Cadent
Your Gas Network

Appendix 10.15

Uncertainty Mechanism Case

High pressure valves

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

High Pressure (HP) valves

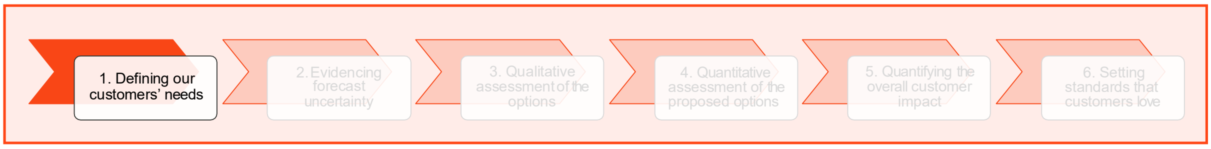
Cadent proposal

Volume Driver Uncertainty Mechanism

To ensure we remain compliant with Pipeline Safety Regulations, we need to maintain the condition and operability of valves on our high-pressure network. Our inspection program during RIIO-1 has raised several issues around valve operability, particularly that several valves have been buried as a result of roadworks.

These critical valves were installed when pipeline was originally constructed up to 40 years ago. We are beginning a programme of more detailed survey work including excavation of buried assets to better understand these issues. It is envisaged that this work will generate the need for further investment. This could be the rebuilding of a chamber which has collapsed following third-party work, reinstating pressure points which have aged or been damaged, or more comprehensive interventions to replace whole valve units. The volume and type of work are unknown until these excavations have taken place.

1. Defining the need



1.1. What is the area?

We have requirements under the Pipeline Safety Regulations 1996 "*to ensure that pipelines are maintained in an efficient state, in efficient working order and in good repair*". This means that we must maintain the condition and operability of valves on our high-pressure network.

If there is an emergency, for example an uncontrolled escape of high-pressure gas, it may be necessary to operate valves quickly to contain and control the situation, and to make the network safe. If an existing valve cannot be used, due to being either non-operational, unlocatable, or due to poor asset condition, alternative measures would have to be considered such as:

- Locating a valve further upstream.
- Excavating and installing a physical flow-stop in the gas pipework.
- Isolating the flow at the upstream pressure reducing installation.

These alternative options all have the potential to delay the safe isolation of the pipeline or asset involved in an emergency and increase the health and safety risk to customers and to our operatives. They also add considerable costs and increase the number of customers who could lose supply.

1.2. Why is it important?

Routine maintenance and timely, appropriate and cost-effective interventions ensure that values remain fully accessible and functional. This ensures that sections of the Local Transmission System (LTS) and key assets can be quickly and safely isolated both for emergency and for routine operations.

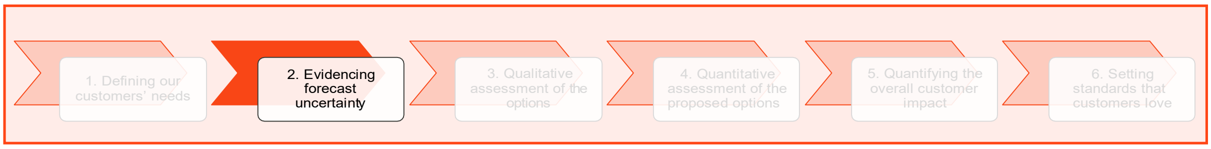
Properly maintained isolation valves help to reduce the following risks:

- Risk to life and property from explosion due to an uncontrolled gas release:
    - There is a risk that it takes longer to isolate sections of the network if valves are not maintained and become inoperable.
- Extensive supply interruptions caused by inoperable or inaccessible valves:
    - There is a risk that larger areas of the network may require isolation for routine maintenance or emergencies in the absence of operable and accessible valves.
- Occupational safety risks:
    - Fully functional valves allow routine maintenance operations to be carried out in a safe environment.
- Environmental risks:
    - Valves can be used to contain methane gas escaping from HP pipelines (greenhouse impact) in a timely manner, after a pipeline defect or third-party damage. Leakage on valves themselves would also have a negative impact.

