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Unlocking benefits through data and metering

A case for investment in Advanced Metering Infrastructure (AMI) smart water metering.

Water companies' choice of smart water metering technology will be critical to meeting their ambitions. AMI can generate up to £2.2 billion in net benefits whilst contributing to climate change targets, supporting actions to reduce customer bills, helping to achieve regulatory targets and improving overall customer engagement.

May 2022

READ ON

For utility companies, infrastructure-level investments need to be made with a clear appreciation of long-term costs and benefits.

Key findings

Water companies face an important choice around the type of water meters they choose to install on customers' premises. This choice will influence outcomes including cost performance, customer experience, for meeting regulatory requirements and for the environment. In this report, we look at the choice between Advanced Metering Infrastructure (AMI) and less advanced options, including Automated Meter Reading (AMR). In summary, we learned that:

- **AMI presents significantly greater benefits than other forms of metering, including Automated Meter Reading (AMR), due to the completeness of the data it provides and that this data is delivered in near real time.** These benefits include a much higher overall benefit-cost ratio, major operational efficiency gains, and the chance to adopt a more strategic and better-informed approach to customer engagement.
- **A rollout of AMI will deliver between £1.3 billion and £2.2 billion in net benefits across England and Wales,** depending on companies' level of ambition in their metering programmes. This compares to the £30 million to £0.3 billion achievable through AMR. AMI also delivers benefits faster than AMR.
- **AMI is a 'low regret' investment that is more resilient to high impact future scenarios.** AMI shows greater adaptability than AMR – meaning that if the challenges of climate change and demand growth are more severe than expected, the comparative net-benefit of an AMI rollout increases further in comparison.
- Evidence shows that there are likely to be **major customer-facing benefits** that result from investment into AMI – additional insights helping to drive better experiences, particularly for the vulnerable. Cost savings achieved, including through reduced water consumption and leakage and improved network management, can also lower household water bills.
- AMI is also more likely to **help companies meet or exceed the targets set by the regulator,** who will continue to set financial and reputational incentives for the best performers.
- **The cost of delaying a decision to invest in AMI could be material.** The five-year planning cycle that water companies work to means that a delay could significantly push back benefits realisation from AMI data for companies, customers, and the environment.

