at a rate determined by Ofgem to undertake such work. To date, we have undertaken 28,131 of this workload. Our RIIO-2 base plan includes costs for a further 6,250 fuel poor connections.

Table 1: RIIO-2 base plan costs associated with fuel poor connections

Base costs *£m, 18/19 prices*	2021/22	2022/23	2023/24	2024/25	2025/26
East of England	£0.92m	£0.92m	£0.92m	£0.92m	£0.92m
London	£0.28m	£0.28m	£0.28m	£0.28m	£0.28m
North West	£1.11m	£1.11m	£1.11m	£1.11m	£1.11m
West Midlands	£0.71m	£0.71m	£0.71m	£0.71m	£0.71m

The proposed re-opener for the FPNES relates directly to these base plan costs. A PCD has been prescribed for fuel poor connections in RIIO-2, with a re-opener providing the flexibility to end the scheme in response to government policy.

2.2. Why we face forecasting difficulties

There is considerable uncertainty over what form a government decision may take, alongside the potential timing of any decision on heat and energy policy. Given the potentially wide-ranging implications of any decision in this area, it is not possible to develop an accurate forecast for our RIIO-2 plan.

The activities described above would have associated costs in the hundreds of millions; however, it is not possible to accurately forecast this value until the scope of any future policy change is known. There is also uncertainty over how these projects could be funded – this could be partly done through Government or other regional authorities.

We are unable to control the timing or scope of a future heat policy decision which will determine the work we may need to undertake. However, we will continue to engage extensively with stakeholders and to provide actionable evidence from our innovation projections to support a Government decision. Once a decision has been made by the Government, we will be able to develop a **better view** of the projects that can be advanced, and their associated costs of delivery.

2.3. Network impacts and behaviours from including in the base plan

The risk with including costs dependent on a future heat policy decision in our base plan is that we would be required to speculate on what projects this decision may enable. This creates significant risk that funding may be requested for projects that do not go ahead, or instead that the scope of a decision significantly alters our Business Plan proposals.

If we were to include costs in the base plan, we would need to rely on indicative cost estimates for several large projects. Given the scale of potential impacts from a future heat policy decision, the implications of a forecast error in this area are extremely significant. Any margin of error around initial cost estimates in the hundreds of millions of pounds would result in significant detriment both to customers and to our business.

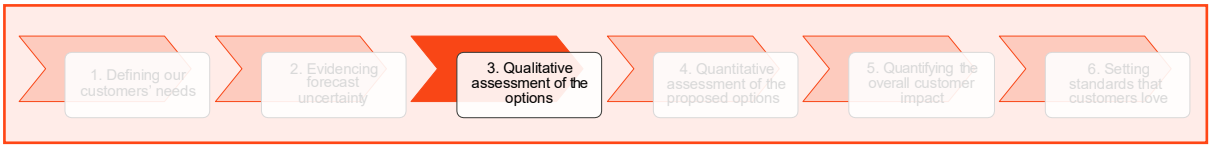
There is a **risk** that our estimates could underpredict the work we may need to undertake, creating a financial risk. We would face an incentive to price risk into any base plan estimates to ensure we were adequately funded to deliver projects relating to heat policy.

However, this creates **a risk to customers.** A decision might not be made on heat policy in RIIO-2, or its scope might not support the deployment of hydrogen projects. This would create the opportunity for windfall gains.

In summary, the Government may require the gas networks to deliver several projects, all of which require significant funding, and the detailed design and costings are not currently known. Without this information, it is not possible to include accurate cost forecasts in our baseline plan. Any estimate at present could result in either a windfall gain if projects or volumes do not appear or an investment constraint if we underestimate.

In the case of the FPNES, the re-opener proposed by Ofgem relates to removing costs from our base plan in response to changes in future heat policy direction. Costs that have been included in the base plan are also prescribed as a PCD.