1.3. What insights are shaping our thinking?

Our inspection program during RIIO-1 has raised several issues around valve operability, particularly that several valves have been buried as a result of roadworks by third parties. These critical valves were installed when pipeline was originally constructed up to 40 years ago. We are now beginning a programme of more detailed survey work including excavation of buried assets to better understand these issues. It is envisaged that this work will generate the need for further investment. This could be the rebuilding of a chamber which has collapsed following third-party work, reinstating pressure points which have aged or been damaged or more comprehensive interventions to replace whole valve units.

2. Evidencing the uncertainty



2.1. What we know about the future

From initial survey work conducted to date in RIIO-1, several issues have been identified in our HP valve population that need to be addressed, to manage our health and safety and operational risk. We have undertaken interventions where required to date in RIIO-1 on HP valves which have also provided insight into the potential unit cost of undertaking required works. This work has not been funded in RIIO-1.

Comparing uncertainty to costs included in our base plan

During RIIO-1, no spend was incurred during the first two years of the control period on HP pipeline valve installations. Thereafter, £4.1m has been spent in the subsequent four years. Our survey work to date has demonstrated that further investment is required in RIIO-2 to manage and mitigate valve deterioration.

Given the significant uncertainty on future workload, as discussed further in Section 2.2, we have not included any costs in our base plan for HP valve interventions in RIIO-2. Our proposal for an uncertainty mechanism will provide funding for **all relevant volumes of work**. Therefore, there are no baseline allowances to consider incentive properties against. In Section 3, we provide a full valuation of how the mechanism would work in practice

2.2. Why we face forecasting difficulties

There is significant uncertainty over the proportion of valves in the HP population that will require interventions during RIIO-2. While our inspection programme to date has identified several issues that we know need to be addressed, we are undertaking further detailed surveys to gain a greater understanding the work required.

This uncertainty is further complicated by the number of valves that have been buried as a result of roadworks by third parties. In these instances, excavations need to be undertaken to fully evaluate the condition of our assets, which may identify the need for further remediation works.

The volume of interventions we will be required to undertake will be driven by the health of our assets upon further evaluation, which we **cannot fully control**. This will be driven by historical factors associated with our assets, including the role of third parties in burying assets and obstructing access. We have begun a survey programme in RIIO-1 to further understand our future intervention requirements. This will allow us to develop a **better view** of the likely volumes of work that may be required, and the nature of specific interventions.

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

The risk with including volumes of interventions for HP valves in our base plan is that we would be required to rely on an uncertain estimate of future workload, and the condition of our assets. This creates a risk that our estimate either under or overpredicts the volume of work we will need to undertake, in an area where we have licence obligations to maintain the safety of our network.

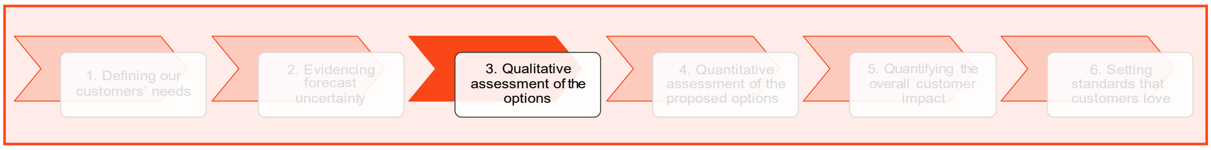
If we were to include costs associated with HP valve interventions in our base plan allowances, we would be required to rely on uncertain estimates of required workloads based on the initial inspections we have taken to date on our assets.

There is a credible **risk** that our estimate would underpredict the number of interventions we would be required to undertake in RIIO-2, given the health of our HP valve assets. We would face an incentive to price risk into a base plan estimate to ensure we were adequately funded in a scenario where significant interventions were required.

However, this **creates a risk to customers**: there is potential that volumes that materialise in RIIO-2, which will be driven by the conclusions of further detailed survey work underway, may be lower than the assumptions used to develop a base allowance. This creates the opportunity for windfall gains.

Addressing all future volumes of work through an uncertainty mechanism ensures that customers only pay for the volumes of work that we are required to deliver and that funding is available to allow the maintenance of our network in line with safety requirements.