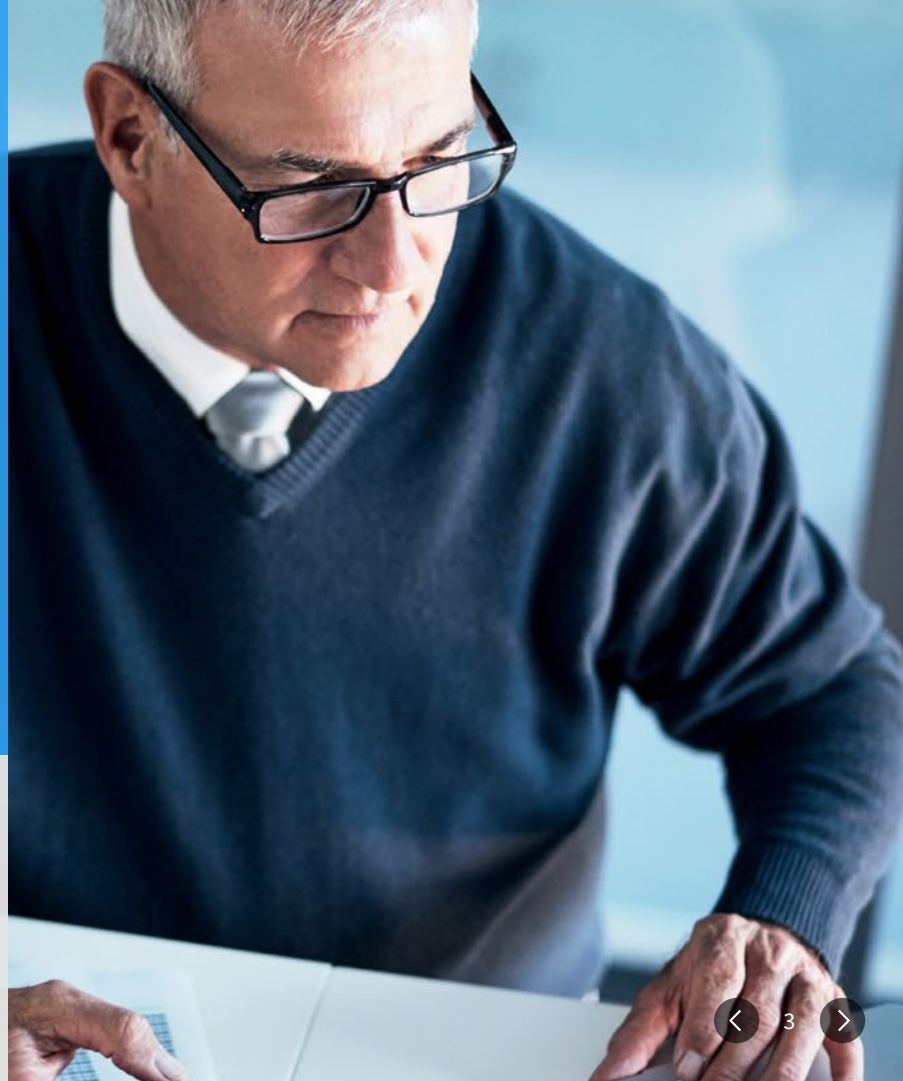
Introduction

Water metering creates benefits for water companies and customers alike. From helping to reduce consumption and identify leaks faster, to improving the accuracy and fairness of bills, water metering can deliver a wide range of societal and service-related benefits.

As the next round of investment planning approaches, water companies are faced with a critical choice. At its most basic, this choice is about which type of water meters to install on customers' premises.

It is vital to choose the best value solution. The different approaches on offer present varying degrees of performance in regard to data. This, along with each water company's ambition to use that data in a strategic and cohesive way, will play a major role in shaping the scale of the eventual outcomes. And whatever the decision, once made, it will be both costly and difficult to change.

To support water company decision-making, we evaluated the case for adoption of AMI against AMR solutions. This is a summary of the research findings. The full report is available at www.arqiva.com/AMI_Benefits.pdf.



Background to the study

This study was undertaken by Frontier Economics and Artesia and commissioned by Arqiva. The study assessed the expected costs and benefits of AMI and AMR metering roll-outs across England and Wales, and other key benefits with a focus on adaptive planning and resilience; impact on company performance commitments; and additional data benefits.

The analysis is based on evidence obtained from company rollouts of both technologies, cost and performance data provided by Arqiva, and international experience through a number of case studies.

The modelling of costs and benefits is conducted over a 30-year horizon, starting in 2021/22, and it is assumed that the underlying companies will reach ≥80% metering penetration by the end of 2030.

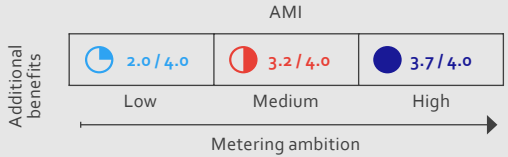
The analysis reflects best practice and is consistent with the HM Treasury Green Book.

In addition to the cost-benefit analysis, this study also uses what is known as Multi-Criteria Decision Analysis to evaluate the additional benefits that result from different water metering approaches. These benefits are scored from 0 (low) to 4 (high), as shown in the example graphic to the right.

Three scenarios are considered for each metering technology according to the benefits achievable under three levels of metering ambition. These scenarios reflect the different levels of ambition water companies exhibit in driving data benefits from their metering programmes.

The methodology for this study is explained in more detail in the annexes of the full report.

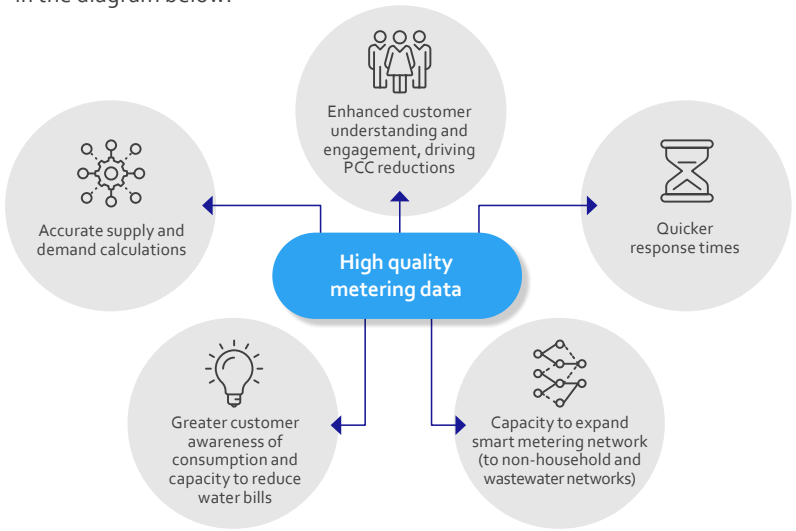
Example of how Multi-Criteria Decision Analysis findings are shown throughout the report:



This is a follow-on report to the Frontier Economics & Artesia 2021 'Report: Cost benefit analysis of water smart metering'. This analysis showed that a coordinated rollout of AMI smart metering across England and Wales would deliver £4.4bn in benefits to society against costs of £2.5bn. The modelling showed that AMI would be beneficial in every region and for every water company in England and Wales. In addition, this report found a positive benefit-cost ratio even focussing just on private costs and benefits, which would enable savings on household bills of on average nearly £3 per household per year. The full report is available online.