3. Qualitative assessment



3.1. Options for addressing uncertainty

Funding for heat policy enabling and supporting projects cannot be included in our base plan as the specific requirements and projects are not currently known and would only emerge after Business Plan submission and at any time during RIIO-2 in response to a government policy decision. Instead, we have identified and evaluated other mechanisms that could be used to address this risk.

Table 2: Evaluating options for uncertainty mechanisms

Mechanism Option	Description
Volume Driver	A volume driver is not appropriate. Any future expenditure in this area will be project-specific, and therefore cannot be easily compared against a unit cost structure. Furthermore, there is considerable uncertainty on the type of work that may be triggered by a heat policy decision.
Re-opener mechanism	A re-opener mechanism would account for the current uncertainty in understanding costs when both the design and requirement for projects in RIIO-2 is currently unknown. This mechanism would allow us to effectively develop an evidence-based cost forecast in response to future policy changes once its timing and scope are known.
Use it or lose it allowance **PCD**	This would involve a Price control Deliverable (PCD) as part of our RIIO-2 plan. While this would protect customers from under-delivery, a PCD does not address the challenge we face in forecasting a total cost when the scope of a future heat policy decision is unknown. There is also a risk that barriers are created if there are insufficient funds to deliver against any new requirements.

We have also undertaken a qualitative assessment of uncertainty in this area to understand the challenges an uncertainty mechanism must aim to address.

Table 3: Qualitative assessment of risks posed by heat policy and FPNES

Risk	Volume risk	Unit cost risk	Impact on outputs	Material cost/bill impact
Heat Policy	**High**	**High**	**High**	**High**
FPNES	**Medium**	**Low**	**Medium**	**Medium**

Further detail on our assessment is provided below:

- **Volume risk:** A significant amount of work in this area is dependent on a government policy decision and is largely out of our control. We are currently undertaking pilot work that is producing evidence that will inform these decisions and engaging with key stakeholders. For FPNES, we have included volumes in our base plan to deliver our target level of fuel poor connections. However, there is a degree of uncertainty over the future workload if a change in government policy does not support the scheme.
- **Unit cost risk:** There is considerable uncertainty over costs that may be incurred in response to a heat policy decision. It will only be possible to develop a more accurate view following such a decision when its scope and impact can be fully evaluated. In the case of the FPNES, unit costs are determined in accordance with a voucher value, removing uncertainty in unit costs.
- **Impact on outputs**: Heat policy will have significant and wide-ranging implications for our business, especially in relation to our output commitments on the environment and safety. It is possible that the policy may drive significant changes in how we operate as a business. For FPNES, impacts on other outputs are largely restricted to our commitments on fuel poverty.
- **Material cost/bill impact:** If heat-policy decisions were taken that enable a greater role for hydrogen on our networks, this will drive significant investment that may have a substantial effect on bills. Given the scale of such projects, alternative funding arrangements or sources may be used; therefore, there is considerable uncertainty on the final bill impact potential. For FPNES, the re-opener would, in fact, lead to bill reductions as costs are removed from our allowances if this mechanism is used.

3.2. Proposed uncertainty mechanism

Ofgem has proposed to address heat policy uncertainty with a **re-opener mechanism** subject to a materiality threshold[1]. We propose including an anytime trigger. Given the significant implications of a government policy decision in this area, a re-opener would allow us to develop accurate cost forecasts when the scope and timing of future projects are known. The use of a materiality threshold also ensures that customers only experience bill increases when significant investment is required. Below we provide further details on the operation of this mechanism in practice, including further specific considerations for the final design of the mechanism.

[1] For the purposes of our modelling and analysis we have used a 1% materiality threshold, as is used in RIIO-1. However, due to potentially significant changes in financeability and totex sharing arrangements in RIIO-2 we are assessing if the materiality threshold should be revised.

Operation of the heat policy re-opener in practice

This is an Ofgem proposed mechanism, therefore the specific conditions of the mechanism will be concluded on during the determination process. Below we outline our key considerations for this mechanism.

