Appendix
YKY28_Metering Enhancement Case [Redacted]

YKY28_Metering Enhancement Case

YorkshireWater

Navigating this document

This Appendices document is separate to and supports the main business plan document.

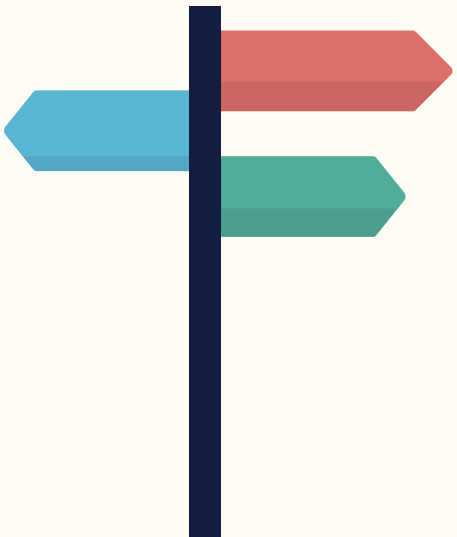
Links outside of this report

Read more links
This icon can be clicked on to link to any further documents or resources outside of this report

Read more about this at **Cost Adjustment Claim Appendix**

Business plan links
This icon can be clicked on to go to the main Yorkshire Water Business Plan document where more information can be found.

More detail on this subject can be found in **Chapter 8 Part 2: What our plan will deliver**



Contents

[Content in this document has been redacted due to it containing commercially sensitive information]

1. Metering Enhancement Case

1.1 Driver:

Customer Metering

1.1.1 Requested Investment:

Table 1.1: Metering Case AMP8 Expenditure

	£m	Table Line Ref.
Enhancement Expenditure Capex	123.539	CW3.60, CW3.66, CW3.72, CW3.75, CW3.81, CW3.84, CW3.87
Enhancement Expenditure Opex	10.530	CW3.61, CW3.67, CW3.73, CW3.76, CW3.82, CW3.85, CW3.88
Base Expenditure Capex	141.108	CW2.15, 16
DPC value	0.000	
Total	**275.177**	

1.1.2 Associated Reporting lines in Data Table:

Table 1.2: CW3 Reporting Lines

Line Number	Line Description
CW3.60	New meters requested by existing customers (optants); metering capex
CW3.61	New meters requested by existing customers (optants); metering opex
CW3.62	New meters requested by existing customers (optants); metering totex
CW3.66	New meters for existing customers - business; metering capex
CW3.67	New meters for existing customers - business; metering opex
CW3.68	New meters for existing customers - business; metering totex
CW3.72	Replacement of existing basic meters with AMI meters for residential customers; metering capex
CW3.73	Replacement of existing basic meters with AMI meters for residential customers; metering opex
CW3.74	Replacement of existing basic meters with AMI meters for residential customers; metering totex
CW3.75	Replacement of existing AMR meters with AMI meters for residential customers; metering capex
CW3.76	Replacement of existing AMR meters with AMI meters for residential customers; metering opex
CW3.77	Replacement of existing AMR meters with AMI meters for residential customers; metering totex
CW3.81	Replacement of existing basic meters with AMI meters for business customers; metering capex

CW3.82	Replacement of existing basic meters with AMI meters for business customers; metering opex
CW3.83	Replacement of existing basic meters with AMI meters for business customers; metering totex
CW3.84	Replacement of existing AMR meters with AMI meters for business customers; metering capex
CW3.85	Replacement of existing AMR meters with AMI meters for business customers; metering opex
CW3.86	Replacement of existing AMR meters with AMI meters for business customers; metering totex
CW3.87	Smart meter infrastructure; metering capex
CW3.88	Smart meter infrastructure; metering opex
CW3.89	Smart meter infrastructure; metering totex

1.1.3 Glossary

- **AMI** Advanced Metering Infrastructure - Logging and wireless data transmission of flow data, without the need for any human intervention to collect, usually using an Internet of Things networks (IoT).
- **AMR** Advanced Meter Reading - Logging and wireless data transmission of flow data, with the need for proximal “walk by” or “drive by” activity to communicate with meter and retrieve data.
- **DMO** Domestic Meter Optants - Household properties which opt to switch to a metered supply are known as domestic meter optants.

1.2 High Level Driver description

Customer metering is an important tool in driving service improvement across a range of performance commitments. Yorkshire Water has adopted previous advances in technology embracing Automated Meter Reading (AMR) technology, which allowed for meter reading efficiency from the AMP5 period onwards. With the existing AMR asset base approaching the end of its functional life, Yorkshire Water now wishes to replace its metering asset base at customers premises with the latest metering solution, Advanced Metering Infrastructure (AMI), often termed Smart metering.

AMI affords the ability to improve water usage data granularity, data frequency, and enable a step change in service improvement for our customers. The cost of delivering this improved infrastructure is greater than the AMR solutions costed within previous Price Review submissions. To realise the benefits of the AMI and its data, changes to customer engagement, business processes, analytics and IT systems are required.

The cost variance from delivering the current AMR solution and service level, to the cost to fully implement an AMI Smart metering operational design is the Enhancement funding we seek. This will underpin a benefit in AMP8 of 7.73 Ml/d leakage reduction, ~2 l/p/d per capita consumption (PCC) reduction, 4Ml/d non-household distribution input (DI) reduction, contribute to Zero Net Carbon, and modify our customer service provision.

Yorkshire Water intends to transition to a full AMI smart metering asset base over the next three price review periods, maximising the benefits from the increased data granularity, near real time data frequency and advanced analytics implemented to create actionable insights.

Our AMP8 focus will be on delivering an efficient replacement of the majority of our existing life expired AMR meter assets at the premises of both residential and business customers. With policy changes required from AMP9, pending support from the Water Resources Management Plan (WRMP), to increase Smart meter penetration. This strategy will limit the cost exposure to

customers, allow for protection of Yorkshire's precious water resources through improved leakage management, equip our customers with the ability to better understand their water use, and help Yorkshire Water support vulnerable customers in a more personalised manner.

Yorkshire Water's wider engagement confirms that customers support the Smart metering initiative. It is an expectation of customers to have more granular information on water use in today's world given widespread adoption of both gas and electricity Smart meters in the UK.

This enhancement area was included in the business plan presented to customers and this plan was accepted by the majority of customers (79%). Read more about our customer and stakeholder engagement and acceptability testing in Chapter 6 of our main business plan.

More detail on this subject can be found in
Chapter 6: Customer and Stakeholder Engagement

1.3 Need

1.3.1 The need for the proposed investment

Yorkshire Water has the ambition to achieve new national targets for this price review period, with a compelling case to achieve the strategic targets to reduce water use, waste and protect the natural environment.

- Water UK and the National Infrastructure Commission (the NIC) recommends a common leakage reduction of 50% by 2050, compared to 2017-18 levels.
- Defra has set a national goal to reduce per capita consumption (PCC) to 110 l/p/d and a make a 15% reduction in non-household demand by 2050.

In recent years, external factors have significantly impacted our customers, stakeholders and partners, and Yorkshire Water. Individuals and communities have been significantly affected by the cost-of-living crisis, and businesses have had to increase costs to deliver their services. We have also seen increasing political, regulatory, and stakeholder expectations, particularly in respect of the environment. These have culminated in the government introducing legally binding targets for water under the powers of the Environment Act, 2021. This regulation includes a target to reduce the use of public water supply in England, per head of population, by 20% by March 2038.

Smart metering is a key enabler to effectivity target demand side reductions across all three performance commitment areas - leakage, per capita consumption and non-household demand. This enhancement case only seeks funding for our AMI metering programme. We set out our demand reduction activities (excluding AMI metering) in our WRMP supply-demand enhancement case. The mechanism by which Smart metering enables the delivery for these targets is reviewed in the sections below.

1.3.1.1 Yorkshire Water delivery of demand side reduction targets

Yorkshire Water has a meter asset base which will be largely life expired or beyond battery life within AMP8 (between 2025 and 2030). 91% (~1.385 million) of meters (AMR and other types) which will be beyond asset life in AMP8 are included in the proposed plan for exchange in AMP8. The 9% of meters which are not expected to be beyond their AMR battery life are not included in the AMP8 plan and will be subject to investment instead in AMP9.

Investment in the meter asset base is required in AMP8 in order to:

- Mitigate the risk of excessive meter under registration by maintaining meter accuracy.
- Avoid meter reading inefficiencies relating to AMR's being end of life/battery expired.
- Deliver sustained reductions in PCC, non-household demand and leakage.

Given the need to replace the majority of the existing metering asset base, the case for enhancement to AMI is built from the cost delta between an AMR meter replacement programme and the additional costs for an AMI based programme. Yorkshire Water's strategy

does not require for premature replacement of the existing AMR metering asset base and therefore minimises excess asset stranding.

The step change in performance expected by our regulators, government, and stakeholders commencing from AMP8 and the concurrent meter life expiry challenge in Yorkshire Water asset base, results in an optimal timing to invest now in Smart meters and drive the service improvements at the lowest cost delta.

AMI Smart metering transforms the insight and capabilities for water companies supporting the following outcomes:

- Helping to reduce customer side leakage which is, currently ~30% of reported leakage.
- Allowing for improved targeting of leakage on the Yorkshire Water network.
- Enabling engagement with household customers on their water use habits.
- Providing retailers and non-household customers with actionable insight to drive Water efficiency.

1.3.1.2 Leakage related requirements for Smart Metering

Smart metering is a critical capability within our leakage management required to achieve the frontier levels of service targeted over the next 25 years. Yorkshire Water have a Smart, Calm and Resilient water network strategy which utilises frequent, granular data to drive a ‘point of interest’ leakage approach (POI), allowing for improvements in leakage prioritisation and efficiency in the time and cost to find leaks and bursts.

In AMP8 Yorkshire Water will use meters that log hourly and 15-minute water flow data. This data will be transmitted to Yorkshire Water for analysis on at least a daily basis. The specified granularity provides data to allow for significantly improved analysis over the limitations of our current AMR enabled meters.

The benefits are detailed more extensively below.

1.3.1.3 Leakage improvement through identification of continuous flows

Through analysing 15-minute flow data provided on a daily basis from AMI meters, Yorkshire Water can identify properties where the demand through the meter doesn’t go lower than defined flow rates, for a sustained period of time.

This will allow for the effective and timely prioritisation of interventions and support for our customers where a continuous atypical flow indicates persistent leakage or plumbing losses. With AMR enabled meters, the current limitations relate to the 6 monthly reading cycle resulting in infrequent data collection. This does not help us work with customers to tackle prolonged water wastage, which is reported as leakage, as well as having coarse methodologies to determine the level of continuous flow with lower granularity data. AMI meters will improve our ability to effectively prioritise workloads and have informed discussions with our customers.

1.3.1.4 Leakage improvement through understanding of customer night-time usage

AMI meters will give us the ability to analyse customers night-time consumption and resolve usage from leakage on the customer side. The daily understanding of ‘night use’ will allow for improved targeting of Yorkshire Water network leakage and is one of the main limitations of the AMR technology we have in service today. AMR only allows for analysis of customers night use with hindsight and with a limited sample size.