Why metering data matters

For water companies to manage consumption and leakage effectively, they need high quality data, delivered as often as possible. Some of the key benefits that high quality metering data can provide are highlighted in the diagram below:



Different options mean differing approaches to data

There are three main choices for water companies when it comes to metering, each with a differing approach to data collection. These are:

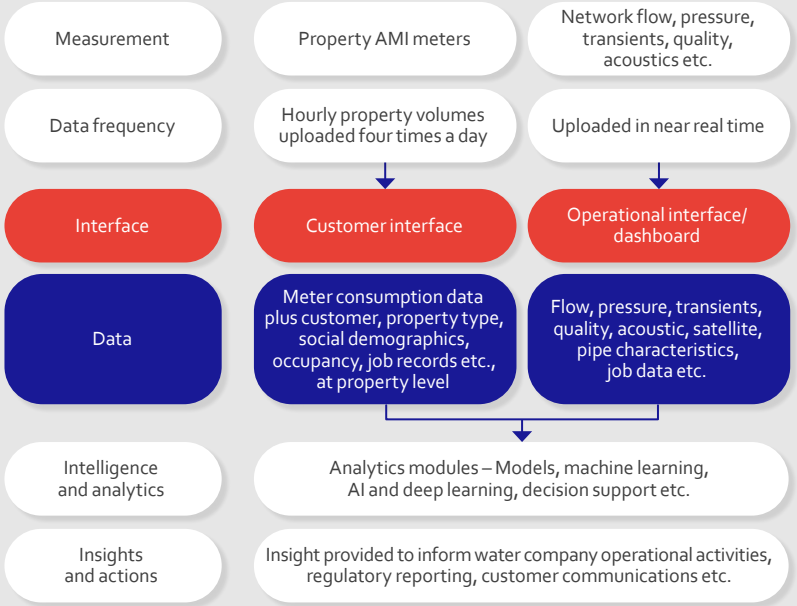
- **Manual read meters.** Mechanical meter readers with a visual register. Manual readings are entered into a device and uploaded to a meter read database. Readings are collected twice a year.
- **Automated Meter Reading (AMR).** AMR meters get a wireless 'wake-up call' from a reading device which is driven by, and then sends data to the reading device. Data is uploaded directly to a meter management database and integrated into other utility systems such as billing. Readings are typically taken twice a year.
- **Advanced Metering Infrastructure (AMI).** Every day, hourly meter data is transmitted to the utility via a fixed wireless network. Data from a smart water meter is transmitted to a base station, before being relayed securely to a data centre and on to the utility. In this report, 'AMI' is taken to mean solutions that use Sensus water meters and the Arqiva fixed network.

The AMI approach to data delivers actionable insights

AMI can build more complete and granular datasets which in turn enable greater levels of benefits including the ability to integrate meter data with network data to improve network operations and increase leakage efficiency.

Figure 1 illustrates how at a property level, customer and network data can be combined to deliver actionable insights for the utility, and provide customers access to data to help them manage their own water use more effectively.