- **Form of the trigger:** We propose that the re-opener mechanism is triggered through the passage of legislation or a clear direction from regulators or Government to pursue strategic innovation or a project. This allows for the full impact of policy changes to be assessed before relevant projects are identified as being relevant to the re-opener mechanism. For example, a future policy may establish commitments to support the extend role of hydrogen in gas networks. Given the significant impact of such a decision and its complexity, we would engage extensively with Government and Ofgem throughout this process. It is important that the mechanism is designed with enough flexibility to respond to future policy change.
- **Mitigating the likelihood of the trigger:** Mitigating the likelihood of this trigger would go against our ambitions to support decarbonisation. The gas networks have an important role to play in the transition to net-zero – it would not be appropriate for us to seek to mitigate the likelihood of a heat policy decision. Instead we are working proactively to provide evidence to support this decision.
- **Claiming costs through the re-opener:** As outlined above, we have proposed that costs can be reclaimed at any time during the RIIO-2 period for this mechanism, once a materiality threshold has been breached. We propose that this includes a point in time whereby evidence can be presented that the threshold will be breached in the near future. As part of this process, we would demonstrate costs incurred or expected to be incurred in response to the heat policy decision.

Other considerations

- **Flexibility:** There is potential for several projects to be triggered by a future heat policy decision. Therefore, we propose within this mechanism a NIC type approach where projects are designed and costed, before going through a robust approval and assurance process offers the most suitable approach. As with the NIC, passing through associated costs to the NTS for recovery across all gas customers would recognise the UK-wide benefit of the initiatives. It would also avoid one network's customers being adversely impacted if more trials and pilots are concentrated in a single geography.
- **Supporting a decision:** As discussed in Section 2.1, we are currently undertaking a number of projects to help develop the evidence base to enable a government decision. We also envisage that further support and liaison will be required with the Government as it finalises its strategic direction during RIIO-2. Depending on this direction, significant work could be required including advising on legislation and framework changes and providing detailed information and analysis. We propose that the heat policy re-opener should account for these costs.
- **Blending Regime:** As discussed in our Environmental Action Plan (Appendix 07.04.00), we are proposing through RIIO-2 innovation mechanisms to design an efficient and effective hydrogen blending regime that supports and facilitates the growth of hydrogen production, while protecting end consumers. It is important that this work is undertaken before formal legislation is passed, to enable the timely implementation of a regime. Therefore, it is important that the re-opener also maintains the flexibility for enabling works that may be required.

Ofgem has also proposed a re-opener for the FPNES scheme to retain the flexibility to stop the scheme, if appropriate, in response to developments in government policy. We have not evaluated further the application of this mechanism in practice, given that it would simply involve an adjustment to our allowances to remove associated costs if required.

3.3. Evaluating the proposed uncertainty mechanism

For heat policy, customers will benefit from a significant reduction in cost uncertainty under this mechanism. Further, additional assurances over costs and designs under a NIC type project will promote the efficient delivery of projects, and bill increases in line with efficient costs. Without a mechanism to adjust for changing government requirements in the future, it would not be possible to deliver projects in line with this future vision within our baseline plan.

Nevertheless, it is important to fully evaluate the behaviours that the uncertainty mechanism will encourage, to ensure it does not create perverse incentives. Below, we consider the positive behaviours that should be promoted by the heat policy re-opener.

Table 4: Evaluating incentives created by proposed uncertainty mechanism

Behaviours and incentives	Evaluation
To minimise costs	The costs we submit to Ofgem through the re-opener will be subject to review and challenge. Any costs identified as inefficient will be disallowed. This creates an incentive to focus on incurring or estimating efficient costs and demonstrating this with robust evidence. The further checks and balances we have proposed in relation to the NIC-type project approach to heat policy costs will ensure an additional layer of assurance and challenge over proposed costs.
To deliver required work	Alongside reviewing the efficiency of costs submitted through the re-opener process, Ofgem will focus on ensuring that these only relate to relevant activities. Any costs submitted for work Ofgem does not believe to be required will be disallowed, creating an incentive to focus on work with a compelling need and clearly related to the scope of any future heat policy decision. Compared to the base plan, one could consider that a re-opener does not maintain the same incentive to work itself. However, as identified in Section 1.1 this risk relates to work that will be triggered by external legislation, and we have an important role to play in the path towards decarbonisation – we would be compelled to move forward and support the implementation of any new policy. Failing to do so would create safety risks for customers and financial and reputational risks to our business.
To take a whole-systems approach	Opportunities for taking whole-system approaches or identifying strategic solutions in response to a future heat policy decision will remain incentivised under the re-opener mechanism. These incentives are strengthened by our proposals to use the NIC approach to evaluate and develop products, ensuring that strategic solutions can go through an effective design and appraisal process.