The delays in understanding customer night use through use of AMR has two consequences, both of which are detrimental to successful leakage management:

1. To improve certainty that an increase in leakage nightlines is due to leakage or bursts rather than customer night use, water companies corroborate the data by observing the nightline for additional days, ensuring there is a sustained increase in night flow, concurrent with leakage or a burst. Consequently, this prolongs the leak life of bursts.
2. Water companies may defer from responding to increased nightlines on the first day to avoid significant inefficiency as many leakage investigations would be abortive when the nightline naturally returns to an acceptable level when customer night use abates. This

would also mean genuine leakage would not be addressed as early as it could be with richer more timely data provision. Higher leakage ultimately increases the costs to customers.

Smart metering (AMI) and the associated analytical capabilities will overcome these challenges, supporting the ambition to deliver 50% leakage reduction, whilst mitigating some of the increase in costs to achieve a step change in performance.

1.3.1.5 Per capita consumption and non-household demand requirement for Smart metering

National per capita consumption (PCC) targets set by government, which Yorkshire Water wish to align to, are to achieve 110 l/p/d, against a baseline of 128.2 l/p/d. This 14% reduction in PCC will require a significantly better understanding of water use and water wastage and greater collaboration with residential customers to make sustained improvements. AMR meter reading provides a coarse level of understanding of water use, usually limited to monthly consumption values, a single continuous flow alarm (usually set to 8 l/hr), and maximum flow. Flow data granularity provided by AMI is the enabler for transforming the relationship with customers across a range of capabilities:

1. Communication of water wastage through plumbing losses.

Through the use of continuous flow analysis, leaky loos, dripping taps and other internal water uses can be identified and communicated to customers enabling intervention and a reduction in the prevalence of small scale but persistent water loss, which accumulate to significant volumes of water loss per day across our region.

2. Water wastage through inefficient processes (comparison of similar industry water efficiency, or similar residential customer types).

For both household and non-household customers, the presence of granular flow data will enable the contextualisation of water use for the property, identifying outliers compared to similar cohorts and identify actions to be taken to support improved water efficiency. This would enhance the targeting of water efficiency devices, audits, and campaigns, included within the WRMP.

3. Improving awareness of activities which have an impact on water use.

Currently customers have little awareness regarding which of their activities within the day, are most impactful on water use and the subsequent impact on bills - both water bills and associated heated water bills. In providing customers with more granular insight into their water use at sub-daily intervals, the link between activity, water use, and utility bill impact can be established and encourage sustainable habit changes which underpin water efficiency.

Reduction of water use and water wastage is a key component in the delivery of our WRMP, mitigating the need to increase the abstraction of water from the natural environment and the use of chemicals and energy to treat and distribute the water. The optimisation process between supply and demand side options within the Yorkshire Water revised draft WRMP, are supportive of the use of Smart metering to reduce demand, in place of increasing supply options, both through cost assessment and through a Six Capitals assessment that includes environmental factors.

Yorkshire Water’s current metering penetration and ambition to transition to Smart metering is in line with the national picture. Our overall meter penetration is close to the national average, but our Smart meter penetration is currently below the national average. With the AMP8 plan Yorkshire Water will achieve ~91% Smart meter penetration within its meter asset base, with WRMP setting out the policies to be adopted to increase the Smart meter penetration further over subsequent price review periods.

1.3.1.6 Climate change and peak pressures

Extreme weather and the unforeseen changes in consumer behaviour triggered by the increase in home and hybrid working during and following the Covid-19 pandemic, have created substantial additional challenges for water companies. Metering can help inform better network management during high demand periods. A thorough understanding of where and when

demand changes are occurring and under what scenarios, will allow for better planning of demand and network control into the future. Which in turn will help mitigate the likelihood of customers experiencing interruption to supply, low pressure or discoloured water.

The early adopters of Smart metering in the water sector have utilised the data during periods of dry weather or excessive heat to better target communications to specific areas and communities in need. This has achieved improved outcomes protecting service for all customers and avoiding consequential environmental impacts.

1.3.2 The Scale and Timing of the Investment

Yorkshire Water is planning to undertake an AMR meter exchange programme in AMP8 which will exchange 1.39 million AMR enabled meters which will be life-expired during AMP8.

This meter replacement programme requires:

- **£77.18m of enhancement capex** to fund the step change in costs related to improved functionality. This funding will deliver the required hardware replacement, design and update of applications and systems to realise the benefits associated with AMI Smart metering over and above the capabilities supported by the aged AMR asset base.

- **£9.54m of enhancement opex** is required to fund the cost delta from AMR for Data as a Service and data hosting.

- Therefore, a **totex enhancement value of £86.72m** is required to deliver a successful AMR meter replacement programme.

The AMR meter replacement programme is dependent upon a related cost adjustment claim (Metering CAC – CW01) for costs related to replacement of the existing AMR modules and meters (as though on a like-for-like basis).

In addition to the AMR to AMI replacement/upgrade programme, in AMP8 all domestic metered optants will be fitted with a Smart meter at their premises as the default meter technology which is more costly than the ‘base’ AMR scenario.

The DMO programme requires:

- **£46.35m of enhancement capex**.

- **£0.94m of enhancement opex**.

- Therefore, a **totex enhancement value of £47.29m**.

For new developments the meter requirement provided by Yorkshire Water to developers and self-lay providers will be a Smart meter (AMI) of the required specification. The ongoing increased opex costs associated with Smart metering, its Data as a Service model and data hosting for our forecast numbers of new connections for AMP8 is:

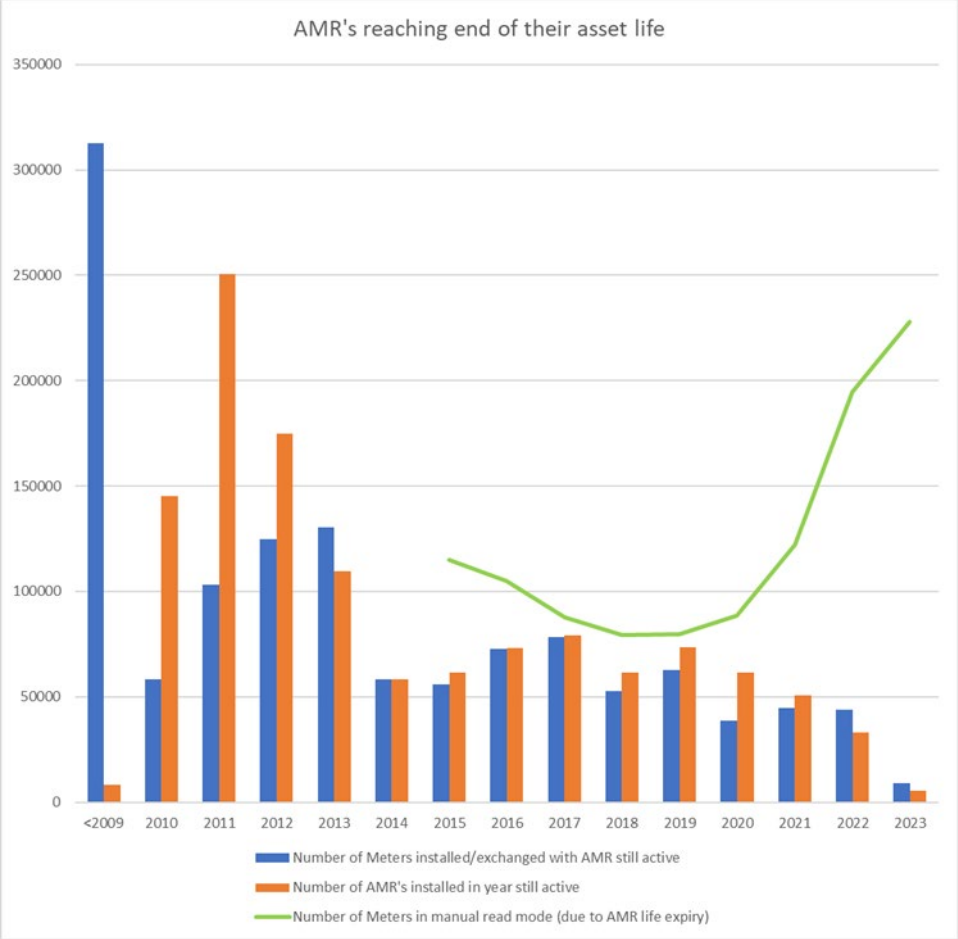
- **£0.44m of enhancement opex**.

Yorkshire Water’s ambition and maturity timeline is summarised in figure 1.1 below. It shows the transition from AMR in AMP7 to full AMI Smart metering aligned out to AMP10. The plan sets the ambition and transition states. The plan below is dependent on ongoing customer and WRMP support and will be iterated as the benefits case matures through delivery in AMP7 and AMP8.

Figure 1.1: Ambition and Maturity Timeline

The plan above will enable all Yorkshire Water's metering asset base to be upgraded to Smart meters operating to the required service levels. Depending on the revised draft Water Resource Management Plan (rdWRMP) and change of occupancy policy, we will deliver full Smart metering population across Yorkshire at the end of AMP10 or early in AMP11. Full Smart metering is discussed in more detail in the "Options Considered" section.

Figure 1.2: AMRs Reaching Asset Life End



The table above shows the number of operational AMR meters in situ (orange bars) by the year of their install. Operational AMR meters represents 83% of the metering asset base, with 17% of AMR meters having already reached battery life expiry (green line). The spike in 2011 shows the AMR's being fitted onto existing meters (conventional non-AMR enabled) through AMP5, before a return to a lower level of AMR installs with an associated meter, for DMO and new connections.

Given the current battery life expiry on AMR units and the asset life profile of the metering asset base, all AMR units and meters that were installed before 2020 will have to be replaced by the end of 2030. Therefore, we have a need to invest in around 1.4 million meter devices. Refer to our metering cost adjustment claim for more on this AMR asset replacement investment need above base cost allocations.

1.3.3 Interactions with Base Expenditure

The split of base and enhancement for this case is shown in Table 1.1.

Yorkshire Water has significant customer meter penetration with over 1.5 million meters out of the 2.36 million properties in the region. In determining the base and enhancement costs and to facilitate an alignment in categorisation, Yorkshire Water has consulted other English water companies who are into their third price review period of Smart metering. A simple overview would be that costs associated with the additional functionality which Smart metering enables, including the improved levels of data availability, data operability and insight generated, would be classed as enhancement. Any activity which would be required independent of the upgrade to Smart metering would be deemed base investment. The table 1.3 below provides a comprehensive overview of the make up of the Smart meter cost units and their categorisation into base or enhancement.

Table 1.3 below is specific to end-of-life meter replacement which is Yorkshire Water's preferred strategy for transition to a Smart metering asset population. There are a very small number of non-household properties which will have a meter installed with this enhancement expenditure (~2,500 properties), these are non-household properties which Yorkshire Water discover have not followed the developer services process whereby a meter has not been installed (generally this scenario arises through the conversion of existing buildings into new multi-use properties). Yorkshire Water retrospectively installs a meter once these exceptions have been discovered.