3. Qualitative assessment



3.1. Options for addressing uncertainty

Given the uncertainty on the volume of interventions required on HP valves in RIIO-2, we have identified and evaluated other mechanisms that could be used to address this risk:

Table 1: Evaluating options for uncertainty mechanisms

Mechanism Option	Description
Volume driver	A volume driver makes use of available information on the unit cost of intervening on HP valves. This would effectively address the uncertainty we have identified in future workloads, and ensures we have access to funding that allows us to meet our legal requirements to maintain the safety of our network.
Re-opener mechanism	A re-opener accounts for uncertainty in costs when both the design and requirement for projects in RIIO-2 is unknown. HP valves are not well suited to this, given the insight we have from interventions that took place in RIIO-1. There is also a risk that a re-opener would create friction in our intervention process. We have a requirement to maintain the safety of our network, however the additional checks and balances associated with revenue recovery could result in delays. This could impact the timeliness of interventions we are required to make.
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 at present, given the volume of work is unknown. There is a risk that a PCD may be introduced which does not adequately fund the levels of HP valve interventions that are required in RIIO-2.

We have also undertaken a qualitative assessment of uncertainty in this area to further understand the need for an uncertainty mechanism for HP valves.

Table 2: Qualitative assessment of risks posed by HP valves

Volume risk	Unit cost risk	Impact on outputs	Material cost / bill impact
High	**Low**	**Medium**	**Medium**

Further detail on our assessment is provided below:

- **Volume risk:** Our work in this area is driven by the identification of risks and issues in our HP valve population. We are required to make interventions to maintain our obligations under the Pipeline Safety Regulations.
- **Unit cost risk:** There is uncertainty over cost forecasts at present, given the uncertainty in intervention volumes. However indicative unit costs have been identified.
- **Impact on outputs:** This has implications for our outputs on the safety of our assets, minimising disruption to customers and providing a safe and secure supply of gas.
- **Material cost / bill impact:** As discussed further in Section 5, this may be a material cost in RIIO-2 that has customer bill implications. There is potential for significant expenditure to be required depending on the intervention rate across our assets.

3.2. Our proposed uncertainty mechanism

We are proposing to address uncertainty related to HP valves using a **volume driver i**n RIIO-2, using a unit cost approach to reflect the cost of undertaking different types of interventions. In practice, this mechanism would involve agreement on the relevant unit rate to apply to specific volumes of HP valve interventions with Ofgem.

Operation of the proposed volume driver in practice

- **Form of the trigger:** As discussed in Section 1.1, interventions on our HP valve assets will be determined by evaluations of safety considerations, in line with our requirements under the Pipeline Safety Regulations. This work will be triggered following identification of a need under our continued survey work.
- **Mitigating the likelihood of the trigger:** We are required to maintain the safety of our network; it would not be appropriate for us to mitigate the likelihood of an intervention being triggered through the volume driver. This will be determined against objective safety considerations.
- **Claiming costs through the volume driver:** As part of the RRP process, we would, on an annual basis, submit data on the actual volumes of new interventions that we have undertaken. Revenues would be recovered with a year lag, in line with agreed unit rates, allowing time to verify our submitted volumes.

Form of the volume driver:

- **Unit of volume:** We propose volumes are measured in relation to the number of interventions on our HP valves (measured in terms of the number of valves worked upon). This is in line with information already reported on the interventions undertaken on other valve assets.
- **Establishing unit costs:** As discussed further in Section 4.0, we have proposed indicative unit costs within this volume driver as the initial basis for future intervention work. However, we recognise that further work is required to develop a robust unit cost for use in this mechanism, given the length of time that has passed since interventions have been undertaken on our HP valve assets. Further evidence could be developed in advance of the RIIO-2 period to ensure the volume driver is calibrated on a contemporary estimate of interventions costs.

3.3. Evaluating our proposed uncertainty mechanism

A volume driver allows us to protect against the risk of submitting a full base plan allowance that may be calibrated on an incorrect forecast of future growth. If this was to occur, customers may be exposed to the risk that actual volumes in RIIO-2 turn out below our allowed rate. We face the opposite risk to as a business if volumes turn out above this allowed rate, especially given our need to maintain the safety of our network under Pipe Safety Regulations. A volume driver would make used of agreed unit costs to ensure customers only pay for work undertaken.

Nevertheless, it is important to fully evaluate the behaviours that our proposed uncertainty mechanism will encourage, to ensure they do not create perverse incentives. Below, we consider positive behaviours that a mechanism should promote.