As discussed in Section 3.2, Ofgem's proposed mechanism for the FPNES would simply involve an adjustment to our allowances to remove associated costs if required. Therefore, we have not evaluated the incentives associated with this mechanism, given that it will be determined externally and involve the removal rather than the addition of costs. Customers are protected by this mechanism by removing the opportunity for windfall gains.

4. Quantitative assessment

4.1. Inputs for uncertainty modelling

Heat policy

At present, it is difficult to forecast the workload that will be triggered under this uncertainty mechanism while the outcomes of the NIC projects are not yet available to help consider the total cost impacts. Funding must also be available for supporting work leading up to government decisions as well as project delivery after a key decision or direction.

As a reasonable proportion of the uncertainty mechanism hinges on government policy decisions, the timing of the event is out of our control. In advance of this decision, we are continuing to build evidence for BEIS to help inform the decision-making process. Our view of the uncertainty triggers and the likelihood of the events occurring is our best view at present based on this engagement. As information is amassed, we will continue to reassess the implications on each of the outcomes.

Table 5 below summarises our current view of the likelihood of this trigger in RIIO-2. This view is based on our current engagement with stakeholders on the matter.

Table 5: Input assumption - RIIO-2 likelihood of government heat policy legislation

Assumption	21/22	22/23	23/24	24/25	25/26
Likelihood of legislative change by a given year	40%	50%	60%	65%	70%

Alongside the likelihood of the trigger taking place, we have also considered estimates of relevant costs that may be incurred for us in our uncertainty analysis. As we continue to progress existing RIIO-1 hydrogen projects under existing innovation mechanisms, we are developing a stronger evidence base to understand the future cost implications of deployment.

Table 6 below summarises the projects that we have included in our analysis. Given the considerable uncertainty associated with future projects that are currently under development, these costs are indicative and have been selected to illustrate the need for a heat policy mechanism. For the purpose of analysis, we have equally phased large capital projects across the RIIO-2 period and amongst our networks bases on supply points. On an actual basis, costs would be incurred in line with construction profiles, and the distributional impacts will need to be fully considered.

Table 6: Input assumptions - RIIO-2 costs scenarios for heat policy

Hydrogen project	Low case	Likely case	High case
HyNet capital costs	£180m	£200m	£220m
Opex costs associated with the day to day operations of the HyNet system	£5m	£15m	£25m
Hydrogen blending system establishment	£15m	£15m	£15m
Hydrogen blending management framework and day to day operations	£7.5m	£10m	£12.5m
Occupied premises trial (single trial)	£30m	£40m	£50m

- **HyNet:** we have included indicative costs for investment required during the construction phase of hydrogen pipelines in the North West. This also includes additional opex associated with the operation of the network on a day to day basis during this phase.
- **Blending:** we have included an indicative cost for the establishment of the hydrogen blending system alongside costs for the management of the framework and day to day operations.
- **Occupied premises trial:** Finally, we have included costs for a single occupied-premises trial, whereby blended gas would be used in a controlled selection of domestic properties. There is uncertainty over the scope of such a trial, and the volume of which may be required to enable the wider rollout of hydrogen. Therefore, including costs for only a single trial in RIIO-2 is a conservative position.

Further supporting details on each of these activities are included in our Environmental Action Plan, in Appendix 07.04.00.