Figure 1. Using AMI and Network Monitoring for actionable insight and outcomes

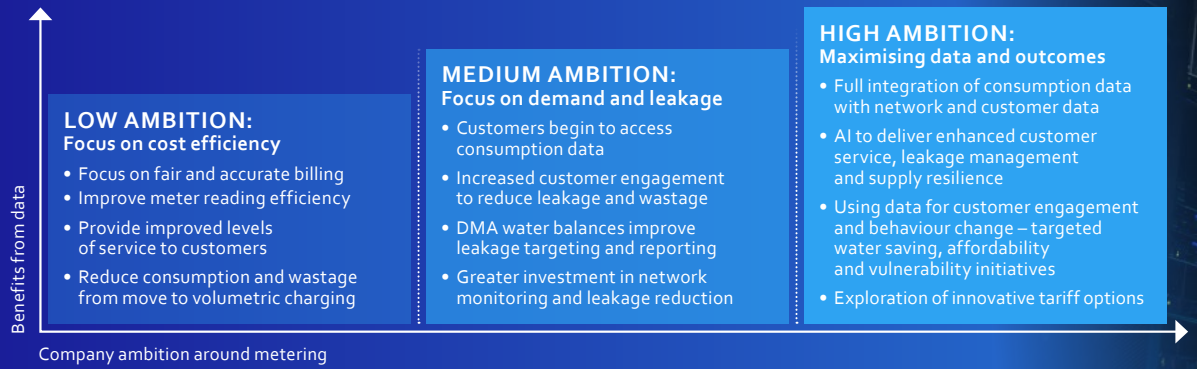


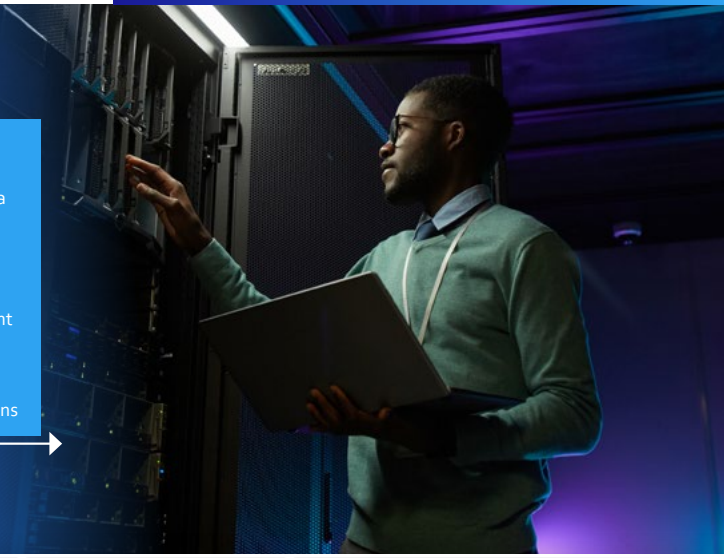
The importance of ambition

As well as having a choice of metering options, water companies also have a decision to make in terms of their ambition in regard to data. The extent to which they embrace the use of data gained through smart metering will determine both short and long-term outcomes. At a high level, we see three 'tiers' of ambition, with the behaviours in each defining the extent of the returns (see Figure 2).

Water companies' choice of metering will determine their ability to achieve the benefits of a high ambition approach, with AMI unlocking far greater opportunities as a result of the data it provides. The options to utilise the data and insights that AMI can provide are much harder or not possible to replicate under AMR.

Figure 2. Metering ambition and data benefits





On average, combined savings are £135 a year and last for 3 years and counting. Thousands of customers experience water poverty and consume more than 500 litres per day. Targeted water efficiency measures can make a meaningful difference, reducing customer bills.

Case study:
Thames Water's 'Smarter ways out of water poverty'

Thames Water have over half a million smart meters in place, and they have harnessed the data from these to quantify the opportunity for water efficiency to support customers who find it hard to balance their budget.

The study provides important insight into how smart meter data can enhance water efficiency and affordability strategies (Thames Water, Smarter ways out of water poverty, December 2021). Using data from their smart water meter network and water efficiency audits – known as Smarter Home Visits – Thames Water measured the impact of water efficiency activities on household bills.

The study showed that households with affordability indicators do have opportunities to significantly reduce their water bill if they are consuming more than 500 litres per day.

Households can benefit with a bill reduction of between 8% and 17%, equivalent to a saving of between £40 and £166 a year.

10% of households using over 500 litres per day are also found to have a continuous flow of water from internal wastage (e.g. a leaky toilet). On average, households benefit by £200 per year when these are fixed.

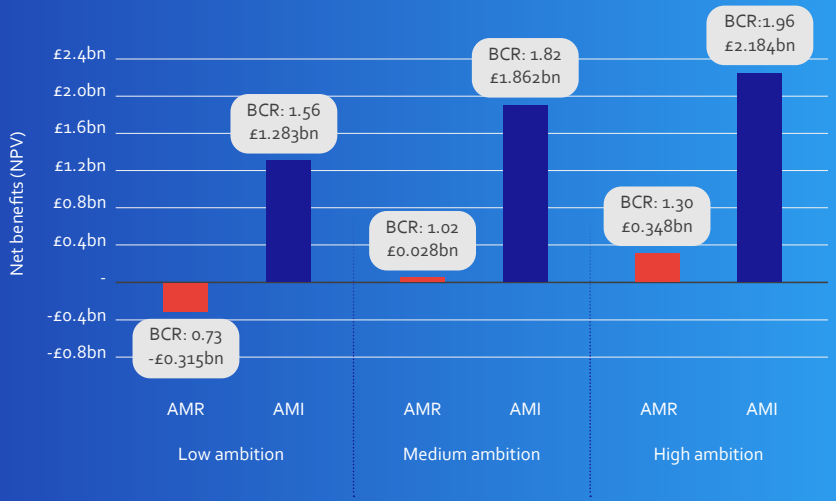
Additionally, households benefit from additional energy savings of £18 to £77 a year by reducing demand for hot water.

Evaluating meter options

Our cost-benefit analysis (CBA) shows that – regardless of a water company's level of ambition – AMI approaches are expected to produce significantly higher returns than AMR. AMI is expected to deliver £1.3bn – £2.2bn in net benefits across England and Wales compared to £30m – £0.3bn achievable through AMR (see Figure 3).