Table 1.3: Categorisation of Different Investment Types

Investment Title	Base or Enhancement	Capex or Opex	Description
Meter Body	Base	Capex	The component of the meter solution which measures flow. This could be mechanical or ultra sonic and can function independent to the presence of AMR or AMI technology.
AMR	Base	Capex	Automated Meter Reading is the current Technology utilised by Yorkshire Water since AMP5 and allows for walk-by or drive by meter reading of monthly indexes and a suite of pre-defined alarms.
AMI cost difference	Enhancement	Capex	Advanced Metering Infrastructure refers to the capability to wirelessly and regularly receive logged flow data without the need to make a visit to the meter or within its proximity. Generally utilising IoT networks to relay meter reads at sub daily intervals. In this example if an AMR cost £20 and an AMI £50, only the cost difference would be classed as 'enhancement', meaning £30 of enhancement costs. In some cases, the meter has never had an AMR fitted, in this case the whole of the AMI cost would be included as enhancement.
Meter exchange	Base	Capex	The costs related to the planning, scheduling and deployment of the Smart meter for customers with a pre-existing meter. In this case the fixtures and fittings should be in place to replace the existing meter with a new Smart meter.
Meter install	Enhancement	Capex	Customers who previously have not had a meter and no chamber or ancillaries are present. This would usually be through Domestic Metered Optants.
Meter depth adjustment	Enhancement	Capex	Much of the existing meter infrastructure is contained within chambers below ground ~70cm depth and with Iron lids. To increase the radio signal propagation and reception by the AMI, fittings can be applied to MSM chamber spindles, raising the meter towards the top of the chamber, improving meter connectivity on the IoT network.
Smart metering IoT infrastructure	Enhancement & Base	Opex	To support the regular receipt of customer flow data, a series of masts, gateways or similar infrastructure is required to be installed to create signal and allow for meters to transmit their readings. These IoT networks are owned and operated by telecommunication specialists, with connectivity managed through a Data as a Service (DaaS) model, with payment upon satisfaction of contractual Service Levels. The existing cost of collecting meter readings has been included in base, only the additional costs above base AMR meter reading will be included as enhancement.
Maintenance of Smart meter operability	Enhancement	Opex	To realise the benefits from the data which Smart meters generate it is important to maintain operability of the asset base. This could be

Investment Title	Base or Enhancement	Capex or Opex	Description
			hampered by third party interference, asset failure, temporary or permanent infrastructure on top or proximal to meter chambers etc. There is therefore a greater requirement to understand meter performance and ensure high levels of meter operability enabling service improvement and customer trust in a high % of data availability.
Repair of CSL	Base	Opex	The insight generated from smart meters will be important to identify customers who have a continuous flow, indicative of leakage or water wastage. The repair of pipes on the customer side will be subject to company policy, as these are not Water Company owned assets. Any direct intervention, such as in supporting vulnerable customers would be funded through base leakage investment.
MDMS systems	Enhancement	Capex	Enhancements are required to meter data management systems to accommodate the regular data ingestion from smart meters and new information about the meters, their performance, the information they have collected and any analytics to aid in service improvement. Many of these meter centric activities happen with in the Meter Data Management system and will require integration and upgrade.
MDMS AMR data hosting	Base	Opex	Current capabilities for ingesting meter reading data from AMR's and management processes for maintaining operability exist and do no present a step change in capability.
MDMS AMI data hosting	Enhancement	Opex	In transitioning to Smart metering, the number of readings collected for each property per year, will increase from 12 to 10,960. The capacity and cost of hosting additional data will increase.
Process and Solution Architecture changes	Enhancement	Capex	To achieve a step change in service associated with committed PCL, capability requirements, process definition and subsequent Enterprise and solution architecture redesign is required. The assessments to date of the defined capability upgrades relating directly to realising benefits from Smart metering, (such as enhanced leakage, PCC, non-household demand and billing), indicate significant Tec architecture change is required across multiple IT systems. This step change in service and capability is therefore included as enhancement.
Enhanced levels of data availability	Enhancement	Opex	Yorkshire Water through the solutions architecture changes will be creating solutions to provide customers with sub daily information on their water use habits. This high granularity data will be underpinned by SLAs to ensure data availability. The expectations of customers are heightened when they have access to such levels of data and to ensure sustained benefits are realised for PCC and non-household NHH business demand, enhanced levels of field investigations are required to resolve stale meters or technical issues with the meters or comms infrastructure. This has been categorised as enhancement.

The delivery of the enhancement aspect of the programme is dependent upon sufficient funding from base totex expenditure. Yorkshire Water has submitted a Cost Adjustment Claim (CAC) for capex in support of the level of investment to exchange ~90% of the metering asset base in

Yorkshire in AMP8. The enhancement totex spend is the 'top up' spend to ensure the base expenditure (which would have funded the equivalent of an AMR like for like exchange programme) has enhancement to upgrade the functionality of the meter asset base from AMR to AMI and the associated capability upgrade to realise the benefits to customers of a Smart meter portfolio.

To deliver this programme in its totality the following Base, CAC and Enhancement funding is required. A shortfall in funding for any aspect would risk delivery of the overall programme.

Table 1.4: Categorisation of Different Investment Types by Programme

	Nr of meters	Base Capex (£M)	CAC Capex (£M)	Enhncmnt Capex (£M)	Opex Base (£M)	Opex enhncmnt (£M)	Totex (£M)
Metering Exchange Programme (AMR upgrade)	1,389,314	30.98	110.13	38.87	17.17	9.54	206.69
Tech Change supporting Smart Metering	0	0	0	38.31	0	0	38.31
Domestic Metered Optants	125,000	0	0	46.35	0	0.94	47.30

Read more about this at
Cost Adjustment Claim Appendix

1.3.4 Activities Funded in Previous Price Reviews

AMI Smart metering is a new activity to Yorkshire Water and the cost variance for asset hardware and the transformation required to support the realisation of AMI benefits have not previously been funded under our AMR approach. The enhancement requested is in line with the categorisations in the table 1.3 above, all of which are new to Yorkshire Water.

From AMP5, Yorkshire Water has been funded for the deployment of AMR metering solutions for metering growth. AMP5 included an enhancement in funding for the replacement of previous life expired metering solutions, termed "Atypical investment- Meter exchanges".

1.3.5 Long-term Delivery Strategy Alignment

The transition to Smart meters is a key element of our long-term water resources strategy to reduce leakage and water demand across the region and address risks to the security of future water supplies. We provide further details of our water resources plans beyond AMP8 in our Long-Term Delivery Strategy, which includes our timeline for rolling out Smart meters to our customers over the coming years.

Read more about this at
Long-Term Delivery Strategy

1.3.6 Customer Support

We engage with our customers on an ongoing basis, and at regular intervals we carry out specific research to inform our future plans. We have a solid understanding of our customers' desire to include Smart metering as an option to reduce demand overall. In this section we will

outline the insight that has drawn us to conclude that this is an important enhancement case and one that should be included in our plan.

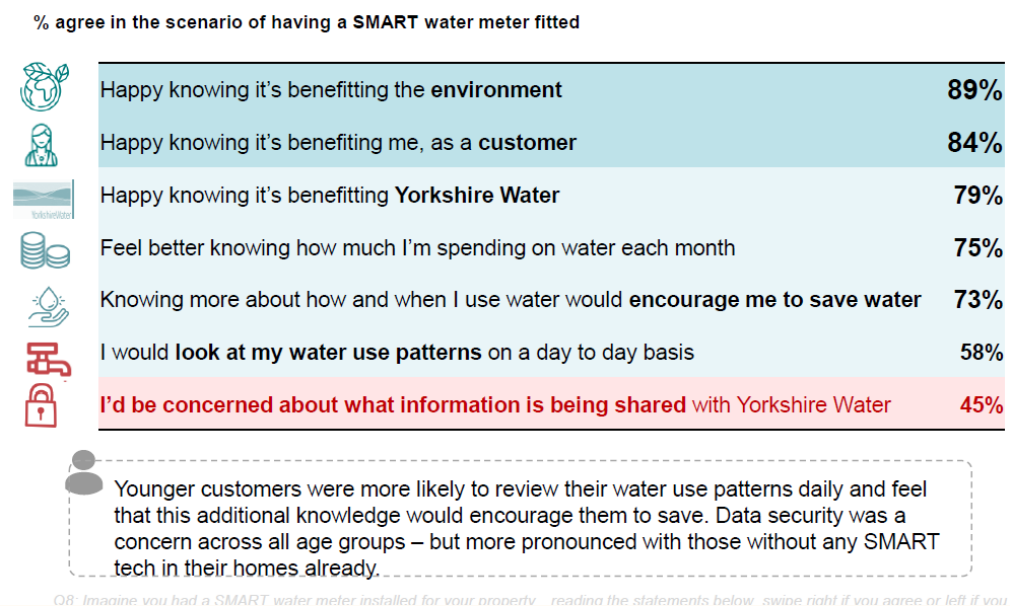
We know, from our research informing our water resources management plan that an important area of focus our customers expect of water companies is to educate customers on their water use to help them save water, and for customers who have a meter - to help them save money. We believe that the most effective way to do this is through the implementation of smart meters, to provide more regular, detailed data on customer water usage.

> *"Educate people that our planet's water resources, are not infinite. We should treat every usage as precious as all life-saving commodities." Your Water community member. Water Resources Management Plan Research.*

In August 2020 and March 2023, we completed research studies seeking to understand customers views on Smart metering and their water usage to inform our future plans in this area. From our research we found that almost two-thirds of customers were interested in having a Smart water meter, with environmental and cost saving benefits resonating the most. These views were most salient in groups that already had a water meter or had embraced Smart technology in other aspects of their home. Those not on a water meter, who do not have Smart technology in their home, or those who were in the middle-aged bracket showed negative or ambivalent attitudes towards Smart meters. The greatest concern for these groups of customers was data protection, with significantly more data and insight being generated once a Smart meter is in place.

An extract of the findings from this research showing the benefits of having a Smart meter fitted can be found below in figure 1.4.

Figure 1.3: Research Findings



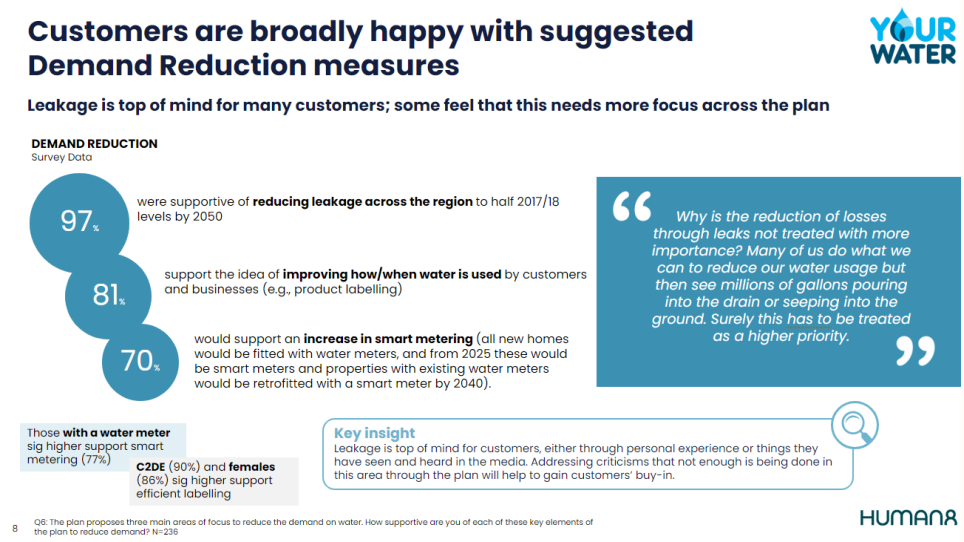
More recently, we followed up with customers who had been part of our 'My water use trial study' beginning in 2021 and running through to 2023. While definitive conclusions about the trial could not be drawn, due to low awareness of trial involvement, the study did find that half of those aware of the trial had reduced their water usage, and this was largely driven by reduction in their bill. Given the focus on affordability, this is unsurprising, but we are mindful to ensure that we focus on this benefit to support smart meter implementation. We have responded by designing a multi-channel service that empowers users to engage with their own water use in more detail.