FPNES

As discussed in Section 3, the FPNES mechanism is designed to remove costs from our base plan for fuel poor connections if a policy change occurs that ends the scheme. To model the potential cost impact of this, we first identified the relevant costs included in our base plan, as outlined earlier in Table 7. We have then made indicative assumptions on the likelihood of this trigger taking place, as summarised below. It is extremely challenging to develop a likelihood assumption for this item; however, we have assumed that this is expected to increase over time as we move closer to decarbonisation targets.

Table 7: Input assumption - RIIO-2 likelihood of FPNES ceasing

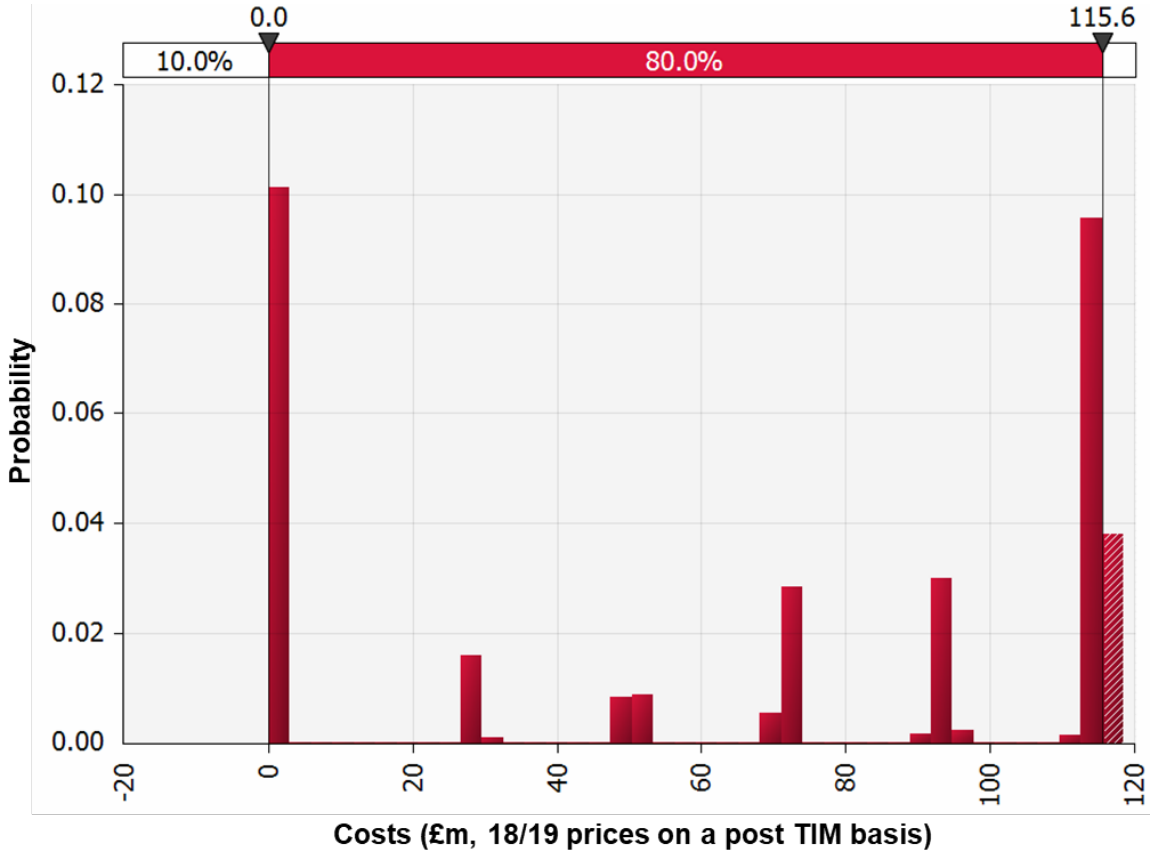
Assumption	21/22	22/23	23/24	24/25	25/26
Likelihood of legislative change by a given year	0%	5%	10%	15%	20%

4.2. Assessing uncertainty

Heat policy

Using our input data described above, we have undertaken Monte Carlo analysis to understand the range of cost impacts for this area of uncertainty in RIIO-2. This provides a distribution of the potential cost outcomes for government heat policy, based on 10,000 iterations. This approach illustrates the high and low scenarios of uncertain costs, alongside the mean cost outcome and associated volatility. Figure 2 below summarises this distribution, while **Error! Reference source not found.** provides a breakdown of this risk by network.