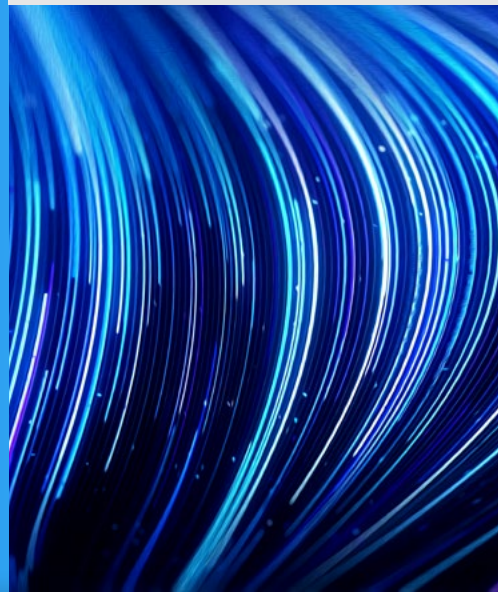
This is due mainly to AMI's capabilities in terms of data collection, with frequent reading and granular insights helping to maximise the benefits of consumption reduction and leakage efficiency. These benefits are not as clear when AMR is employed, due to its data constraints.

Figure 3. Cost-benefit analysis results across three levels of ambition



Note: BCR stands for Benefit-Cost Ratio and represents the expected value of benefits per £1 of costs incurred. A BCR greater than 1 indicates higher benefits than costs, while a BCR below 1 indicates lower benefits than costs.

Frontier Economics and Artesia's 2021 analysis found a positive business case for AMI when focussing just on private costs and benefits, which means cost savings would lower households bills on average by nearly £3 per household per year.



The short and long-term benefits of AMI

As well as offering a larger economic opportunity overall, the AMI approach is also expected to become cost-beneficial much faster than AMR – with positive benefits realised as early as 2029 for AMI, compared to 2035 for AMR (see Figure 4).

AMI is expected to have a much higher net benefit compared to AMR. Not only are the data-related benefits more substantial, the managed service approach to meter acquisition costs that exists for AMI (and is currently unavailable for AMR) will provide additional cashflow-related benefits.

Critically, the net benefit of the AMI approach does not fall when the secondary rollout of meters comes due between 2040 and 2045. Conversely, due to installation costs outweighing metering benefits in the second rollout, AMR's net benefit declines during this period.

Figure 4. AMI outperforms AMR in the cost-benefit analysis over time

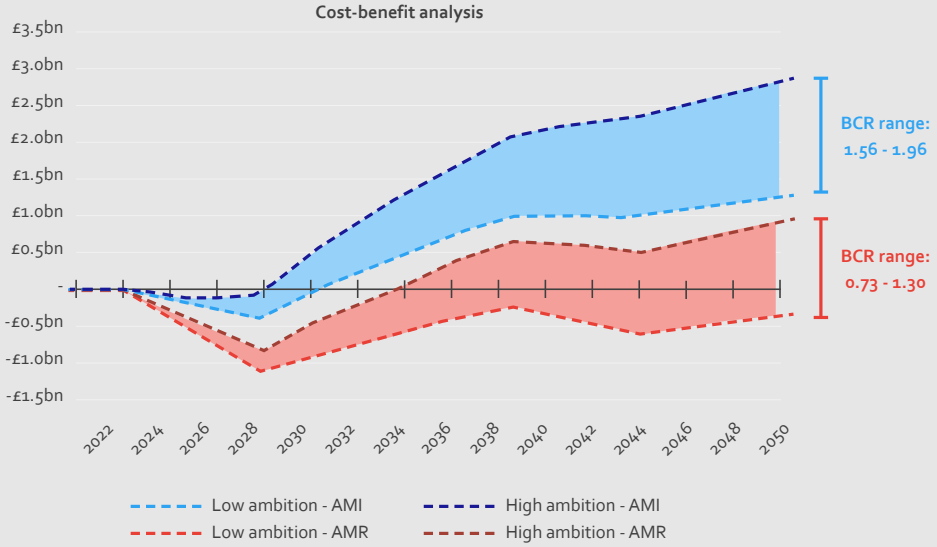
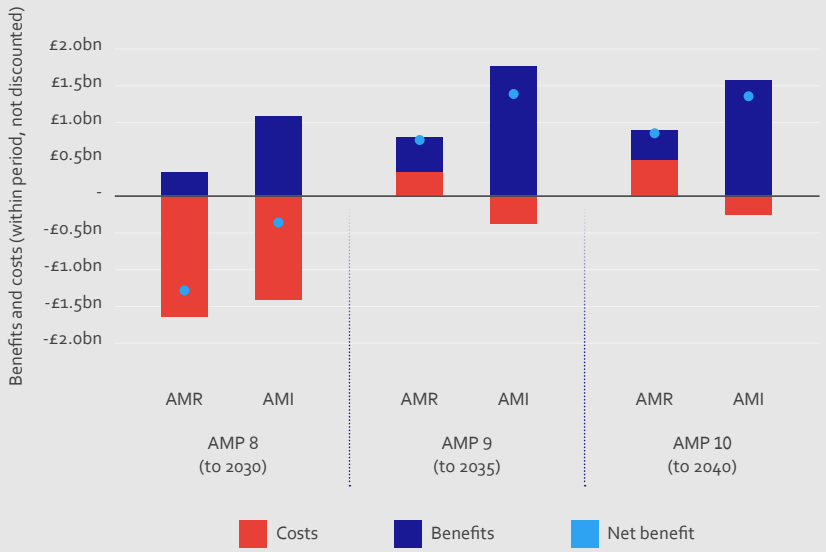