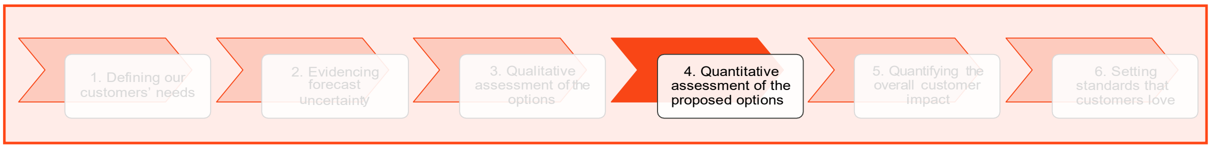
Table 3: Evaluating incentives created by our proposed uncertainty mechanism

Behaviours and incentives	Evaluation
To minimise costs	A financial incentive remains under the volume driver to identify further efficiencies and to deliver HP valves below these unit costs where possible. This would also benefit customers, by achieving a lower unit cost in the future and sharing through the totex incentive mechanism. In Section 3.2, we further discussed the steps that could be taken to develop an appropriate cost estimate for use in the volume driver to ensure customers are protected.
To deliver required work	As discussed in Section 1, interventions on our HP valves will be driven by objective safety considerations, and we face obligations under the Gas Pipeline Regulations to maintain the operability of our network. A volume driver would not create an incentive to avoid undertaking such work. This would have wider implications in terms of our performance in customer satisfaction surveys (CSAT) given the relationship between valve operability and interruptions. There would also be reputational and financial risks to us from failing to address safety concerns. There may be a concern that a volume driver incentivises us as a business to identify HP valve interventions that have associated costs below the agreed unit rate. However, as described above, this would not be possible given that the work is driven by safety requirements. It would not be possible under our obligations to leave more complex projects and thus create an unacceptable level of risk in our networks. It also would not be possible for us to undertake HP valve interventions beyond the economically efficient level. The need for an intervention would have to be proven by risk assessments before the work was triggered.

Behaviours and incentives	Evaluation
To take a whole systems approach	There may be a concern that a volume driver for HP valves limits our incentive to consider wider strategic solutions, or to take a whole-systems approach to new customer demand. In the case of HP valves, this concern is less applicable than in other areas of uncertainty, given that risk assessments will require interventions on specific assets.

A potential drawback for customers is that bills may be exposed to any observed volatility in interventions required on an annual basis, with revenues recovered on a yearly lag. However, the alternative option would be for a low-confidence cost to be included in our base plan, placing a greater level of risk on our customers.

4. Quantitative assessment



4.1. Inputs for uncertainty modelling

We have considered potential scenarios for the volume of HP valve interventions in our uncertainty analysis. We have considered the following factors:

- **Unit costs –** the individual rates that apply to specific interventions
- **Volumes -** we have considered potential scenarios for intervention volumes in RIIO-2.

Table 4, below, summarises the costs for interventions included in our analysis. These values are based on our existing experience to date in RIIO-1 with HP valve interventions. We have also included a fixed value of £xxx,xxx per network area in our analysis to account for anticipated major interventions. This is based on our historical experience of a single major intervention undertaken on a relevant asset, and it is equivalent to assuming two major interventions per network during RIIO-2.

Table 4: Input assumption – HP valve intervention costs

Intervention costs, (£, 17/18 prices)	Minor intervention per valve	Major interventions p.a.
Costs	Redacted due to commercial sensitivity	

Table 5 below summarises the population of HP valves across our networks. We have created scenarios of future workloads in RIIO-2 by considering the percentage of this population that may require a minor intervention. These assumptions are outlined in Table 6 and represent the total value of work that would be undertaken – as summarised in Section 2.1, no volumes have been included in our base plan.