We carried out further research to test customers' thoughts on smart metering and their preferences for managing the data gathered as a result i.e. their channel preference. Most customers were reported to prefer an App as the method to easily stay engaged with their water

usage and reducing this (55%), followed by a portal/website (47%) and bill (29%). We have utilised this insight in the generation of our Tech enhancement funding (see the detailed requirements specifications section for more information) to ensure we have a multi-channel approach to customer engagement, reflecting our varied customer base needs and preferences.

Our research exploring customers thoughts on our dWRMP highlighted a number of customer preferences with regards to demand reduction measures, the principal areas are highlighted in the graphic below in figure 1.5. It is clear customers support our efforts to increase metering overall and to do this with Smart meters.

Figure 1.4: Customer Preferences on Demand Reduction Measures



In addition to the research carried out on household customers above, we know that Smart metering is an area our non-household customers are interested in. Through the UKWRC response to Ofwat on the methodology for PR24, we know that retailers are looking for improved availability, quality and consistency of consumption data to help customers with their usage and subsequent bills, through the implementation of Smart meters.

To conclude, our research demonstrates that Yorkshire Water's customers are largely in favour of driving water efficiency through the improved visibility of water leaks and water efficiency. Achieving these goals through Smart metering is also largely supported and should be a significant part of the overall strategy to protect the environment, ensure water security and enable customers to manage their water use habits more effectively, positively impacting their bills.

This information has been important in transitioning to a 'Smart only' strategy in AMP7 and building the business case for WRMP24 in AMP8. New meters being installed or exchanged will use AMI technology from August 2023, ensuring Yorkshire Water limit the chance of investing in older technology which needs to be replaced before the end of its asset life. This is a more sustainable option avoiding redundant meters going for scrappage, recycling and consequences on landfill.

To learn more about our customer and stakeholder engagement, see Chapter 6 of our main business plan.

1.3.7 Factors Outside of Management Control

The water industry has precedent that the upgrade to Smart metering is an enhancement funded activity. With several water companies making submissions through the PR19 review or the Economic Green Recovery and Accelerated Infrastructure Delivery Funds being granted enhancement expenditure to accommodate the additional costs associated with Smart hardware, IT systems upgrades and new customer engagement and communications to realise service improvements.

The enhanced funding comes with increased financial exposure to water companies, as the benefits expected from Smart metering are baked into the performance commitment levels proposed in future price review periods, such as leakage, PCC and non-household demand reduction.

Underachievement of the targets proposed will result in significant financial exposure. Further the projected benefits are included within the rdWRMP future demand forecasts, under delivery of performance improvements impacting supply demand future resilience would result regulatory impacts from Defra and the EA.

Yorkshire Water has only included the cost delta within the enhancement case across hardware, meter reading, data hosting and analytics. Mitigating the size of the enhancement case within management control.

The strategy proposed by Yorkshire Water to exchange assets at or near end of life in AMP8, further limits enhancement expenditure and ensures limited capital write-off, from assets with significant asset life remaining. A further meter replacement programme will be put forward at PR29 to achieve ~100% Smart meter coverage for metered properties across Yorkshire, subject to rdWRMP finalisation into our final WRMP.

With the progression of the Yorkshire Water metering strategy through AMP7 and the development our improved rdWRMP Yorkshire Water made the decision to mandate Smart meters as standard from 2023 for new developments and DMO customers. The additional costs of hardware and install have been absorbed by Yorkshire Water for this interim period and has limited the number of meters which would potentially be operating for 10-15 years into the future without Smart capability, or the impact of capital write off of assets before the end of their asset life. We expect this policy decision will result in circa 110k Smart meters being operational before AMP8, which the capex investment delta has been absorbed by Yorkshire Water.

With a clear AMP7 and AMP8 Smart meter strategy subject to finalisation of the rdWRMP, the capability enhancement requirements, process mapping and IT system gap analysis has reached a level of maturity within existing funding, allowing for the enhancement expenditure for IT systems and business transformation to focus on detailed design and delivery.

Yorkshire Water has led the industry in Smart metering innovation in AMP7, successfully partnering with three Smart meter technology providers in the award-winning Hadfield Smart network trial. In partnership with LORAWAN provider Connexin and meter provider Itron, Yorkshire Water delivered the successful trial of LORAWAN technology within the UK water sector. This trial starting in 2020 paved the way in opening up the smart metering market in the UK to a variety of technical solutions, previously being dominated by a single supplier. Subsequently several LORAWAN providers have been awarded frameworks across the UK driving cost efficiency and competition across the sector.

1.4 Best option for customers

1.4.1 Options considered.

Yorkshire Water has considered seven options regarding meter investment, against a backdrop of an asset base largely at the end of its operational life during AMP8.

A long list of options has undergone modelling to confirm suitability to include in the WRMP for delivery within the WRMP24 plan. The modelling prior to inclusion in scenario optioneering in the WRMP Optimiser includes consideration of the following factors:

- The level of service improvement in relation to cost to achieve.
- The cost of “regret spend”. This would include early Capital write off or enhancing operational costs to mitigate decreases in efficiency due to assets being end of life.
- The design of an efficient Smart Meter roll-out programme, allowing for volume and workforce efficiencies

- The deliverability of the Programme, ensuring supply chain and people resources can cope with the scale of the investment.
- Dependencies between Policies, impacting the trajectory to “Full Smart metering”.
- The blend of technologies required to achieve “full smart metering”.

For each of the factors above there will be an impact on the following service / efficiency areas:

- Per Capita Consumption
- Non household Demand
- C-MeX
- BR-MeX
- Leakage targeting
- Customer side leakage

Figure 1.6 below sets out a variety of strategy scenarios considered by Yorkshire Water within the WRMP for our metering assets. It demonstrates that we do not have the option to spread this investment over multiple periods, because asset performance is limited by the life of battery powered components and life of metrology. If we don’t invest in life expired assets in AMP8 to maintain service, significantly higher opex would be required to perform manual meter reading activities and risks of meter under registration and data integrity and accuracy would increase. Additionally, it would erode benefits from leakage, PCC and NHH demand reduction, putting at risk the resilience of the Yorkshire Water supply demand balance within the WRMP. Further additional miles driving to manually read meters, would impact Yorkshire water’s Net Zero Carbon Strategy and impact accuracy of billing, causing a regression in customer satisfaction.

The figure below, details the scenarios which were carried forward for optimisation within the WRMP. The “Cost delta” column demonstrates the totex change in investment over the next 15 years compared to a baseline of replacing AMR like-for-like at the end of asset life. A negative figure demonstrates a reduction in costs, a positive figure demonstrates an increase in costs.

Benefits impacts are shown as a Red, Amber, Green status across key performance commitments. Red indicating a negative impact, Amber as marginal impact, Green being a positive impact. An estimated, quantified leakage benefit is shown in the Benefit Delta box. Within our AMP8 programme, no investment is being proposed to be brought forward from AMP9. Circa 100k AMR meters are due to be replaced as end of life in AMP9. These have not been brought forward due to risks to deliverability increasing the AMI further beyond that proposed in AMP8.

The best available data in the progression to submitting a revised draft WRMP is that scenario 4 is the strategy to adopt, with Change of Occupancy (scenario 6) being a preferred option to include from AMP9.

The figure below shows £0 base totex as the assumption within WRMP, this assumes that a Cost Adjustment Claim would be successful allowing funding the base element of the Smart metering programme, with enhancement funding supported by the WRMP to provide the upgrade from AMR to AMI and releasing the benefits from Smart metering.

Figure 1.5: Optimisation Scenarios

Scenario No	Investment Scenario		Cost Delta (Millions, 1st investment cycle 0-15 years)	Benefit Delta DI MLD (AMP8)	Outcome	
1	No AMR meter Replacement- Revert to visual Read		Base Totex: – £64.00 Enhancement Totex: £0	- 8 MLD, regression	**Rejected**: Regression in service is not aligned with strategic requirement to reduce Water Demand	
	Description: Allow AMR solution batteries to fail and do not replace with new AMR. Attempt to maintain 6 monthly reading cycle with increased meter reading resource. Lose capability to understand AMR alarms, such as continuous flow leak alarm, limiting capability to target customer side leakage.					
	Customer Side Leakage impact	Leakage Targeting impact	Per Capita Consumption impact	Non Household Demand impact	C-Mex impact	BR-Mex impact
2	AMR for AMR replacement end of life		Base Totex: £0 Enhancement Totex: £0	0 MLD	**Progressed**: Included as the baseline assumption for WRMP scenario modelling	
	Description: Replace end of life AMR meter, with an new AMR meter. Service levels and capabilities will be maintained as BAU service.					
	Customer Side Leakage impact	Leakage Targeting impact	Per Capita Consumption impact	Non Household Demand impact	C-Mex impact	BR-Mex impact
3	AMR for AMR replacement, smoothed AMP impact		Base Totex: £36.00 Enhancement Totex: £0	-4 MLD, regression	**Rejected**: Regression in service to attain a reduction in Water Demand and higher whole life cost to customers.	
	Description: To mitigate bill impact of large AMR meter replacement programme in 1 AMP, replace ½ the AMR meters in AMP8 and the second half in AMP9. Attempt to maintain 6 monthly reading cycle with increased meter reading resource, for meters with end of life AMR's. Half of meters lose capability to understand AMR alarms, such as continuous flow leak alarm, limiting capability to target customer side leakage. Performance would recover during 2nd AMP with AMR EOL replacement.					
	Customer Side Leakage impact	Leakage Targeting impact	Per Capita Consumption impact	Non Household Demand impact	C-Mex impact	BR-Mex impact
4	AMR for AMI replacement End of life		Base Totex: £0 Enhancement Totex: £80.0	19.3 MLD DI reduction	**Progressed**: Included as option for delivering service improvement and long term DI target attainment.	
	Description: Replace end of life AMR meter, with an new AMI meter. IT systems, process, customer communications, maintenance, future DMO and New Developments all Smart. Note enhancement costs include cost delta for DMO & New Developments vs AMR.					
	Customer Side Leakage impact	Leakage Targeting impact	Per Capita Consumption impact	Non Household Demand impact	C-Mex impact	BR-Mex impact
5	AMR for AMI replacement, smoothed AMP impact		Base Totex: £36.00 Enhancement Totex: £80.0	5.65 MLD DI reduction	**Rejected:** Over a 15 year Whole life cost, this model is more costly, impairing AMP8 performance improvements and regressing service levels in areas of delayed AMR replacement.	
	Description: To mitigate bill impact of large AMR meter replacement programme in 1 AMP, replace ½ the AMR meters in AMP8 and the second half in AMP9. Attempt to maintain 6 monthly reading cycle with increased meter reading resource, for meters with end of life AMR's. Half of meters lose capability to understand AMR alarms, such as continuous flow leak alarm, limiting capability to target customer side leakage. Benefits for ½ of region with AMI replacement would be eroded against less ability to respond to continuous flow alarms which would no longer be generated from AMR's with expired batteries. Note enhancement costs include cost delta for DMO & New Developments vs AMR.					
	Customer Side Leakage impact	Leakage Targeting impact	Per Capita Consumption impact	Non Household Demand impact	C-Mex impact	BR-Mex impact
6	AMR for AMI, Change of Occupancy metering		Base Totex: £0 Enhancement Totex: £74.25	13.00 MLD DI reduction	**Progressed:** Included due to strategic alignment and service improvement acceleration option. Required to achieve "full Smart metering".	
	Description: When a new occupier contacts Yorkshire Water to become the bill payer, Yorkshire Water would install a meter at that property for billing purposes. This would speed up the transition to Full Smart Metering, but increasing the number of unmetered properties per which would switch to Metered charging, enabling all the benefits of water efficiency to be realised through a link to the customer bill. This has a dependency on scenario 4 which would deliver the capabilities to realise a service improvement. In the first AMP of adopting this policy circa 167.7K properties would have a meter installed through this policy change. If selected, constraint may be required to start in AMP9, as delivery of AMP8 programme may be overambitious to include this additional volume of meters.					
	Customer Side Leakage impact	Leakage Targeting impact	Per Capita Consumption impact	Non Household Demand impact	C-Mex impact	BR-Mex impact
7	AMR for AMI, enhanced Domestic Metering Programme		Base Totex: £0 Enhancement Totex: £14.38	2.32 MLD DI reduction	**Progressed:** Included due to strategic alignment and service improvement acceleration option. Required to achieve "full Smart metering".	
	Description: Through proactive campaigns and targeting, enhance the number of customers opting to have a meter installed. This would equate to 31.5K properties in AMP8 and 24.5K properties in AMP7. This has a dependency on scenario 4 which would deliver the capabilities to realise a service improvement. This option has a relationship with scenario 6, both policies are not to be selected together as the overlap in customers targeted is too great. If chosen, scenario 6 would take precedent.					
	Customer Side Leakage impact	Leakage Targeting impact	Per Capita Consumption impact	Non Household Demand impact	C-Mex impact	BR-Mex impact