Figure 5. Meter costs and benefits over the next three AMPs (medium ambition metering scenario)



Cost and benefits over the next three Asset Management Periods

Figure 5 shows the cost and benefits of an AMI or AMR rollout under a medium ambition scenario over the next three Asset Management Periods (AMPs) – the five-year pricing and performance periods regulated by Ofwat.

Both metering options require a significant investment outlay over AMP 8, with meter acquisition, installation and back-office costs all playing a role. AMI has a lower overall cost in the first period, due to cashflow benefits of a managed service approach compared to full upfront device costs for AMR meters.

Over the next two AMPs, both technology rollouts would result in lower costs, as no further installations are required until the end of the 15-year asset life of the meters. AMR is modelled to have negative costs, as there are no further BAU metering costs following a rollout in AMP 8. AMI has low ongoing costs, namely back office and managed service costs, but its benefits far outweigh these costs.

Overall, AMI enables much greater net benefits compared to AMR over the three regulatory periods.

Resilience in the face of a changing environment

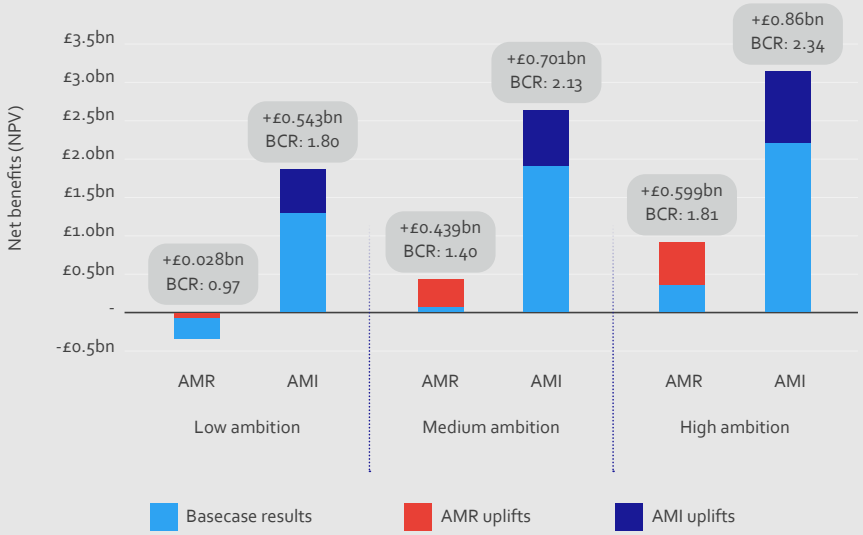
Climate change

Climate change is a serious threat to water companies, with warmer climates and extreme weather events likely to have a significant impact on water resources and customer demand.

To further evaluate the benefits of AMI and AMR in the future, we employed the core principles from Ofwat's PR24 high climate change scenario, and applied a "high" value to carbon emissions in line with BEIS' published carbon values for policy appraisal and evaluation (see Figure 6). Full details on the methodology employed can be found in the full report.

In such an environment, AMI is expected to deliver higher benefits compared to AMR. This is due to the key role that AMI can play in helping to reduce consumption, particularly at peak times.