Table 5: Input assumption – HP valve population by network

HP valve population	East of England	London	North West	West Midlands
Number of valves	1257	722	796	302

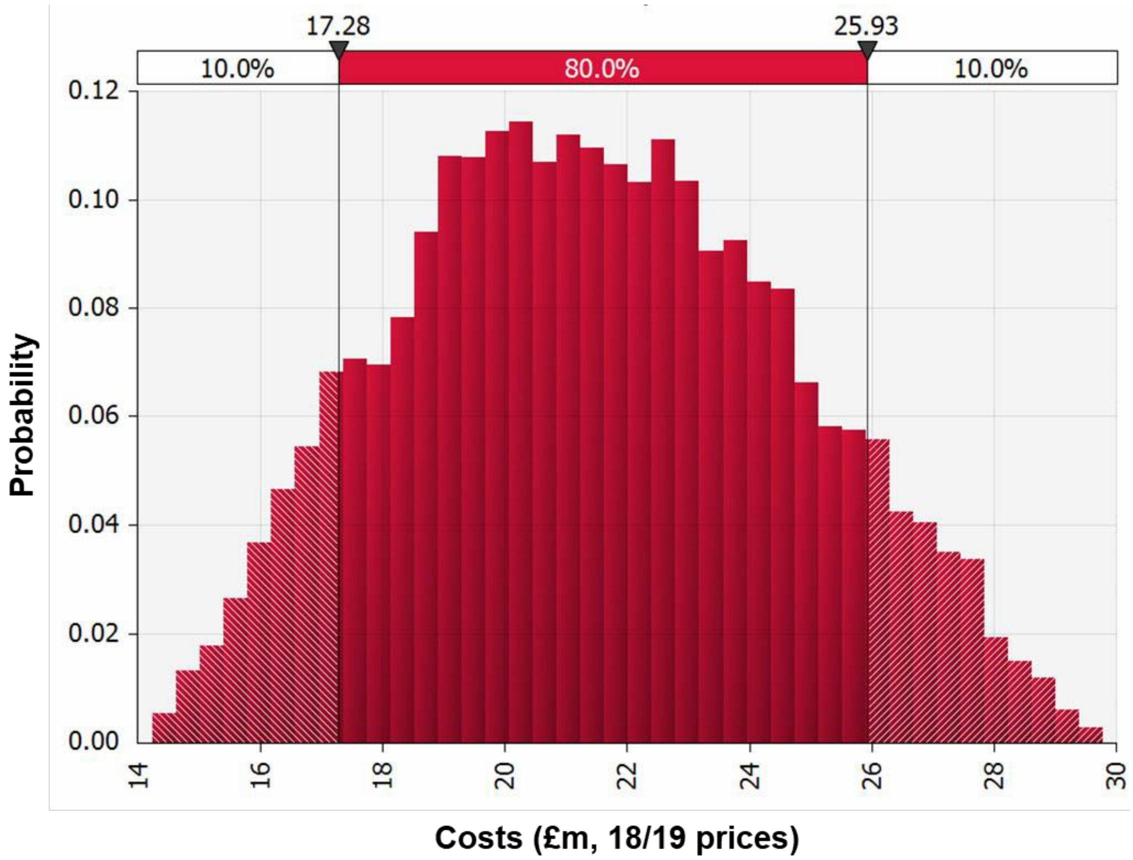
Table 6: Input assumption – % of HP valve population requiring minor intervention

Scenario	21/22	22/23	23/24	24/25	25/26
High scenario	3%	3%	3%	3%	3%
Likely scenario	1%	1%	2%	2%	3%
Low scenario	1%	1%	1%	1%	1%

4.2. Assessing uncertainty

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 HP valves, 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 1, below, summarises this distribution, while Table 7 provides a breakdown of this risk by network.

Figure 1: Monte Carlo: Total Cadent RIIO-2 cost risk for HP valves, no mechanism. Costs, £m, 18/19 prices



Minimum	Maximum	Mean	Standard Dev	Iterations
£14.24m	£29.80m	£21.51m	£3.20m	10,000

This analysis illustrates the uncertainty in HP valve intervention volumes, and the associated cost risk. 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 base line allowance.

Table 7: Monte Carlo: Total RIIO-2 cost risk by network for HP valves, no mechanism. Costs, £m 18/19 prices.