Figure 2: Monte Carlo: Total RIIO-2 cost risk for Heat Policy, no mechanism. Costs, £m 18/19 prices on a post TIM basis



Minimum	Maximum	Mean	Standard Dev	Iterations
£0.0m	£118.49m	£66.46m	£49.24m	10,000

This illustrates the uncertainty in the potential options for future investments that may be enabled by a heat policy decision. Without the introduction of an uncertainty mechanism, there is a considerable risk that actual costs incurred in RIIO-2 may deviate from an initial estimate proposed as a baseline allowance.

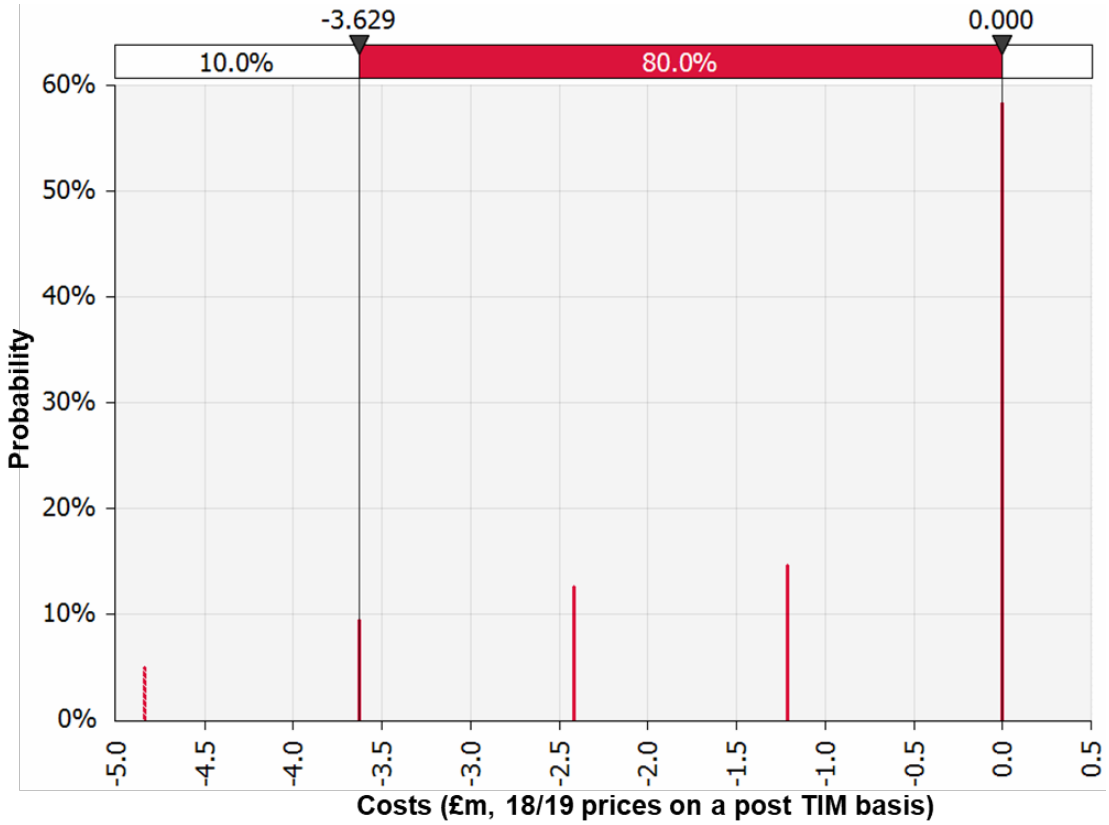
Table 8: Monte Carlo: Total RIIO-2 cost risk by network for heat policy, no mechanism. Costs, £m 18/19 prices, post TIM basis