1.4.1.1 Definition of Full Smart Metering

The funding to achieve full Smart metering, in terms of increasing meter penetration is not included in the AMP8 plan. However, the costs for transition of the existing asset base to Smart is largely included in this plan.

Achieving a high meter penetration provides multiple benefits to water network management. These include:

- Efficient targeting of customer side leakage.
- Water efficiency insight & discussions with customers.
- Accurate Water Balance & night use allowances, driving better leakage targeting and reporting accuracy.
- Hydraulic model accuracy & operational response to incidents.
- Demand forecasting & network resilience planning.

Yorkshire Water has undertaken an analysis to understand what ‘full Smart metering’ would mean and then incorporate this into Yorkshire Waters Smart Meter Strategy, considering both the Ofwat’s fast technology and slow technology scenarios.

Full Smart meter penetration has been determined as ~93% meter penetration. This has been determined through two assessment types.

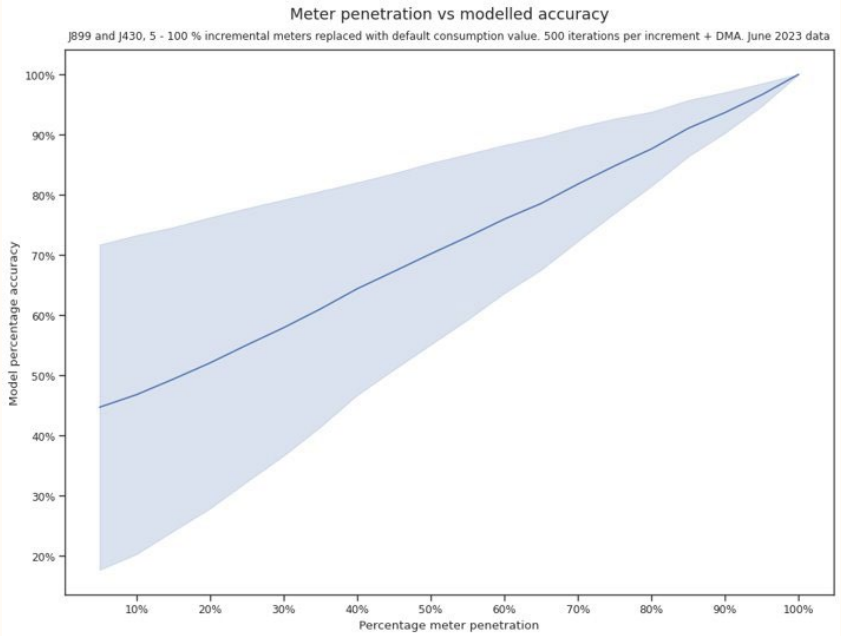
1. Understanding the benefit relationship between meter penetration and the accuracy of leakage water balancing.
2. Understanding the number of properties within which a meter cannot practically be installed. These are usually joint supplies where an external meter cannot be fitted for a single supply, as such an internal meter location is sought, but the following challenges are faced:
    a. No access to pipework.
    b. No space around accessible pipework.
    c. No Internal Stop Tap or ability to practically install an internal stop tap.

1.4.1.2 Relationship between Smart meter penetration and water balance accuracy

Yorkshire Water used 2 DMAs which have nearly 100% meter penetration to model the accuracy of DMA water balancing, as meter penetration lowers. A water balance looks to understand the water network inputs into and export from the hydraulically sealed areas (typically an area of 1000 properties) plus the water used by customers. The remaining water through an assured calculation is proportioned to leakage.

The approach taken by Yorkshire Water was to assess the accuracy of the water balance by achieving a ~100% accurate water balance in 2 DMAs with ~100% meter penetration, then removing 5% of meter penetration in increments and undertaking a Monte Carlo simulation of 500 iterations per 5% increment, to determine the relationship between water balance accuracy and having a lower smart meter penetration. This study showed the relationship for water balancing to water balance accuracy was largely linear. As such there is no threshold % penetration where accuracy exponentially improves, rather an incremental improvement in accuracy. The requirement for full smart metering is therefore to achieve as high a metering penetration as is practical and will be based on the practicality and cost curve of achieving incremental improvements in meter penetration.

Figure 1.6: Meter Penetration Vs Modelled Accuracy



1.4.1.3 Relationship between Smart meter penetration and successful meter installs

The ability to physically install a meter allowing for property level insight is therefore the constraint to achieving “Full Smart Metering”.

Yorkshire Water currently has 2.5% of its 2.36 million residential customers on Assessed Charges, whereby a meter has unsuccessfully been attempted to be fitted.

By tracking DMO install success, Yorkshire Water can develop an estimated success rate of install on the remaining 901k unmetered Household (HH) properties in the region. The chart below shows the 3-year average for unsuccessful DMO meter install is 10%, however there is a recent upward trend in assessed charges for DMO following an increase in appointments with complex joint supplies. This trend will be tracked, and forecasts amended if persistent.

Figure 1.7: Meter Fit Compared to Assessed Charge

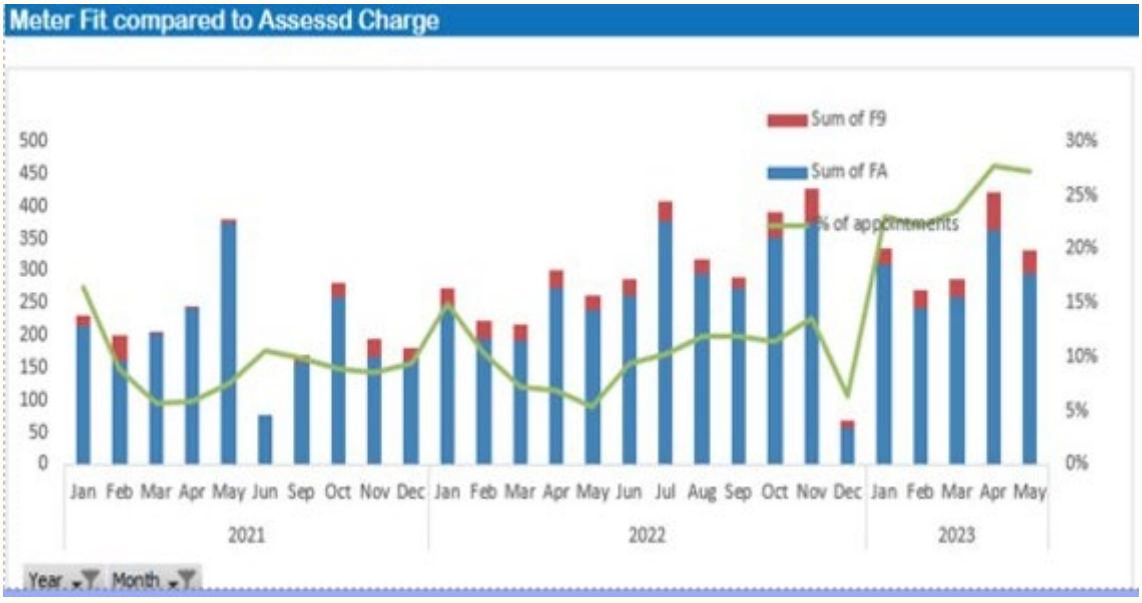


Table 1.5: Metered Status

Metered Status	Number of properties (k) APR22/23	Success rate for installing Meter	Unmetered to metered number apportioning success rate	Future potential metered	% future potential metered
Metered	1,339	90%	811	2,150	93%
Assessed Charge	59	10%	90	149	7%
Unmetered	901	-	-	0	0%

By applying a 10% un-meterable logic to the remaining HH metered population, this would result in “Full Smart Metering” at Yorkshire Water being ~93%. This level of metering will be cyclically reviewed, and policies aligned to achieve the required strategic milestones.

To attain a full Smart meter penetration Yorkshire Water is considering a number of options as well as modelling the best plan for our customers to achieve Full Smart Metering, whilst also considering the deliverability of the scale of investment. The revised draft WRMP will confirm the best value plan for customers through the adoption of additional Metering policies.

- Change of Occupancy
- Further enhancement of DMO

Under a change of occupancy policy, implemented from AMP9, Yorkshire would be close to achieving full smart metering at the end of AMP10 or early AMP11, which is in line with the “Slow technology scenario”.

To achieve a fast technology scenario for "full smart metering” Yorkshire Water would have a shortfall of 273K meters even adopting change of occupancy from AMP8. So additional policies would need to be implemented to achieve this target.

Note by 2035 under the Yorkshire Water core plan all customers meters would be on an AMI smart meter.

1.4.1.4 Technology options

Yorkshire Water began its metering specification process in September 2019 undertaking innovation trials with three of the leading and emerging technology types: NB-IOT, LORAWAN and the proprietary Flexnet solutions. Together this trial covered ~2700 properties to understand the performance of differing solutions and help update the existing metering specification to a Smart metering specification and IOT network specification.

Following 2 years of meter rollout and data analysis Yorkshire Water undertook an industry benchmarking process utilising partners Efficio Consulting to establish the benchmark of cost efficiency across the UK and Europe. The meter specification, SLA’s regime for establishing meter reading success and benchmarking informed OJEU procurement process, starting in October 2021.

1.4.1.5 The lifespan of the technology

Yorkshire Water has used AMR technology for metering since the 2010-15 pricing period. This solution allows for the meter to be read and alarms collected during a “walk by” or “drive by”, without needing to visually read the meter or book customer appointments. We have found this has enabled meter reading efficiencies and customer satisfaction as billing accuracy has improved. We have also recorded a modest leakage benefit through “leak alarms” built into AMR loggers.

Yorkshire Water were an early adopter of AMR and planned a 15-year replacement cycle based on the technology’s battery life constraints. Through the 2015-20 pricing period, we have

discovered the technology has a battery life of ~10 years. Internal meters last slightly longer due to favourable conditions, external have slightly shorter lifespans.