Network	Minimum	Maximum	Mean	Standard Dev
East of England	£5.76m	£12.12m	£8.74m	£1.31m
North London	£3.13m	£6.78m	£4.83m	£0.75m
North West	£3.32m	£7.34m	£5.20m	£0.83m
West Midlands	£2.03m	£3.55m	£2.74m	£0.32m

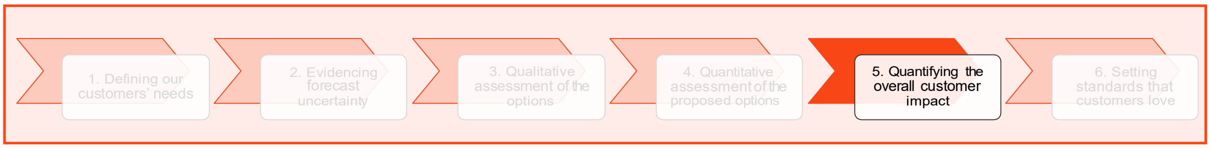
4.3. Impact of our proposed uncertainty mechanism

As we have assumed that income from volume drivers is not subject to the totex incentive rate, and given that a materiality threshold is not applicable, our modelling implies from a theoretical perspective that the uncertain cost risk outlined above would be fully mitigated using our proposed mechanism.

This **does not imply** that the costs associated with the uncertain volumes are fully mitigated and removed. Instead, the volume driver effectively allows us to collect associated revenues for HP interventions. This removes a cost risk (i.e. there are no remaining costs that we are exposed to that cannot be recovered).

In practice, we will remain exposed to residual risk based on how outturn unit costs compare to the rate agreed as part of the mechanism. This places an incentive on us to maintain a focus on cost efficiency when delivering HP interventions. Customers are also protected as costs are only recoverable for the actual volumes of work we undertake. Given that identified safety risks drive the interventions, this is out of our control.

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 between us and 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.

We have also quantified the bill impact associated with the HP valve volume driver individually. Table 8 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 period. For the mean cost impact below, this is equivalent to £0.05 per annum at the Cadent level.

Table 8: RIIO-2 end bill impacts for P10 mean and P90 costs from uncertainty analysis

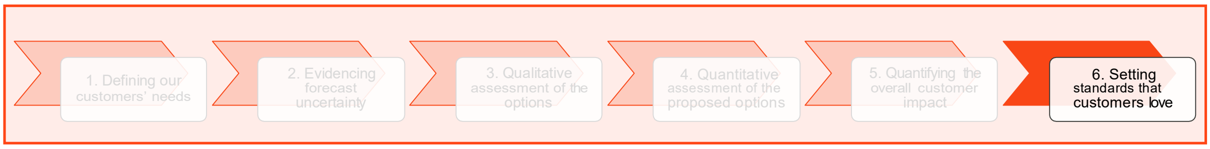
RIIO-2 end bill impact (£, 18/19 prices)	P10	Mean	P90
East of England	£0.07	£0.09	£0.11
London	£0.07	£0.09	£0.10
North West	£0.06	£0.08	£0.09
West Midlands	£0.04	£0.06	£0.07

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 driver. In practice, bill impacts would materialise with a lag following a successful claim through the mechanism.

As outlined in Chapter 10 (Managing risk and uncertainty), Ofgem's business plan guidance suggests that "uncertainty mechanisms that highlight risks to consumers of which Ofgem would not otherwise have been aware" is an example that could constitute part of a Consumer Value Proposition (CVP). We discuss our CVP in Section 7.1 of Chapter 7.

The value of a bespoke uncertainty mechanism to customers does not obviously lend itself to be monetised in the same way of some of outputs commitments, where we have calculated a social return on investment (SROI) or have clear willingness to pay data. One way the value could be calculated is to look at the value that might otherwise have needed to be forecast into the base expenditure plan that may not have been subsequently needed if the uncertainty did not arise. For example, you could take consider our likely cost estimate, and multiply this by the totex incentive sharing factor that the customer would be faced with (e.g. 60%). This is not as robust a method as SROI or willingness to pay but provides an indicative estimate. For HP valves, this is equivalent to approximately **£12.91m in RIIO-2.**

6. Setting the standards



Our proposals for a volume driver are clear and simple for our customers to understand. We will only be able to recover revenue for HP valve interventions we undertake. Our proposed unit cost rate must be agreed by Ofgem as part of this mechanism to ensure we deliver interventions efficiently. We are also unable to control the volumes of interventions that will be required in the future, as we respond to identified risks. This protects customers and avoids the creation of an incentive to maximise volumes beyond an efficient level. These proposals have also incorporated challenges we have received from our CEG.

Our evaluation on the implications of including costs for connections in our base plan, as outlined in Section 2.3, and of the incentives associated with our proposed volume driver mechanism 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 process to manage RIIO-2 cost risk.