Figure 6. Adverse climate scenario results

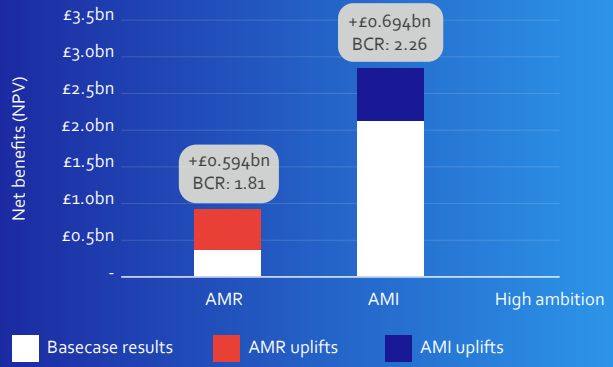


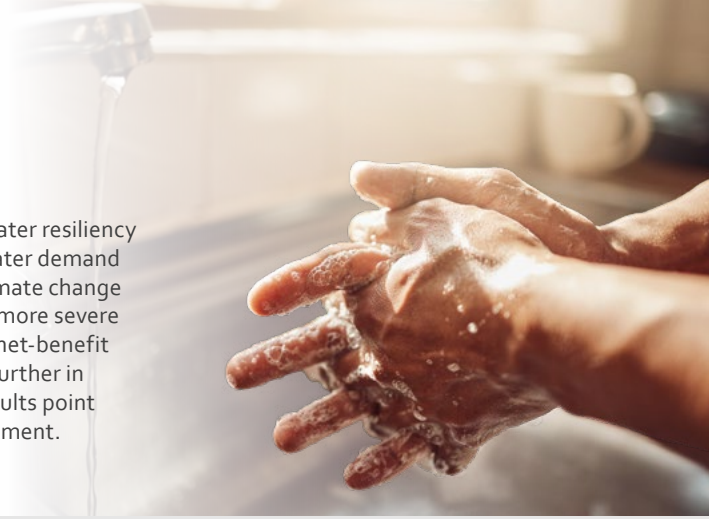
Water demand

Applying principles from Ofwat's PR24 high demand scenario, we evaluated the case for both AMI and AMR under the assumption that companies will face growing pressure to protect the public water-supply and minimise any impact on the water environment.

Compared to AMR, AMI is expected to deliver higher incremental benefits in this high demand scenario. This is due to the greater efficiency that AMI offers in terms of leakage response, as well as improvements in peak demand consumption.

Figure 7. Adverse demand scenario results





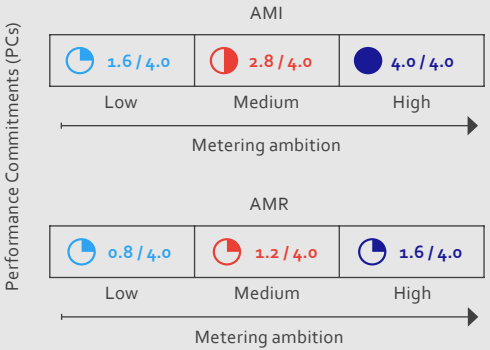
Conclusion

Investments into AMI enable greater resiliency to extreme future climate and water demand scenarios. If the challenges of climate change and demand growth prove to be more severe than expected, the comparative net-benefit of an AMI rollout only increases further in comparison with AMR. These results point to AMI being a 'low regret' investment.

Figure 8. Multi-Criteria Decision Analysis scores for adaptive planning scenarios

Meeting performance targets

Figure 9. Multi-Criteria Decision Analysis scores for performance commitments



As well as delivering strong returns from a cost-benefit standpoint, AMI and AMR can help water companies meet key performance commitments (PCs) established by Ofwat. AMI, thanks to its higher levels of data frequency and granularity, should enable companies to improve performance further than AMR (see Figure 9). This is the case across all of the following commitments for PR24 – the next periodic review.

Customer measure of experience (C-MeX)

The additional data and insights provided through AMI can help companies better engage with their customers, as insights can help target specific customer groups and needs.

Leakage reduction

More frequent and granular data from AMI meters allows companies to identify and respond to leakage incidents more quickly, compared to AMR meters.

Per Capita Consumption (PCC) reduction

Better insight into residential usage via AMI should help companies support their customers in lowering their consumption.

Asset health and supply interruption measures

Alongside other network data, metering data can help highlight issues with network assets and identify supply interruptions, reducing the time lost to interruptions.

Operational greenhouse gas emissions

By reducing consumption, leakage, and the amount of wastewater that needs to be treated, meters help companies reduce energy consumption and emissions related to pumping and treatment.

Additional benefits of AMI

While not quantified in this study, there are a number of additional benefits to AMI that present further opportunities for water companies (see Figure 10). These include:

Better customer understanding and engagement

Due to the higher frequency of reads enabled by AMI, companies can better support vulnerable customers, such as those with a history of bill debts. Thames Water, for example, has found that data from its smart meter network can help better target water efficiency audits to bring down bills for vulnerable customers.

Behavioural science and nudging

With more frequent data provided by AMI meters, behavioural nudges (e.g. letters to households of greater than average water consumption) are possible. Future advancements may also enable communication between AMI meters and other technologies to further optimise water usage.

Expanding the network

The communication network offered by the AMI approach offers opportunities for scale beyond just household meters. For example, non-household smart meters could be installed – helping to identify wasted consumption and leaking supply pipes, and providing wider insight across the water network.