To achieve the 25-year targets we have presented within the WRMP, Yorkshire Water not only need to replace the AMR technology deployed over the past ~13 years but also improve the insight which can be derived from customer meters. Therefore, a known number of AMR meter replacements are required in AMP8 to maintain service, based upon the known customer meter penetration and known life expiry of the AMRs.

1.4.2 Cost-Benefit Appraisal

As discussed in the Best Option for customers section, Yorkshire Water has an existing meter penetration of ~60%. The majority of the metering asset base will become life expired in AMP8. Seven strategic options were considered for investment in metering, as shown in Figure 1.6 above.

The strategy options considered:

- The timing of investment
- The service improvements across a range of PC's and statutory regulated outcomes
- The deliverability of the strategy

The Demand forecasting for New Developments and DMOs has been calculated using the WRMP compliant methodology. Full details are included in the dWRMP.

Please refer to section 5.5 Forecasting of Demand of the dWRMP technical document[1].

Yorkshire Water has chosen strategy solution 4 to take forward within the PR24 submission, providing an optimum outcome for cost, service and satisfying the requirements of the WRMP for supply security.

The requirement to invest in the replacement of Metering assets due to end of life (scenario 4), derived the best cost solution in three ways.

Timing:

- The metering enhancement case would only fund the cost delta to achieve an upgrade from AMR to AMI. The chosen strategy therefore limits the enhancement costs of a meter exchange programme from £179.98 million to £38.87 million capex, with the remaining investment being delivered through base expenditure.
- Strategy scenarios 3 and 5 which look to smooth the investment profile to AMI over a longer timeline, resulted in a higher whole life cost over a 15-year investment cycle due to the increase in manual meter reading activity to maintain an acceptable level of service. This prevented a potential £36 million base pressure in meter reading.
- The strategy to move to a region wide Smart metering strategy, has allowed for Smart metering to be implemented for New Developments and DMO from 2023. The strategy will result in circa 75k smart meters being installed which would otherwise have functional life until ~2035-2040.

Service improvement:

- Strategy 4 allows for significant improvements in water efficiency through AMP8, contributing to the interim and long-term targets relating to Demand Reduction. Strategy options 1, 2, 3 and 5 would all reduce progress in achieving the long-term goals and would have resulted in an increase in alternative demand reduction solutions which delivered a less holistic performance improvement. Smart metering being a key enabler to all three demand reduction strategies.
- Strategy 4 allows for the attainment of the required supply resilience in AMP8 and provides a sustainable performance improvement for the duration of the asset life.

[1] yorkshire-water-draft-water-resources-management-plan-2024-technical-document.pdf (yorkshirewater.com

Alternative solutions such as active leakage control and pressure management would provide short to medium term benefits, but not maintained in the long term.

Deliverability:

- Options 6 and 7 consider the acceleration of metering penetration across Yorkshire Waters customers. The revised draft management plan, in its current iteration would select additional metering as a preferred option to manage the supply demand balance starting in AMP8. However, Yorkshire Water have to consider deliverability of the policy decisions. Change of Occupancy being the preferred policy would require an additional ~£65million of enhancement investment and require ~170k additional meters be installed. After extensive pre-market engagement to assess the ability of the market to deliver the required increase in skilled resources, hardware and tools & equipment, Yorkshire water believed additional scope on top of the ~1.6million smart meters to be installed or exchange in AMP8, would be too high risk and have differed the investment to AMP8 subject to WRMP24.

1.4.2.1 Smart meters offer value to customers.

In addition to the drivers above which have influenced Yorkshire Water to choose strategy 4 as the preferred option, there are also customer benefits to the selected strategy.

Customers have a right to be charged based on what they use. They are legally entitled to have a meter installed free of charge, unless it's impractical or unreasonably expensive to do so. Tenants also have the right to ask for a meter if their tenancy agreement is for six months or longer. Properties with a small number of residents can easily be overcharged for water, so metering can offer much better value.

Our research shows that our customers are supportive of reducing water wastage through leakage and water efficiency programmes such as metering. Customer-side leakage is a significant issue – it accounts for 30% of all reported leakage. As such, it is a key focus for driving demand reduction, and compliments our other customer-centric initiatives to reduce Per Capita Consumption (PCC) and Non-household Demand.

With an enhanced level of actionable insight from Smart meters and analytics, Yorkshire Water can target leakage both on our own network and on the customer side. Yorkshire Water will continue to offer support to customers who are financially vulnerable, offering free supply pipe repairs. For non-financially vulnerable customers we will be able to quantify the cost of water lost through continuous flows on their property and pipework, allowing customers to understand the economic impact of water waste and support the customers in undertaking “self-fix” activities.

Against a backdrop of a cost-of-living crisis, enabling customers to have more insight into the cost of their water use habits is the right thing to do. Whilst water bills are lower than other utilities, the cost of heating water contributes to a significant proportion of the household bill. Smart meter data provided to customers will allow for customers to understand the relationship between water and heat use, and better manage the decisions they make which will impact their multiple utility bills.

1.4.3 Carbon impact and best value

The carbon impact of Smart metering has been considered within the operational carbon performance commitments and net zero carbon enhancement case, whereby a decrease in treatment and pumping associated with the decrease in Distribution Input (DI) from leakage, PCC and non-household demand reduction has occurred. The market based and location based kgCO2 equivalent have been reported for demand reduction.

1.4.4 Impact Quantification

The selection of Strategy 4 for customer metering, has defined benefits to demand reduction within the Water Resources Management Plan, which have been included in the Performance

Commitment regimes put forward in this plan and are summarised below. These benefits have been included within the optimisation of the delivery strategy to achieve the long-term leakage, PCC and NHH demand reduction targets. The demand reduction within this enhancement case should be considered in relation to the WRMP Supply-Demand enhancement case, whereby alternative supply side options may otherwise have been selected to deliver the required supply resilience, which would deliver higher embedded and operational carbon solutions.

Performance area	Cumulative AMR Delta benefit	Cumulative Metering benefit
Leakage	7.73 Ml/d	7.73 Ml/d
PCC	7.48 Ml/d	14.32 Ml/d
NHH Demand	4.04 Ml/d	4.04 Ml/d

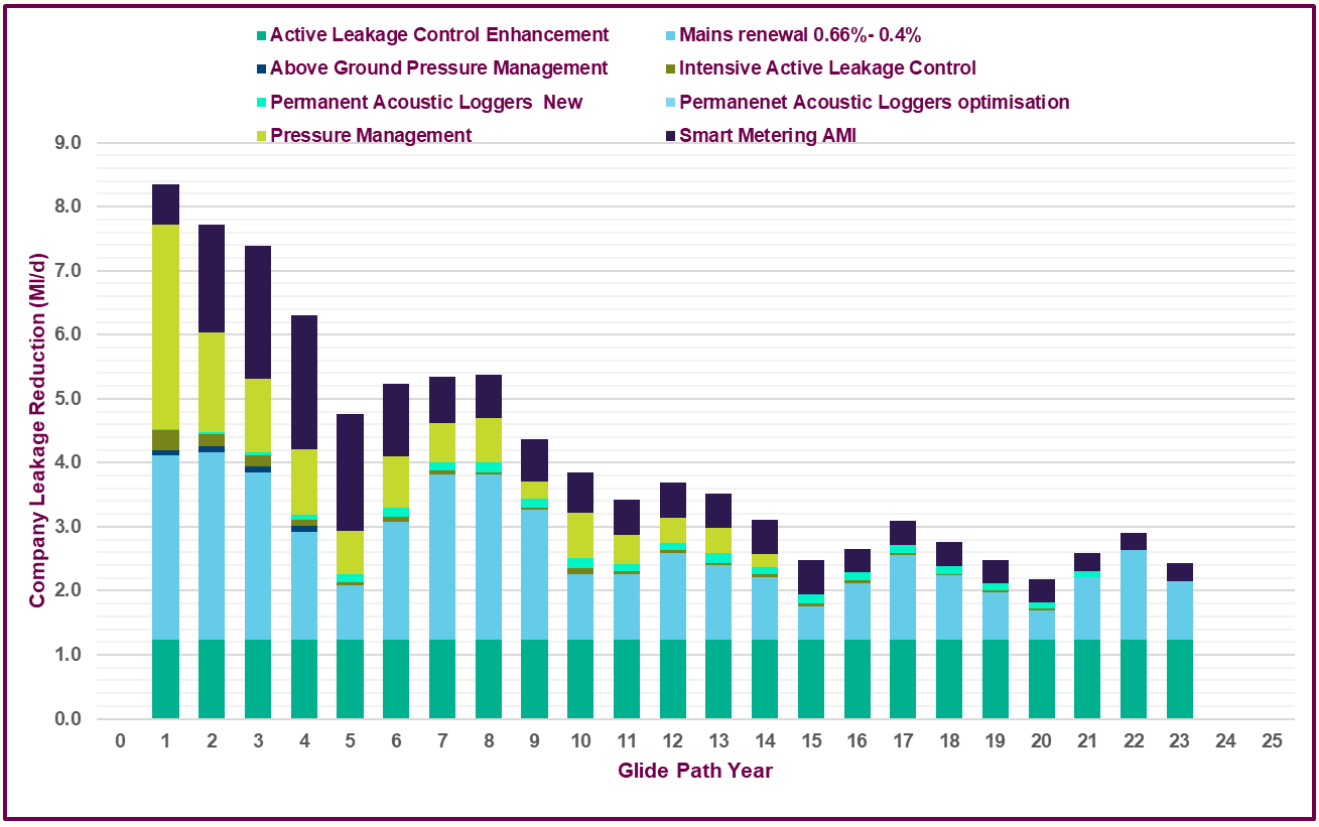
These benefits have been considered when constructing the Price Control Deliverable associated with this enhancement case.

The benefits from the chosen metering strategy have been integrated into a variety of optimisation scenarios, which have been included within the WRMP. The benefits from Smart Metering contribute 17% of the 94Ml/d required to achieve 50% leakage reduction by 2050. The enhancement investment in technology & systems in AMP8 will provide an ongoing capability to continue realising Smart metering benefits across multiple AMPs with the potential for additional leakage benefits if additional Smart metering through Change of Occupancy or Compulsory metering is adopted in the rdWRMP or future iterations.

The inclusion of Smart metering benefit within the leakage plan, has offset the requirement to deliver alternative more costly leakage solutions within the plan. The table below shows the contribution from smart metering to the overall 25-year leakage reduction plan, being dark blue at the Cap of each year leakage reduction bar. This table shows the optimised interventions required in additional to base activity and is discussed in more detail in the Leakage enhancement case.

A similar process has been followed for NHH demand reduction and PCC, to provide a holistic smart metering benefit quantification, with an optimised programme of activity in addition to smart metering to achieve the long-term statutory targets.

Figure 1.8: Leakage Reduction by Year



1.4.5 Cost and Benefit Uncertainties

1.4.5.1 Cost Uncertainty

Yorkshire Water has built up the costs across the enhancement programme in a bottom-up approach to establish an appropriate level of investment required:

Existing framework rates:

- Meter Hardware
- Data as a Service

The delivery of the Smart metering hardware and DaaS is subject to a procurement process underway. To take an appropriate efficient risk-based approach YW have utilised existing framework costs to establish the unit costs for these elements of the programme. With the outcome of the procurement exercise aiming to outturn at a similar rate to the existing frameworks.

The existing framework rates were also benchmarked through 3rd Party assurance as detailed in the table below.