Network	Minimum	Maximum	Mean	Standard Dev
East of England	£0.00m	£43.54m	£23.81m	£17.63m
London	£0.00m	£24.57m	£13.45m	£9.96m
North West	£0.00m	£32.47m	£17.58m	£13.07m
West Midlands	£0.00m	£21.20m	£11.62m	£8.61m

FPNES

We have also undertaken Monte Carlo analysis on the same basis of for the FPNES re-opener. Figure 3 below summarises this distribution while Table 9 provides a breakdown of this risk by network.

Figure 3: Monte Carlo: Total RIIO-2 cost risk for FPNES Policy, no mechanism. Costs, £m 18/19 prices on a post TIM basis



Minimum	Maximum	Mean	Standard Dev	Iterations
(£4.84m)	£0.00m	(£1.07m)	£1.49m	10,000

Table 9: Monte Carlo: Total RIIO-2 cost risk by network for FPNES policy, no mechanism. Costs, £m 18/19 prices, post TIM basis

Network	Minimum	Maximum	Mean	Standard Dev
East of England	(£1.48m)	£0.00m	-£0.33m	£0.46m
London	(£0.45m)	£0.00m	-£0.10m	£0.14m
North West	(£1.77m)	£0.00m	-£0.39m	£0.55m
West Midlands	(£1.13m)	£0.00m	-£0.25m	£0.35m

4.3. Impact of our proposed uncertainty mechanism

Heat policy

Table 10 below summarises the impact of introducing a re-opener mechanism to address this risk. As shown, the use of a re-opener reduces the materiality and volatility of the residual risk that remains in costs after sharing associated with heat policy. As the uncertainty mechanism would ensure we only recovered appropriate and acceptable costs from customers, this is an improvement from including a potentially higher base plan allowance to mitigate against the cost risk identified without an uncertainty mechanism in Table 10.

Table 10: Range of cost risks with and without a mechanism, heat policy. Costs, £m 18/19 prices on a post TIM basis.

Value	Without mechanism	With mechanism
Range of Impacts	£0.00m to £118.49m	£0.0m to £3.79m
Materiality (mean risk)	£66.46m	£1.66m
10th Percentile	£0.00m	£0.00m
90th Percentile	£115.64m	£3.12m
Standard Deviation	£49.24m	£1.29m

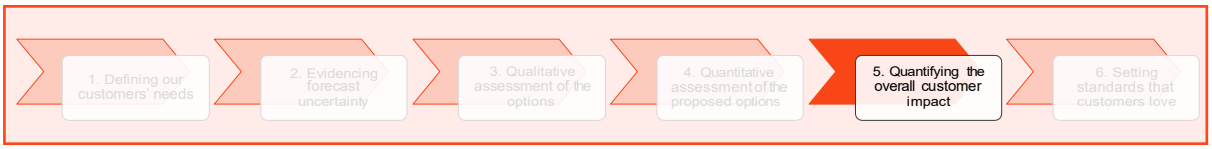
Several assumptions have been made to produce these results:

- Figures are presented on a post TIM basis, using a totex incentive rate of 40%.
- In the case of re-openers, we have assumed a 1% materiality threshold of average annual revenues. We have also assumed 100% of costs are reclaimed in re-openers.
- Finally, we have not considered the phasing of income in this analysis – we have focused on the value of risk and potential incomes.

FPNES

The FPNES re-opener would involve removing costs from our base plan, therefore we have not constructed the impact with and without a mechanism for comparison. Without a mechanism, no costs would be removed from our base plan.

5. Quantifying the customer impact



In Section 5 of Appendix 10.00 Our approach to managing risk and uncertainty, we have analysed the overall customer impact of uncertain costs with and without our proposed package of mechanisms. We have also evaluated how our proposed package recognises the trade-off between sharing exposure of cost risk with our customers. In Chapters 10 and 11 of our Business Plan, we also quantify the impact of our proposed package of uncertainty mechanisms on customer bills in RIIO-2.