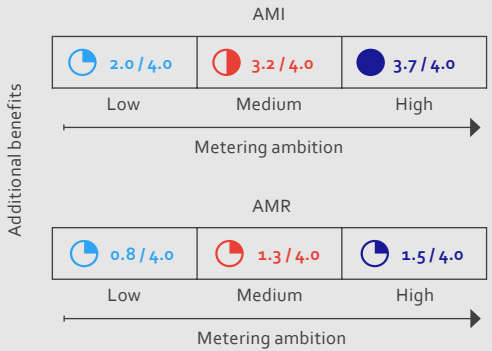
Innovative tariffs and customer insight

AMI meters could permit a much wider and more flexible range of tariff options to be introduced. This includes time-of-use tariffs, peak demand tariffs and drought resilience tariffs. These may in turn drive greater consumption reductions and further protect the resilience of water supplies. Companies may also provide social tariffs for vulnerable households. There is a positive business case for rolling out AMI even in a scenario where customers have the option to stay on an unmetered charge (see Frontier Economics and Artesia's 2021 Cost-benefit analysis).

Other benefits

AMI may also enable benefits around health and safety, eliminating the need for meter readers to work on roads or bending to check below-ground meters.

Figure 10. Multi-Criteria Decision Analysis scores for additional benefits



Case study:
Anglian Water putting behavioural science to the test

In 2017, Anglian Water and Advizzo teamed up to deploy a data and behavioural science customer engagement strategy to help customers reduce water consumption, focussing on 4,500 households in Newmarket, Colchester, and Norwich.

A bespoke water usage portal was developed specifically for this project and was coupled with smart meter deployment for participating customers. The portal provided customers with access and insight into their water consumption, including comparisons to other households in the area.

The project team observed that 15% of customers signed up to access the portal, which resulted in an 8% water consumption reduction in Newmarket's measured customers over a 12-month period.

AMI provides the data and insight that can support customers in reducing their household water bills

Why now is the right time to invest

AMI is a 'low regret' investment with significant positive net-benefits, including in higher impact future climate and water demand scenarios. This analysis shows that the costs and risks of delaying investment in AMI could be significant, while any potential benefits would be small.

Companies could struggle to meet leakage and consumption reduction targets if they delay investment, as the five-year planning cycle could mean they may be unable to rollout AMI until the mid-2030s.

It is highly unlikely that companies will not need to adopt smart data technologies in the future, as these come to define best practice. Companies could find that they do not perform as well as others that rollout AMI and increase data capabilities sooner.

There is already a growing body of experience in utilising AMI data in England that water companies can learn and benefit from.

Metering infrastructure has a short asset life compared to other water projects such as reservoirs or pipelines. This means delaying investment in expectation of falling costs is a minor factor.

Accelerating the rollout of AMI, however, supports the faster realisation of benefits, including increasing water companies' ability to meet leakage and consumption targets, enhancing companies' engagement with customers, and providing insights that can help customers take action to reduce their water bills.

Recommendations

The results of this study lead us to two sets of recommendations, one pertaining to water companies, and the other specifically to Ofwat.

Water companies

i. Water companies should analyse their metering investment choices in a strategic and holistic way. These choices should align with a wider long-term strategy for engagement of all customers, integrating data from smart networks, and for unlocking the power of data across the business.

ii. In applying the Adaptive Planning Framework to metering investment companies should account for the greater optionality that AMI provides relative to AMR. Companies should also recognise that the internal investment and reorganisation needed to achieve the benefits of AMI is likely to be part of a wider data strategy and therefore very unlikely to be a stranded cost.

iii. Companies should consider the risks of delaying a decision to invest in AMI and the subsequent impact on leakage and consumption reduction during the 2030s – particularly as the use of the technology and data comes to define best practice in the sector.

Ofwat

i. When assessing investment strategies, Ofwat should challenge companies on whether they have considered the full range of benefits that metering options may present. In addition, Ofwat should:

- Recognise that the full benefits of AMI involves wider investment in, and re-organisation of, company processes.
- Recognise that the benefits of AMI develop over time, and ensure that the assessment of water companies' business plans does not favour short term options.

If a case is made to delay investment in AMI, Ofwat should challenge companies on whether they have considered the additional optionality of AMI and the 'low regret' nature of the investment.

About the authors

Frontier Economics is a consulting firm with over 300 economists across London, Berlin, Brussels, Cologne, Dublin, Madrid and Paris.

Frontier Economics specialises in competition, regulation, and strategy across all major sectors and areas of economic analysis. The company also advises on all aspects of the economics of water including regulatory design, market mechanisms, investment appraisal, and environmental economics. Recent clients include Ofwat, UKWIR, Water UK, and many water utilities.

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