Existing unit cost rates:

- Maintenance
- Programme delivery
- Metering Operations Centre

Yorkshire Water have an established Programme delivery team and Model Office for the companies Smart, Resilient and Calm leakage programme to deliver the enhancement investment for leakage transformation. The delivery structure and costs have been adjusted to the needs of the Smart metering programme to establish the costs and organisational design to deliver the required outcomes. The existing Data Maintenance and Metering teams within the business have been utilised to establish maintenance costs, with the existing smart metering

frameworks asset maintenance rate, being utilised to establish the maintenance requirements of smart, above the level for AMR.

Benchmarked Industry costs:

- Exchange and install programme.

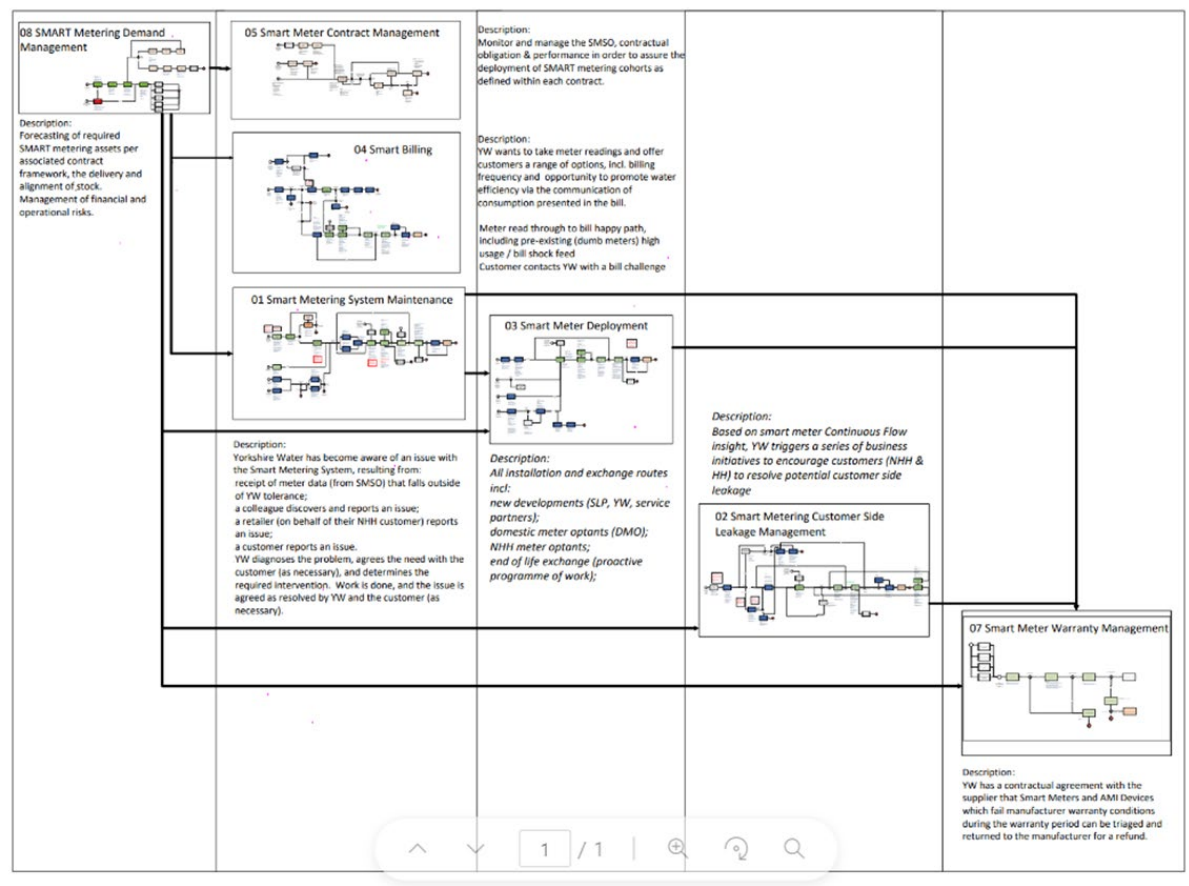
The exchange programme was benchmarked against a range of other anonymised companies exchange rates. The proposed exchange cost was more efficient than the industry average exchange cost, from the benchmarking being undertaken. Yorkshire Water considered comparing APR data analysis; however, the delivery of a proactive planned meter exchange programme would attract significant efficiency compared to reactive install or exchange and would not have allowed for a like for like comparison.

Detailed requirements specifications

- Technology and systems change.

Detailed business architecture analysis has been conducted to identify the key business processes and capabilities required to deploy, manage and exploit run smart meters at Yorkshire Water. The diagram below illustrates the Process Mapping, which then informed capability requirements and SIPC creation. These have then been converted into a high-level solution architecture that looks to exploit existing platforms and capabilities where possible, and the smart metering programme will cover costing for any changes required to those platforms where required.

Figure 1.9: Technology Changes



The design and cost estimates have been ratified by technical experts in those platforms to ensure that the design is robust, the assumptions made are reasonable and the estimates realistic. In addition, there is funding to cover advanced analytics that become possible with the more granular data provided by Smart meters and then to drive automation from the results of those analytics to improve water efficiency (leakage), deliver customer water efficiency (PCC and non-household demand), save customers money and improve customer experience.

IT operates a partner framework which has been subject to due diligence on a number of fronts e.g., legal, procurement, quality, Information Security, to ensure Yorkshire Water is able to access services that represent value in both capability and financial terms. This framework is made up of several leading IT consultancies as well as smaller niche providers ensuring a wide range of business and technology needs can be met. Package solutions have been selected via a robust, competitive tender process.

Whilst work has been done to a medium level to identify requirements and solutions, there are still a number of technical specifications which require granular assessment and conversion to a detailed specification. These are mainly capabilities which build on the basal level of maturity established early in the programme delivery, where amendments and enhancements are required to the initial process and capability design. These will manifest in areas such as enhanced analytics, automation of process and analytics, integration with other data sets, data management to maintain GDPR and governance controls and unforeseen technology advances. Whilst most aspects of the submission are based upon understood requirements, there has been a level of risk incorporated to accommodate the assumption that there will need to be ongoing work through the AMP to deliver continuous improvement in these areas to fully maximise the benefits of the programme.

1.4.5.2 Benefit uncertainty

Leakage Benefits

During FY 22/23 & 23/24, Yorkshire Water undertook a survey of 100,000 properties to identify continuous flows and document the frequency of customer side water losses across 3 size cohorts Small 0-50 Litres per hour (l/hr), Medium 50-180 l/hr, Larger >180 l/hr.
The frequency of each size cohort has been utilised to create a bottom-up assessment of the opportunity to deliver a leakage reduction, considering the largest leaks involve direct intervention by Yorkshire Water, whilst using published data from Thames Water, assuming 60% of the medium and small leaks are resolved through communication between water company and customer.

This sample size is significant and should mitigate against significant variance in benefits realised, however there will inherently be risk in upscaling studies to deduce an expected leakage benefit and subsequent modelling through the complex leakage calculation and MLE water balance calculation.

Through the delivery of this programme in AMP8 an improved modelling of benefits will be established and integrated into future WRMP optimisations, with outperformance of assumptions resulting in the requirement for less demand reduction enhancement in future AMPs. Whilst an underperformance compared to the modelled assumptions, will inform future demand reduction strategy development and the adoption of an alternative leakage reduction pathway.

PCC & NHH demand reduction benefits

Yorkshire Water have utilised studies both internal and through UKWIR into continuous flow and plumbing losses to establish an expected benefit to PCC from addressing continuous water use/wastage. Yorkshire Water have also liaised significantly with more mature Smart metering water companies in the UK, who have established many years of PCC data and incorporated the data into subsequent WRMP’s. Establishing the initial benefit and sustained demand reduction benefits.

Utilising this approach Yorkshire Water have derived a 3% PCC & NHH demand reduction in the transition from AMR to AMI technology. With 4% additional PCC reduction compared to AMR for customers who are having a meter installed for the first time.

1.4.6 Third Party Funding

There is no planned third-party funding for this case.

1.4.7 Customer Views

We know from our customer research that the implementation of Smart meters is supported by our customers in general. We have not carried out any specific optioneering testing with our customers on the implementation approach.

1.4.8 Direct Procurement for Customers (DPC)

We do not propose to address this driver via a DPC approach following clarification from Ofwat on what investment schemes make a suitable DPC scheme. For more information on the process followed and the cases that were ultimately judged as suitable for DPC please see section 6.3 in Introduction to Enhancement Cases.

Read more about this at
Introduction to Enhancement Cases

1.5 Cost Efficiency

Cost efficiency is a core tenet in our PR24 Business Case planning. We have been proactive in integrating best practices, leveraging new markets and collaborations, harnessing innovative technologies, and building an excellent procurement system to deliver cost efficiency across our whole business plan. This is no different for our metering assets.

A meter exchange programme consists of 4 cost categories.

1. Meter Hardware
2. Data as a service
3. Meter exchange
4. Battery life warranty (part of whole life cost assessment but not unit cost)

Yorkshire Water has undertaken an efficiency assessment across all 4 aspects, as described below and summarised in Table 1.5.

1.5.1 Meter Hardware

In 2021 we undertook premarket engagement exercise and industry benchmarking to understand the UK industry costs of Smart metering hardware and Data as a Service (DaaS). The benchmarking and subsequent procurement activity was led by Efficio, who are our strategic procurement partner. The benchmarking exercise established that for the predominant Smart meter deployed across the UK for the most common meter size (DN15), that a target for DN15 meters was ~£54 per unit.

The DN15 meter represents 96.8% of Yorkshire Waters proposed meter exchange/upgrade programme in AMP8.

As shown in Figure 1.11, Yorkshire Water then entered an OJEU process with the selected vendors significantly outperforming the efficient rate as highlighted above.

1.5.2 Data as a Service (DaaS)

The above benchmarking exercise established that for the predominant Smart meter deployed across the UK the target cost for DaaS would be £4.5 per meter per year. This benchmark was significantly higher than the cost per meter using AMR data collection (a physical meter read visit planned as a productive cyclic programme). However, under the Smart and DaaS model, the number of meter reads collected is vastly superior (see Table 1.3).

As shown in Figure 1.11, Yorkshire Water then entered an OJEU process with the selected vendors significantly outperforming the efficient rate as highlighted above.

1.5.3 Exchange costs

The exchange programme Yorkshire Water will be completing in AMP8 has been designed to deliver the most efficient outcome. Focusing on a conurbation, street by street exchange strategy, allowing for high volumes of external meters to be exchanged per day, with appoints

within the prioritised conurbations occurring for internally metered and non-household customers.

Yorkshire Water has undertaken market pre-engagement with suppliers able to provide meter exchange services to help design the requirements for the exchange programme to go to tender by October 2023. They have provided indicative costs for an exchange programme which have been included as the unit costs for YW exchange programme.

Benchmarking for exchange/install cost is complex, especially when using a single unit cost value to compare efficiency across companies. This difficulty arises due to large variance in cost being driven by company specific factors, which are hard to normalise across.