Heat Policy

As outlined in earlier sections, we have proposed that the heat policy re-opener is also used to consider the appropriate charging regime for large-scale hydrogen projects, given the potential wider economic benefits they will generate. The values presented below are for illustrative purposes only and demonstrate the impact of different cost scenarios flowing directly to Cadent domestic customer bills. In practice, bill impacts would account for any costs which are charged through NTS or external sources of funding used to support projects.

We have also quantified the bill impact associated with the heat policy re-opener individually. Table 11 below summarises the potential bill impact per annum by the end of RIIO-2 for the mean, P10 and P90 costs estimated in our Monte Carlo analysis. As the costs associated with this uncertainty mechanism are categorised as capex, the bill impact is spread over a significantly longer period. For the mean cost impact below, this is equivalent to £0.38 per annum at the Cadent level.

Table 11: RIIO-2 end bill impact, P10 mean and P90 costs from uncertainty analysis

RIIO-2 end bill impact (£, 18/19 prices)	P10	Mean	P90
East of England	£0.00	£0.77	£1.34
London	£0.00	£0.77	£1.34
North West	£0.00	£0.77	£1.34
West Midlands	£0.00	£0.77	£1.34

For the purpose of constructing bill impact estimates, we have focused on the costs from our Monte Carlo analysis and have not considered the potential timing effects on revenue recovery from the use of a volume. For simplicity, these costs were also allocated equally across our networks by supply points. In practice, bill impacts would materialise with a lag following a successful claim through the mechanism.

FPNES

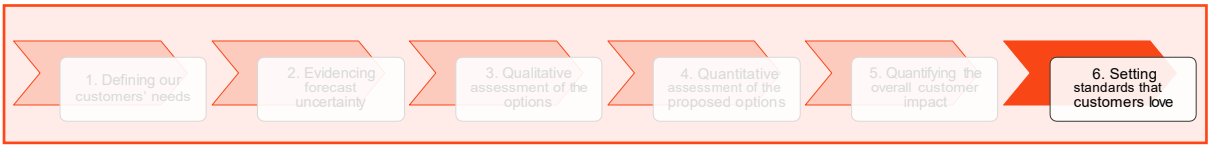
We have also quantified the bill impact associated with the FPNES re-opener individually. These impacts differ in the sense that they involve returning costs to customers. Table 12, below, summarises the potential bill impact per annum by the end of RIIO-2 for the mean, P10 and P90 costs estimated in our Monte Carlo analysis.

Table 12: RIIO-2 end bill impact, P10 mean and P90 costs from uncertainty analysis

RIIO-2 end bill impact (£, 18/19 prices)	P10	Mean	P90
East of England	(£0.02)	(£0.01)	£0.00
London	(£0.01)	(£0.00)	£0.00
North West	(£0.03)	(£0.01)	£0.00
West Midlands	(£0.03)	(£0.01)	£0.00

For the purpose of constructing bill impact estimates, we have focused on the costs from our Monte Carlo analysis and have not considered the potential timing effects on revenue recovery from the use of a volume. For simplicity, these costs were also allocated equally across our networks by supply points. In practice, bill impacts would materialise with a lag following a successful claim through the mechanism.

6. Setting the standards



Proposals for both re-openers are clear and simple for customers to understand. The mechanisms are both triggered by external policy decisions. If required to lodge a notification through this mechanism within RIIO-2, we would clearly articulate to customers the detail behind any additional expenditure. This would also provide an opportunity for further engagement during the re-opener window.

Our evaluation on the implications of including costs in our base plan, as outlined in Section 2.3, and of the incentives associated with the proposed re-opener mechanisms demonstrate the benefits of this approach for customers and stakeholders.

Our overall approach to managing risk and uncertainty using uncertainty mechanisms has been tested with customers through our acceptability testing. A full discussion of this engagement is provided in Chapter 10. It is noted here that customers found this approach to be acceptable, and that we had been thorough in our work to manage cost risk in RIIO-2.