Below is a summary of the cost impacting factors which will cause a variation in unit cost of any metering exchange programme:

- Proportion of properties in metering programme with existing chamber/ ancillaries in place
- The split of external to internal meter location
- The breakdown of meter sizes to be included within the metering programme.
- The proportion of meters which are non-household and the blend of NHH's which have water critical operations.
- The ratio of meters which are no longer accessible (built over or constructed into ducting by property owner)
- The customer willingness to allow access to property, which will change with customer base demographics.
- The ancillaries required to adjust meter lay length (pipe length either side of the inline meter) if a change in meter manufacturer occurs this may vary exchange cost.
- What costs have been included in the calculation of exchange cost (programme team, overheads etc)

Yorkshire Water utilised a third-party consultant to undertake a benchmarking of dWRMP meter exchange unit costs. The resultant industry average was established as , with the Yorkshire Water average unit cost being , providing assurance that Yorkshire Water is proposing an efficient exchange cost.

Content in this document has been redacted due to it containing commercially sensitive information

1.5.4 Overall efficiency

Yorkshire Water has based its WRMP24 and PR24 Smart metering hardware and DaaS costs from the framework agreement costs put in place in 2022 for Yorkshire Water. This framework significantly beat the market benchmarking for the most common meter type, and also provided significant efficiency for DaaS. The exchange cost is more efficient than the assessed industry average exchange cost. Yorkshire Water did not use APR data to inform cost efficiency as a planned programme of meter exchange would derive a significantly different cost efficiency than an "on demand" reactive meter exchange programme.

Yorkshire Water assessed the costs for the OJEU process as a 30-year whole life cost assessment, considering:

1. Meter Hardware cost
2. Data as a Service cost
3. Exchange costs
4. Battery life warranty (leading to how many reinvestment cycles would be required over 30 years)

Table 1.6: Summary of YW Efficiency Cost Benchmarking

	Meter hardware (DN15) - Capex	Exchange - Capex	Installation - Capex	Annual Data as a Service (15 years) – Opex	Whole-life Totex
Benchmarked cost	Content in this document has been redacted due to it containing commercially sensitive information				
YW proposed cost					
Overall efficiency to benchmark					

Yorkshire Water has aimed for a battery life warranty of 10 years, with an operational design of 12-15 years. Driving two investment cycles over three AMPs, as opposed to solutions which have a shorter battery life and may therefore require additional investment cycles at a greater whole life cost over 30 years.

Together the Whole Life Cost saving over 30 years was circa 40% compared to the benchmarked cost. The prescribed OJEU process was followed for this Framework award with a competitive market engaging through the process.

Yorkshire Water will be undertaking a new framework exercise for the AMP8 scope of work. AMP8 costs put forward at PR24 align to existing known costs. Given the challenges in Microchip and Metal production across the globe affecting meter manufacture costs, it is not expected that significant further efficiency will be realised.

1.5.5 IT systems and transformation efficiency

Please see the section “Detailed requirements specifications Technology and systems change” of this document to view how the costs for IT systems and transformation have been derived, utilising existing framework costs, which have been procured through competitive tender and industry benchmarking.

The IT Systems transformation will be delivered through two work streams. The first workstream which will establish foundational capabilities for the Smart metering programme, with minimal links to other programmes, building on existing business capabilities and augmenting to Smart metering needs.

In the second phase, Yorkshire Water will mature the foundational capabilities to achieve features such as automation, for the enhancement of a sustainable efficient enterprise architecture and business process design. Yorkshire Water will deliver an efficient programme, by aggregating technical design and technical solution deployment using an enterprise level view of needs, delivering changes to systems which deliver benefits to multiple service areas through one systems change project. Only the costs for systems changes directly related to smart metering have been included within the enhancement funding request. This aggregation of business requirements and solutions design will derive an efficient phasing of delivery to limit abortive costs and technical debt.

1.5.6 Need for enhancement model adjustment.

Without a view of the Ofwat approach to setting cost allowances to each driver, anticipating any model adjustment requirements is challenging.

However, for metering, we note that Ofwat has historically developed a unit cost model to assess efficient metering costs. We ask that when assessing these costs Ofwat continues to

reflect the differences between Smart meter costs and basic meters and that these are reflected in the modelling.

We also suggest that Ofwat maintains its approach to a separate shallow/deep dive assessment of any technological enabling solutions related to the implementation of Smart metering. These costs are likely to be specific to individual companies' strategies and timing of Smart Metering rollout, so a modelling approach is unlikely to be appropriate.

1.6 External assurance

For information on Assurance please see section 7.4 in Introduction to Enhancement Cases.

1.7 Customer Protection

For information on the methodology we have used and the central assumptions we have applied for our Price Control Deliverables (PCDs) please see section 8.2 in Introduction to Enhancement Cases.

We reviewed our forecast enhancement Totex and found we met the 1% materiality threshold for PCDW12. Whereas our enhancement funding for PCDW10 is immaterial. Accordingly, we propose to implement a Price Control Deliverable to safeguard customers from non-delivery of our proposed smart meter offering. We recognise that providing our customers with the latest smart metering solutions will drive an enhanced customer experience, as well as providing numerous environmental benefits. We also considered whether additional customer protection mechanisms were in existence or should be introduced to complement the PCD.

1.7.1 Price Control Deliverable (PCD)

We set out our proposed PCD parameters and payment rate in the following tables.

Table 1.7: PCD Parameters

PCD Delivery Expectation	
Description	Enhancing our metering programme in AMP8 to fast-track smart meter rollout for both household and non-household customers. Installation of 1,514,314 advanced monitoring infrastructure (AMI) meters, through a combination of new AMI meter installations and the replacement of existing AMR meters with AMI meters. Basic meters are meters that require manual reads of consumption data through direct physical access to the meter installation or property. AMR meters are meters using automated meter reading (AMR) technology. This enables consumption data to be read remotely without having to physically access the meter or property to obtain a manual reading. It does not however enable consumption data to be read by customers (directly or via contractors/agents) and the company at near real time. AMI meters enable consumption data to be read remotely without having to physically access the meter or property to obtain a manual reading. Consumption data is transferred to the company through an integrated system of Smart meters, communications networks, and data management systems. Such systems have the capability to: • Record consumption data and allow ready access to this data by customers (directly or via contractors/agents) and the company at near real time, with data updated daily at a minimum, and made available at a minimum granularity of 1-hour intervals, or such greater frequency and/or granularity as reasonably requested by the customer or the customer's contractors/agents; • Enable automated leak alarms to be communicated to the customer and company; and • Communicate with the internet.

	Company should engage and collaborate with other water companies, meter suppliers and other stakeholders across the sector to agree on common standards relating to the data collected from smart meters to ensure data interoperability across the sector. The company must ensure all meters comply with the appropriate regulations governing cold water meters, and that their metering systems comply with their obligations under competition law.
Output measurement and reporting	Company must deliver the number and type of meters in line with the profile specified in the 'forecast deliverables' table. Company should report spend and number of meters installed under this scheme annually in parallel with the APR. This information should be split by: 1. New AMI meter installations where no meter was previously installed. 2. AMI for AMR meter replacements. 3. AMI for basic meter replacements. 4. Business or residential for the above three categories.
Assurance	The company must commission an independent, third-party assurer, with a duty of care to Ofwat, to assure, to our satisfaction, that the conditions below have been met and the outputs of the scheme set out below have been delivered.
Conditions on Scheme	None

We propose a delivery profile for each meter type, consistent with our plan under our WRMP.

1.7.1.1Forecast deliverables

Table 1.8: Forecast Deliverables.

Deliverable	Unit	Forecast Deliverables				
		2025/26	2026/27	2027/28	2028/29	2029/30
New meters requested by existing customers (optants)	Number	25,000	25,000	25,000	25,000	25,000
New meters for existing customers - business	Number	500	500	500	500	500
Replacement of existing basic meters with AMI meters for residential customers	Number	200	200	200	200	200
Replacement of existing AMR meters with AMI meters for residential customers	Number	128266	320665	320665	320665	192399
Replacement of existing basic meters with AMI meters for business customers	Number	4212	10531	10531	10531	6318
Replacement of existing AMR meters with AMI meters for business customers	Number	6103	15258	15258	15258	9155

1.7.1.2Proposed PCD payment rate

This PCD protects all totex allocated to PCDW12, covering the enhancement spend identified for smart meter installation and infrastructure costs in AMP8. This case does not include any third-party funding.

We will incur our smart metering infrastructure costs no matter the extent of meters that we install. We face most uncertainty over our forecast meter installation for optants as we are reliant on customers to reach out to us. Therefore, we propose to attribute the Smart metering Tech systems transformation costs to all meters unit rates except for optants. We have applied two types of costs:

- For our technology costs, we have applied a standard unit rate of £27.57 per meter across all meter cohorts, apart from Optants.
- For our enhancement opex costs, we applied a standard unit rate of £6.86 across all meter cohorts, apart from Optants.

We have applied the enhancement capex costs to each relevant meter cohort, and we set out the totals and our calculations in the table below.

We propose to apply the PCD payment per unit to the difference between the forecast and actual cumulative number of meters delivered for each meter type at the end of 2029/30.

1.7.1.3PCD payment rate

Table 1.9: Payment Rates

Deliverable – meter installation type	Cumulative number of meters for AMP8	Unit payment (£)
New meters requested by existing customers (optants)	125,000	Capex= 370.80 Opex= 7.56 Totex unit rate = 378.36
New meters for existing customers – business	2,500	Enhance Tec = 27.57 Opex = 6.86 Capex= 446.75 Totex unit rate= 481.18
Replacement of existing basic meters with AMI meters for residential customers	1000	Enhance Tec = 27.57 Enhance Opex = 6.86 Enhance Capex= 43.75 Totex unit rate= 78.18
Replacement of existing AMR meters with AMI meters for residential customers	1,282,659	Enhance Tec = 27.57 Enhance Opex = 6.86 Enhance Capex= 26.68 Totex unit rate= 61.11
Replacement of existing basic meters with AMI meters for business customers	42,123	Enhance Tec = 27.57 Enhance Opex = 6.86 Enhance Capex= 43.75 Totex unit rate= 78.18
Replacement of existing AMR meters with AMI meters for business customers	61,032	Enhance Tec = 27.57 Enhance Opex = 6.86 Enhance Capex= 26.69 Totex unit rate= 61.11

1.7.2 Annualised Outcome Delivery Incentives

We identified three common performance commitments that are impacted by this enhancement case and provide us with an annual incentive for meter installation. We are improving our performance through base and enhancement demand reduction activities. We have only included the forecast performance from enhancement totex to calculate the ODI impact for this case.

1.7.2.1 Forecast benefits

Table 1.10: Forecast Benefits

PC	Unit	Forecast Benefits				
		2025/26	2026/27	2027/28	2028/29	2029/30
Per Capita Consumption	l/h/d (cumul)	0.10	0.42	0.93	1.52	2.05
Leakage	Ml/d (cumul)	0.60	2.17	4.10	6.03	7.72
Business demand	Ml/d (cumul)	0.16	0.74	1.73	2.97	4.04

1.7.2.2 Forecast ODI impact

Table 1.11: ODI Impact

PC	ODI rate (£m per unit)	Total ODI exposure (£m)
Per Capita Consumption	1.94	9.76
Leakage	0.36	7.52
Business demand	0.36	3.47
Total		**20.75**

1.7.3 Annualised time delivery incentive

We consider the PCs and ODIs associated with this enhancement case provide sufficient protection for customers against late installation of meters for each year of AMP8. Our ODI exposure is greater than 3.5% of our enhancement totex. Consistent with Ofwat's guidance IN 23/05, we do not propose an additional time incentive mechanism.

1.7.4 Third Party Funding or Delivery Arrangements

This is not applicable for this enhancement case as no third party funding or DPC is proposed.